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Fifty-Ninth Annual Meeting of the Society for Psychophysiological Research

Hyatt Regency Hotel on Capitol Hill, Washington, DC September 25–29, 2019 Website: www.sprweb.org

The 2019 Annual Meeting Program includes three Pre-Conference Workshops, three Invited Addresses, Special Symposia, and the SPR Presidential Address. Specific research topics will be covered in the Symposia. The majority of the research reports will be discussed at three Poster Sessions.

This Supplement contains the abstracts from each presentation in the Symposia, Faces of the Future Flash Talks, and Poster Sessions. The abstracts are listed in the order in which they will occur at the Annual Meeting.

All authors are listed in the Index to Abstract Authors. In addition, abstract topics are listed in the Index to Abstract Descriptors.

We would like to thank all contributors for sharing their research and making this meeting a rich and stimulating event!

Catherine Norris

2019 Program Chair

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Program Highlights

Wednesday, September 25, 2019

9:00 a.m.-4:30 p.m.

Pre-Conference Workshop #1

Ambulatory Psychophysiology

Organizer:

Greg Siegle, University of Pittsburgh

9:00 a.m.-4:30 p.m.

Pre-Conference Workshop #2

Open Science in Psychophysiology

Organizers:

Eric Vanman, University of Queensland

Jenny Gutsell, Brandeis University

Andreas Keil, University of Florida

Peter Clayson, University of California, Los Angeles

9:00 a.m.-4:30 p.m.

Pre-Conference Workshop #3

Time-Frequency Principal Components Analysis: A Practical Introduction to Applications with Event-Related Potential Data

Organizer:

Ed Bernat, University of Maryland, College Park

5:00 p.m.–7:00 p.m.

Special Symposium

METHODOLOGICAL RIGOR AND MULTI-SITE REPLICATIONS IN PSYCHOPHYSIOLOGY: CHALLENGES AND RECOMMENDATIONS

Session Chairs: Peter Clayson¹, Michael Larson²

¹*Veterans Affairs Greater Los Angeles Healthcare System*, ²*Brigham Young University*

Thursday, September 26, 2019

1:30 p.m.–2:30 p.m.

Invited Address

CAN WE IMPROVE BRAIN MECHANISMS OF EMOTION REGULATION BY INCREASING HEART RATE VARIABILITY?

Mara Mather, PhD

Professor of Gerontology and Psychology, University of Southern California, Los Angeles

3:00 p.m.– 4:30 p.m.

Presidential Symposium

IMITATION, SYNCHRONIZATION AND EMPATHY: EVIDENCE FROM BRAINS, BODIES AND BOTS

Session Chairs: Catherine Norris¹; Ursula Hess²

¹*Swarthmore College*, ²*Humboldt University of Berlin*

Friday, September 27, 2019

8:30 a.m.–10:00 a.m.

Faces of the Future Flash Talks

Session Chair: Stephen Benning

University of Nevada, Las Vegas

10:30 a.m.–11:30 a.m.

Invited Address

THE VISUAL PREFRONTAL CORTEX OF PRIMATES: AVAILABILITY, DESIRABILITY AND AROUSAL

Elisabeth A. Murray, PhD

Chief, Section on the Neurobiology of Learning and Memory and Chief, Laboratory of Neuropsychology, National Institute of Mental Health

4:45 p.m.–5:15 p.m.

Early Career Award Address

NEUROVISCERAL REGULATORY CIRCUITS OF AFFECTIVE RESILIENCE IN YOUTH

Julian Koenig

Universität Heidelberg

5:15 p.m.–5:45 p.m.

Early Career Award Address

A MULTIMODAL APPROACH TO EMOTIONAL PROCESSING AND REGULATION IN DEPRESSION

Lauren M. Bylsma

University of Pittsburgh School of Medicine

Saturday, September 28, 2019

10:30 a.m.–11:00 a.m.

Invited Address

FMRI-BASED MODELS OF AFFECTIVE EXPERIENCE: COMPUTATION, REPRESENTATION, AND BRAIN-BODY COMMUNICATION

Tor Wager, PhD

Diana L. Taylor Distinguished Professor, Department of Psychological and Brain Sciences, Dartmouth College

11:30 a.m.–12:30 p.m.

Presidential Address

WHO TO WHOM AND WHY: THE SOCIAL NATURE OF FACIAL MIMICRY OF EMOTIONS

Ursula Hess, PhD

Professor of Psychology, Humboldt University of Berlin

3:30 p.m.–6:30 p.m.

Symposium 8.1

“SO, WHAT’S NEW?” EMANUEL DONCHIN’S CONTRIBUTIONS TO THE COGNITIVE PSYCHOPHYSIOLOGY OF THE 21ST CENTURY

Session Chairs: Gabriele Gratton, Monica Fabiani

University of Illinois, Urbana-Champaign

Symposia Abstracts

WEDNESDAY, SEPTEMBER 25, 2019

5:30 p.m.-7:00 p.m.
Special Symposium

METHODOLOGICAL RIGOR AND MULTI-SITE REPLICATIONS IN PSYCHOPHYSIOLOGY: CHALLENGES AND RECOMMENDATIONS

Session Chairs: Peter Clayson¹; Michael Larson²

¹Veterans Affairs Greater Los Angeles Healthcare System, ²Brigham Young University

Discussant: Andreas Keil, University of Florida

The reproducibility, replicability, and robustness of findings in psychological science have led to a perceived crisis. The purpose of this symposium is to identify barriers to the replicability of psychophysiological data and to provide recommendations for improving psychophysiology research practices. The symposium begins with Carbine reporting the sample sizes and statistical power that are common in studies of event-related brain potentials (ERPs) and highlighting the importance of *a priori* power calculations. Clayson then discusses how researchers are not reporting all the necessary data collection and processing steps outlined in the ERP methodology guidelines published in 2014, which is a barrier to replication studies. Sandre provides an example of the impact of various processing pipelines on error-related negativity (ERN) scores, psychometrics, and relationships with external correlates. One recommendation for improving replicability and robustness of research is to conduct large multi-site studies. The symposium concludes with two presentations that cover the results and challenges of such studies. Bauer presents on a multi-site replication of the relationship between intolerance of uncertainty and threat generalization using skin conductance responses (SCR) and ERPs. Moser reports on a multi-site replication of the relationship between ERN and worry. Together, these presentations highlight challenges to the reproducibility, replicability, and robustness of psychophysiological findings and provide recommendations for best practices moving forward.

SAMPLE SIZES, SAMPLE SIZE CALCULATIONS, AND STATISTICAL POWER IN ERP RESEARCH: CONCERNS AND BARRIERS FOR REPLICABILITY

Kaylie Carbine¹; Peter Clayson²; Scott Baldwin¹; Michael Larson¹

¹Brigham Young University, ²Veterans Affairs Greater Los Angeles Healthcare System

Small sample sizes and low statistical power contribute to replication difficulties, as reported effects may be attenuated or exaggerated (Type M error) or go in the opposite direction (Type S error) of a true effect. We reviewed 150 randomly-sampled event-related potential (ERP) studies from 2011-2017 in high-impact psychophysiology journals for average sample size and power. Average sample size was 29 ($SD = 21$) overall and 21 ($SD = 11$) per group in between-group designs. Studies were powered at 80% to detect only large effects: $d = .89$ for independent samples; $d = .62$ for paired samples; $f = .44$ for 2-between x 2-within interaction. To see if researchers are ensuring *a priori* that they are powered to detect effects of interest, a separate set of 100 randomly selected electroencephalography (EEG) and ERP studies from 2010-2015 were assessed for presence of sample size calculations and information needed to conduct such calculations. Zero percent of studies reported sample size calculations, 0% reported correlations among repeated measures, 40% reported effect sizes, 56% reported means, and 46% reported measures of variance. Findings suggest EEG/ERP research is underpowered to detect all but large effects in simple statistical designs; researchers neither conduct sample size calculations nor report the information necessary for accurate sample size calculations. Reproducibility of psychophysiological

research will improve with larger samples to detect small effects, conducting sample size calculations, and reporting effect sizes and information necessary for sample size calculations.

METHODOLOGICAL REPORTING GUIDELINES FOR ERP STUDIES: REPORTING RATES AND ROLE IN REPRODUCIBILITY AND REPLICABILITY

Peter Clayson¹; Kaylie Carbine²; Scott Baldwin²; Michael Larson²

¹Veterans Affairs Greater Los Angeles Healthcare System, ²Brigham Young University

Methodological reporting guidelines for studies of event-related potentials (ERPs) were updated in 2014 to facilitate the reporting of data collection and processing pipelines. Collecting and analyzing ERPs is computationally intensive and requires many methodological choices. Hence, pipelines rapidly ramify, resulting in many possible researcher degrees of freedom. A key purpose of a Methods section is to clearly communicate the pipeline, and the guidelines identified which key steps must be reported. We aimed to determine whether ERP reporting guidelines are followed and whether these guidelines improved reporting behavior. Reporting behavior based on the 2014 guidelines published in *Psychophysiology* was coded for 150 randomly-sampled articles from five high-impact ERP journals from 2011 to 2017. An average of 63% of required guidelines were reported. Percentage of guidelines reported was similar across journals, suggesting that gaps in methods reporting is a shortcoming of the field, rather than any specific journal. Notably, tests of equivalence indicated that there was no meaningful effect of the guidelines on reporting behavior. Thus, failing to report all key guidelines is a ubiquitous research practice, which serves as a substantial barrier to replication efforts. Although authors should detail all aspects of data collection and processing, there also appears to be a need for editors and reviewers to enforce reporting guidelines. Open sharing of processing code and experimental tasks could enhance reporting of most pipeline steps and further facilitate replication.

COMPARING THE EFFECTS OF DIFFERENT METHODOLOGICAL DECISIONS ON THE ERROR-RELATED NEGATIVITY AND ITS ASSOCIATION WITH BEHAVIOR AND GENDER

Aislinn Sandre¹; Iulia Banica¹; Anja Riesel²; Julia Klawohn³; Anna Weinberg¹

¹McGill University, ²Humboldt University, ³Florida State University

The error-related negativity (ERN) is an event-related potential (ERP) component that is used to study intra- and inter-individual differences in human performance monitoring. However, substantial methodological differences exist across studies that examine the component. These differences influence not only the measured amplitude of the component, but also its psychometric properties and association with target variables. The goal of the present study was to compare the many common methodological approaches to measuring and scoring the ERN and to examine their effects on the component's measured amplitude, psychometric properties, and association with target variables, specifically behavior and gender. To this end, we collected ERN data in 263 young adults during a Flanker task and again in a subsample of 33 participants five months later. We compared means, internal consistencies, and test-retest reliabilities of the ERN across different reference schemes (mastoid versus average), baseline correction periods (-100 to 0, -200 to 0, and -500 to -300 ms), amplitude scoring approaches (area, peak, peak-to-peak), and electrode sites (at Cz and region-of-interest, ROI). This talk will present data demonstrating the effect of these different processing pipelines on consistency, reliability, and associations between the ERN and target variables, and will discuss implications for future studies of the ERN.

INTOLERANCE OF UNCERTAINTY AND THREAT GENERALIZATION: A MULTIMETHOD, COLLABORATIVE REPLICATION

Elizabeth Bauer¹; Jayne Morriss²; Aislinn Sandre³;
Tina Lonsdorf⁴; Carien van Reekum²; Anna Weinberg³;
Annmarie MacNamara¹

¹Texas A&M University, ²University of Reading, ³McGill University,
⁴University Medical Center Hamburg-Eppendorf

Intolerance of uncertainty (IU), a dispositional tendency to perceive uncertainty as threatening, has been associated with both increased reactivity to threat and with *less* differential responding to threat versus non-threat cues (i.e., threat generalization). Here, we report on the challenges and lessons learned from a multi-site replication and extension of Morriss and colleagues' (2016) results, which provided evidence via SCR for greater threat generalization in higher IU participants during threat acquisition, as well as delayed learning of cue pairings and failure to extinguish threat. Three labs attempted direct and conceptual replications with an extension to EEG ($N_s = 43-96$; original study $N = 54$). Various task designs were used between sites to replicate the original paradigm, optimize the design for SCR, and optimize the design for ERPs. Results were broadly in line with the original study: as evidenced by SCR, higher IU was associated with less differentiation between threat and non-threat cues in two of three labs; higher IU was associated with greater SCR discrimination between stimuli in one lab. In addition, higher IU participants showed greater differentiation between threat and safety cues during extinction, as measured by the late positive potential. Individuals higher in IU also showed greater anticipation of threat cues in acquisition, as measured by the stimulus preceding negativity. Together, these results suggest that individuals with higher IU may show greater threat generalization, fail to extinguish threat as readily and may anticipate threat more.

Funding: AM is supported by National Institute of Mental Health grant, K23MH105553.

A PRELIMINARY REPORT ON A MULTI-SITE EFFORT TO REPLICATE THE ASSOCIATION BETWEEN WORRY AND ENLARGED ACTION MONITORING BRAIN POTENTIALS (MOSER ET AL., 2012)

Jason Moser¹; Peter Clayson²; Alexandra Muir³; Whitney Allen³; Erin Modersitzki³; Courtney Louis¹; Akina Umemoto⁴;
Michael Inzlicht⁴; Michael Larson³

¹Michigan State University, ²Veterans Affairs Greater Los Angeles Healthcare System, ³Brigham Young University, ⁴University of Toronto

As psychological science grapples with its replication crisis, scholars from across subdisciplines of psychological science are turning inward to examine whether their area, too, is in a crisis of non-replication. Psychophysiology is one such subdiscipline that is looking inward at its own findings. This talk reflects the efforts of this movement in psychophysiology by presenting preliminary results from a multi-site study to replicate a seemingly robust relationship in the literature – the association between worry and enlarged action monitoring brain potentials. Three research groups from the United States and Canada, including the site of the original study being replicated (Michigan State University), standardized procedures across sites and have collected data on 227 participants to date. Preliminary findings indicate considerable differences in the association between worry and action monitoring brain potentials across sites. Moreover, preliminary findings suggest an important role of gender as was demonstrated in an extension of the original study (Moran et al., 2012). When focusing on women only, findings from two sites show effects in the expected direction, such that worry is associated with enlarged action monitoring brain potentials (especially the error-related negativity), whereas one site shows somewhat of an opposite effect. Discussion will center on continued data collection at each site to achieve robust final estimates, the challenges of multi-site studies and the potential role of demographic and cultural differences across sites.

8:30 a.m.-10:00 a.m. Symposium 1.1

BRAIN AND BODY IN DANGER: CENTRAL AND PERIPHERAL ELECTROPHYSIOLOGY OF STIMULUS PROCESSING UNDER THREAT

Session Chairs: Yuri Pavlov¹; Christian Panitz²
¹Ural Federal University, ²University of Marburg

Studies on induced and cued threat (e.g., fear conditioning) have made important contributions to the understanding of affective learning mechanisms as well as its applications (e.g. anxiety disorders). While peripheral measures have a long and important tradition in threat learning research, researchers have increasingly turned to MEG and EEG to elucidate associated central mechanisms. This symposium brings together four speakers to discuss associations and dissociations between such central and peripheral threat-modulated responses. First, Stephan Moratti presents data showing differential effects in steady-state visual evoked fields and SCR modulation during fear conditioning in post-traumatic stress disorder. Next, Yuri Pavlov reports results showing that wakefulness rather than sleep supports fear memory consolidation. This effect is reflected in differential ERP effects but not in cardiovascular data. Then, Sabine Schellhaas reports data on enhanced ERP markers of selective attention during recognition of faces previously encoded in a threatening context – independent from explicit recognition performance. Last, Christian Panitz discusses potential mechanisms underlying intraindividual cortico-cardiac coupling in defensive responding to anticipated aversive stimuli in participants with anxiety disorders and healthy controls. Altogether the symposium provides an overview of recent attempts to understand the relationship between central markers of threat-modulated stimulus processing and peripheral components of threat expectancy and defensive responding.

MODULATION OF STEADY STATE VISUAL EVOKED FIELDS BY FEAR LEARNING AND ITS RELATION TO AUTONOMIC RESPONSES

Stephan Moratti¹; Javier Echegaray¹; Melissa Yuan²;
Tamara Giménez Fernández³

¹Complutense University of Madrid, ²Polytechnic University of Madrid,
³Autonomous University of Madrid

Research over the last decade has shown, that neuromagnetic and electrocortical responses of early visual cortex can be modulated by acquired fear relevance during CS-US association learning. Thereby, visual cortex activity increases for acquired fear relevant stimuli but only during defense system activation as indexed by heart rate (HR) acceleration. Further, we show that amplitude modulations in visual cortex as a function of CS-US contingency can occur very fast within a few learning trials. Additionally, sensory gain modulations of early visual cortex can be excitatory and inhibitory for fear relevant and irrelevant stimuli, respectively, as indexed by steady state visual evoked field (ssVEF) amplitude changes. Further, this response pattern is accompanied by corresponding skin conductance responses (SCR) usually observed during fear learning. However, in anxiety disorders such as post-traumatic stress disorder (PTSD), discriminative sensory representations of fear relevant and irrelevant stimuli in visual cortex as reflected by ssVEF amplitude increases and decreases, respectively, are absent. Critically, the acquisition of increased SCR expression for fear relevant stimuli is intact in PTSD patients, indicating a dissociation between ssVEF and SCR modulation during fear conditioning in these patients. Therefore, autonomic and central nervous response patterns recorded during well-established fear conditioning paradigms may not only elucidate basic autonomic central nervous system interactions but also specific pathologic mechanisms in affective disorders.

EFFECTS OF SLEEP AND WAKEFULNESS ON PSYCHOPHYSIOLOGICAL INDICES OF FEAR CONDITIONING

Yuri Pavlov¹; Boris Kotchoubey²

¹Ural Federal University, ²University of Tuebingen

The positive effects of sleep on the consolidation of learning and memory are generally well known. Regarding fear conditioning as a specific form of learning, animal studies suggest a critical role of REM sleep. However, only a few studies in humans have used physiological indices of conditioning, and none used central physiological measures. In our experiment event-related brain potentials (ERP) were recorded during a fear conditioning procedure presented twice, before sleep or control intervention and after. The procedure involved pairing of a neutral tone (CS+) with a highly unpleasant sound (UCS+). As a control, another neutral tone (CS-) was paired with a neutral (for some subjects slightly pleasant) sound (UCS-). Between two session of conditioning separated by approximately 2.5 hours, on one experimental day, subjects watched a silent movie, on another day (with different tones as CS) they lied in bed and all of them fell asleep. The two days were separated by at least two weeks and counterbalanced in respect to the stimulus mapping. Differential conditioning manifested itself in the ERP components P3a and N3 with peak latencies about 220 and 420 ms, respectively. The period of wakefulness resulted in an additional increment of P3a and N3 amplitude differences between CS+ and CS- as compared with the nap. The data indicate that wakefulness rather than sleep affects fear conditioning traces. Advantages and disadvantages of EEG/ERP in comparison with other measures of conditioning are discussed.

Funding: German Research Society (Deutsche Forschungsgemeinschaft), Grant KO-1753/13-1.

FACE IDENTITY LEARNING DURING INSTRUCTED THREAT: ELECTROCORTICAL EVIDENCE FROM A SOURCE MEMORY TASK

Sabine Schellhaas¹; Nina Arnold²; Christian Schmahl¹; Florian Bublatzky¹

¹University of Heidelberg, ²University of Mannheim

Emotional arousing stimuli like happy or angry faces are more likely to be recalled than neutral ones. This beneficial effect of emotion on memory can spill over from an arousing context to an otherwise neutral stimulus. Using event-related brain potentials and an item/source memory task, the modulatory effect of contextual threat on face perception and identity recognition was investigated. During an encoding phase, 30 participants saw 60 face pictures with neutral facial expressions (1 s each) in either a context signaling threat-of-shock or safety (30 pictures each) without a learning instruction (incidental). During the recognition phase, all 60 old and 30 new faces were presented. Participants had to decide whether a face was new or previously presented in a threatening or a safe context. Faces encoded with threat compared to safety were associated with increased neural processing, revealed by enhanced early parietal-occipital and late fronto-central negative potentials. Regarding recognition performance, overall memory for face and source recognition was very poor. Still, differences in brain activity were revealed by an enhanced fronto-central positivity for old compared to new faces. Furthermore, enhanced late central and parieto-occipital negativities indicate selective attention to faces previously encountered in a threatening context compared to old safe faces. Intriguingly, these differential ERP memory effects are not reflected in conscious recognition performance. Implications are discussed with regard to motivated memory processes and anxiety disorders.

Funding: This work was supported by the German Research Foundation (BU 3255/1-1).

CORTICO-CARDIAC COUPLING IN RESPONSE TO AVERSIVE UNCONDITIONED STIMULI IN ANXIETY DISORDERS AND HEALTHY CONTROLS

Christian Panitz; Sarah-Louise Unterschemmann; Erik Mueller
University of Marburg

Noxious stimuli reliably trigger defensive mobilization as, for example, in fight-flight responses. Functional relationships between central markers of stimulus processing and peripheral components of defensive responding (e.g., cardiac acceleration), however, are not well understood. Investigating these associations may help to understand mechanisms of normal and pathological fear. Here, we analysed data from participants with panic disorder (PD; $n = 34$), social anxiety disorder (SAD; $n = 31$) as well as healthy controls (HC; $n = 30$) who completed a threat conditioning paradigm with face stimuli as CS and an aversive white noise burst as unconditioned stimulus (US). US-evoked single-trial EEG at centromedial sites and heart period were used to compute intraindividual coupling of cortico-cardiac responses. Presentation of aversive US evoked strong cardiac acceleration which was intraindividually predicted by more negative centromedial EEG amplitude as early as in the N1 time window. In addition, and specifically in the SAD group, stronger cardiac acceleration was predicted by more positive amplitudes in the P3 time window. The present results imply a central role of early neural stimulus processing (i.e., 100-400 ms) in subsequent cardiac defensive responding. Mechanisms that underlie this functional cortico-cardiac coupling and that may be altered in anxiety disorders are discussed.

8:30 a.m.-10:00 a.m.
Symposium 1.2

NOW YOU SEE IT, NOW YOU DON'T: DELINEATING THE CAUSAL ROLE OF THE AMYGDALAE IN AFFECTIVE PROCESSING

Session Chair: Johanna Kissler
Bielefeld University

Medial temporal lobe structures, and in particular the amygdalae, are assumed to play a pivotal role in affective processing. However, most of the extant neuroimaging evidence is correlational rather than causal. At the same time, more recent theories emphasize the role of multiple structures and pathways in emotional processing. This symposium aims to bring together recent research regarding the causal role of medial temporal lobe structures including the amygdalae in processing affective stimuli. We will present studies from four different groups in three countries, combining resection, lesion, inflammation and direct stimulation approaches, all of which target the amygdala, with neuroimaging, eye tracking, and peripheral physiology, as well as behavioral and memory measures. The studies employ a range of visual stimuli, including faces, pictures, and body language. Depending on the cerebral hemisphere, the type of stimulus, the task and the outcome-measure, the results reveal both medial-temporal lobe dependent and independent facets of emotional processing in adults and also demonstrate a causal role of amygdala activity for PTSD symptoms. Together, the data help narrow down the function of the amygdalae and surrounding structures in affective processes and thereby advance affective neuroscience and psychophysiology knowledge. They also have important implications for the understanding of emotional disturbances as they occur for instance in anxiety and affective disorders.

EFFECTS OF LEFT OR RIGHT UNILATERAL TEMPORAL LOBE RESECTIONS ON VISUAL PROCESSING OF EMOTIONAL FACES AND SCENES

Lea-Marie Stieghorst¹; Alexandra Mehlmann¹; Malena Mielke¹; Martin Wegrzyn¹; Friedrich Woermann²; Johanna Kissler¹; Christian Bien²
¹Bielefeld University, ²Epilepsy Center Bethel

Stronger hemodynamic responses to emotional than to neutral stimuli in the visual brain have been attributed to feedback from the amygdala. However, previous studies testing effects of amygdala lesions on these effects provided contradictory evidence. This could be due to the use of different stimuli or analyses collapsing across different types of lesions. Here, we investigate effects of unilateral anterior temporal lobe resections (ATLR), encompassing the amygdala, on BOLD responses elicited by emotional pictures and faces in 13 healthy controls, 13 right and 9 left ATLR patients. Healthy controls showed emotion effects for faces in bilateral fusiform gyri as well as right superior temporal sulcus (STS). Right ATLR patients showed emotion effects only in the left fusiform gyrus and STS. Left ATLR patients likewise had a tendency for a contralesional shift of emotion effects, but activation patterns were more diffuse. For pictures, healthy controls showed emotion effects in bilateral dorsal and ventral visual pathways. In right ATLR patients, this effect was preserved, if attenuated, in the right hemisphere. Left ATLR patients showed no emotion effect for pictures at all. In sum, both left and right medial temporal lobe structures appear to contribute to emotional face processing in the ipsilateral hemisphere. In contrast, affective picture processing seems to depend particularly on left medial temporal lobe structures. These findings reveal stimulus and hemisphere specific influences of medial temporal lobe structures including the amygdalae on visual emotion processing.

Funding: German Research Foundation KI1286/8-1 and BI1234/4-1 to J. Kissler and C.G. Bien.

PRESERVED BEHAVIORAL PERFORMANCE AND GLOBAL NETWORK CHARACTERISTICS IN THE EMOTION NETWORK FOLLOWING ANTERIOR TEMPORAL LOBECTOMY

Jan van den Stock; Yun-An Huang; Patrick Dupont;
 Laura Van de Vliet; Jan Jastorff; Tom Theys; Johan van Loon;
 Wim Van Paesschen
 KU Leuven

Amygdala lesions are associated with reductions in response to facial expressions in the fusiform face area (FFA) as well as deficits in facial emotion recognition. While processing of bodily expressions shares many similarities with facial expressions, there is no substantial evidence that amygdala lesions result in similar sequelae. We combined behavioral assessment with functional neuroimaging in patients with unilateral anterior temporal lobe (ATL) resections including the amygdala, aiming to assess whether the amygdala is critical for recognition and for modulatory effects on distant areas during perception of body expressions. Furthermore, we investigated neural changes at the global network level to investigate reorganization of the network in the absence of network nodes. Results revealed normal behavioral performance in both patient groups, but no enhanced activations in right fusiform body area (FBA) and left extrastriate body area (EBA). Furthermore, left ATL patients lacked enhanced activations in right pSTS and right EBA. Multi-voxel pattern analysis revealed altered categorization of emotional versus neutral stimuli of right pSTS in right ATL patients. Graph analysis revealed preserved global network characteristics in the patient groups. The results indicate that the amygdala and anterior temporal lobes are not necessary for recognition of body expressions, but that amygdala lesions affect body emotion processing in distant brain areas, without affecting the global network characteristics, consistent with psychological construction accounts of emotion.

GAZE BEHAVIOR AND EMOTION DISCRIMINATION IN PATIENTS WITH AMYGDALA DAMAGE DUE TO HERPES ENCEPHALITIS

Marie-Louise Roth-Paysen; Insa Schlossmacher;
 Maximilian Bruchmann; Nico Melzer; Thomas Straube
 University of Muenster

It has been proposed that the amygdala is relevant for facial emotion discrimination, especially of fearful expression and gaze behavior towards emotional salient facial features. For example, reduced gaze focus to eyes has been suggested to cause disturbed facial emotion discrimination in patients with amygdala damage. The present study investigated facial emotion discrimination and gaze behavior in five patients with unilateral and two patients with bilateral amygdala damage due to herpes encephalitis (HE). HE is the result of a rare viral infection that leads to lesions within the temporal lobe and adjacent structures. These patients are particularly interesting since they have no history or acute symptoms of epilepsy and no other known impairments in brain structure and function before the onset of HE. Based on previous studies, we expected reduced recognition of fearful faces and reduced gaze behavior towards the eyes in all patients. Furthermore, it was assumed that patients with unilateral amygdala damage would show an asymmetrical spatial bias towards the eyes. The results showed varying impairments of emotion discrimination ability in three patients, but normal ability in four patients, including one patient with bilateral amygdala damage. Except one patient with an ipsilesional bias, no patient showed abnormal gaze behavior towards the eyes compared to the control group. These findings question the necessity of a functioning amygdala for emotion discrimination and modulation of gaze behavior in adult humans.

Funding: intramural grant from the University of Muenster.

IMPAIRED EMOTIONAL PROCESSING IN LIMBIC ENCEPHALITIS: AUTONOMIC, BEHAVIORAL AND BRAIN RESPONSES

Insa Schlossmacher; Marie-Louise Roth-Paysen;
 Maximilian Bruchmann; Nico Melzer; Thomas Straube
 University of Muenster

Limbic encephalitis (LE) is an autoimmune disorder that is characterized by an inflammation of limbic structures including the amygdala. In addition to temporal lobe epilepsy and episodic memory deficits, affective disturbances also count as diagnostically valid criteria. However, the influence of amygdala inflammation on the processing of emotional stimuli is only poorly understood. Therefore, we investigated emotional responses to varying types of emotional stimuli (including videos, visual scenes, and facial expressions) in treatment-naïve patients with LE compared to a healthy control group. Across several experiments emotional responses were explored on different levels of processing including autonomic (skin conductance responses), neural (functional magnetic resonance imaging) and behavioral measures (ratings). In addition, we conducted morphometric analyses of the amygdala to better understand different aspects of possible effects of amygdala inflammation. We observed impaired emotional responses (SCR, amygdala and network responses, arousal ratings) on all processing levels in patients compared to controls. Furthermore, these effects were correlated with the degree of amygdala inflammation based on the morphometric analyses. This work suggests causal effects of the amygdala on the processing of emotional stimuli and broadens the understanding of emotional deficits in LE.

EFFECTS OF HUMAN AMYGDALA STIMULATION AND ABLATION ON EMOTIONAL PHYSIOLOGY, MEMORY, AND PTSD

Jon Willie; Cory Inman
Emory University

The amygdala plays a role in memory for emotional events. We examined the effects of direct electrical amygdala stimulation on physiological and subjective emotional responses in epilepsy patients with amygdala depth electrodes compared to sham and lateral temporal lobe controls. Amygdala stimulation specifically elicited dose-dependent increases in skin conductance response and decelerations of heart and respiratory rates, consistent with orienting/defensive responses, but only rarely elicited subjective emotional responses. Next, we tested whether brief low amplitude amygdala stimulation could enhance declarative memory for specific neutral object images. Patients viewed a series of images, half of which were immediately followed by amygdala stimulation. Amygdala stimulation elicited no subjective emotional response yet led to reliably improved memory the next day compared to control images. Thus, amygdala can initiate memory prioritization in the absence of emotion. In epilepsy patients with comorbid post-traumatic stress disorder (PTSD), we found that brief amygdala stimulation during safety cues can hasten safety learning in a fear acquisition-fear extinction paradigm measuring skin conductance and blinking to conditioned stimuli. Finally, epilepsy patients with PTSD that underwent right stereotactic amygdalohippocampotomy experienced not only seizure reductions, but also decreases in symptoms and physiological markers of PTSD without impairing emotional memory. Overall, human amygdala gain of function can reinforce memories but reducing function can alleviate PTSD.

Funding: NIH R21-A1-xml: Novel strategies for mapping the emotional neural circuitry using human brain stimulation. PI: Jon T. Willie.

8:30 a.m.-10:00 a.m.

Structured Panel Presentation 1.3

ASK ME ANYTHING: RESEARCH DOMAIN CRITERIA (RDOC)

Session Chair: Sarah Morris
National Institute of Mental Health

Speakers: Sarah Morris, Jennifer Pacheco, Uma Vaidyanathan
National Institute of Mental Health

This panel discussion will focus on an open conversation with US National Institute of Mental Health (NIMH) Program Officers who work with the Research Domain Criteria (RDoC) initiative. The session will start with a brief summary of RDoC, its current status and role within NIMH, and touch upon future directions for the initiative. Following this overview, the session will be opened to questions and comments from attendees related to any aspect of RDoC, including fundamental principles and strategies for applying for RDoC-related NIMH grants. The session will provide an opportunity to separate myth from fact with regard to RDoC and provide feedback about the initiative to NIMH staff. The panel particularly welcomes questions from early career investigators and researchers looking for general guidance on structuring research questions and hypotheses for RDoC-related grant applications.

8:30 a.m.-10:00 a.m.
Symposium 1.4

INNOVATIONS IN DYNAMIC PHYSIOLOGICAL MEASUREMENT APPROACHES ACROSS THE LIFESPAN: IMPLICATIONS FOR RISK AND RESILIENCE

Session Chairs: Tracy Dennis-Tiway; Sarah Myruski
Hunter College, The City University of New York

Discussant: Tracy Dennis-Tiway, Hunter College, The City University of New York

Physiological measures can reveal temporally-sensitive mechanisms underlying trajectories of risk and resilience. Yet, the temporal dynamics of emotion and cognition and the interplay among and within biological systems are often ignored. The proposed symposium addresses this gap. First, Deneffrio et al. examine trial-level reductions in EEG variance, or neural quenching, to aversive and neutral stimuli in relation to the BDNF Val66Met polymorphism. Quenching was increased in the Met risk allele group, as was the magnitude of error-related negativity, suggesting disinhibition in the time-course of threat processing. Second, Weissman et al., using neuroimaging and indices of PNS functioning in adolescents, document that threat exposure increases risk for internalizing problems, but also recalibrates vmPFC regulation of the PNS in ways that may promote resilience. Third, Hastings et al. use a non-linear index of vagal flexibility measured during an emotional challenge in young children. More controlling mothers had children with less vagal flexibility, which predicted maternal and child anxiety two years later, suggesting that dynamic vagal flexibility may be a parentally-and risk-influenced biomarker of emotion regulation. Fourth, Anaya et al. examine delta-beta EEG synchrony as a neural correlate of emotion regulation in three age groups. Delta-beta synchrony predicted anxiety precursors and interacted with other individual and environmental factors. Discussion will focus on challenges and opportunities for integrating across dynamic measures from a lifespan perspective.

Funding: A portion of this research was made possible by grant SC1MH104907 awarded to T. Dennis-Tiway from the National Institute of General Medical Sciences, grant R56MH111700 awarded to T. Dennis-Tiway from the National Institute of Mental Health, both of the National Institutes of Health, and grant TR000457 of the National Center for Advancing Translational Sciences of the National Institutes of Health.

LOOKING UNDER THE HOOD OF THE ANXIETY-ERN LINK USING GENETIC AND DYNAMIC NEURAL MEASUREMENT APPROACHES

Samantha Deneffrio¹; Sarah Myruski¹; Tracy Dennis-Tiway^{1,2}
¹Hunter College, The City University of New York, ²The Graduate Center, The City University of New York

The error related negativity (ERN) is exaggerated in a range of anxiety disorders, including generalized anxiety disorder (GAD). Yet, in a recent study (Deneffrio et al., 2018), a GAD diagnosis was not associated with exaggerated ERN and instead was linked to broad reductions in discrimination between aversive and non-aversive responses. To further probe this finding, we re-examined the data by categorizing participants based on the BDNF Val66Met polymorphism rather than GAD diagnosis. The BDNF Met variant has been linked to stress vulnerability and risk for anxiety (Gatt, et al., 2009). We also examined links with neural quenching, a dynamic measure of reduced or "quenched" EEG trial-level variance to visual stimulus. While neural quenching may confer perceptual and performance advantages (Ayelet, et al., 2016), in the context of aversive stimuli, it may instead reflect reduced processing inhibition to threat. EEG was recorded while 29 adults completed a flanker task preceded by neutral or angry faces. ERN was generated to flanker responses and neural quenching to faces. Met allele relative to Val/Val carriers showed potentiated ERN [$t(24) = 2.51, p = .019$] and greater neural quenching [neutral $t(16.65) = 3.57, p = .002$; angry $t(13.68) = 3.15, p = .007$]. Increased ERN was correlated with more quenching for the entire sample [neutral $r(28) = .38, p = .045$; angry $r(28) = .42, p = .023$]. Results provide insight into the anxiety-ERN link by targeting trans-diagnostic genetic vulnerabilities and dynamic measures of neural processing efficiency and inhibition.

Funding: A portion of this research was made possible by grant SC1MH104907 awarded to T. Dennis-Tiway from the National Institute of General Medical Sciences, grant R56MH111700 awarded to T. Dennis-Tiway from the National Institute of Mental Health, both of the National Institutes of Health, and grant TR000457 of the National Center for Advancing Translational Sciences of the National Institutes of Health.

CALIBRATION OF BRAIN-AUTONOMIC COUPLING BY PRIOR THREAT EXPOSURE: IMPLICATIONS FOR INTERNALIZING PROBLEMS IN MEXICAN-ORIGIN ADOLESCENTS

David Weissman¹; Amanda Guyer²; Emilio Ferrer²;
Richard Robins²; Paul Hastings²

¹Harvard University, ²University of California, Davis

Past exposure to threat increases the risk for internalizing problems in adolescents. However, individual adaptations in the coordination of autonomic nervous system (ANS) responses to threat may differentiate adolescents who do and do not develop significant problems. This study investigated the role of the brain's regulation of ANS activity in calibrating adolescents' emotional and physiological reactivity, leading to risk for or resilience to internalizing problems as a function of past threat exposure. 179 Mexican-origin adolescents (88 female) reported on neighborhood and school crime, peer victimization, and discrimination when they were 10, 12, 14, and 16 years old. At age 17, participants underwent a functional neuroimaging scan during which they viewed and rated pictures of emotional faces while measures of respiratory sinus arrhythmia (RSA) and skin conductance responses (SCRs) were collected simultaneously. Post scan, adolescents reported on their symptoms of internalizing problems. Greater exposure to threats earlier in adolescence was associated with more internalizing problems at age 17. Threat exposure was also associated with stronger negative coupling between the ventromedial prefrontal cortex (vmPFC) and RSA. Stronger negative vmPFC-RSA coupling was associated with fewer internalizing problems. Taken together, these results suggest that while threat exposure poses a significant risk for internalizing problems, it may also recalibrate vmPFC regulation of the parasympathetic nervous system in some adolescents, possibly contributing to greater resilience.

CHILDREN'S DYNAMIC VAGAL FLEXIBILITY PROTECTS AGAINST ANXIETY SYMPTOMS BUT IS SENSITIVE TO MATERNAL PSYCHOLOGICAL CONTROL

Paul Hastings¹; Elisa Ugarte¹; Jonas Miller²
¹University of California, Davis, ²Stanford University

Hypotheses: Children's vagal flexibility, the capability to both suppress and augment parasympathetic control over time, was expected to be a marker of dynamic physiological regulation that would protect against anxiety but would be sensitive to socialization. Method: We recorded cardiac IBIs from 182 children ($M = 5.60y$, $SD = 1.11$; 96 boys) while watching 1min videos of a child in fear, sadness and anger eliciting situations (15s calm intro, 30s escalating emotion, 15s positive ending). RSA was examined in 15s epochs. Mothers reported their use of psychological control and children's anxiety symptoms. Two years later, mothers again reported and children self-reported anxiety symptoms. Results: Second order latent growth curve modeling showed a non-linear slope of RSA decreasing then increasing during the 30s of escalating emotion for each emotion scene, and the three slopes loaded onto a common structure of vagal flexibility to negative emotions. More psychologically controlling mothers had children with less vagal flexibility (flatter slopes), $b = -.16$, $p < .05$. Vagal flexibility was not associated with concurrent mother-reported anxiety, $b = .03$, ns, but less vagal flexibility predicted more self-reported anxiety, $b = -.20$, $p < .05$, and tended to predict more mother-reported anxiety, $b = -.16$, $p < .06$, 2 years later. Moderation analyses showed that greater psychological control enhanced the predictive link of lower vagal flexibility with more self-reported anxiety, $b = -.31$, $p < .01$. Conclusion: Dynamic vagal flexibility may be a parentally-influenced biomarker of emotion regulation.

THE ROLE OF DELTA-BETA SYNCHRONY IN EARLY DEVELOPMENT OF ANXIETY ACROSS INFANCY, CHILDHOOD, AND EARLY ADOLESCENCE

Berenice Anaya¹; Kristin Buss¹; Vanessa LoBue²;
Rebecca Brooker³; Koral Perez-Edgar¹

¹The Pennsylvania State University, ²Rutgers University, ³Texas A&M University

Anxiety emerges as multiple individual and environmental factors transact over time across levels of analyses (Levitt, 2015). Based on this perspective and findings from previous studies (Brooker et al., 2014; 2016), we examined the role of delta-beta EEG synchrony as an individual, neural correlate of emotion regulation in three studies. In particular, we examined how delta-beta

synchrony predicts anxiety precursors across development and interacts with other individual and environmental factors. In Study 1, we found that inhibitory control at age 3 predicted over-anxious behaviors at age 5 ($N = 30$). This link was particularly strong for children with negative delta-beta synchrony scores. In Study 2, among pre-adolescents oversampled for anxiety risk, inhibitory control marginally predicted anxious social interactions ($\beta = 0.38$; $p = .07$) during a behavioral peer-dyad ($n = 45$), but synchrony did not moderate this association. Behavioral coding of these dyads is ongoing (expected $n = 92$), and this moderation will be tested with added power. In Study 3, we are examining how delta-beta synchrony unfolds during the first years of life. We are following a sample of infants from 4 to 24 months. Preliminary findings ($N = 53$) suggest that delta-beta synchrony ($\beta = 0.31$; $p = .02$) and maternal anxiety ($\beta = -.02$; $p = .03$) predict increases in temperamental fear from 4 to 8 months. Temperamental fear is an individual factor associated with early precursors of anxiety. We discuss the overarching role of delta-beta synchrony in light of these findings across infancy, childhood, and early adolescence.

10:30 a.m.-12:00 noon
Big Question Session 2.1

GIVEN THAT AN UNDERLYING THEME FOR THIS YEAR'S CONFERENCE IS MULTI-METHOD INTEGRATION, HOW CAN WE BEST INTEGRATE DATA FROM MULTIPLE PHYSIOLOGICAL MEASURES (BROADLY CONSTRUED) TO ANSWER PSYCHOLOGICAL QUESTIONS OF INTEREST?

Session Chair: James Cavanagh
University of New Mexico

Discussant: Julian Thayer, University of California, Irvine

THE UTILITY OF ASSESSING CENTRAL AND PERIPHERAL NERVOUS SYSTEMS AMONG WOMEN EXPERIENCING SOCIAL IDENTITY THREAT

Zachary Petzel¹; Melinda Kittleman²; Christina Garasky²;
Bettina Casad²

¹Queen's University Belfast, ²University of Missouri, St. Louis

Descriptors: Social identity threat, Multi-method integration, Autonomic nervous system

Measures of the central and peripheral nervous systems are well-established and widely used in psychophysiological research. However, many of these physiological measures are assessed independently of each other, despite evidence suggesting these indices likely assess related psychological constructs. Little research has examined how multiple, concurrently recorded physiological measurements may predict, inform, and interact with each other. The present research examined a combination of physiological measurements of the central (i.e., electroencephalogram) and peripheral (i.e., heart rate, cardiac output, total peripheral resistance) nervous systems among women experiencing social identity threat (i.e., sexism, stereotype threat). Across 3 studies, women with higher heart rate variability were more likely to exhibit advantageous cardiovascular responses (i.e., challenge reactivity) and greater neurophysiological indices of self-control (i.e., error-related negativity) following social identity threat. Further, 2 studies provide evidence toward concurrent validity of cardiovascular (i.e., challenge reactivity) and neurophysiological (i.e., cortical asymmetries) indices of motivation, and their influence on self-control. The utility of using multiple physiological assessments and how this may better inform research on social identity threat, motivation, and self-control will be discussed. Issues related to the integration of multiple psychophysiological assessments to maximize knowledge gain will also be discussed.

Funding: Support for this research was provided by the National Institute of General Medical Sciences of the National Institutes of Health under Award Number R01GM094536, a University of Missouri - St. Louis Research Award, the University of Missouri Research Board, the Society for the Psychological Study of Social Issues, and the Psi Chi International Honor Society in Psychology.

THE LAME, THE BLIND, AND THE UGLY: INTEGRATING FINDINGS ON COGNITIVE CONTROL USING MULTIMODAL DATA FUSION FOR SIMULTANEOUS EEG-FMRI

Malte Gueth¹; Jose Garcia Alanis²; Peer Herholz^{3,4}; Jens Sommer²
¹Rutgers University, ²Philipps-Universität Marburg, ³Université de
Montréal, ⁴McGill University

Descriptors: data fusion, EEG-fMRI, cognitive control

Multimodal data fusion allows the examination of both shared and unique features of data, unifying evidence collected from multiple methods, such as EEG and fMRI. In cognitive control tasks, fMRI studies point towards activation of the dorsolateral prefrontal cortex (DLPFC) for maintenance of information in working memory and the anterior cingulate cortex (ACC) as well as supplementary motor cortex (SMC) for updating and response selection. In EEG research, a variety of ERPs have been suggested to be indicative of similar cognitive processes. A common feature across tasks is midfrontal theta, indexing the detection of information that signals the requirement for cognitive control effort. In order to integrate these findings, we used a dot pattern expectancy task with simultaneous EEG-fMRI and established a baseline of neurovascular coupling using single trial correlation of task-related oscillatory power and hemodynamic activation. To explore shared signatures with blind signal separation methods, we employed joint independent component analysis and partial least squares. While ERP amplitudes accounted for only limited spatial variance, oscillatory measures, such as single trial theta power, following imperative information for behavioral adaptation were connected to DLPFC, ACC, SMC and posterior parietal cortex. Task-related theta oscillations yielded strong co-variation with increased activation in the medial PFC. In summary, this study successfully established connections between signal components associated with cognitive control exertion in EEG and fMRI.

CONTEXT-AWARE EXPERIENCE SAMPLING REVEALS THE SCALE OF VARIATION IN AFFECTIVE EXPERIENCE

Katie Hoemann¹; Zulqarnain Khan¹; Catie Nielson¹;
Madeleine Devlin¹; Mallory Feldman¹; Jennifer Dy¹;
Jolie Wormwood^{2,3}; Lisa Feldman Barrett^{1,4}; Karen Quigley^{1,3}
¹Northeastern University, ²University of New Hampshire, Durham,
³Edith Nourse Rogers Memorial Veterans Hospital, ⁴Massachusetts
General Hospital, Martinos Center for Biomedical Imaging

Descriptors: emotion, individual differences, machine learning

There is immense heterogeneity in affective experiences: even experiences identified by a single emotion term (e.g., “anger”) vary dramatically across individuals, as well as within individuals across contexts. Yet scientists typically ignore this variability, searching instead for consistency across all instances of a given emotion and across all participants in a given sample. Moreover, standard in-lab approaches to measuring affective experience use sterile environments that artificially limit variation. To address these issues, we integrated experience sampling with ambulatory physiological monitoring to specifically assess variation in affective experience in everyday life. Participants completed a context-aware experience sampling paradigm, during which they wore devices that recorded peripheral physiological activity (e.g., cardiovascular activity, skin conductance) and physical movement, and prompted participants to describe their current affective experience after substantive heart rate changes in the absence of movement. We used unsupervised machine learning to examine multimodal within-subject patterns of physiological activity for each prompted event, revealing a variable number of disparately-sized clusters of events per participant. Each cluster corresponded with a wide range of self-reported emotions, pleasantness, and activation, such that affective experiences were associated with heterogeneous patterns of bodily activity within and across participants. These findings showcase a potent, multi-method approach for investigating individual differences.

Funding: This research was supported by the Army Research Institute (ARI; W911NF-16-1-0191) awarded to K. Quigley and J. Wormwood, Co-PIs, as well as by the National Heart, Lung, and Blood Institute (1 F31 HL140943-01) awarded to K. Hoemann.

EXTENDING MULTI-METHOD MEASUREMENT OF TRAIT DISINHIBITION TO THE NEUROIMAGING MODALITY

Keanan Joyner¹; Max Owens²; Emily Perkins¹; Noah Venables³;
Christopher Patrick¹

¹Florida State University, ²University of Vermont, Burlington,
³University of Minnesota, Minneapolis

Descriptors: Multi-method, Neurobehavioral Trait Model, Disinhibition/ Externalizing

The emerging neurobehavioral trait model for psychopathology (Patrick et al., *Psy Assess*, 2019) focuses on quantifying clinically-relevant traits at the interface of neurobiology, behavior, and experiential report. A multi-method (MM) measurement model has been reported for the neurobehavioral trait of disinhibition (DIS) that includes multiple indicators from three assessment modalities: trait questionnaire, task performance, and brain-ERP (Venables et al., *Clin Psy Sci*, 2018). The current work sought to extend the MM-DIS model to include measures from the modality of functional neuroimaging (fMRI). Applying a split-half, exploratory/cross-validation strategy to data for a large adult sample ($N = 1059$), scores on a scale measure of DIS were tested for relations with (a) indicators of performance from a set of executive function tasks, and (b) BOLD activations within *a priori* ROIs (superior and medial frontal gyri, cerebellum, insula) from an fMRI working memory task. An MM, latent-variable model of DIS was then specified using task performance and fMRI indicators that proved replicable, along with the scale measure, as indicators. Convergent validity of scores on the DIS factor of this MM model was evidenced by positive relations with criterion measures of substance abuse and aggression, and discriminant validity was evidenced by null relations with positive affect and life satisfaction measures. These findings encourage efforts to extend the MM model for DIS – and MM models for other constructs of the neurobehavioral trait model – into the functional neuroimaging modality.

UNDERSTANDING NEURAL MECHANISMS OF ADOLESCENT DEPRESSION USING MULTIMODAL PSYCHOPHYSIOLOGICAL APPROACH

Jingwen Jin¹; Lauren DeLaparte^{1,2}; Jared Van Snellenberg^{1,2,3}; Greg
Perlman²; Christine DeLorenzo²; Brady Nelson¹;
Daniel Klein^{1,2}; Aprajita Mohanty¹; Roman Kotov^{1,2}
¹Stony Brook University, Department of Psychology, ²Stony Brook
University, Department of Psychiatry and Behavioral Health, ³Stony
Brook University, Department of Biomedical Engineering

Descriptors: depression, neuroimaging, EEG

First onset depression increases sharply during adolescence, particularly for females, making this population an optimal demographic stratum to examine mechanistic risk factors of depression. In the present talk, I discuss how we integrated data across multiple physiological modalities including electroencephalography (EEG), diffusion tensor imaging (DTI), resting and task-based functional magnetic resonance imaging (fMRI) activity and connectivity to examine neural mechanisms of depression in the Stony Brook ADEPT cohort, a large sample of adolescent females. Diagnoses and symptoms were assessed longitudinally over multiple waves. We applied a data- and theory-driven approach on resting state fMRI ($N = 170$) and DTI ($N = 208$) data to examine a frontomesolimbic circuit that relates to depression. We will then show that task-related alterations in the activity and connectivity of this circuit are related to depression. Finally, taking advantage of the temporal resolution of EEG ($N = 444$), we will demonstrate that time- and frequency-domain indices of reward processing are related to depression. The talk will focus on convergent evidence across structural and functional, spatial and temporal domains that reveals the neural circuitry of adolescent depression as well as discrepancies related to variation in paradigms and temporospatial features. Using this multi-method longitudinal project, this presentation attempts to provide an integrative summary of findings and demonstrate how to integrate multiple psychophysiological measures in investigating mechanisms of adolescent depression.

Funding: NIMH R01.

10:30 a.m.-12:00 noon
Symposium 2.2

**PERCEIVING OTHERS AS A FUNCTION OF
 THREAT OR SAFETY: THE ROLE OF ACQUISITION,
 GENERALIZATION, REVERSAL, AND EXTINCTION
 LEARNING**

Session Chair: Florian Bublatzky
 Central Institute of Mental Health

Discussant: Ottmar Lipp, Curtin University

How we perceive and respond to other people depends on what we have learned and know about them. Such learning processes link differently complex information ranging from low-level facial features to contextual settings and social communication. This is particularly relevant in threatening situations, when a fellow's face might indicate potential harm. Based on the acquisition of threat or safety, such associations are not fixed; they can be changed, generalized, reversed, and extinguished. With a focus on different learning processes involved in person perception, this symposium comprises measures of cortical activity (EEG/ERP, MEG, fMRI) and its relation to peripheral physiological responding (e.g., startle EMG, SCR), behavioral performance and subjective evaluations (recognition, ratings). Markus Junghöfer reports about low-level face information modulating multi-CS face conditioning and generalization effects. Florian Bublatzky focuses on the recognition of low-intense nuances of emotional expressions as a function of contextual threat. Camilla Luck demonstrates the impact of the intention to harm on differential fear conditioning. Lauren Atlas will discuss the interplay of verbally instructed and feedback-driven reversal learning. Finally, Pedro Guerra will talk about threat/safety reversal learning competing with life-long learning history. In summary, this symposium takes an integrative perspective to approach face and person perception as a function of different learning mechanisms, from basic facial features to high-level social learning, emotion and behavior.

Funding: This Symposium was supported in part by the German Research Foundation (BU 3255/1-1).

**NEUROCOGNITIVE MECHANISMS OF IMPLICIT
 BIASES: FEAR GENERALIZATION OF CONDITIONED
 FACIAL FEATURES IN ABSENCE OF CONTINGENCY
 AWARENESS**

Markus Junghöfer; Nele Wiens; Kati Roesmann
 University Hospital Münster

Generalized social biases may partly be rooted in repeated public presentations of single criminal individuals. Here we investigated the neurocognitive mechanisms of implicit biases based on facial "generalization features" (GF). In a MultiCS conditioning phase, 32 facial identities were either always paired with an aversive scream (CS+) or remained unpaired (CS-). Importantly, CS+ and CS- systematically differed regarding their ratio of eye distance and mouth width – the relevant GF. In pre- and post-conditioning phases, all CS and 32 generalization stimuli (GS) – different faces that either shared the GF of CS+ or CS- faces – were presented. Pair comparisons with various "Fake-GF" revealed complete absence of GF-US contingency awareness. In 2x2 ANOVAS, we observed main-effects of GF (CS+GF vs CS-GF) and interactions of GF and Stimulus Type (CS vs. GS) on valence-, arousal-, and US-expectancy ratings. In line with higher unpleasantness-, arousal- and US-expectancy-ratings for faces with the CS+GF, MEG source-estimations showed three significant clusters in temporo-occipital and anterior temporal brain regions with stronger neural responses to CS+ and GS+ compared to CS- and GS-, respectively. Three additional clusters in dorsal frontal areas revealed reverse effects, consistent with a reduced GS+ inhibition by these regions. Our data reveal a rapid development of implicit biases and show that early amplifications of "emotional attention" towards the CS+ in visual brain regions generalize to novel individuals sharing relevant facial features.

Funding: Supported by the DFG (project SF58C08).

**RECOGNIZING FACIAL EMOTIONS DURING THREAT:
 BEHAVIORAL AND MAGNETO-ENCEPHALOGRAPHIC
 CORRELATES**

Florian Bublatzky¹; Fatih Kavcioglu²; Pedro Guerra³; Sarah Doll⁴;
 Markus Junghöfer⁴

¹Central Institute of Mental Health, ²University of Würzburg, ³University of Granada, ⁴University Hospital Münster

Environmental conditions bias the perception of other peoples' facial expressions. This becomes even more relevant in threatening situations, when a fellow's face might indicate potential harm. To test this hypothesis, low- and medium-intense smiling and fearful faces (morphed to 10, 20, 30, or 40% emotional intensity) were presented within a context of instructed threat-of-shock or safety. Behavioral data show that instructed threat led to a biased recognition of fearful but not smiling faces. MEG data revealed spatio-temporal clusters of neural network activity associated with contextual threat/safety and emotion recognition in early- to mid-latency time windows in the left parietal cortex, bilateral prefrontal cortex, and the left temporal pole regions. Early parietal activity showed a double dissociation of face-context compounds as a function of the intensity of the expressions: When facial emotions were difficult to recognize (low-intense), contextual threat enhanced fear processing, and a safety context enhanced processing of subtle smiling faces. However, for rather easily recognizable faces (medium-intense) the left hemisphere (parietal cortex, PFC, and temporal pole) showed enhanced activity to happy faces during threat and fearful faces during safety. Thus, contextual information boost early face processing of low-intense congruent facial emotions, whereas face-context incongruity or mismatch effects drive neural activity to easy recognizable facial emotions. These results elucidate how environmental settings help recognize even subtle nuances of fear.

Funding: This work was supported by the German Research Foundation (BU 3255/1-1).

**ADAM WANTS TO SHOCK YOU: SHOCK INTENTION
 INFORMATION MODERATES DIFFERENTIAL FEAR
 CONDITIONING**

Camilla Luck²; Tanya Pritchard¹; Ottmar Lipp²;
 Gabrielle Weidemann¹

¹Western Sydney University, ²Curtin University

Pictures of faces are frequently used as conditional stimuli (CS) in human fear conditioning, but it is not known whether attributions about the persons depicted affects fear learning. Here, we examined whether informing participants about whether the person depicted intended to harm them (or not) would moderate fear learning. Two neutral faces were presented with shock intent information (intent CSs; i.e. Adam wants to shock you) and two faces were presented with no shock intent information (no intent CSs; i.e. Gary does not want to shock you). Electrodermal responding and CS valence evaluations were measured continuously. During acquisition, two faces (one from each intent category) were paired with a shock unconditional stimulus (CS+ faces) and two other faces (one from each intent category) were presented alone (CS- faces). CS+ faces elicited higher electrodermal responses and were evaluated as less pleasant than CS- faces. The intent CS+ elicited larger electrodermal responses than the no intent CS+ and the intent CS- was evaluated as less pleasant than the no intent CS-. During extinction, all faces were presented alone. Differential responding to intent CSs remained intact (resistance to extinction) but was abolished for no intent CSs. Negative evaluations failed to extinguish, with CS+ evaluated as less pleasant than CS- and intent CSs evaluated as less pleasant than no intent CSs. Overall, the results reveal that information about intentions to harm strengthens fear acquisition and results in fear learning that is resistant to extinction.

THE INTERPLAY BETWEEN INSTRUCTED AND FEEDBACK-DRIVEN REVERSAL LEARNING: INFLUENCES ON SUBJECTIVE, AUTONOMIC, AND NEURAL RESPONSES

Lauren Atlas
National Institutes of Health

In this talk, I will review a series of studies that leverage reversal learning to gain insights on the interplay between higher order knowledge and pure feedback-driven learning in human participants. In our studies of pain and aversive learning, individuals are instructed about contingencies prior to reversal. This allows us to dissociate the influences of instructed knowledge and associative learning and to test for interactions. We find that instructions directly influence skin conductance responses during fear conditioning, for both neutral and prepared stimuli, and cause immediate reversals in corticostriatal circuits. However, the amygdala is more responsive to feedback-driven reversal learning, irrespective of instructions. I will also discuss recent extensions of this work, which indicate that instructed reversals also have robust effects on subjective and autonomic responses to painful thermal stimulation. Finally, I will discuss clinical extensions of this work, which indicate that anxiety is associated with dissociations in the effects of instructed and feedback-driven reversal learning on subjective and autonomic responses to painful stimulation.

FROM LOVED TO FEARED AND BACK: REVERSAL LEARNING OF THREAT CONTINGENCIES IN A THREAT OF SHOCK PARADIGM

Pedro Guerra¹; Cristina Morato¹; Florian Bublatzky²
¹University of Granada, ²Central Institute of Mental Health

Recent research on the psychophysiological correlates of attachment-induced safety has shown beneficial effects when viewing pictures of supportive others. In addition, it has been proposed that these stimuli could act as prepared safety signals, showing resistance to acquire aversive features in a classical conditioning paradigm and improve extinction learning. We could not support this notion in a previous study using verbal threat learning. Pictures of loved familiar (e.g. partner, parents) and unknown people served equally well as instructed threat cues, prompting pronounced defensive responding (e.g., increased SCR and potentiated startle reflex). Extending these findings, this talk will focus on the impact of reversal instructions. To this end, previously acquired threat associations were partially changed from threat to safety and vice versa. When participants were instructed that a previous threat cue now signaled safety, a profound reduction of defensive reactions was observed (e.g., startle inhibition). Interestingly, this effect was independent from face category (either loved or unknown). Nevertheless, loved familiar faces still evoked facial EMG responses that are distinctive of a positive emotional reaction, for instance, significantly larger zygomaticus responses, compared to pictures of unknown individuals. The present results highlight the importance of verbal instructions in learning threat but also safety associations and call into question the role of loved faces as prepared safety signals.

Funding: This work was supported in part by the German Research Foundation (BU 3255/1-1).

10:30 a.m.-12:00 noon Symposium 2.3

BEYOND OBSERVATION: TRANSCUTANEOUS VAGUS NERVE STIMULATION IN PSYCHOPHYSIOLOGICAL RESEARCH

Session Chairs: Julian Koenig¹; Mathias Weymar²
¹Heidelberg University, ²University of Potsdam

Discussant: Bruce Friedman, Virginia Tech

Transcutaneous Vagus Nerve Stimulation (tVNS) is an emerging method of neuromodulation with critical relevance for psychophysiological research. Allowing for the experimental manipulation of vagal activity, advanced study designs - beyond the pure observation - are feasible at relatively low costs and minimum risk. The symposia will present latest research on tVNS, covering the full range of its application from bench to bedside. Talks will highlight physiological mechanisms of tVNS action, its effects on cognitive processes and pre-clinical studies in psychiatric patients. Research presented aims to understand the pathways involved in eliciting changes in autonomic activity seen with tVNS, focusing on the effects of tVNS on spontaneous cardiac baroreflex sensitivity. Further, the effects of tVNS on fear extinction in context dependent cue conditioning are addressed, illuminating the role of afferent vagal projections to the locus coeruleus-norepinephrine system facilitating attention, learning and memory. Aiming to identify a biomarker for the hypothesized noradrenergic action of tVNS (i.e., pupil size, salivary alpha-amylase), results from studies provide evidence for the mechanism underlying tVNS action on reversal learning. Pre-clinical research presents findings on the effects of acute tVNS on proxies of depression (negativity bias in facial emotion recognition) in adolescents with major depressive disorder. Finally, all talks will address ethical implications of tVNS research and the need to standardize stimulation protocols across labs.

THE EFFECTS OF TRANSCUTANEOUS VAGUS NERVE STIMULATION ON CONTEXT DEPENDENT CUE CONDITIONING: DO THE CONTEXTS OR THE CUES MATTER?

Hannah Genheimer; Marta Andreatta; Paul Pauli
University of Würzburg

Vagus nerve stimulation (VNS) facilitates fear extinction in animals. In humans, transcutaneous VNS (tVNS) has mixed effects meaning extinction facilitation in cue paradigms but no effects on contextual paradigms. Here, we investigated the effects of tVNS in context-dependent cue conditioning. During acquisition, participants received a sham tVNS and were guided into two virtual offices in which two colored lights were alternately switched on. A painful electric stimulus (unconditioned stimulus, US) was administered in one context (anxiety context, CTX+) at the offset of one light (conditioned stimulus, CS+), but never at the offset of the other light (CS-). In the second context (safety context, CTX-), both CS+ and CS- were turned on and off, but never paired with US. During extinction, no US was delivered and participants revisited the two virtual offices with the two lights. Half of the participants received tVNS, while the other half a sham tVNS. Successful cue and context conditioning were indicated by startle potentiation and more aversive ratings for CS+ compared to CS- and for CTX+ compared to CTX-, respectively. Interestingly, startle responses showed slower extinction of cued fear, but faster extinction of contextual anxiety for tVNS versus sham group. In summary, we could demonstrate for the first time a modulation of the conditioned physiological responses by tVNS in humans. The specificity of our effects is in line with the distinction between fear and anxiety learning. However, systematic investigations on the underlying mechanisms of tVNS are still necessary.

THE EFFECTS OF DAILY TRANSCUTANEOUS VAGUS NERVE STIMULATION (TVNS) ON AUTONOMIC TONE

Beatrice Bretherton; Lucy Atkinson; Susan Deuchars;
Jim Deuchars
University of Leeds

In young, healthy adults, a single session of non-invasive transcutaneous electrical stimulation of the vagus nerve (tVNS) promoted parasympathetic and reduced sympathetic activity. Here we test if daily tVNS for 14 days promotes increases in parasympathetic and decreases in sympathetic activity in volunteers aged ≥ 55 years. Twenty-nine healthy participants (11 males) attended on two occasions. During both visits, participants underwent a 10 minute baseline period, 15 minutes of tVNS (administered via a TENS machine bilaterally to the tragus) and a 10 minute recovery period. Heart rate variability (HRV) and baroreflex sensitivity (BRS, responsiveness of changes in RR interval following changes in blood pressure) were derived. Participants self-administered tVNS at home once daily for 15 minutes over 14 days following visit 1. The lab-visit tVNS period was associated with increases in measures of overall variability in heart rate compared to baseline and remained elevated 10 minutes following stimulation. Measures reflecting parasympathetic outflow were improved at visit 2. Resting BRS in visit 1 significantly predicted change at visit 2 baseline: low values in visit 1 were linked with greater increases following 14 days of tVNS. Also, resting sympathetic-parasympathetic balance significantly predicted change to tVNS: low balance was related to greater improvements. These findings therefore show that daily tVNS for 14 days confers autonomic benefits in individuals aged ≥ 55 years. Perhaps daily tVNS helps attenuate autonomic changes that occur with aging.

EFFECTS OF TRANSCUTANEOUS VAGUS NERVE STIMULATION (TVNS) ON SELECTIVE ATTENTION AND EMOTIONAL EPISODIC MEMORY: FINDINGS FROM ERP RESEARCH

Mathias Weymar¹; Carlos Ventura-Bort¹; Janine Wirkner²; Hannah Genheimer³; Julia Wendt²; Alfons Hamm²
¹University of Potsdam, ²University of Greifswald, ³University of Würzburg

Recent research indicates that non-invasive stimulation of the afferent auricular vagal nerve (tVNS) may modulate various cognitive and affective functions, likely via activation of the locus coeruleus-norepinephrine (LC-NE) system. In a series of ERP studies we found that the attention-related P300 component is enhanced during continuous vagal stimulation, compared to sham, which is also related to increased salivary alpha amylase levels (a putative indirect marker for central NE activation). In another study, we investigated the effect of continuous tVNS on the late positive potential (LPP), an electrophysiological index for motivated attention toward emotionally evocative cues, and the effects of tVNS on later recognition memory (1-week delay). Here, vagal stimulation prompted earlier LPP differences (300-500 ms) between unpleasant and neutral scenes. During retrieval, vagal stimulation significantly improved memory performance for unpleasant, but not neutral pictures, compared to sham stimulation, which was also related to enhanced salivary alpha amylase levels. In line, unpleasant images encoded under tVNS compared to sham stimulation also produced enhanced ERP old/new differences (500-800 ms) during retrieval indicating better recollection. Taken together, our studies suggest that tVNS facilitates attention, learning and episodic memory, likely via afferent projections to the arousal-modulated LC-NE system. We will, however, also show data that point to critical stimulation parameters (likely duration and frequency) that need to be considered when applying tVNS.

EFFECTS OF TRANSCUTANEOUS VAGUS NERVE STIMULATION (TVNS) ON REVERSAL LEARNING, PUPIL SIZE, SALIVARY ALPHA-AMYLASE, AND CORTISOL

Martina D'Agostini¹; Andreas Burger¹; Nathalie Claes¹;
Mathias Weymar²; Ilse Van Diest¹
¹KU Leuven, ²University of Potsdam

Transcutaneous vagus nerve stimulation (tVNS) accelerates extinction learning in humans. Findings from animal studies employing invasive VNS suggest an enhancement in central Noradrenaline (NA) as a possible mechanism underlying such findings. This study aims to investigate whether tVNS enhances reversal learning and error-driven attention in a predictive-learning task, and whether tVNS increases tonic NA activity and cortisol. Seventy-one healthy participants were randomly assigned to receive electrocutaneous stimulation on either the cymba concha (tVNS) or lobe (sham) of the left ear. After learning a series of cue-outcome associations during the acquisition phase, participants received the stimulation 10 minutes before and during a reversal learning phase, where cue-outcome associations were changed for some cues but not for others. Percentage of correct predictions and change in pupil size (PS) in anticipation of the outcome (i.e., index of error-driven attention) were assessed. In addition, tonic PS, salivary alpha-amylase (sAA; both employed as NA biomarkers), and cortisol were assessed at three points in time: t0 (prior to acquisition), t1 (after acquisition but prior to stimulation), and t2 (after reversal). Preliminary findings indicate that there was no significant difference between tVNS and sham on reversal learning and sAA. In line with our hypothesis, tVNS (vs. sham) increased cortisol at t2 compared to t1 (partial $\eta^2 = .05$). These findings will contribute to understand the mechanisms underlying the effects of tVNS on associative learning.

Funding: FWO Strategic basic research PhD fellowship [194599] granted to Martina D'Agostini and "AstheneS" long-term structural funding [METH/15/011] granted to Johan Vlaeyen, Ilse Van Diest, Andreas von Leupoldt and Omer Van den Bergh.

ACUTE TRANSCUTANEOUS VAGUS NERVE STIMULATION ALTERS EMOTION RECOGNITION IN ADOLESCENT MAJOR DEPRESSION

Julian Koenig¹; Peter Parzer¹; Niklas Haigis¹; Jasmin Liebemann¹;
Tamara Jung¹; Franz Resch¹; Michael Kaess²
¹Heidelberg University, ²University of Bern

Transcutaneous vagus nerve stimulation (tVNS) is a promising therapeutic option for major depressive disorder (MDD) in adults. Alternative third-line treatments for MDD in adolescents are scarce. In a pre-clinical experimental trial, we evaluated the effects of acute tVNS on emotion recognition in adolescents with MDD. Adolescents (14-17 years) with MDD ($n = 33$) and non-depressed controls ($n = 30$) received tVNS or sham-stimulation in a cross-sectional, case-control, within-subject cross-randomized controlled trial, while performing different tasks assessing emotion recognition. Simultaneous recordings of electrocardiography and electrodermal activity as well as sampling of saliva for the determination of α -amylase, were used to quantify effects on autonomic nervous system function. tVNS altered response inhibition on the emotional Go/NoGo-task. Specifically, tVNS increased the likelihood of omitting a response towards sad target-stimuli in adolescents with MDD, while decreasing errors (independent of the target emotion) in controls. Effects of acute tVNS on autonomic nervous system function were found in non-depressed controls only. Acute tVNS alters the recognition of briefly presented facial expressions of negative valence in adolescents with MDD while generally increasing emotion recognition in controls. tVNS seems to specifically alter early visual processing of stimuli of negative emotional valence in MDD. These findings suggest a potential therapeutic benefit of tVNS in adolescent MDD that requires further evaluation within clinical trials.

Funding: The project was funded through a Post-Doctoral Scholarship (JK) provided by the Daimler and Benz Foundation (Ladenburg, Germany) and the Thrasher Research Fund Early Career Award provided (JK) by the Thrasher Research Fund (Salt Lake City, UT, USA).

**10:30 a.m.-12:00 noon
Symposium 2.4**

**THE USE OF VIRTUAL-REALITY IN
PSYCHOPHYSIOLOGY: A CASE FOR GOAL-DIRECTED
NAVIGATION RESEARCH**

Session Chair: Travis Baker

Center for Molecular and Behavioral Neuroscience, Rutgers University

Goal-directed navigation has been studied for more than a century in animal experiments, and continues to produce a wealth of information about spatial cognition, reinforcement learning, and decision making. Only recently has the development of combined psychophysiological and virtual-reality (VR) methods made goal-directed navigation amenable for investigation in humans. This pairing of methodology offers a number of advantages afforded over traditional experimental apparatus such as tighter control of the environment and creating more ecologically valid stimulus presentation and response protocols. In this symposium, we will begin by discussing the latest advancements in combining wireless EEG (Ekstrom) and intracranial EEG (Jacobs) recordings with VR to investigate the neural correlates of spatial navigation. We will discuss recent efforts to challenge the brain's noradrenergic system using a continuous, naturalistic motorway driving paradigm, combined with eye tracking and EEG (Reid). We will then discuss recent advancements in combining transcranial ultrasound with EEG recordings to investigate neural correlates of approach and avoidance behavior during virtual navigation (Rodrigues). This symposium will finish by proposing that imaging humans navigating VR environments can be utilized as a powerful translational model by which to map the dynamic interaction between disparate neural systems underlying "real-life" goal-directed behavior in both health and disease (Baker).

**WIRELESS SCALP EEG AND IMMERSIVE VIRTUAL
INTERFACES PROVIDE NOVEL INSIGHT INTO THE
NEURAL BASIS OF HUMAN SPATIAL NAVIGATION**

Arne Ekstrom; Mingli Liang; Michael Starett
University of Arizona

Most approaches to understanding human spatial navigation involve navigation with desktop computers, which provide an incomplete sampling of the rich set of body-based cues involved in navigation. In addition, many such studies involve invasive recordings from the human brain, which are limited to clinical situations. Here, we present a novel experimental set-up combining wireless non-invasive neural recordings and virtual reality with free ambulation to investigate the neural correlates of space/time information during spatial navigation. In our first study, we found that frontal-midline delta-theta oscillations increased during movement compared to standing-still periods, suggesting a role of cortical low frequency oscillations in navigation. In a follow-up study, we aim at identifying the precise drivers of such low-frequency oscillations. Participants navigate in a virtual plus maze, with four possible targets. Before looking for a target, they enter a teleporter inside the maze, and the spatial/temporal characteristics of such teleporters will give participants cues of where they should go next. Analyses will test whether frontal low-frequency oscillations code spatial/temporal information during navigation. Together, our novel approach allows the unprecedented opportunity to record from the healthy human brain simultaneously during navigation approximating our real-world experience, providing insight into how low-frequency oscillations code aspects of space and time during navigation.

Funding: National Science Foundation (NSF BCS-1630296) (to A.D.E.).

**MULTIPLE HIPPOCAMPAL THETA OSCILLATIONS
SUPPORT HUMAN SPATIAL NAVIGATION AND
MEMORY**

Joshua Jacobs
Columbia University

In my talk I will discuss my lab's research probing the neural basis of human spatial memory and navigation using direct brain recordings from neurosurgical patients. A key goal of my work is to explain the electrophysiological role of the human hippocampus, which is a structure that is known to be critical for both navigation and memory. Whereas our current understanding of the electrophysiology of navigation and memory is largely derived from studies in rodents, I will show new data indicating the human hippocampus exhibits distinctive patterns that were unexpected from animal studies. In this work, neurosurgical patients with electrodes implanted in their hippocampus played virtual-reality spatial navigation and memory tasks and we compared

the properties of their electrical brain activity with multiple aspects of task behavior. Whereas previous studies based on animal models suggested that a single hippocampal 'theta' oscillation at ~8 Hz coordinated both memory and navigation, instead we show that the human hippocampus exhibits two anatomically different patterns of theta with functional characteristics: a slower anterior rhythm related to memory and a faster posterior signal related to spatial navigation. These results demonstrate that the electrophysiological signatures of spatial processing in humans differ from signals found in rodents and, more generally, illustrate the potential for performing detailed research on the human electrophysiology of spatial cognition using direct brain recordings in conjunction with virtual reality.

Funding: NIH, NSF.

**DRIVING THE LOCUS COERULEUS USING A
NATURALISTIC DRIVING TASK**

Andrew Reid
University of Nottingham

The locus coeruleus (LC) is a small brainstem nucleus that hosts the majority of the brain's noradrenergic (NE) neurons. LC/NE activity has a global neuromodulatory influence on brain activity, and can be roughly classified into tonic and phasic modes. The balance between these modes has been proposed to subserve an "adaptive gain" mechanism, influencing arousal, alertness, and cognitive performance (see Aston-Jones & Cohen, 2005, for a comprehensive review). While the LC/NE system is a dynamic neuromodulatory system, responding to environmental stressors in a continuous manner, to date its function has primarily been assessed under non-dynamic, highly-controlled laboratory conditions. In this talk, I will present my recent efforts to challenge the LC/NE system using a continuous, naturalistic motorway driving paradigm, combined with eye tracking and EEG. Pupillometry has been established as a reliable proxy measure for LC/NE activity, and thus serves as a means of estimating its function in the absence of other more direct observations. Our recent findings indicate a robust event-related pupil dilation occurring around decisions of whether to overtake other vehicles on the motorway, and this dilation is modulated by the difficulty of the traffic scenario. Mean pupil diameter was also generally higher across overtake periods versus baseline periods where no traffic was present. Additionally, initial EEG results indicate a robust ERP response, predominantly in medio-frontal electrodes, time-locked to button press events corresponding to the onset of an overtake maneuver.

Funding: Radboud Excellence Fellowship.

**STILL SOUNDS LIKE APPROACH: AN UPDATE ON
TRANSCRANIAL ULTRASOUND OVER RIGHT
INFERIOR FRONTAL CORTEX LEADING TO APPROACH
BEHAVIOR IN AMBIGUOUS SITUATIONS IN A VIRTUAL
T-MAZE**

Johannes Rodrigues¹; Philipp Ziebell¹; John Allen²;
Johannes Hewig¹

¹Universität Würzburg, ²University of Arizona

Transcranial ultrasound (TUS) is a relatively new non-invasive neuromodulation for human use (Fini & Tyler, 2017). TUS has several advantages over other procedures like tDCS or TMS, due to a more focused application (Tyler et al., 2008), the ability to reach deep targets, and avoidance of unpleasant side-effects (e.g. headaches or skin irritation, Tyler, 2011). Hameroff and colleagues (2013), Sanguinetti and colleagues (2014) and Reznik, Sanguinetti and Allen (2017) showed for pain patients, healthy subjects and depressed participants a change to positive mood after TUS delivered over the right trans-temporal window. This would be consistent with the inhibition of the withdrawal system proposed by the theory of frontal asymmetry by Davidson (1984). Therefore, TUS may also influence behavior, especially if the positive affect can be used as a cue for a behavioral decision in ambiguous situations. This hypothesis was tested in a virtual T-maze on three different days following delivery of either no TUS, TUS, or sham TUS. The T-Maze required the participants to use a joystick to approach or withdraw from potential reward or punishment stimuli following a cue. As expected, the participants showed more approach behavior in ambiguous cue situations after the real TUS. Also, after real TUS, the subjective rating of conflict was lower than with sham or no TUS. These results suggest that TUS may influence behavior and that it could be used in further studies on patients to amplify their approach behavior and lower their sense of conflict, for example in anxiety or affective disorders.

Funding: Universität Würzburg: Faculty of human sciences.

A COMPREHENSIVE MAP OF GOAL-DIRECTED NAVIGATION IN THE HUMAN BRAIN

Travis Baker
Rutgers University

Most species spend a great deal of their wakeful lives navigating their environments towards a selected goal, such as locating food, water, mates, shelter or avoiding danger. For decades, T-maze paradigms have been used extensively across several animal species to investigate this “real-life” goal-directed behavior. The simplicity of the T-maze paradigm belies its utility and versatility for examining goal-directed navigation, and such investigations have produced a wealth of information about spatial learning and memory, reinforcement learning, and decision making. This line of research has also indicated that animals bind reinforcement experience with spatial context in the service of common goals, a process coordinated by multiple interacting neural systems. Yet, in humans, the interaction between these systems during goal-directed behavior is still poorly understood. In this talk, I will present a comprehensive analysis of human electrophysiological and hemodynamic responses to reinforcement in a virtual reality T-maze paradigm, providing new evidence for this high-level integration of spatial and reinforcement information in humans. When paired with large-scale data repositories, the results presented will reveal the spectral, temporal, and spatial architecture of goal-directed navigation in humans. Together, I propose that imaging humans navigating a simple virtual T-maze can be utilized as a powerful translational model by which to map the dynamic interaction between disparate neural systems underlying “real-life” goal-directed behavior in both health and disease.

Funding: Canadian Institute of Health Research, Jeanne Timmins Costello Fellowship McGill University, Rutgers University.

3:00 p.m.-4:30 p.m.
Presidential Symposium 3.1

IMITATION, SYNCHRONIZATION AND EMPATHY: EVIDENCE FROM BRAINS, BODIES AND BOTS

Session Chairs: Catherine Norris¹; Ursula Hess²
¹Swarthmore College, ²Humboldt University of Berlin

Human beings are social creatures and interact with others in social contexts. In recent years research has moved from studying humans alone in “context-free” situations to assessing social interactions in context. During social interactions, interaction partners often synchronize at the level of physiology, expression and behavior. The presidential symposium comprises four talks which focus on the function of synchronization in different social context.

IS PHYSIOLOGICAL LINKAGE BETWEEN PEOPLE GOOD OR BAD? IT DEPENDS...

Emily Butler
University of Arizona

Ample evidence shows that when people interact their autonomic physiology (e.g., heart rate, skin conductance, etc.) becomes coordinated. On the one hand, this physiological linkage may provide an automatic and unconscious basis for joint action (e.g., coordinating behavior to achieve shared goals) and co-regulation (e.g., coordinated emotional responding that contributes to psychological and physiological homeostasis). On the other hand, physiological linkage may exacerbate conflict and perpetuate negative emotional exchanges between partners. I will discuss three factors that may help to explain when physiological linkage will be good or bad: 1) interpersonal context (arguing with someone versus trying to take their perspective), 2) which physiological indicator is involved (sympathetic versus parasympathetic nervous system), and 3) the pattern of coordination (rising and falling in synchrony versus anti-synchrony; oscillations that become more or less stable). Finally, I will introduce a new R statistical package that simplifies testing whether different patterns of interpersonal physiological coordination predict different outcomes in different circumstances.

DYNAMIC EMERGENCE OF SOCIAL CONNECTION THROUGH SYNCHRONOUS MOVEMENT

Kerry Marsh
University of Connecticut

Research suggests that being spontaneously pulled into synchrony with the incidental movements of another person may be the basis of forming minimal connections with others. Continuous motion tracking of individuals while they shake maracas, or sit in rocking chairs yields patterns of synchrony states that closely follow the predictions of bidirectional coupling models developed for the mechanical coupling of metronomes and biomechanical coupling of limbs on an animal's body. Surprisingly though, interpersonal research illustrates that mere informational coupling yields these emergent social unity states, or social “synergies”. Lab experiments manipulating visual or auditory information, and contextual variables, illustrate the conditions under which synchronous states emerge and their links to social connection. The importance of apparently low-level perceptual and motoric behavior for grounding people in their physical and social world is also illustrated by research examining populations with unique perceptual differences (students with dyslexia) and more profound motoric and perceptual challenges (children with autism spectrum disorder). Findings from such research raises the question as to whether difficulties responding to the natural rhythms of the world may untether one socially as well.

HOW WE CONNECT: FROM SHARED ATTENTION TO SOCIAL NETWORKS

Thalia Wheatley
Dartmouth College

The human mind evolved to be massively interactive with other minds. A deep understanding of human thought and behavior will therefore require research that incorporates the social context. In this talk I will present behavioral and neuroimaging studies that demonstrate how people interact in ways that synchronize attention and align their mental models and how this alignment predicts influence and friendship in real-world social networks.

SPONTANEOUS IMITATION IN SOCIAL COGNITION: FACES, GESTURES, AND CONCEPTS

Piotr Winkielman
University of California, San Diego

My talk will address the role of spontaneous imitation in social cognition, focusing on the domain of facial expressions and gestures. I will present data that bear on three questions: First, does spontaneous imitation facilitate conceptual understanding? Second, is spontaneous mimicry driven by associative processes or reflects goals and context? Third, what mechanisms of imitation are revealed by studying atypical individuals and robots. The presented data will suggest a dynamic, context-sensitive, and somewhat limited causal role of imitation in social cognition.

**3:00 p.m.-4:30 p.m.
Symposium 3.2**

**METHODOLOGICAL AND STATISTICAL
CONSIDERATIONS FOR ASSESSING AND
INTERPRETING CHILDREN'S AUTONOMIC STRESS
PHYSIOLOGY**

Session Chair: Kristen Rudd
University of California, Riverside

Discussant: Elizabeth Davis, University of California, Riverside

Physiological self-regulation is a key component of child development and overall adaptive functioning (Gross et al., 2014). However, the complex interplay within and across these systems raises concerns regarding methodological design, statistical analysis, and interpretation. This symposium will illustrate and redress these concerns across three paper presentations that demonstrate innovative approaches to capture autonomic nervous system (ANS) regulation regarding a) parasympathetic and sympathetic coordination, b) dynamic ANS assessments, and c) co-regulatory influences of parent-child ANS processes. The first paper presents findings regarding the reliability and utility of three competing analytic approaches for assessing sympathetic and parasympathetic ANS coordination. The second paper considers the problematic disconnection between the theorized dynamic modulation of ANS physiology and the typically static assessments of current practice to illustrate a novel approach to capture response variability and dynamic ANS processes. The third paper utilizes innovative second-by-second behavioral state space grid coding to evaluate the link between parent-child co-regulation and children's parasympathetic response and recovery. As discussed by a preeminent scholar in the field, these papers will encourage scientists to reflect on the applied value of methodological and statistical techniques to capture ANS processes across coordinating regulatory and relational systems, over time, and in consideration of *all* phases of the stress response from rest to reactivity to recovery.

**ASSESSING COMPETING APPROACHES FOR
UNDERSTANDING SYMPATHETIC AND
PARASYMPATHETIC REGULATORY COORDINATION**

Kristen Rudd¹; Abbey Alkon²; Tuppett Yates¹

¹University of California, Riverside, ²University of California, San Francisco

The autonomic nervous system (ANS) is comprised of parasympathetic and sympathetic branches, which control core adaptive systems (Berntson, 1994). Despite their heavily interconnected functions, research examining coordinated ANS regulation is limited. Among the studies that do exist, each has used a different methodological approach (e.g., profiles, interactions, *or* balance), and this analytic pluralism has stymied advances in our understanding of ANS regulation as a dynamic system of complementary activity. The current study compared 3 approaches for assessing ANS coordination, or the degree to which parasympathetic and sympathetic systems respond according to theorized reciprocal activation patterns, in a diverse community sample of 215 children ($M_{age} = 6.2$ years; 50% male). Findings suggest that across two different reactivity tasks, profile analyses were the most robust assessment of ANS regulation for understanding children's competence. Interaction analyses were only significant within one reactivity task and suggest interactions may provide more detailed information on the relation between branches of the ANS within larger samples. Balance-based analyses were not significant across either task. This comparative analysis affords a unique opportunity to evaluate the reliability and utility of 3 analytic approaches to study joint parasympathetic and sympathetic regulation. Further discussion also highlights the task-specific response patterns of the ANS (i.e., parasympathetic and sympathetic augmentation vs. withdrawal) across the varied reactivity paradigms in this study.

Funding: NSF Developmental and Learning Sciences DLS-0951775.

**A METHODOLOGICAL CONTRIBUTION TO
UNDERSTANDING PHYSIOLOGICAL SELF-
REGULATION**

Keira Leneman; Daniel Berry
University of Minnesota

In daily life, self-regulation involves the dynamic modulation of physiology and behavior to changing environmental demands (e.g. Montroy et al., 2016; McEwen and Wingfield, 2010). In practice, physiological dynamics are often obscured by rather static comparisons of baseline and challenge conditions. The aim of the present pilot study was to better capture this dynamic nature of self-regulation. Twenty-seven individuals (ages 18-39, mean = 23) were presented with a series of lab-based tasks, alternating between resting baselines, active baselines, and four different challenges (total tasks = 14). RSA and PEP were estimated from cardiac time-series data collected via ECG and ICG during the tasks, indexing parasympathetic and sympathetic activity, respectively. This design enabled us to test the repeated reactivity, recovery, and internal organization of autonomic processes. Preliminary descriptive results demonstrate notable individual differences in physiological variability. For RSA, and also PEP, there were clear distinctions between those that fluctuated dramatically across tasks and those that remained stable. We are presently leveraging idiographic and nomothetic methods to model individual differences in the organization of individuals' physiological response patterns across the task battery. Investigating physiological regulation in this more nuanced way will help clarify the process of dynamic adjustment to the environment, with the hypothesis that lower regulatory capacities will be related to less variability in physiological responding across a variety of tasks.

Funding: Institute of Child Development Small Grant.

**PARENT-CHILD CO-REGULATION AND YOUNG
CHILDREN'S PHYSIOLOGICAL RESPONSE TO
EMOTIONAL CHALLENGE**

Emma Armstrong-Carter; Jelena Obradović; Michael Sulik
Stanford University

Physiological sensitivity to contextual challenges has been linked to self-regulatory skills in young children. For example, moderate decreases in respiratory sinus arrhythmia (RSA), an index of parasympathetic nervous system, were associated with greater executive functions in preschoolers (Marcovitch et al., 2010). The quality of parent-child interactions has also been shown to relate to children's physiology (Miller et al., 2013). Thus, we examine how the quality of parent-child interaction relates to children's physiological response during and after an emotional challenge. 102 children ($M_{age} = 5.6$ years) and caregivers participated in four interaction tasks. Their behaviors were coded second-by-second on a state space grid: a new dynamic measure of parent-child positive co-regulation (PCR). Children also completed Perfect Circles task, designed to elicit frustration in response to adult's negative feedback. Physiological response was assessed with RSA, an index of children's capacity to regulate emotional arousal. Multilevel models tested PCR as a predictor of individual differences in RSA trajectories during reactivity to and recovery from the challenge. Children in high PCR dyads showed moderate RSA decreases during and after challenge. Moderate RSA decrease during challenge has been previously linked with better attention and engagement (Calkins et al., 2007). In contrast, children in low PCR dyads showed no RSA decrease during challenge, but a large decrease immediately afterwards, indicating possible emotion dysregulation in response to adult negative feedback.

**3:00 p.m.-4:30 p.m.
Symposium 3.3**

**AN IMPROVED UNDERSTANDING OF THE
COGNITIVE CONTROL SYSTEM THROUGH THE
INTEGRATION OF COMPUTATIONAL MODELING AND
ELECTROPHYSIOLOGY**

Session Chair: George Buzzell
University of Maryland

Cognitive control reflects the ability to monitor and adapt performance in the service of goal-directed behavior. This includes *performance monitoring* to detect when control might be needed, and the recruitment of top-down *control* to achieve task goals. While fMRI research has provided an increasingly detailed anatomical description of the neural systems involved in cognitive control, including links to medial frontal cortex (MFC) and other fronto-parietal regions, some of the earliest studies of cognitive control in humans employed a combination of electrophysiological methods and computational modeling approaches. As the cognitive neuroscience of cognitive control approaches 30 years of inquiry, there is an increasing need to employ electrophysiological methods—particularly in combination with computational modeling approaches—to characterize the rapid, complex, and sometimes counterintuitive nature of cognitive control. Across four talks, this symposium will survey recent examples of combining electrophysiology (EEG, MEG) and various computational modeling approaches to provide a more fundamental understanding of cognitive control. In particular, we provide examples of characterizing the electrophysiological correlates of reward prediction errors (RPEs; talk 1), associations between RPEs and episodic encoding (talk 2), modeling work distinguishing between subprocesses involved in error monitoring (talk 3), and individual differences in how error monitoring relates to subsequent control (talk 4).

**DECODING REINFORCEMENT-LEARNING SIGNALS
FROM FEEDBACK-LOCKED EEG DYNAMICS**

Markus Ullsperger
Otto-von-Guericke University Magdeburg

To understand the mechanisms guiding future decisions based on action outcomes has been in the focus of research for more than two decades. Event-related potentials (ERP) related to performance monitoring such as the feedback-related negativity (FRN) have played a major role in these research efforts. In a seminal paper, Holroyd and Coles (2002) suggested the FRN to reflect a teaching signal used to update value representations which, in turn, guides future decisions. Accordingly, the FRN is proposed to represent a key parameter of reinforcement learning (RL), the reward prediction error (RPE). Due to averaging, ERPs are poorly suited to directly test this hypothesis, as the RPE varies from trial to trial. Model-based analysis of single-trial EEG dynamics, in contrast, enables investigating whether cortical activity related to feedback processing represents RL parameters. In a series of instrumental learning studies using model-based single-trial regression analysis we showed that the EEG in the time range of the FRN indeed covaries with the RPE. By regressing both expected value and outcome against the EEG we confirmed that axiomatic indices of reinforcement learning contribute to the FRN. Furthermore, we showed that the learning rate, which weights the RPE for value updating, is reflected in a sustained centrally distributed positive shift of the EEG spanning the time range of the FRN, P3a and P3b. Finally, I will discuss results suggesting a close relationship of working memory capacity and reversal learning and their EEG correlates.

**MEMENTO MALUM: NEGATIVE PREDICTION ERRORS
BOOST EPISODIC ENCODING**

James Cavanagh¹; Brian Coffman²; Daniel Dillon³
¹University of New Mexico, ²University of Pittsburgh School of
Medicine, ³Harvard Medical School

Recent theoretical work has suggested that prediction errors should trigger encoding and thereby enhance memory. To test this idea, we recorded MEG while human participants completed a reinforcement learning task with trial unique stimuli. Hierarchical drift diffusion modeling revealed how larger negative prediction errors during encoding were associated with a

significantly larger drift rate (more accurate memories) during recognition. MEG beamforming revealed increased theta band power in right orbitofrontal cortex (OFC) during large negative prediction errors and activation of this area and left parahippocampal cortex (PHC) during encoding predicted memory accuracy. Right OFC was also active during successful retrieval attempts, suggesting reinstatement of encoding activity. In sum, we found support for the idea that negative prediction errors should enhance episodic encoding, and we also identified a candidate neural mechanism: theta band phase synchrony between right OFC and left PHC during encoding, with reactivation of right OFC during recognition.

**MODELING ERROR DETECTION AND ERROR
EVALUATION IN THE MEDIAL FRONTAL CORTEX**

Marco Steinhauser; Martin Maier
Catholic University of Eichstätt-Ingolstadt

Current theories of error monitoring can explain how errors are detected and how this is reflected in neural activity in the medial frontal cortex, such as the error-related negativity in event-related potentials. However, little is known how the brain evaluates the type of error and derives which adaptive adjustments of attention and behavior are required to prevent these errors in the future. Here, we present a computational model that provides a parsimonious account of this ability. It assumes that error monitoring involves two processes: An error detection process that identifies whether an error has occurred, and an error evaluation process that utilizes error precursors to predict the type and source of an error. The model creates not only an internal representation of error sources and error types, but also learns to derive appropriate adaptive adjustments. We apply this model to account for behavioral data and event-related potentials in paradigms in which different types of errors can occur, such as attention errors versus non-attention errors, or errors associated with different costs. Finally, we demonstrate that this model can be viewed as a generalization of existing models and discuss how the two processes are mapped on neural generators of the error-related negativity.

**CLARIFYING THE LINK BETWEEN PERFORMANCE
MONITORING AND CONTROL IN ADOLESCENTS WITH
A HISTORY OF BEHAVIORAL INHIBITION**

George Buzzell¹; Alec Solway¹; Edward Bernat¹;
Santiago Morales¹; Tyson Barker²; Sonya Troller-Renfree³; Heather
Henderson⁴; Daniel Pinne⁵; Nathan Fox¹

¹University of Maryland, ²University of Oregon, ³Columbia University,
⁴University of Waterloo, ⁵National Institute of Mental Health

When humans commit errors, increased theta power over medial frontal cortex (MFC) is linked to *performance monitoring* and detecting such errors typically leads to behavioral changes reflecting increased *control* on subsequent trials. However, behavior does not always improve following errors and activation of the performance monitoring system can sometimes lead to decreased control. Across development or different psychological disorders, performance monitoring may differentially associate with increased vs. decreased control. For example, the temperament of behavioral inhibition (BI)—one of the best early risk markers for anxiety—is associated with overactive performance monitoring; yet, it remains unclear whether such overactive performance monitoring leads to increased or decreased control. Here, 122 adolescents assessed for BI in toddlerhood performed a flanker task while EEG was recorded. Combining analysis of error-related MFC theta power and hierarchical drift-diffusion modelling (HDDM) of post-error behavior, we tested whether overactive performance monitoring predicts increased/decreased control for those with a history of BI. A three-way interaction was present ($b = .18$; 95% CI = .04 – .32); such that for those high in BI, error-related MFC theta power (performance monitoring) predicted post-error increases in the HDDM boundary separation parameter (increased control). These results clarify aspects of the neurocognitive phenotype associated with early risk for anxiety; further implications for understanding links between BI and anxiety will also be discussed.

**3:00 p.m.-4:30 p.m.
Symposium 3.4**

**DEPRESSION AND BLUNTED NEURAL RESPONSE
TO REWARD: INCREASING SPECIFICITY AND
PROSPECTIVE ASSOCIATIONS**

Session Chairs: Greg Hajcak; Julia Klawohn
Florida State University

Discussant: Greg Hajcak, Florida State University

Depression is associated with reduced neural response to the receipt of reward, evident in a blunted ERP referred to as the reward positivity (RewP). The current symposium focuses on the nature of this association, especially in terms of prospective changes. Klawohn et al. report data in which both the RewP and the late positive potential (LPP) to pleasant pictures are independent predictors of clinical depression and relate to different symptom measures within depressed adults; these measures are also examined in relation to within-person changes in symptoms. Barch et al. similarly find reduced RewP and LPP in a large sample of children with preschool onset depression; moreover, the authors find that LPP predicts treatment response, whereas the RewP is normalized following treatment as a function of treatment-related reductions in depression. Weinberg et al. examine the RewP in the context of social reward—linking reduced social RewP to history of and familial risk for depression and to poorer peer functioning both in and out of the lab; additionally, Weinberg et al. suggest that greater sensitivity to social reward moderates the impact of interpersonal stress on depressive outcomes. Finally, Mumper and colleagues present data on determinants of the developmental trajectory of the RewP—finding that both temperamental behavioral inhibition and the experience of peer stress reduce developmental increases in the RewP from age 9 to 12. Collectively, these studies highlight how ERPs can be used to study normative development, risk, and the etiopathogenesis of depression.

**INSENSITIVITY TO REWARD AND PLEASANT PICTURES
IN DEPRESSION: EVIDENCE FOR INDEPENDENT
DEFICITS AND RELATION TO SYMPTOMS CROSS-
SECTIONALLY AND PROSPECTIVELY**

Julia Klawohn; Alec Bruchnak; Nicholas Santopetro; Greg Hajcak
Florida State University

Multiple studies have found a reduced reward positivity (RewP) among adults and children with major depressive disorder (MDD). Event-related potential studies have also found blunted neural responses to pleasant pictures in MDD. These deficits have been interpreted broadly in terms of anhedonia and decreased emotional engagement characteristic of depression. In the current study, a community-based sample of 83 participants with current MDD and 44 healthy individuals performed both a guessing task and a picture viewing paradigm that included neutral and pleasant pictures to assess the RewP and the LPP, respectively. We found that both reduced RewP and LPP were reduced in the MDD group; moreover, these effects were specific to reward and pleasant picture trials, and were independent predictors of MDD status. Within the MDD group, we found an age-moderated association of RewP with lack of mood reactivity—a core symptom of the DSM melancholic subtype—indicating that a smaller RewP predicted impaired reactivity in younger but not older MDD. Within the MDD group, smaller LPP amplitudes were associated with increased PID-5 anhedonia scores, but not the mood reactivity symptom of melancholic depression. These data replicate separate previous lines of work in MDD, and further suggest that a blunted RewP and LPP are independent neural deficits in MDD. All participants are returning to the lab 8 to 10 months after their initial lab visit, so that we can examine how both the RewP and LPP relate to the persistence or remission of specific symptoms of depression.

**ERP INDICATORS OF ANHEDONIA: PREDICTORS
AND MECHANISMS OF TREATMENT CHANGE
IN A RANDOMIZED CLINICAL TRIAL IN EARLY
CHILDHOOD DEPRESSION**

Deanna Barch¹; Diana Whalen¹; Kirsten Gilbert¹; Danielle Kelly¹; Emily Kappenman²; Greg Hajcak³; Joan Luby¹
¹Washington University in St Louis, ²San Diego State University,
³Florida State University

Depression across the lifespan, including early childhood, is associated with anhedonia and reduced ERP responses to rewarding (i.e., the Reward Positivity, RewP) and emotional (i.e., the late positive potential, LPP) stimuli. However, it is not yet clear whether these neural measures are indicators of target engagement or treatment outcome in young children. We measured ERP responses to win and loss feedback in a guessing task and to pleasant versus neutral pictures in young depressed children (4.0 to 6.9 years) before and after randomization to either 18 weeks of Parent Child Interaction Therapy – Emotion Development (PCIT-ED) or waitlist (WL). Analyses included RewP data from 118 children randomized to PCIT-ED and LPP data from 99 children. Children in PCIT-ED showed a greater reduction in anhedonia than children in WL. RewP increased more for PCIT-ED compared to WL, and a greater change in RewP was associated with a greater reduction in MDD symptoms across the course of treatment. Baseline RewP did not predict treatment change. The LPP did not change with treatment, but increased baseline LPPs predicted a higher likelihood of remission from depression in PCIT-ED. These data indicate that the ERP reward response improved in young children with depression during a treatment designed to enhance emotion development, providing evidence of target engagement of the neural systems associated with reward. Further, the LPP data suggest that neural correlates of emotional engagement can predict which children are most likely to respond to treatment.

**WITH FRIENDS LIKE THESE: NEURAL RESPONSES
TO PEER FEEDBACK IN DEPRESSION AND RISK FOR
DEPRESSION**

Anna Weinberg¹; Paige Ethridge¹; Clara Freeman¹;
Samantha Pegg²; Melanie Dirks²; Autumn Kujawa²
¹McGill University, ²Vanderbilt University

One of the strongest predictors of depression is maternal history of the disorder, and adolescent daughters of depressed mothers are at particularly high risk. However, half of the children of depressed parents will *not* develop depression themselves, indicating a need for more specific risk markers. Moreover, the mechanisms of intergenerational transmission are not clear, though data suggest that neural response to reward plays a role. Yet, while informative, previous studies have focused on cues that do not have specific relevance to MDD (e.g., monetary incentives). Deficits in *social* functioning play a critical role in the etiology and maintenance of MDD, particularly for women, making careful study of neural responses to social reward imperative. This talk, therefore, will focus on event-related potential (ERP) data showing that women with remitted depression show a blunted reward positivity (RewP) to positive feedback from peers and, moreover, that their never-depressed adolescent daughters show this same deficit, suggesting this blunted RewP may be a marker of vulnerability for depression relapse as well as first onset. I will also present data demonstrating that the blunted RewP relates to less adaptive behavior in a peer interaction task, as well as poorer friendship quality outside of the lab, suggesting these neural responses are implicated in interpersonal behavior. And finally, I will discuss data indicating a larger RewP to social acceptance may buffer against the deleterious effects of interpersonal stress, resulting in reduced symptoms of depression.

INFLUENCE OF ENVIRONMENTAL STRESS AND TEMPERAMENT ON TRAJECTORIES OF REWARD SENSITIVITY

Emma Mumper¹; Sara Bufferd²; Ellen Kessel¹; Autumn Kujawa³; Daniel Klein¹

¹Stony Brook University, ²California State University, ³Vanderbilt University

Reward sensitivity appears to increase from childhood to early-mid adolescence, and abnormal reward processing contributes to subsequent psychological problems. However, little is known about distal and proximal influences on developmental trajectories of reward sensitivity. Growing literatures suggest that temperamental fearfulness (i.e. behavioral inhibition) predicts subsequent perturbances in neural responses to reward-based cues, and exposure to stress attenuates reward sensitivity. Peer relationships are a particularly salient source of stress in adolescence. This study examined if early childhood BI and peer stress in early adolescence predicted the developmental trajectory of reward sensitivity from late childhood (age 9) to early adolescence (age 12). The sample consisted of a community sample of 313 youth. Reward sensitivity was indexed by the Reward Positivity (RewP), a frontocentral ERP which reflects sensitivity to reward versus loss. The children participated in a laboratory assessment of BI at age 6, were interviewed with the UCLA Life Stress Interview at age 12, and completed ERP assessments at ages 9 and 12. Greater BI and peer stress independently predicted a lower RewP at age 12, adjusting for RewP at age 9. These findings indicate that BI and peer stress both contribute to blunted trajectories of reward sensitivity during the transition from childhood to adolescence.

4:40 p.m.-6:10 p.m.
Big Question Session 4.1

(HOW) CAN PHYSIOLOGICAL MEASURES INFORM US ABOUT ETIOLOGY, DIAGNOSIS, AND/OR TREATMENT OF PSYCHOPATHOLOGY (AND VICE VERSA)?

Session Chair: Jason Moser
Michigan State University

Discussant: Peter Lang, University of Florida

RIISING FROM THE ASHES? PARADIGM SHIFTS IN THE STUDY OF ANXIETY-RELATED ATTENTION BIASES USING NEUROPHYSIOLOGY

Tracy Dennis-Tiwary
Hunter College and the Graduate Center of The City University of New York

Descriptors: Anxiety, Attention Bias, EEG/Neurophysiology
Despite an explosion of interest in the anxiety-related attention bias (AB), or selective and exaggerated attention towards threat, as a causal mechanism in anxiety, initial enthusiasm for the construct of AB has flagged under the weight of null studies and the detection of AB heterogeneity. Has the construct of AB lost its clinical relevance? This talk directly tackles this question, with an emphasis on methodological innovations that leverage the temporal resolution and functional specificity of EEG measures, including event-related potentials (ERPs), steady-state visual-evoked potentials, and delta-beta coupling. I draw on several studies, including a multi-method examination of the neural bases of AB in anxious adolescents and a randomized clinical trial of attention bias modification. For example, we have used ERPs to delineate how distinct components of AB change with ABMT and differentially predict anxiety severity, and delta-beta coupling, as an index of cortical coherence, to clarify the association between AB and anxiety. I also consider emerging methods for analyzing dynamic variability in behavioral measures of AB, such as trial-level-bias scores, and drift-diffusion modeling to isolate extra-decisional processes in reaction time-based measures to quantify a “low noise” behavioral metric of AB. I argue that these techniques can foster empirical innovations that will rescue AB from the looming ash heap of scientific history by informing our understanding of risk and resilience, clarify neural mechanisms underlying AB, and inform emerging treatment approaches.

Funding: Funding for data included in the proposed presentation: R56MH111700 (NIMH) and SC1MH104907 (NIGMS).

RESURRECTION OF GLUCOCORTICOID RESISTANCE AS A KEY INDICATOR IN DEPRESSION

Heather Abercrombie
University of Wisconsin, Madison

Descriptors: depression, cortisol, memory bias
Glucocorticoid resistance, reflecting systemic and cellular under-sensitivity to cortisol, occurs more frequently in severe depression than in the general population. In the 1980s, measures of glucocorticoid resistance, such as the dexamethasone suppression test (DST), were thought to indicate melancholic depression. However, subsequent research showed that the DST was a poor proxy for clinical diagnosis. Nonetheless, we hypothesize that glucocorticoid resistance is associated with psychological function in depression. The role of glucocorticoid resistance in psychological features of depression is understudied, despite glucocorticoids' known role in emotional memory. Our research addresses this knowledge gap and shows that glucocorticoid resistance is related to emotional memory biases. We have found that acute cortisol augmentation reduces negatively biased memory formation most prominently in glucocorticoid resistant individuals. We also found that early adverse caregiving (which is related to glucocorticoid resistance) moderates cortisol's effects within corticomotor circuitry involved in stress neuromodulation. Other investigators have shown that glucocorticoid resistance, measured using a variety of methods, is relevant for personalized medicine in depression. Our research is consistent with evidence suggesting that: 1) glucocorticoid resistance is more than a mere biomarker and is psychologically relevant in depression, and 2) efforts should be made to standardize measures of glucocorticoid resistance and specify its relevance for use in clinical settings.

Funding: NIMH R01MH094478 Project: “Learning, neural signaling of cortisol, and early adversity in depression” PI: Heather C. Abercrombie, PhD.

TRAUMA SEVERITY ACROSS THE INTERNALIZING DISORDERS SPECTRUM: BRAIN FUNCTION AND STRUCTURE

Sambuco Nicola; Margaret Bradley; Peter Lang
Center for the Study of Emotion and Attention, University of Florida

Descriptors: trauma, psychopathology, MRI
It is proposed that experienced trauma is not uniquely symptomatic of post-traumatic stress disorder (PTSD), and that trauma exposure may contribute significantly to the severity of psychopathology across the diagnostic spectrum. To test this hypothesis, the current study measured the effects of trauma on brain function and structure in a large sample of patients ($n = 162$) diagnosed with anxiety and mood disorders. Limbic-visual functional activity during emotional challenge was assessed. Participants observed rapidly presented scenes depicting violence, mutilation, erotica, as well as happy families, neutral objects and people. Patients reporting high trauma-symptom severity failed to differentiate emotional from neutral scenes, and overall showed the smallest blood oxygen level dependent (BOLD) changes in the amygdala-ventral visual stream; in contrast, patients with strong amygdala-ventral visual reactivity (emotional minus neutral) were least trauma severe. Furthermore, the emotionally non-reactive patients showed significant morphological alterations in dorsal and ventral visual cortex, with reduced gray matter volume, thickness, and less cortical complexity. In summary, experiencing life-threatening events, reported PTSD-like symptoms, and related functional impairment are associated with both compromised functional limbic-visual processing and significant brain structure abnormalities. These effects are independent of primary diagnosis, suggesting that experienced trauma is a transdiagnostic vulnerability factor across the internalizing disorders.

COMORBIDITY LOAD AND NEGATIVE PICTURE PROCESSING IN THE ANXIETY DISORDERS: A COMBINED FMRI, STARTLE EYEBLINK AND EEG STUDY

Annmarie MacNamara¹; Stewart Shankman²; K. Luan Phan³

¹Texas A&M University, College Station, ²Northwestern University,

³University of Illinois, Chicago

Descriptors: Comorbidity, Anxiety, Multitmethod

Comorbidity in the anxiety disorders is common and relates to severity and measures of emotional reactivity such as self-reported negative affectivity (NA). However, despite its clinical relevance, evidence of the underlying neurobiology of comorbidity is scarce. Here, 58 individuals, all meeting criteria for a specific phobia but with varying levels of anxiety and/or depressive comorbidities performed a picture viewing task in the scanner while startle eyeblink was recorded simultaneously. During a separate lab visit (counterbalanced), we recorded EEG while participants viewed the same pictures. In line with results from single-disorder studies, individuals with greater comorbidity load showed increased negative > neutral BOLD response in the amygdala and insula. In addition, greater comorbidity load was associated with increased BOLD response in the dorsolateral prefrontal cortex. On the other hand, negative > neutral startle and the late positive potential (LPP) were reduced for participants with greater comorbidity load. Therefore, increased comorbidity load may be associated with both heightened BOLD and blunted peripheral and electrocortical response to negative stimuli. In addition, dimensional variation in biobehavioral NA (a transdiagnostic, psychophysiological and self-report factor) effectively predicted clinical outcomes, such as illness severity and quality of life. Results demonstrate how multiple measures might be combined to help explain comorbidity and negative affectivity in the anxiety disorders, potentially improving classification and treatment.

Funding: NIMH K23 MH105553 (to AM).

THE OSCILLATORY NATURE OF DEPRESSIVE SYMPTOMS IN YOUTH DURING RESTING EEG

Jia Wu; Linda Mayes; Michael Crowley
Yale University

Descriptors: oscillation, depression, youth

Background: Oscillatory bio-markers have been investigated in previous literature regarding depression. Previous literature has found that theta-asymmetry difference during rest and music listening were reversed in depressed patients versus controls (Dharmadhikari et al 2018). Gamma power was larger in depressed patients compared to controls (Siegle et al 2010, Strelets, et al 2007). But literatures in youth is lacking. **Method:** Resting EEG oscillation was examined in 161 healthy youth (age 10-17 yrs, female = 80). Three common oscillatory analysis approaches were performed (power, coherence, and asymmetry) to study the association of oscillatory measures with depressive symptoms (shortened as depression). In addition, we examined the oscillatory associations under the light of heart rate variability (HRV), which predicted depression in the same sample (Blood et al., 2015). **Results:** We found that gamma power and coherence were positively associated with depression as expected. Beta power was negatively associated with depression. Gamma had overlapping variance with HRV while beta did not. **Conclusion:** Resting gamma power and coherence were positively associated with depression in adolescents, while resting beta power were negatively associated with depression. Gamma had overlapping variance with HRV which previously predicted depression in the same dataset, suggesting the gamma oscillation might relate to parasympathetic capabilities. Beta did not share any variance with HRV suggesting it explained unique variance in depression that was unrelated to parasympathetic capabilities.

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THE POSTAURICULAR REFLEX DIAGNOSES ANHEDONIA (BUT NOT DEPRESSION) COMPARABLY TO SELF-REPORTED CONSUMMATORY PLEASURE

Stephen Benning¹; Belei Ait Oumeziane²; Stephany Molina¹

¹University of Nevada, Las Vegas, ²Purdue University

Descriptors: depression, emotion, diagnosis

Within the internalizing disorders, depression is uniquely related to anhedonia, or low positive emotion. However, it is unclear whether psychophysiological measures of consummatory positive emotional reactivity assess depression beyond easily obtained self-reports of positive emotion. In a sample of 126 community participants with at least moderate Inventory of Depressive Symptoms interview scores ($n = 92$) or almost no IDS symptoms ($n = 34$), we used the consummatory facet of the Temporal Experience of Pleasure Scale and a picture viewing paradigm with late positive potential (LPP) ERPs and postauricular and startle blink reflexes to assess consummatory positive emotion. Neither TEPS consummatory pleasure [area under receiver operating characteristic curve (AUC) = .56 ($SE = .05$), $p = .34$] nor the psychophysiological measures, AUCs < .56, $ps > .39$, were discernibly related to depression diagnoses. However, the postauricular reflex's potentiation during pleasant versus neutral pictures, AUC = .63 ($SE = .06$), $p = .027$, and TEPS consummatory pleasure, AUC = .64 ($SE = .06$), $p = .016$, were discernibly associated with clinically significant anhedonia in depression, unlike startle blink or LPP, AUCs < .60, $ps > .08$. Postauricular reflex potentiation and TEPS consummatory pleasure were essentially uncorrelated, $r = -.04$, $p = .35$, and both contributed independently to predicting 9% of variance in anhedonia scores. Thus, self-reported and psychophysiological consummatory positive emotion specifically assess anhedonia (albeit weakly) rather than the broad syndrome of depression.

Funding: Funding for this work was provided by the National Institute of Health grant R21 MH093692.

4:40 p.m.-6:10 p.m.
Symposium 4.2

PSYCHOPHYSIOLOGICAL INSIGHTS ON THE EMOTIONAL EXPERIENCE OF INDIVIDUALS WITH AUTISM

Session Chair: Heather Nuske
University of Pennsylvania

Discussant: John Herrington, Children's Hospital of Philadelphia,
University of Pennsylvania

Our panel features experts in psychophysiology and Autism Spectrum Disorder (ASD), drawing on various methods (fMRI, EEG, ECG, EDA, PPG, pupillometry) to examine the interrelationships between the physiological and psychological aspects of behavior in children, adolescents and adults with ASD. We examine associations between physiological responses and expressions (facial, bodily, vocal), self and parent report of anxiety, ASD symptomatology and response to intervention. Dr. Adam Naples will present data showing significant relationships between the physiological dynamics of norepinephrine system which reflect impacted global cortical background activity. Dr. Heather Nuske will present data showing reduced internal physiological and external communicative concordance in children. Dr. Valentina Parma will present data showing that physiological and subjective predictors provide better classification of youth with/without ASD and with/without anxiety than each variable alone. Dr. Matthew Goodwin will show that PPG data are feasible and useful indices of arousal in severely affected youth with ASD unable to provide self-reports. PhD Candidate Hillary Schiltz will present data showing RSA as a marker of social skills intervention response. In each of the studies, psychophysiology provides insights into the emotional experience of individuals with ASD not achievable based on behavior and report alone, suggesting that psychophysiology can not only give clinical insights and assist with progress monitoring, but can also help to inform personalized treatment approaches in ASD.

AMBULATORY CARDIORESPIRATORY REACTIVITY TO ENVIRONMENTAL STRESSORS IN SEVERELY AFFECTED YOUTH WITH AUTISM SPECTRUM DISORDER

Matthew Goodwin¹; Karen Mathewson²; David DeSteno¹
¹Northeastern University, ²McMaster University

The objective of this study was to record inter-beat interval (IBI), respiratory rate (RR), and respiratory sinus arrhythmia (RSA) responses to experimentally presented environmental stressors in youth with ASD and typically developing (TD) controls. Forty-one *DSM-IV* confirmed, severely affected youth with ASD (75% male), aged 4 to 25 yrs ($M = 13$ yrs, $SD = 5$ yrs) were included and subdivided into those taking one or more medications ($n = 21$) versus those not prescribed medications ($n = 20$). Four male TD youth ranging in age from 8 to 18 yrs ($M = 14.8$ yrs, $SD = 4.6$ yrs) served as a reference group. Cardiorespiratory responses were recorded at 1kHz using the Vivometrics LifeShirt. Obtained data was analyzed in MindWare. The three subgroups did not differ in mean age, and there were no significant subgroup differences in sex distribution. For IBI, a mixed ANOVA revealed a main effect for stressor condition, a main effect for group, and an interaction between the two. For RR, a mixed ANOVA revealed a main effect for stressor condition. For RSA, a mixed ANOVA revealed a main effect for stressor condition. Finally, test-retest reliability assessed in a subset of 5 participants with ASD spanning observations one to seven months apart indicated no significant differences for any of the measures. We conclude that ambulatory cardiorespiratory measures are a feasible and useful objective measure of arousal in more severely affected youth with ASD who are unable to provide reliable self-reports about their reactions to environmental stressors.

Funding: This research was supported by the National Institute on Deafness and Other Communication Disorders (NIDCD).

EEG AND PUPILLARY RESPONSE IN CHILDREN WITH AUTISM: RESULTS FROM THE AUTISM BIOMARKERS CONSORTIUM FOR CLINICAL TRIALS INTERIM ANALYSIS

Adam Naples¹; Frederick Shic^{2,3}; April Levin^{4,5}; Raphael Bernier²; Geraldine Dawson⁶; Michael Murias⁶; Shafali Jeste⁷; Charles Nelson^{4,5,8}; Susan Faja^{4,5}; Katarzyna Chawarska⁹; Catherine Sugar⁷; Damla Senturk⁷; Gerhard Hellemann⁷; James Dzuira¹⁰; Cynthia Brandt²; Sara Webb^{2,3}; James McPartland⁹
¹Yale University School of Medicine, ²University of Washington, ³Seattle Children's Research Institute Center for Child Behavior, ⁴Boston Children's Hospital, ⁵Harvard Medical School, ⁶Duke University Medical Center, ⁷University of California, Los Angeles, ⁸Harvard Graduate School of Education, ⁹Yale University School of Medicine, ¹⁰Yale University

Dysregulated attention and arousal are comorbid features of ASD associated with activity of norepinephrine (NE), which can be indexed by the pupil light reflex (PLR). Individuals with ASD show attenuated PLRs. However, despite broad NE activity in cortex, there have been no studies linking PLR dynamics to (EEG) in ASD. Understanding this relationship may help to link symptomatology and mechanisms in ASD. We examined PLR, EEG, and clinical symptoms collected across 2 days in 225 participants aged 6 to 11 (ASD: 161; TD: 64). EEG power and slope were calculated from 2 minutes of resting EEG. The PLR was measured in response to a 133ms flash. PLR dynamics included constriction and latency. There was no relationship between PLR constriction and EEG. However, PLR latency was negatively associated with alpha power ($p = .026$) and the slope of the EEG spectrum ($p = .01$), such that later PLRs were associated with greater high frequency activity. With regard to symptoms, ADOS calibrated severity score correlated with increased power across the delta, theta, beta, and gamma bands ($ps = .02, .02, .04, .01$). The dynamics of NE and EEG in ASD are associated and detectable across different days, likely reflecting relatively stable, trait-like relationships. The association with EEG slope suggests that NE impacts

global EEG background activity. Given that NE is a common medication target, these findings could inform novel mechanisms of assessing therapeutic effects. Ongoing analyses are quantifying NE/EEG activity within individuals and its relationship with clinical symptoms.

Funding: Autism Biomarkers Consortium for Clinical Trials is supported by the National Institutes of Health (NIH), including the National Institute of Mental Health (NIMH), the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD), and the National Institute of Neurological Disorders and Stroke (NINDS), as well as the Foundation for the NIH (FNIH), and the Simons Foundation Autism Research Initiative (SFARI).

REDUCED INTERNAL PHYSIOLOGICAL AND EXTERNAL COMMUNICATIVE CONCORDANCE IN CHILDREN WITH AUTISM

Heather Nuske¹; Emma Finkel¹; Liza Tomczuk²; Daniel Forsyth³; Yelena Kushleyeva³; Darren Hedley⁴; Jeffrey Pennington³; Aaron Masino³; Cheryl Dissanayake⁴; Christopher Bonafide³; John Herrington^{1,3}

¹University of Pennsylvania, ²Dickinson College, ³Children's Hospital of Philadelphia, ⁴La Trobe University

Children's ability to communicate their stress is important as it allows for emotion-regulation learning opportunities. Many children with Autism Spectrum Disorder (ASD) have difficulties communicating their emotional experiences, however, it is likely that the physiological correlates of emotion are intact in ASD. The present study tested the hypothesis that ASD is characterized by a lack of concordance between behavioral manifestations of emotion and psychophysiological indicators of emotion. Forty-nine children with ASD and 45 TD children of two age groups (2-6 and 8-12 years) participated in a low-level stress task, whilst wearing a wireless ECG monitor. Children's emotional communication behaviors (facial, vocal and bodily expressions) were coded following standardized protocols. All children showed heart rate increase during the low-level stress task relative to baseline. In the younger TD children, increased heart rate (BPM) was correlated with facial ($r = .36$) and vocal ($r = .33$) expressions, and in the older TD children, decreased heart rate variability (RMSSD) was associated with bodily reactions ($r = -.45$). However, in both age groups of children with ASD, no associations were found between BPM or RMSSD and expressions. Children with ASD may have more difficulty expressing physiological emotional reactions via communicative behavior, relative to their TD peers. Our results suggest that by relaying heart rate signals to parents or teachers, this may provide important information that can directly inform interventions for emotional communication in children with ASD.

Funding: This study was supported by a Veski Victoria Fellowship, the Pierce Armstrong Foundation, La Trobe University, the McMorris Family Foundation and a Foerderer Award.

A PSYCHOPHYSIOLOGY-INFORMED APPROACH TO THE EVALUATION OF THE NEGATIVE VALENCE SYSTEM IN AUTISM

Valentina Parma¹; John Herrington²

¹Istituto Superior de Psicologia Aplicada, ²Children's Hospital of Philadelphia, University of Pennsylvania

Psychophysiological measures can critically inform our understanding of the fundamental dimensions of psychopathology. However, measures such as heart rate, heart rate variability (HRV), and electrodermal activity (EDA), are best leveraged in the context of other converging and diverging measures of clinical phenomena (for example, self-report of symptoms). Following the RDoC framework, here we present a series of studies investigating the Negative Valence System (NVS) in which both peripheral (e.g., EDA, HRV) and central physiological measures (e.g., fMRI) have been used in association with subjective reports (self- and parental), standardized questionnaires and behavioral data. To present evidence that speaks to the validity of the RDoC NVS in the context of ASD and anxiety, we evaluate across ~200 youth with ASD and matched neurotypical controls with the goals of determining: 1) the validity and reliability of the NVS in ASD; 2) the divergence of the NVS from the RDoC Social System in ASD, and 3) the relationships of these systems to clinical manifestations of anxiety in ASD. We show that: 1) ASD+Anxiety can be differentiated from anxiety alone by EDA and subjective measures, but not by HRV; 2) fMRI amygdala activity tracks NVS in ASD and non-ASD samples in a transdiagnostic manner. Altogether, these data broadly support the RDoC framework (particularly NVS), while suggesting that the transdiagnostic, dimensional nature of some symptoms are best highlighted using convergent and divergent measures from psychophysiology and symptom inventories.

Funding: This research was supported by the National Institute of Mental Health (NIMH), the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD), the McMorris Family Foundation, Shire Pharmaceuticals and the Pennsylvania Department of Health.

CHANGE IN RSA ACROSS A SOCIAL SKILLS INTERVENTION FOR AUTISTIC YOUNG ADULTS: THE ROLE OF EMOTIONAL CONTEXT

Hillary Schiltz¹; Alana McVey¹; Angela Haendel^{1,2}; Bridget Dolan³; Wendy Krueger¹; Nakia Gordon¹; Amy Van Hecke¹
¹Marquette University, ²Concordia University, ³Medical College of Wisconsin

Low Respiratory Sinus Arrhythmia (RSA) and excessive RSA reactivity are robust transdiagnostic correlates of emotion dysregulation, psychopathology, and challenges with social engagement. RSA is commonly attenuated in autism and has been related to core autism symptoms and secondary characteristics. In the present study, RSA was measured in a sample of young adults (66 autistic and 34 non-autistic) across four conditions: eyes open (EO), eyes closed (EC), and two counterbalanced mood induction paradigms (Happy and Angry). Young adults had an IQ ≥ 70 on the KBIT-2 and autism diagnosis was confirmed with the ADOS-G. RSA data were collected from a subset of autistic young adults ($n = 43$) before and after a manualized social skills intervention (PEERS). A significant Group (Autism vs. Neurotypical) by Condition (EO vs. EC vs. Happy vs. Angry) interaction emerged such that, although the Autism group displayed lower RSA than the Neurotypical group across all conditions, only the Angry condition reached significance ($p = 0.03$). Across PEERS, RSA significantly increased in the Angry ($p = 0.02$) and marginally increased in the Happy ($p = 0.06$) conditions and was not significantly different between the groups post-PEERS (p 's > 0.05). Initial levels of social challenges were predictive of larger increases in RSA in the Happy and Angry conditions (p 's < 0.05). The present study provides evidence for RSA as a potential marker of intervention response in autism and highlights the importance of emotional context.

Funding: The research was funded by Marquette University and the Autism Society of Southeastern Wisconsin.

4:40 p.m.-6:10 p.m. Symposium 4.3

CARDIOVASCULAR STRESS REACTIVITY: FROM BASIC CONCEPTS TO MODERN APPROACHES

Session Chairs: Annie Ginty¹; Ryan Brindle²
¹Baylor University, ²Washington and Lee University

Discussant: J. Richard Jennings, University of Pittsburgh

While convergent epidemiological evidence documents an association between large-magnitude cardiovascular responses to psychological stress and elevated cardiovascular disease risk, the exact underlying pathophysiology and mechanisms remain unclear. This symposium will review the basic tenet of the classic cardiovascular reactivity hypothesis- that metabolically inappropriate cardiovascular stress reactions are pathogenic- and also introduce recent theoretical and methodological advances in cardiovascular reactivity research. The first talk will discuss the importance of measuring metabolic activity during acute stress testing and reporting the degree to which stress reactions are metabolically inappropriate, especially in the context of disease risk. Theoretical advances related to stress response habituation, a dimension of cardiovascular stress reactivity that has been comparatively overlooked, despite it representing a potentially informative and health-relevant aspect of stress responding, will be reviewed in the second talk. The third talk will focus on the value of using group-based analytics to identify novel multivariate and time-dependent stress response phenotypes. Finally, neuroimaging evidence will address how the brain pairs stressful experiences with cardiovascular changes that matter for health. Taken together, this symposium will illustrate how recent methodological and theoretical advances- deployed within the classic stress reactivity paradigm- hold promise for addressing open questions about pathways linking psychological stress and disease.

THE IMPORTANCE OF UNDERSTANDING THE METABOLIC APPROPRIATENESS OF CARDIOVASCULAR RESPONSES TO STRESS IN THE CONTEXT OF DISEASE RISK

Annie Ginty¹; Ryan Brindle²
¹Baylor University, ²Washington and Lee University

There is longstanding and cumulative epidemiological evidence that individuals who exhibit a phenotypic large-magnitude cardiovascular reaction to psychological stress are at elevated risk for clinical and preclinical endpoints of cardiovascular disease. Cardiovascular responses during acute psychological stress occur in the absence of physical exertion and can be metabolically inappropriate—meaning the cardiovascular system is working in excess of metabolic demand. The majority of recent work in the field has focused on the magnitude of cardiovascular reactions, but has not quantified the degree to which these reactions are metabolically inappropriate. This is somewhat surprising given that metabolically excessive cardiovascular responses to stress are thought to be the driver of pathophysiology. This presentation will use meta-analytic techniques to examine previous work in the field to demonstrate the proportion to which cardiovascular responses to stress are metabolically-inappropriate, discuss the best methodological approaches for measuring metabolic activity during acute stress, and report new data measuring metabolic and cardiovascular activity under different stress conditions. Drawing on the original cardiovascular reactivity, this presentation will emphasize the potential importance of measuring metabolic activity during acute psychological stress in the context of predicting future disease risk.

RESPONSE HABITUATION IS AN OVERLOOKED (AND UNDER-APPRECIATED) DIMENSION OF CARDIOVASCULAR STRESS REACTIVITY

Brian Hughes¹; Wei Lü²; Siobhán Howard³

¹National University of Ireland Galway, ²Shaanxi Normal University, ³University of Limerick

Extensive research evidence supports the claim that cardiovascular stress reactivity accounts for variance in lifetime disease risk. However, in by far the majority of the relevant studies, research designs fail to account for the way stress responses adapt (e.g., habituate) across time, patterns that may be central in determining future health outcomes. Drawing on that subset of studies which allow for such inferences, including several datasets from our own research group, we outline evidence showing how habituation to repeated or prolonged stress represents an informative and health-relevant aspect of cardiovascular stress responses. Our four main inferences are: that cardiovascular response habituation (a) occurs for various types of stressor; (b) is most pronounced after initial responses subside (making initial responses potentially misleading if scrutinized in isolation); (c) emerges in both women and men; and (d) varies by individual differences and social context. As such, not only is habituation etiologically relevant, it appears also to be potentially modifiable through intervention. As yet, there is no prospective evidence to confirm that patterns of adaptation predict long-term health outcomes, despite there being strong reasonable and logical grounds to suspect this. We suggest how existing studies may offer a means to fill this gap in prospective evidence, and outline four potential typologies in cardiovascular reactivity patterns that fit within and extend the classic reactivity hypothesis.

EXPLORING NEW SOURCES OF VARIABILITY IN CARDIOVASCULAR STRESS REACTIVITY USING GROUP-BASED ANALYTICS

Ryan Brindle¹; Katherine Duggan²; Annie Ginty³

¹Washington and Lee University, ²University of Pittsburgh, ³Baylor University

Stressful experiences increase disease risk by provoking phenotypic changes in heart rate and blood pressure. Exaggerated blood pressure and, more recently, blunted heart rate responses to stress have emerged as particularly risky. Univariate phenotypic characterizations, however, fall short in reflecting 1) the inherent interconnectedness of the cardiovascular system and 2) that stress responses are time-varying and evolve within and across stress exposures. This presentation will review findings from analyses designed to characterize stress reactivity using group-based analytics. We show that individuals exhibit distinct multivariate stress reactivity patterns and fall into distinct trajectory groups when time-varying cardiovascular data are analyzed. Importantly, membership to these new phenotypes is associated with health-relevant outcomes. Rather than isolating or averaging time-varying cardiovascular measures, these studies demonstrate the advantages of using group-based analytics within traditional stress psychophysiology paradigms to explore new sources of inter- and intra-individual variability and gain valuable insight into the connection between stress and disease.

HOW DOES THE BRAIN BREAK OUR HEARTS?

Peter Gianaros
University of Pittsburgh

Stressful experiences evoke changes in cardiovascular physiology that may confer risk for heart disease. But how exactly does the brain link stressful experiences to cardiovascular changes that might in turn lead to disease endpoints? This question is important because it has broader implications for our conceptual understanding of the neurobiological pathways that link stressful and other psychological experiences to our physical health. This presentation will review findings from a series of neuroimaging studies guided by this question and focused on one form of cardiovascular stress reactivity—blood pressure reactivity. Using a stressor task battery guided by psychometric principles, blood pressure reactivity has been related most consistently to network-level and multivariate activity patterns in the anterior cingulate cortex and insula. Contextually, the findings reviewed here will be offered as one example of how neuroimaging and health neuroscience methods can be

integrated to address open psychophysiological questions about the pathways linking stress and cardiovascular health.

Funding: NHLBI P01 040962.

4:40 p.m.-6:10 p.m. Structured Panel Presentation 4.4

OUT OF THE LAB AND INTO THE DATA REVOLUTION: AUTONOMIC MULTIMODAL DATA COLLECTION, PROCESSING, AND ANALYSIS IN AMBULATORY SETTINGS

Session Chair: Jolie Wormwood
University of New Hampshire

Discussant: Karen Quigley, Edith Nourse Rogers Memorial VA Hospital

Recent technological advances, including ubiquitous smartphones and consumer biosensors, offer unprecedented abilities to collect longitudinal, multivariate peripheral nervous system data in naturalistic settings. Although these technologies have the potential to enhance science across many disciplines (e.g., engineering, behavioral science, clinical translational science), multimodal ambulatory methods remain underutilized. Some of the challenges include ensuring that devices provide research-quality data, establishing appropriate experimental designs, and addressing complexities of processing, fusing, and analyzing multimodal time series data. In this interdisciplinary panel, five researchers with expertise in multimodal ambulatory physiological research will have a moderated discussion about study design and analysis difficulties they have faced in their research and will provide guidance concerning what have (and have not) been useful tools/approaches for addressing unique challenges associated with this kind of data. Panelists will begin by briefly presenting (5 min each) relevant empirical work to provide context for the ensuing discussion that will: (1) demonstrate the variety of research questions enabled by ambulatory methods; (2) highlight obstacles when conducting multimodal ambulatory data collection across different research settings; (3) present novel tools for automated and semi-automated data quality assessment and feature extraction; and (4) introduce advanced analytic techniques to aid in multimodal data fusion, visualization, and interpretation.

Funding: US Army Research Institute for the Behavioral and Social Sciences (W911N-16-1-0191 to K.S.Q and J.B.W).

LESSONS FROM THE FIELD: USING MULTIMODAL AMBULATORY MEASURES TO STUDY POLICE DECISION MAKING AND USE- OF-FORCE BEHAVIOUR IN TRAINING AND ACTIVE DUTY CONTEXTS

Judith Andersen; Peter Collins
University of Toronto

Judith Andersen is an Associate Professor of Psychology and Affiliated Faculty of Medicine at the University of Toronto. She is the Director of the Health, Adaptation, Research on Trauma (HART) Lab. Prof. Andersen examines risk assessment, decision making, and human performance among police officers during high-stress training and active duty occupational exposures. The HART lab is a fully ambulatory lab and all data is collected in the field. In addition to psychosocial assessment, our research focus centers around objective health and physiological biomarkers (e.g., neuroendocrine - diurnal and reactivity cortisol; cardiovascular stress reactivity; activity and exertion) and objective performance scores (instructor ratings) of correct or incorrect police use-of-force in general and use of lethal force (i.e., shoot/no shoot decisions) specifically. There are numerous challenges that must be overcome to increase ecological validity in this domain, including establishing research collaborations, integrating multiple sources of data (e.g., observational notes, instructor performance ratings, cardiovascular and neuroendocrine measures, audio), and performing rigorous data analyses. Professor Andersen will present some of the benefits and challenges she has faced in her research and discuss how it is being utilized to inform the development of training methods to reduce use of lethal force among police officers.

Funding: This research is funded by the Ontario Ministry of Labour, ROP-15-R-021 and the Social Sciences and Humanities Research Council of Canada, 430-2016-01227.

USING CONTEXT-AWARE EXPERIENCE SAMPLING TO EXAMINE INDIVIDUAL DIFFERENCES IN AFFECTIVE REACTIVITY AND COGNITIVE PERFORMANCE

Jolie Wormwood¹; Zulqarnain Khan²; Katie Hoemann²;
Catie Nielson²; Madeleine Devlin²; Mallory Feldman²;
Jennifer Dy²; Lisa Feldman Barrett²; Karen Quigley³

¹University of New Hampshire, ²Northeastern University, ³Edith Nourse Rogers Memorial VA Hospital

Dr. Jolie Baumann Wormwood is an Assistant Professor at the University of New Hampshire with expertise in the design, implementation, and analysis of studies utilizing experience sampling and ambulatory physiological monitoring. Her research broadly examines the role of the body in affect, decision-making, and perception and has received funding support from the National Science Foundation and the Army Research Institute. This presentation will overview a recent study that utilizes context-aware experience sampling and ambulatory physiological monitoring to assess within-person variability in affective experience and cognitive performance. Over 14 days, participants received prompts on a smartphone whenever a significant change in heart rate was detected (not due to movement). At each prompt, participants reported on their current emotion and affective experience and completed a 1-item cognitive task (e.g., solving an anagram). Features derived from cardiovascular, respiratory, and electrodermal activity surrounding each prompt were fed to idiographic machine learning algorithms. Unsupervised cluster analyses revealed immense within- and between-subject heterogeneity in patterns of bodily activity and their associations with affective experience and cognitive performance. Design and implementation challenges, particularly with regard to physiologically-triggered experience sampling, will be discussed.

Funding: This research was supported by the U.S. Army Research Institute for the Behavioral and Social Sciences (W911N-16-1-0191 to K.S.Q. and J.B.W.). The views, opinions, and/or findings contained in this paper are those of the authors and shall not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documents.

DEVELOPING NOVEL ANALYTICS TO OVERCOME CHALLENGES WITH AMBULATORY RECORDINGS OF ELECTRODERMAL ACTIVITY

Matthew Goodwin¹; Ian Kleckner²; Murat Akcakaya³;
Jolie Wormwood⁴; Rebecca Jones⁵; Lisa Feldman Barrett¹;
Karen Quigley⁶

¹Northeastern University, ²University of Rochester Medical Center, ³University of Pittsburgh, ⁴University of New Hampshire, ⁵Weill Cornell Medicine, The Center for Autism and the Developing Brain, ⁶Edith Nourse Rogers Memorial VA Hospital

Dr. Goodwin is an interdisciplinary Associate Professor with appointments in the Bouvé College of Health Sciences and Khoury College of Computer Sciences at Northeastern University, where he is a founding member of a new doctoral program in Personal Health Informatics. He is also a visiting Associate Professor in the Department of Biomedical Informatics at Harvard Medical School. Before joining Northeastern, he was the Director of Clinical Research at the MIT Media Lab where he co-directed a multi-disciplinary research team developing innovative technologies (including video and audio capture, telemetric physiological monitoring, accelerometry sensing, and digital video/facial recognition systems) for behavioral science research applications. He has extensive first-hand knowledge of the challenges associated with making technology sufficiently robust to transfer from short-term laboratory use to longer-term, sustained use in natural settings. This presentation will report on (and share open-source code for) the following novel analytics our group has developed to address common methodological challenges associated with ambulatory electrodermal activity (EDA) data: (1) an automated procedure for evaluating ambulatory EDA data quality; (2) an adaptive thresholding technique that reduces confounding of skin conductance response detection by skin conductance level and increases analytical sensitivity and specificity; and (3) state-dependent EDA analyses

utilizing change point detection to assess physiological shifts that may track affective changes over time.

Funding: This research was supported by the Simon Foundation (336363 to M.S.G., I.R.K., C.L., R.M.J.), the National Institute of Nursing Research (NR013500 to M.S.G.), the National Institute on Deafness and Other Communication Disorders (P50 DC013027 to M.S.G.), the National Cancer Institute (K07CA221931, R25 CA102618, and UG1 CA189961 to I.R.K.), and the U.S. Army Research Institute for Behavioral and Social Sciences (W911NF-16-1-0191 to K.S.Q. and J.B.W. and W5J9CQ-12-C-0049 to L.F.B.).

AUGMENTED COGNITION: TOWARDS ENHANCING HUMAN INFORMATION PROCESSING CAPABILITIES VIA MULTIMODAL PHYSICAL, PHYSIOLOGICAL, AND COGNITIVE STATE ESTIMATION

Sarah Ostadabbas
Northeastern University

Sarah Ostadabbas is an Assistant Professor in the Electrical and Computer Engineering Department of Northeastern University (NU). At NU, Professor Ostadabbas directs the Augmented Cognition Laboratory (ACLab), which centers around creating Augmented Cognition (AC) systems to enhance human cognition rather than replace it. AC systems have three primary components: (1) sensing (2) analysis; and (3) feedback. The sensing element gathers and fuses multimodal/longitudinal data from humans and their environment including 4D color-depth videos, neurophysiological signals, and audio/speech information. Robust analytics are the cornerstone of an AC system. In the ACLab, we use both machine learning/computer vision models and biomechanically/biologically inspired structural models. When possible, a structural model is preferred because it can incorporate existing knowledge into the model without requiring a large training set. In addition, structural models tend to be more transparent and easier to analyze for failure modes and edge cases. Careful design of the feedback element is also critical because unless it is useful, timely, and understandable, the system will be unusable regardless of the quality of the other two components. Professor Ostadabbas will present an overview of the AC system design and how an augmented cognition system can be seen as an analytical tool in psychophysiological research, including those involving rich multimodal data streams from longitudinal ambulatory recordings.

Funding: This research was supported by the following agencies and industrial support: Amazon AWS, NSF-IIS 1755695, Northeastern Tier 1 Award, and MathWorks.

BAYESIAN METHODS FOR MULTIMODAL DATA FUSION, STATE ESTIMATION, AND CLASSIFICATION

Murat Akcakaya
University of Pittsburgh

Murat Akcakaya is an Assistant Professor in the Electrical and Computer Engineering Department of the University of Pittsburgh (Pitt). The research interests of his group are in the fields of statistical signal processing, machine learning, and optimization. In his group, they develop methods for: (i) optimization, adaptation, and personalization of human-computer interaction systems and assistive technologies; (ii) analysis of ambulatory and/or multimodal physiological data; (iii) providing cognition to systems operating in nonstationary environments or demonstrating nonstationary behavior; and (iv) probabilistic modeling and simulations of large and complex physical systems. In this panel, Dr. Akcakaya will focus on (a) feature extraction, (b) probabilistic modeling of extracted features through parametric and non-parametric methods, and (c) Bayesian approaches, specifically maximum likelihood and maximum a posteriori methods for data fusion, classification, and state estimation. These techniques are particularly relevant to processing and analyzing ambulatory and/or multimodal physiological data given the volume of data collected in studies utilizing these methods.

Funding: This research is supported by NSF IIS # 1717654.

FRIDAY, SEPTEMBER 27, 2019

8:30 a.m.-10:00 a.m.
Faces of the Future Flash Talks

Session Chair: Stephen Benning
University of Nevada, Las Vegas

AMYGDALA HABITUATION TO UNPLEASANT PICTURES IN BORDERLINE PERSONALITY DISORDER PATIENTS WITH AND WITHOUT A HISTORY OF SUICIDAL BEHAVIOR

Abby Feinberg^{1,2}; Daniel Vaccaro^{1,2}; Morgan Corniquet¹;
Jake Szeszko; King-Wai Chu²; Kim Goldstein²; Erin Hazlett^{1,2}
¹Icahn School of Medicine at Mount Sinai, ²James J. Peters VA Medical Center

Descriptors: Borderline Personality Disorder, Suicidal Behavior, Amygdala
Borderline Personality Disorder (BPD) is often characterized by emotion dysregulation and suicidal behavior (SB). Three-fourths of BPD patients attempt suicide at least once in their life; 10% eventually commit suicide. The inability to habituate to repeated unpleasant emotional stimuli is one form of emotion dysregulation, and amygdala dysfunction has been linked to BPD. This study employed fMRI to compare amygdala activation in three groups: unmedicated BPD patients with ($n = 15$) and without ($n = 18$) a history of SB, and healthy controls (HCs; $n = 32$) while they viewed an intermixed series of novel and repeated pleasant, neutral, and unpleasant IAPS images. Participants were recruited from the community, diagnosed using structured interviews (SCID and SIDP), and SB was determined using the Columbia Suicide Severity Scale. Amygdala volume was hand-traced on each participant's structural MRI blind to diagnosis and coregistered to their fMRI scan. Amygdala BOLD activation was examined using mixed-model MANOVA with Group as the between-subjects factor. Hemisphere, Picture type (unpleasant, neutral, pleasant), and Time (novel, repeated presentation) were the within-subjects factors. Compared with HCs and BPD without SB, the BPD with SB group showed *greater* amygdala activation in response to repeated unpleasant pictures (Group x Picture type x Time interaction, $p < 0.01$, Wilks). These novel findings indicate that abnormal amygdala habituation is associated with severity of SB in BPD and suggest it may be a biomarker of suicide risk. Affective-startle modulation will also be examined.

Funding: This research was funded by grants from the NIH (R01 MH073911) and Department of Veterans Affairs (CSR&D Research Career Scientist Award 1 IK6 CX001738-01) to Dr. Hazlett.

ATTENDING TO AUDITORY WORKING MEMORY REPRESENTATIONS: TARGET FACILITATION OR DISTRACTOR SUPPRESSION?

Laura-Isabelle Klatt; Stephan Getzmann; Alexandra Begau; Daniel Schneider
Leibniz Research Centre for Working Environment and Human Factors

Descriptors: working memory, selective attention, alpha lateralization
The ability to retroactively shift attention to representations within working memory is critical in order to successfully adapt to changing task demands. Through which mechanisms such internal attentional orienting aids the updating of working memory contents remains a matter of debate: Selective retroactive attention could either facilitate and enhance the processing and maintenance of relevant information or suppress irrelevant working memory contents. Using an auditory retroactive cueing paradigm, we aimed at distinguishing between those mechanisms. Participants were initially cued to attend a lateral (left or right) and a central sound in an upcoming three-sound-array (-90° , 0° , 90°). A retroactive cue then indicated only the lateral, the central item, or both items, that were maintained in working memory, to be subsequently relevant. The analysis of oscillatory activity in the alpha band (8-12 Hz) revealed opposing patterns of lateralization when the lateral working memory item was cued to be relevant in contrast to when it was indicated to be irrelevant. A contralateral decrease of alpha power over posterior electrodes, indicating target facilitation, was observed when the lateral item remained relevant. In contrast, a contralateral increase of alpha power, indicating the suppression of irrelevant information, was present when the central item remained relevant (i.e., the lateral item had to be ignored). Hence, we argue that the retroactive deployment of attention involves both excitatory as well as inhibitory control mechanisms.

THE ERROR-RELATED NEGATIVITY AND VIRTUAL REALITY

Jonathan Ryan; Julia Klawohn; Greg Hajcak
Florida State University

Descriptors: Virtual Reality, ERN, Emotion

Virtual reality (VR) increasingly provides opportunities to experience immersive, detailed, and realistic artificial environments. Researchers have begun to leverage the technology to influence and alter emotional states. In the current study, we aimed to use VR to investigate the impact of an emotional manipulation on the error-related negativity (ERN). To this end, we first developed an auditory analogue to the well-established Stroop task that could be used concurrently with VR and without visual interference. In order to validate this task, 40 college students were administered both the visual and auditory Stroop in a traditional laboratory setting, in counter-balanced order. Analyses confirmed a comparably larger ERN than correct response negativity (CRN) in both tasks, and that these ERPs were strongly correlated across tasks. In a second study, college students completed the auditory task in two different VR environments: once while standing on the ground and once while standing on a plank suspended several stories in the air, in counter-balanced order. Participants reported higher levels of arousal on the plank. Results demonstrated that the ERN was potentiated when participants committed errors on the plank compared to the ground, indicating that VR induced a change in emotional state that increased error signaling. We interpret these results as reflecting increased error salience when mistakes were committed in the context of potential danger. These findings further demonstrate that VR could be beneficial in future ERP studies on emotion and individual differences.

THE ERROR-RELATED NEGATIVITY PREDICTS REAL-WORLD DAILY DISTRESS DURING PERIODS OF ACADEMIC STRESS IN EMERGING ADULTS

Iulia Banica; Aislinn Sandre; Anna Weinberg
McGill University

Descriptors: Error-related negativity, Stress, Distress

The error-related negativity (ERN), a neural index of error processing, may represent a vulnerability marker for anxiety, and has been shown to prospectively predict the onset of anxiety disorders. However, the means by which the ERN might contribute to pathological anxiety is unclear. One possibility is that this vulnerability marker renders people more susceptible to the adverse effects of life stress. The present study measured the ERN in 55 high-achieving undergraduate students at the beginning of the academic year, followed by an ecological momentary assessment (EMA) paradigm during the midterm exam period to investigate whether ERN magnitude interacts with daily academic stress to predict distress. Participants completed the Positive and Negative Affect Schedule (9 times throughout the day), as well as questions about daily academic events, for a period of ten days. On days when participants did not report adverse academic events, the ERN did not predict daily negative affect. But on days when participants experienced a stressful academic event (e.g., getting a bad grade, performing badly on an exam), those individuals with a larger ERN reported feeling more upset relative to those with a smaller ERN. These results demonstrate the importance of neural performance monitoring networks for everyday affective responses in the context of academic stress, and indicate that individuals with an enhanced neural response to errors may be more reactive to negative evaluative events, pointing to a potential pathway through which the ERN may increase risk of anxiety disorders.

Funding: Canada Research Chair (Awarded to Dr. Anna Weinberg).

THE EFFECT OF PROVOCATION ON GALVANIC SKIN CONDUCTANCE RESPONSE AND ITS ASSOCIATION WITH IN-VIVO PHYSICAL AGGRESSION

Alexander Puhalla; Kristen Sorgi; Joey Cheung; Martha Fahlgren; Zari Weaver; Sarah Taylor; Carla Capone; Michael McCloskey
Temple University

Descriptors: Galvanic Skin Conductance Response, Physical Aggression, Provocation

Previous studies have shown that blunted sympathetic nervous system (SNS) reactivity is associated with physical aggression. Yet, no study has examined galvanic skin conductance response (GSR; i.e., the immediate SNS response directly after a salient stimuli) to physical provocation nor GSR's association with real-time physical aggression, which may provide vital information as it corresponds to the rapidly occurring SNS activity due to the provocation. The current study filled this gap. Participants ($N = 67$) completed 28 reaction-time trials (four eight-trial blocks) that allowed them to administer electric shocks to a fictitious opponent who also shocked them. This was designed to mimic real-life provocation (i.e., escalating in intensity). Aggression was defined as the average intensity of electric shocks set within each block. We also examined both the effect of provocation on GSR and how average GSR was associated with shock set throughout the task. A repeated measures ANOVA showed a main effect of GSR [$F(1,66) = 43.97, p < .001$], with GSR decreasing in a linear fashion as provocation increased. A second repeated measures ANOVA found a main effect of shock set [$F(1,65) = 12.31, p < .001$], with the average shock set increasing as provocation increased. The GSR x shock interaction was significant [$F(1,65) = 7.43, p < .01$], such that those with blunted GSR selected more intense shocks as provocation increased. Thus, blunted SNS reactivity immediately after provocation seems to be associated with greater engagement in physical aggression, especially as provocation escalates.

THE INTERACTION BETWEEN DISGUST AND VAGAL ACTIVITY INFORMS SUBSEQUENT RISK-TAKING BEHAVIOR

Christopher Mullin; Jared McGinley
Towson University

Descriptors: Disgust, Heart Rate Variability, Risk-Taking

Researchers have proposed that disgust evolved in response to environmental pathogens to mitigate the risk of contamination. Past studies have demonstrated that experimentally-induced disgust can reduce risk-taking behavior. However, to adapt to disgust, humans must possess a way to regulate their response to disgusting stimuli. The present study investigates the possible role of the vagus in regulating the experience of disgust and explores how the interaction of disgust and vagal activity impacts risk-taking behavior. The participants were 30 undergraduate students. Vagal activity was assessed via heart rate variability (HRV). Participants underwent a five-minute baseline recording, then viewed a three-minute picture slide consisting of either disgusting or neutral images. Lastly, they performed the Balloon Analogue Risk Task. Preliminary analyses suggest that HRV change from baseline to stimulus presentation (i.e., vagal reactivity) predicts risk-taking behavior in the disgust condition, $\beta = .527, t(15) = 2.239, p < .05$, but not in the control group, $\beta = -.075, t(15) = .271, p > .05$. Additionally, HRV change from stimulus presentation to the risk task (i.e., vagal recovery) trends toward significantly predicting risk-taking behavior in the disgust, $\beta = -.473, t(15) = -1.938, p = .075$, but not in the control group, $\beta = .340, t(15) = 1.302, p < .05$. These findings imply that individuals with greater control over their vagal activity are more likely to engage in risky decisions than individuals with less reactivity.

YOU DOWN WITH LPP? HIGHER PERCEIVED SOCIAL CONNECTEDNESS CORRESPONDS WITH HIGHER LPP AMPLITUDE DURING PERSPECTIVE-TAKING

Andrea Coppola¹; Erin Maresh¹; Finn Roberts²; James Coan²
¹University of Arizona, ²University of Virginia

Descriptors: perspective-taking, social connection, ERP

Social connection is vital for health and well-being and is facilitated by processes like perspective-taking. However, little is known about how perceived social connectedness relates to temporal dynamics of perspective-taking during self-relevant tasks. In this study, 67 female undergraduate students completed a trait measure of social connectedness and then viewed positive and negative trait words under two conditions while EEG was recorded. In the "self" condition, participants answered whether they think each word describes themselves. In the "other" condition, participants answered whether other people, in general, think each word describes them. Mean amplitude of the late positive potential (LPP), an event-related potential (ERP) thought to index attention to emotional content, was measured across 400-600ms at Cz. There were no main effects of condition or valence on mean LPP amplitude; however, social connectedness interacted with both condition ($p < .001$) and valence ($p = .01$) to predict LPP amplitude. First, higher social connectedness corresponded with higher LPP amplitude when assessing the self-relevance of trait words from the perspective of other people, compared to one's own perspective. Second, higher social connectedness corresponded with higher LPP amplitude when assessing the self-relevance of positive, compared to negative, trait words, regardless of perspective-taking condition. Taken together, these findings suggest that socially connected individuals may put more stock in others' opinions of them compared to those low in social connectedness.

STILL THINKING ABOUT IT: THE ROLE OF RUMINATION IN CARDIOVASCULAR RECOVERY OF AFRICAN AMERICANS AFTER DISCRIMINATION

Mona El-Hout; Kristen Salomon
University of South Florida

Descriptors: Cardiovascular Recovery, Respiratory Sinus Arrhythmia, Racial Discrimination

Research has found associations between racial discrimination and negative health outcomes such as poorer heart rate variability recovery after a racial stressor. To further examine this, we simulated an uncivil interaction between 110 African Americans and White, female research associates, akin to the daily hassles often experienced by African Americans. We measured respiratory sinus arrhythmia (RSA) during baseline, the uncivil interaction, and recovery, and examined the moderating effects of past unfair treatment and ethnic discrimination. As recovery may be worsened via the prolonged cognitive effects of a stressor (Brosschot et al., 2006), we manipulated rumination or distraction using thought prompts displayed to the participants during recovery. Control participants received no thought prompts. A paired samples t-test found a significant decrease in RSA from baseline to interaction, indicating a typical stress response. Controlling for reactivity, a one-way ANOVA revealed no significant differences in RSA recovery between the three conditions. However, moderation analyses revealed significant interactions for condition and RSA recovery, such that individuals with higher levels of past unfair treatment and discrimination displayed improved RSA recovery if they were distracted compared to controls and ruminators. No differences between control and rumination were found across all levels of past unfair treatment, indicating the potential presence of rumination among the controls.

NEURONAL ORIENTATION TUNING UNDER CHANGING THREAT CONTINGENCIES: OSCILLATORY SPECIFICITY OF SAFETY LEARNING DURING FEAR GENERALIZATION

L. Forest Gruss¹; Nathan Petro²; Andreas Keil³

¹Vanderbilt University, ²University of Nebraska, Lincoln, ³University of Florida

Descriptors: Safety learning, ssVEP, Fear generalization

Adapting to changing threat contingencies is necessary for survival. Uncovering the mechanisms of visuocortical processing of threat has brought to light the importance of investigating threat and safety selectivity. In prior work we found distinct orientation tuning responses using steady-state visually evoked potentials (ssVEP) in a fear generalization paradigm, with Gabor gratings serving as the conditioned stimuli (CS): primary visual cortex activation in acquisition revealed CSs most similar to the learned threat cue (CS+) to be inhibited. In the current two studies, we introduced a second acquisition block in which the nearest neighbor of the old CS+ (45°) was conditioned instead (55° for study 1; 35° for study 2). We hypothesized that associative strength of the new CS+ would override prior local and long-range mechanisms of inhibition and that the old CS+ would remain uninhibited due to the value of biased perception towards threat cues. Studies 1 (n=20) and 2 (n=20) were identical in design, except for the new CS+ in the second acquisition block. Results were consistent with our hypothesis in that both CS+ stimuli lead to amplification of the ssVEP response due to conditioning. However, results additionally revealed a unique pattern of activation for the safety stimuli in extinction: safety cues on the side of the old CS+ were enhanced, whereas safety cues on the side of the new CS+ were inhibited. These findings have significant implications for safety learning, demonstrating the need to focus on safety processing in the context of changing threat contingencies.

Funding: Funding was provided through an R01 grant awarded to Dr. Andreas Keil.

1:00 p.m.-2:30 p.m.
Diversity Symposium 5.1

ADDRESSING THE REPRESENTATIVE SAMPLES PROBLEM IN PSYCHOPHYSIOLOGICAL RESEARCH: PRACTICAL AND CONCEPTUAL STRATEGIES FOR ADVANCING THE FIELD

Session Chair: Lisa Gatzke-Kopp
Pennsylvania State University

Chronic under-inclusion of certain demographic groups has resulted in a scientific knowledge base that may not adequately generalize to the full population it is meant to serve. Although NIH first introduced a mandate for inclusive and representative samples in 1993, substantial disparities in minority representation in federally funded research persist (Guerrero et al., 2018; Konkel, 2015; Sheikh, 2006). Although under-representation plagues all biomedical research, psychophysiological research may be especially under-representative. The cumbersome and sensitive equipment used in psychophysiological research often constrains research activities to a University campus. This can create logistical, geographical, and psychological barriers on the communities from which participants are drawn, essentially filtering a certain demographic profile of volunteer participants. Researchers often feel powerless to change these realities, and although there are no simple answers, this panel discussion aims to begin a conversation around the unmet scientific need and the logistical and practical challenges in meeting that need. Panelists will discuss the scientific implications of diverse representation, strategies for enhancing participation by traditionally underrepresented groups, considerations in measurement and interpretation of physiological signals, and social and policy perspectives.

CHALLENGING THE NOTION OF A “HUMAN” DEFINITION OF PROFILE OF BRAIN FUNCTION

Lisa Gatzke-Kopp
Pennsylvania State University

One of the primary arguments against the need to worry about diverse representation in psychophysiological research is the notion that gender, race, and social class are sociopolitical constructs, whereas the brain is universally “human”. Thus research participants are presumed to be fully generalizable (presuming, of course, that they are not left-handed). Many scientists argue for a defaulting presumption of sameness across subgroups unless evidence justifies a different approach, but this argument inherently prevents the accumulation of evidence that would provide that justification. In 2016 *Psychophysiology* published a special issue examining the validity of the presumption of sameness, calling attention to instances in which demographic variables (including race/culture, sex/gender, and socioeconomic status) moderate the association between brain and behavior. Demographic factors represent chronic contextual influences on experience-dependent brain development that could establish different neural pathways underlying a common behavioral outcome. In addition, cultural and psychological differences between groups could (a) fundamentally alter the validity of measurement scales developed on one group when applied to another and/or, (b) fundamentally alter the experience of an experimental condition, such as with stereotype threat, both of which may give rise to potentially artificial group differences. These challenges highlight the need for more a more extensive research base to guide the study of human psychophysiology in a way that is inclusive of all humans.

CULTURAL MODERATION OF THE EFFECTS OF STRESS ON CARDIAC HEALTH: IMPLICATIONS FOR THE CONCEPTUALIZATION, MEASUREMENT, AND DESIGN OF RESEARCH STUDIES

John Ruiz
University of Arizona

Documented associations between stress and cardiovascular health are largely based on White samples. Current research turns to well-established findings in the literature to select variables to measure that have consistently demonstrated strong predictive value. However, the extent to which these findings adequately generalized to groups not included in the original research has been called into question, the most striking example of which is the Hispanic Health Paradox. In the U.S. individuals of Hispanic descent suffer striking disparities in income, housing, social opportunity, and access to services and resources, all factors associated with adverse health outcomes. Surprisingly however, Hispanics are consistently found to have lower rates of morbidity and mortality than non-Hispanic Whites, challenging the established dogma surrounding associations between stress and physical health. Researchers postulate that this phenomenon is mediated by cultural factors that act between the objective exposure to stressors, and the subjective experience of stress. Greater consideration of how measurement validity is affected by culture is needed, as well as ways to better operationalize the construct of culture to focus on its mechanistic pathway. Identifying the levels at which culture creates differences across groups may provide the opportunity to develop measures that more effectively generalize across groups.

LOGISTICAL AND PRACTICAL CHALLENGES TO MEETING THE NIH DIVERSITY EXPECTATIONS

Ishmael Amarreh
National Institutes of Health

The primary mission of the National Institute of Health is to improve the lives of all Americans, which requires addressing the needs of a diverse, and rapidly changing demographic. Epidemiological data indicate that certain demographic groups are disproportionately likely to suffer physical and mental health problems, including: individuals residing in rural communities, living in poverty, identifying as a racial or sexual minority, and/or being an immigrant in this country. Despite carrying the highest health burdens, these groups are often the least likely to be represented in basic science research. Addressing this issue requires an expansion of the scientific knowledge base to include a more global and comprehensive understanding of human health, including factors that moderate neural mechanisms underlying cognitive and behavioral processes. This discussion will orient researchers to the ways that diversifying research participation is prioritized and instrumentally supported at NIH, and discuss strategies researchers can use to enhance their success at recruiting and retaining minority participants in their research.

LEAVING THE IVORY TOWER

Wendy D'Andrea
The New School

University-based research creates psychological barriers to participation even within cities with diverse communities. Some minority populations have adverse histories with medical research and may feel alienated by educational institutions. Furthermore, participants often see an inherent value to participating in medical research seeking to address health problems they themselves struggle with, whereas the value of participation in basic science research is often less apparent. Reaching out to disenfranchised groups requires more than an army of undergraduates with reams of fliers to simply make individuals aware of the opportunity to participate, but a concerted effort to create value in participation. Panelists will discuss their experiences, and lessons learned, in (a) Strategies for establishing productive partnerships in a diverse range of communities, (b) establishing physiological labs in non-traditional environments such as other countries, off-campus community spaces, and mobile vehicles, and (c) practical considerations for measurement and quantification of physiological signals in heterogeneous samples.

1:00 p.m.-2:30 p.m.
Symposium 5.2

PHYSIOLOGY TO CHARACTERIZE ROMANTIC AND NON-ROMANTIC DYAD REGULATION

Session Chair: Nicole Prause
Liberos LLC

Social concern about loneliness and worry about the impacts of technology on our ability to connect with one another are common themes in research on couple's well-being. The ability to model dynamic, dyadic effects would better represent the complexity in dual, interacting systems. However, physiological experiments involving two or more individuals require unique designs and statistical approaches to advance social psychology and investigate coregulation. These talks review statistical methods to describe dual-physiology data appropriate to an underlying model, imaginal partner effects of physiology, and dual-physiology effects during an intimate erotic practice. Peripheral physiological measures are used, with a focus on methods development in each talk. Specifically, talk 1 elaborates statistical techniques for describing physiological data streams from two individuals in a freely-available R package. Talk 2 contrasts standard laboratory stressors with social romantic partner stressors for their physiological impact. Talk 3 examines changes in

felt closeness and measured arousal during a 15-minute, partnered, manual-genital stroking practice. Each suggests unique methods for accounting for the effects of a partner on physiological measures.

A NEW R PACKAGE (RTIES) FOR MODELING DYNAMIC INTERPERSONAL PHYSIOLOGY

Emily Butler
University of Arizona

Anytime people interact they become coordinated across biological systems. For example, muscular movement synchronizes, autonomic physiology begins to rise and fall in loosely coupled patterns, neuroendocrine systems show similar trajectories over time and brains begin to show similar patterns of activation. Understanding the causes and consequences of this physiological linkage requires statistical tools for modeling interpersonal dynamics. I introduce a new R package, *rties*, that simplifies testing whether a set of dynamic interpersonal physiological patterns can either predict, or be predicted by, other variables of interest such as wellbeing. Currently the package includes 2 models: 1) the "Inertia-Coordination" model, which can represent between-partner in-phase versus anti-phase coordination, and 2) a "Coupled-Oscillator" model, which can represent between-person damping (coregulation) and amplification (co-dysregulation) of coupled oscillations. We start with some measure of physiology, assessed repeatedly over time for both partners in a sample of dyads. One of the models is fit to this data for each dyad individually and the parameter estimates for each dyad are then used either to predict, or be predicted by, cross-sectional variables of interest (e.g., each person's wellbeing). I will demonstrate the package with autonomic data from 70 romantic couples engaged in mixed-emotion conversations. If you want to study interpersonal physiology, *rties* offers two powerful models that map directly to theory and can be applied to any bivariate time-series data.

CARDIOVASCULAR REACTIVITY DURING A COLD PRESSOR TASK AND SPEAKING ALOUD ABOUT A ROMANTIC RELATIONSHIP: THE ROLE OF SUPPRESSION AND POSITIVE EMOTIONS

Kyle Bourassa; John Ruiz; David Sbarra
University of Arizona

Cardiovascular reactivity (CVR) is one mechanism implicated in how social relationships might affect health. The current study extends prior results from a laboratory study examining how affiliative cues affect CVR. Participants ($N = 102$) in a romantic relationship were randomly assigned to one of three conditions and completed a baseline, cold pressor, and stream-of-consciousness (SOC) task. In a prior study, we showed that participants in the affiliative conditions (having a partner present and mentally drawing on a romantic partner) had significantly lower systolic BP ($d = -0.54, p = .007$) and diastolic BP ($d = -0.53, p = .005$) compared to controls. The current study extends these results by comparing CVR during a cold pressor task to a SOC task—in which participants were asked to speak aloud about their relationship for 4-mins. The SOC task resulted in significantly greater systolic ($d = 0.68, p < .001$) and diastolic BP reactivity ($d = 0.43, p < .001$) compared to the cold pressor task, but not heart rate (HR; $d = 0.16, p = .113$). Participants' CVR during the SOC was significantly associated with participants' reported suppression of their emotions during the task for systolic BP ($\beta = 0.20, p = .016$) and HR ($\beta = 0.14, p = .045$), but not diastolic BP. Greater reported positive emotion during the SOC also predicted significantly lower HR reactivity ($\beta = -0.16, p = .019$), but not BP reactivity. The results suggest that experiencing and suppressing emotions while talking about a romantic relationship impacts CVR compared to reactivity to a standardized laboratory stressor.

Funding: The current study was supported in part by a grant provided to the first author from the Graduate and Professional Student Council at the University of Arizona (RSRCH-205FY'18).

COUPLES INCREASE CLOSENESS BY A GENITAL STROKING PRACTICE

Nicole Prause¹; Greg Siegle²; James Coan³

¹Liberos LLC, ²University of Pittsburgh, ³University of Virginia

Relationship closeness promotes desirable health outcomes. Most interventions to increase relationship closeness are verbal, which may not suit all couples. We test whether Orgasmic Meditation (OM), a structured, partnered, largely non-verbal practice that includes 15 minutes of clitoral stroking, increases relationship closeness. We hypothesized that OM would increase feelings of closeness. Further, we tested whether partner type (romantic or non-romantic), experience viewing sex films, or sexual arousal moderated closeness effects. These are important, because intimate touch with non-romantic partners and sex films are commonly considered deleterious by clinicians, which may inadvertently increase feelings of shame. Dyads (n=125) reported their feelings of closeness and sexual arousal before and after OM. Galvanic skin response (GSR) and EEG were recorded continuously. Closeness after OM increased across all participants, with non-romantic dyads increasing closeness more than romantic dyads. Further, those who viewed more sex films reported more sexual arousal prior to the OM and partners of those who viewed more sex films had higher GSR. These data support that a partnered, largely non-verbal practice can increase feelings of closeness, including for individuals who are not in a romantic relationship. These changes are not due to differences in sexual arousal alone, and sex film viewing only increased partner sexual anticipation and responsiveness.

Funding: OMFree Foundation to co-PIs Prause & Siegle.

1:00 p.m.-2:30 p.m.
Symposium 5.3

THE COGNITIVE DYNAMICS OF SELECTION AND LIMITED CAPACITY: INTEGRATING METHODS, PARADIGMS, AND CONCEPTS

Session Chairs: Andreas Keil¹; Pierre Jolicoeur²

¹University of Florida, ²University of Montreal

Limited capacity and item selection are at the core of fundamental cognitive processes such as perception, attention, and working memory. Thus, establishing the neural underpinnings of limited capacity and their relation to behavioral performance has been a key objective in cognitive neuroscience. Deviating from information processing accounts that assume a fixed pool of resources available for different cognitive processes, recent research has pointed to flexible and dynamic usage of limited capacity over time, in which the temporal and spatial relations between stimuli as well as their motivational relevance determine the amount of competition between competing items. This symposium demonstrates how human brain imaging, specifically electrophysiology, is used to track the spatial and temporal dynamics of item selection. We identify and discuss commonalities between different experimental paradigms, measurement modalities, and conceptual frameworks. Jolicoeur et al. will discuss how target-target and target-distractor interactions vary with spatial proximity and task demands in the generation of ERP manifestations of visuo-spatial attention. Kappenman et al. use ERPs to characterize the dynamics of threat cue selection versus suppression in observers differing anxiety status. Corballis et al. demonstrate flexible adjustment of attention control to varying task demands, reflected in ERPs and oscillatory brain activity. Finally, Keil et al. will present evidence for the notion that low-level competition can be resolved at higher levels of the visual hierarchy.

UPS AND DOWNS, LEFTS AND RIGHTS, NEAR AND FAR, FAST AND SLOW SPATIOTEMPORAL DYNAMICS OF ATTENTION

Pierre Jolicoeur; Anne Monier; Marie-Eve Picard;

Brandi Lee Drisdelle; Martine Desjardins
University of Montreal

Evidence for distinctions between target processing and distractor processing will be reviewed in the context of new experiments designed to isolate these processes on the basis of ERP components associated with visual attention (e.g., N2pc, N2pb, SN, Pd). Target:possible-target distance, target:distractor distance, distractor presence, and retinal locus of stimuli (upper vs. lower visual hemifields) all have major impacts on the amplitude, latency, and even the polarity, of lateralized ERPs associated with spatial selection. Together with recent work on difficult visual search, showing how response-locked posterior contralateral negativity (RLpcn) can be used to isolate visual search mechanisms from response-selection mechanism, the results of this body of work help to constrain the functional and neuronal interpretation of these well-known ERP components. We will review EEG and MEG work from our laboratory spanning several years and suggesting some commonalities across these "attention-modulated" components that shed light on the underlying neuronal processes implementing attention. The sometimes radical differences between EEG and MEG measurements for attention deployed in the upper versus lower visual fields will be highlighted.

THE TIME COURSE OF ATTENTION TO THREATENING STIMULI: DISTINCT ELECTROPHYSIOLOGICAL MARKERS OF ENHANCEMENT AND SUPPRESSION OF ATTENTION TO THREAT

Emily Kappenman¹; Raphael Gedder¹; Jaclyn Farrens¹;

Greg Hajcak³; Steven Luck²

¹San Diego State University, ²University of California, Davis,

³Florida State University

Emotional stimuli, particularly those that are related to threat, are thought to capture attention, and preferential allocation of attention to threatening stimuli is considered to be a core feature of anxiety. However, there are multiple types of threat and multiple mechanisms of attention, and as a result the relationships among threat, attention, and anxiety are poorly understood. We used event-related potentials (ERPs) to separately measure the time course of two distinct subprocesses of attention: attentional enhancement with the N2pc component, and attentional suppression with the P_D component. Moreover, we examined these distinct mechanisms of attention in response to two types of threat stimuli: inherently threatening images (e.g., guns, snakes) and conditioned threat stimuli (colors paired with electric shock). Both inherently threatening images and conditioned threat stimuli initially captured attention; however, this initial capture of attention was followed by a suppression of attention only in response to conditioned threat. Furthermore, conditioned threat stimuli (but not threatening images) produced a significant and reliable reaction time (RT) bias. Initial orienting of attention to threat was unrelated to anxiety for either threat type. Instead, individuals with higher levels of anxiety showed greater suppression of attention to conditioned threat and, subsequently, an RT bias away from threat. The results suggest that it is the subprocess of attentional suppression and not attentional enhancement that characterizes abnormal attention to threat in anxiety.

PREDICTABLE DISTRACTIONS: EEG AND ERP CORRELATES OF DISTRACTOR PREDICTABILITY IN VISUAL SEARCH

Paul Corballis; Kane Pavlovich; Deborah Yi
The University of Auckland

Successful visual processing frequently adapts to spatial and temporal regularities of the environment in order to optimize performance. Here, I will discuss a new study in which we explored how prior knowledge of distractor location influenced the efficiency of visual search and the manifestation of EEG and ERP correlates of cognitive control and distractor processing. Participants searched for a target stimulus in a circular array of filler items. The array also contained a salient distractor that shared features with the target. Locations of the target and distractor in the array were variable, save that (1) the distractor would appear in the same location for three consecutive trials before switching to a new location and (2) one of the critical stimuli always appeared on the vertical midline. Frontal theta power decreased, and posterior alpha power increased with the number of distractor repetitions, presumably reflecting the increased cognitive control required when the distractor location was unpredictable. The morphology of the lateralized Ptc (or Pd) ERP component also varied as a function of distractor predictability. Ptc was higher in amplitude and shorter in duration when the distractor location was predictable, and lower in amplitude but broader for unpredictable distractors, replicating earlier work linking Ptc morphology with the ease or difficulty of distractor processing. These findings suggest that both frontal and posterior mechanisms of cognitive/attention control adjust dynamically to task demands – engaging more when greater control is required.

OSCILLATORY SAMPLING IN TIME AND SPACE AS A MECHANISM FOR THE FLEXIBLE MANAGEMENT OF LIMITED CAPACITY

Andreas Keil; Maeve Boylan; W. Friedl; Kierstin Riels
University of Florida

Capacity limitations are a key feature of many cognitive systems, including the systems that select aspects of the sensory input for further processing. Past research has found ample support for the notion that capacity limitations may vary as a function of factors such as task difficulty or motivational relevance. Based on EEG and EEG-fMRI studies from our laboratory, this presentation discusses potential neurophysiological mechanisms underlying the dynamic management of flexible resources in the service of adaptive behavior. Using steady-state visual evoked potential frequency tagging, we show how increasing the number of attended items, and increasing the luminance contrast of a distractor alters the temporal and spatial configuration of selective attention effects in visual cortex. Furthermore, changing the number and contrast of targets and distractors alters the rate of perceptual sampling assessed through eye tracking and electrophysiological data. Together, the data suggest a model in which tissue in higher-order visual areas comes online in a flexible fashion to increase capacity, and such increased cortical sampling is temporally organized by rhythms that are consistent with the rate of saccadic sampling of the external world.

1:00 p.m.-2:30 p.m. Symposium 5.4

'CAUSE IT'S YOU, AND ME, AND MY AUTONOMIC ACTIVITY: A MULTI-METHOD EXAMINATION OF PUTATIVE INTERPERSONAL, COGNITIVE, AND BEHAVIORAL MECHANISMS OF DEPRESSION RISK ACROSS DEVELOPMENT

Session Chairs: Ilya Yaroslavsky¹; Xiao Yang²
¹Cleveland State University, ²University of Pittsburgh

Discussant: John Allen, University of Arizona

Though parasympathetic nervous system dysregulation is a putative depression risk factor, its constituent mechanisms remain elusive, as does the role of the sympathetic nervous system (SNS) in depression. This symposium examines cognitive, behavioral, and interpersonal processes that link autonomic (ANS) activity to depression outcomes across development and setting. First, Xiao Yang will present findings from two studies on the relationship between ANS functioning, motivation to engage in cognitive effort, and emotion regulation outcomes among adults with and without depression histories. Second, Anna Olczyk will report data on associations between SNS indices of effort mobilization during emotion regulation, immediate affective outcomes, and recovery from distress in the daily lives of adolescents at high- and low-risk for familial depression. Third, Ilya Yaroslavsky will discuss results that uniquely tie non-linear effects of respiratory sinus arrhythmia (RSA) reactivity to scenes of interpersonal loss with putative interpersonal protective and risk factors for depression across the laboratory and daily life settings in a sample of adults with various depression histories. Fourth, Jessica Hamilton will report findings on resting RSA's buffering against depressogenic effects of interpersonal stress (but not non-interpersonal stressors) in daily lives of young adults with depression histories. Finally, the discussant, John J.B. Allen, will identify common themes across the presented studies, and outline clinical implications for preventing depressive disorders.

MIND OR BODY? THE ROLE OF COGNITIVE EFFORT AND AUTONOMIC FUNCTIONING IN EMOTION REGULATION AMONG INDIVIDUALS WITH HISTORIES OF DEPRESSION

Xiao Yang; Maria Kovacs
University of Pittsburgh

Depression is associated with low use of adaptive strategies to reduce negative emotions and excessive use of maladaptive strategies. In this talk, we present two studies on autonomic and cognitive factors of emotion regulation in depression. In both studies, adults with childhood-onset depression (COD) and controls completed mood induction and repair tasks, during which respiratory sinus arrhythmia (RSA) and pre-ejection period (PEP) were collected. Using multiple regressions, we examined effects of depression history and autonomic activity during mood repair on emotion regulation difficulties in study 1. Results showed that greater RSA but not PEP activity predicted more regulation difficulties in the COD group but less difficulties in controls. In study 2, we further examined whether cognitive effort influences the use of emotion regulation strategies in daily life. The Cognitive Effort Discounting task (Westbrook & Braver, 2015) was used to quantify subjective value of cognitive effort, which reflects motivation to engage in cognitive activity. Multiple regressions indicated that greater RSA withdrawal was related to more use of maladaptive but to less use of adaptive strategies, and high levels of subjective cognitive effort predicted more use of adaptive strategies in the COD group. Moreover, cognitive effort modulated the relation of RSA and emotion regulation. These findings suggest that emotion regulation mechanisms are different between individuals with and without depression, and that less motivation on cognitive effort exacerbates emotion regulation deficits.

Funding: National Institutes of Health Grant No. MH113214.

DOES SYMPATHETIC NERVOUS SYSTEM OUTPUT PREDICT EMOTION REGULATION OUTCOMES ACROSS LABORATORY AND DAILY LIFE SETTINGS?

Anna Olczyk; Ilya Yaroslavsky
Cleveland State University

Mood repair is one component of emotion regulation (ER) that reflects the ability to reduce dysphoria. Adaptive ways to repair mood involve responses, such as distraction, that are flexibly deployed as appropriate to context. Evidence implicates autonomic nervous system (ANS) process in mood repair use and outcomes, though much of this work has focused on the parasympathetic branch of the ANS. A small literature ties sympathetic nervous system (SNS) activity to effort mobilization and persistence, which may influence mood repair. However, the relationship between SNS activation during mood repair on affective outcomes is not known. This study tested whether SNS activation (indexed via cardiac pre-ejection period reduction, PEP) during mood repair can predict immediate mood repair gains in the lab (change in positive & negative affects, PA & NA), and recovery from distress in the daily lives of 42 adolescents (Mean age = 14.57, 57 percent female, 83 percent at high risk for familial depression) who completed a 7-day experience sampling protocol. Independent of demographic characteristics and depression risk status, PEP reduction during mood repair relative to baseline and frustration task levels predicted greater decline in NA (Betas = $-.21$ to $-.27$, $ps < .05$) and increase in PA (Betas = $.25$ to $.30$, $ps < .05$ to $.01$) following mood repair, and NA recovery following 341 instances of distress in daily life (NA Gamma = $.08$ $p = .05$). These findings tie the SNS to effort mobilization during mood repair and highlight a need to consider SNS activity in ER and depression research.

Funding: Cleveland State University Faculty Research Development Award.

POLYVAGAL THEORY CAN INFORM INTERPERSONAL MODELS OF DEPRESSION: RESPIRATORY SINUS ARRHYTHMIA REACTIVITY PREDICTS DEPRESSOGENIC INTERPERSONAL PROCESSES ACROSS LABORATORY AND DAILY LIFE SETTINGS

Ilya Yaroslavsky
Cleveland State University

Interpersonal models of depression posit that stress generating behaviors erode interpersonal resources that reduce depression risk. Interpersonal efforts to downregulate dysphoria contribute to stress generation, whereby ineffective (maladaptive) responses engender interpersonal conflict, while effective (adaptive) responses strengthen social bonds. Polyvagal Theory poses that optimal vagal activity, indexed via Respiratory Sinus Arrhythmia (RSA), facilitates social engagement. Though potentially germane, few examine links between RSA and interpersonal risk and protective factors that may be drawn from the Polyvagal Theory; those that do usually assume linear associations between RSA and interpersonal outcomes despite some evidence to the contrary. This study tested differential effects of RSA at rest (resting RSA) and in response to a sad mood induction (RSA reactivity) on stress (interpersonal v. non-interpersonal), emotion regulation (interpersonal v. cognitive) and social support across laboratory and daily life setting in a sample of 87 adults with various depression histories. RSA reactivity evidenced quadratic associations with interpersonal stress ($B = 6.99$), adaptive and maladaptive interpersonal emotion regulation responses ($B = -.69$ to $.53$), social support ($B = -3.78$), and negative interpersonal event occurrence in daily life ($B = .41$), wherein optimal RSA withdrawal predicted salubrious outcomes ($ps < .05$). RSA reactivity was unrelated to non-interpersonal outcomes, and resting RSA was unrelated to interpersonal ones. Clinical and conceptual implications will be discussed.

Funding: Cleveland State University Undergraduate Summer Research Award.

VULNERABILITY-STRESS MODEL OF DEPRESSION: RESPIRATORY SINUS ARRHYTHMIA IN THE CONTEXT OF LIFE STRESSORS

Jessica Hamilton¹; Jonathan Stange²; Lauren Alloy³
¹University of Pittsburgh, ²University of Illinois, Chicago,
³Temple University

Respiratory sinus arrhythmia (RSA) has been implicated in emotion regulation. Fewer studies have examined RSA in a prospective vulnerability-stress model, in which RSA confers vulnerability for individuals in the context of naturally-occurring environmental stressors. The present study sought to evaluate whether laboratory-based RSA (resting and stress reactivity) predicted daily depressive symptoms in the context of life events, including interpersonal and non-interpersonal stressors. Young adults ($N = 102$; 79% female; 18-22 years) with prior depression completed a laboratory session, in which RSA at rest and during a social stressor task was collected, and two weeks of daily diaries assessing depressive symptoms and daily stressors. Using multilevel modeling, we examined cross-level interactions between RSA and life events on depressive symptoms, controlling for RSA-related variables and prior-day symptoms. Resting RSA interacted with interpersonal stressors ($B = -.30$, $p < .01$), but not non-interpersonal stressors ($B = -.11$, $p = .41$) to predict depressive symptoms. Specifically, lower resting RSA predicted depressive symptoms when individuals encountered more interpersonal stressors on that day. There were no significant effects of RSA reactivity with life events. These findings suggest that resting RSA may confer vulnerability to depression, particularly when individuals encounter higher levels of interpersonal stressors. Results highlight the importance of considering contextual factors in the examination of RSA and emotion regulation in risk for depression.

3:00 p.m.-4:30 p.m.
Big Question Session 6.1

WHAT HAVE WE LEARNED FROM STUDYING AFFECTIVE CHRONOMETRY (I.E., THE TIME COURSE OF AN AFFECTIVE OR EMOTIONAL RESPONSE) USING PSYCHOPHYSIOLOGICAL MEASURES?

Session Chair: Catherine Norris
Swarthmore College

Discussant: Gregory A. Miller, University of California, Los Angeles

WHEN THE STAKES ARE HIGH: PARASYMPATHETIC CONTROL IN THE CONTEXT OF RISK VARIES BY CHILDHOOD TRAUMA

Sarah Herzog; Nicole Kouri; Lauren Krulis; Noga Miron;
Thomas Wilson; Scott McKernan; C.J. Healy; Justine Rudy;
Wendy D'Andrea
The New School

Descriptors: HRV, Threat, Childhood trauma

Previous findings suggest that chronic childhood trauma is associated with impaired or delayed responding to threat, yet less is known about the psychophysiological and affective mechanisms that account for this. We suggest that impaired responding may result from dampened or inconsistent mobilization of autonomic reactivity to threat, which emerges as an adaptation to cumulative childhood trauma. In the current study we examined second-by-second heart rate variability (HRV), an index of parasympathetic control of the heart closely associated with emotion regulation, in women categorized by low, moderate, and high childhood trauma, as they engaged in a 5-minute risk detection task. The task consists of an audio vignette of an encounter between a female subject and male acquaintance that gradually escalates in risk and ends in rape. Using repeated measures ANOVA, we compared HRV at 9 segments that mark the most affectively charged moments of the vignette. Results demonstrate a significant group-by-segment interaction wherein HRV in the low trauma group steadily decreases as the situation grows increasingly risky while the moderate and high trauma groups' HRV climbs, suggesting the latter may experience over-regulation of emotional responding that inhibits mobilization of an appropriate sympathetic response. Moreover, longer reaction times when making determinations of danger were associated with higher HRV values at the time of responding. Results have important implications for the effects of trauma burden on real word decision-making in the context of risk.

Funding: ISTSS Frank W. Putnam Trauma Research Scholars Student Research Award, The New School.

THE TEMPORAL DYNAMICS OF EMOTIONAL RESPONDING: IMPLICATIONS FOR HEALTH AND WELL-BEING

Stacey Schaefer¹; Carien van Reekum²; Richard Davidson¹
¹University of Wisconsin, Madison, ²University of Reading

Descriptors: affective chronometry, electromyography, eyeblink startle response

Affective chronometry findings will be reviewed from the Midlife in the US (MIDUS; <http://midus.wisc.edu/>) and similar studies from our laboratory demonstrating the value in examining the time course of responses to brief emotional provocation for understanding linkages among differences in response styles and factors contributing to health and well-being. Differentiating *reactivity* in response to an emotional stimulus from *recovery* after the stimulus offsets has been particularly important when exploring the interactions between emotional response styles, age, cognitive biases, personality, psychosocial stress, well-being, daily affect, disease status, and even mortality. For example, corrugator electromyography (corEMG) and eyeblink startle magnitude (EBR) measures of negative emotional responses were collected in a large sample whose decedent status was established ten years later. The magnitude difference in corEMG and EBR *during* negative picture presentation compared to *after* offset significantly predicted mortality. The decedent group exhibited blunted responses which increased, rather than decreased, after negative picture offset, suggesting the temporal dynamics of negative emotional responses are critically important for future health. Through affective chronometric analysis of negative and positive emotional responses, relations between health and well-being with specific temporal parameters of the emotional responses can be identified and a better understanding gained of how emotions “get under the skin” to impact health and well-being across the lifespan.

Funding: This research was supported by the National Institute on Aging (U19 AG051426, PO1-AG020166), the National Institute on Mental Health (R01 MH043454), and the Waisman Intellectual and Developmental Disabilities Research Center (P30HD03352).

CONTRIBUTION OF UPDATING EMOTIONAL CONFLICT MONITORING TO EMOTION DYSREGULATION IN TRAUMA-EXPOSED INDIVIDUALS

Jacklynn Fitzgerald¹; Ashley Huggins¹; Tara Miskovic¹; Christine Larson¹

¹University of Wisconsin, Milwaukee, ²VA Northern California Healthcare System

Background: Problems in emotion processing are common after trauma, including deficits in emotional conflict monitoring, or the extent to which emotional distractors compete with task-relevant information. In particular, the ability to update monitoring of emotional conflict after a period of no conflict may be compromised. Nevertheless, there are relatively few studies examining the neurobiological mechanisms of this process in this population. The current investigation tested brain regions involved in the updating of emotional conflict monitoring and their association to emotion dysregulation severity. **Methods:** N=31 traumatic-injury survivors completed a functional magnetic resonance imaging (fMRI) task of emotional conflict monitoring and the Emotion Dysregulation Scale [EDS] within two weeks of their trauma. During the task, participants viewed fearful and happy faces: in half the trials an emotional word superimposed on the face matched the emotion of the face (congruent), while during the other half the word/face was mismatched (incongruent). A timing-dependent update in emotional conflict monitoring was defined as incongruent trials that followed congruent trials, modeled for fearful and happy faces separately. Task-effects were examined at the group level and EDS scores correlated with whole-brain activity.

Results: Updating the emotional conflict monitoring of fearful faces recruited the posterior DMPFC ($p < 0.001$ uncorrected; MNI: -2, 4, 46; $Z=4.02$). Greater recruitment of the posterior DPMFC ($p < 0.001$ uncorrected; MNI: -8, 4, 48; $Z=3.74$) was positively related to severity of emotion dysregulation. **Conclusion:** A greater reliance on DMPFC to update the monitoring of emotional conflict is related to severity of emotion dysregulation in those exposed to trauma.

Funding: This research was supported by R01MH106574. JMF is supported by F32MH117895.

3:00 p.m.-4:30 p.m. Symposium 6.2

KICKING THE CAN (CENTRAL AUTONOMIC NETWORK) FROM PREDICTIVE CODING MODELS TO STRUCTURAL AND FUNCTIONAL CONNECTIVITY

Session Chair: Ben Allen
University of Tennessee

Discussant: John R. Jennings, University of Pittsburgh

Well-established theory and evidence suggest that a distributed group of cortical and subcortical brain regions coordinates the autonomic nervous system. Much of the early work in this area used non-human animals. Through the application of neuroimaging techniques, and with magnetic resonance imaging in particular, extensive research has been conducted to answer the question: which brain systems regulate autonomic function in humans? These human studies have important implications for research utilizing psychophysiological measures of autonomic responding. Across four talks, this symposium will review recent advances in our understanding of the central autonomic network in both health and disease. An update on the neurovisceral integration model will be presented from a computational modeling perspective, along with new evidence of central regulation of the heart using a resting state functional connectivity approach. Heterogeneity in the functional structure of the central autonomic network as it relates to pupillary responses will be discussed in the context of community detection algorithms applied to task-based functional connectivity. Finally, recent advances in how neurodegenerative diseases diminish functional and structural connectivity within the central autonomic network will be put forward.

THE HIERARCHICAL BASIS OF NEUROVISCERAL INTEGRATION

Richard Lane¹; Julian Thayer²; Sahib Khalsa³; Ryan Smith³

¹University of Arizona, ²The Ohio State University, ³Laureate Institute for Brain Research

The neurovisceral integration (NVI) model was originally proposed to account for observed relationships between peripheral physiology, cognitive performance, and emotional/physical health. This model has also garnered a considerable amount of empirical support, largely from studies examining cardiac vagal control. However, recent advances in functional neuroanatomy, and in computational neuroscience, have yet to be incorporated into the NVI model. Here we present an updated/expanded version of the NVI model that incorporates these advances. Based on a review of studies of structural/functional anatomy, we first describe an eight-level hierarchy of nervous system structures, and the contribution that each level plausibly makes to vagal control. Second, we review recent work on a class of computational models of brain function known as “predictive coding” models. We illustrate how the computational dynamics of these models, when implemented within our proposed vagal control hierarchy, can increase understanding of the relationship between vagal control and both cognitive performance and emotional/physical health.

RESTING STATE FUNCTIONAL CONNECTIVITY ASSOCIATED WITH HEART RATE REGULATION

Karl-Jürgen Bär; Feliberto De La Cruz; Andy Schumann;
Gerd Wagner
Universitätsklinikum Jena

The Neurovisceral Integration Model provides a framework linking parasympathetic activity to cognitive and emotional regulation through the central autonomic network (CAN). We investigated whether healthy young subjects divided according to fast or slow heart rates will show differences in functional connectivity in the CAN. Two groups were formed with 28 subjects in each group based on heart rate (HR). The first group had a HR less than 60 beats-per-minute (bpm), the second had a HR faster than 75bpm. Resting-state fMRI was conducted. Functional connectivity (FC) analyses were carried out by correlating the regional time course of three anatomically defined ROIs. Significant differences in the FC were detected between both groups between the right amygdala and the left insula, the left ventrolateral prefrontal cortex and ACC, indicating a significantly stronger right amygdala FC in the group with slow HR relative to subjects with fast HR. A similar pattern of FC differences was found for the left amygdala as seed region in the slow heart rate group. A significantly negative FC from the right amygdala to the dorsal vagal complex in the lower brainstem was observed in the group with slow HR compared to fast HR group. Network analysis revealed a single network of increased functional connectivity in subjects with slow HR relative to subjects with fast HR. Present results indicate that differences in HR are associated with different FC of CAN regions implying different patterns of autonomic control.

PARSING HETEROGENEITY IN THE EFFECTIVE CONNECTIVITY OF THE CENTRAL AUTONOMIC NETWORK DURING FEAR-CONDITIONING USING FMRI

Ben Allen; Shannon Ross-Sheehy
University of Tennessee

The central autonomic network (CAN) is a group of brain regions that regulate autonomic outflow to the periphery. Neuroimaging studies of the CAN often present task-evoked brain activations alongside task-evoked autonomic responses, rather than correlating the two directly. Studies that have directly examined the CAN often report associated brain regions, rather than models of their network or its heterogeneity. Here we use pupil diameter recorded concurrently with the blood-oxygen-level dependent (BOLD) signal collected during a fear-conditioning task. Subjects' BOLD data was decomposed using independent components analysis. Components related to pupil diameter were segmented into regions-of-interest, a time-series for each region was extracted, and an iterative multiple model estimation algorithm was used to estimate group-level and subgroup-specific directed connectivity maps. Increases in pupil diameter correlated with activity in a component of brain regions in the left hemisphere. Group level connectivity maps showed a functional connection from the inferior temporal gyrus to the lateral occipital cortex. Two sub-groups with different connectivity patterns emerged: subgroup A showed a strongly interconnected network (i.e., parahippocampal, inferior and middle temporal, temporal pole, lateral occipital, and periaqueductal grey); subgroup B showed a sparsely connected network between these regions. Overall, these findings show evidence of heterogeneity in the functional structure of the CAN and could provide new insights into individual differences in CAN functioning.

NETWORK ARCHITECTURE UNDERLYING BASAL AUTONOMIC OUTFLOW: IMPLICATIONS FOR EMOTION AND SOCIAL BEHAVIOR

Virginia Sturm¹; Jesse Brown¹; Alice Hua³; Sandy Lwi²;
Howard Rosen¹; Joel Kramer¹; Bruce Miller¹; Robert Levenson³; William Seeley¹

¹University of California, San Francisco, ²San Francisco VA Medical Center, ³University of California, Berkeley

The salience network is a distributed neural system that maintains homeostasis by regulating autonomic nervous system activity and emotional responding. Behavioral variant frontotemporal dementia (bvFTD) is a neurodegenerative syndrome characterized by salience network dysfunction and socioemotional decline. Our studies have shown that there is diminished resting autonomic outflow in bvFTD: patients with bvFTD have lower baseline respiratory sinus arrhythmia (a parasympathetic measure) and skin conductance level

(a sympathetic measure) than healthy older adults. Structural and functional connectivity neuroimaging analyses have revealed that baseline parasympathetic and sympathetic tone depend on the integrity of lateralized salience network hubs, left ventral anterior insula for parasympathetic and right hypothalamus/amygdala for sympathetic, and highly calibrated ipsilateral and contralateral network connections. Degradation of this system in bvFTD not only disrupts resting autonomic activity but also relates to patients' socioemotional deficits. In bvFTD, left-lateralized ventral anterior insula atrophy is associated with both diminished resting parasympathetic activity and impaired prosocial helping behaviors—compassionate, other-oriented actions promoted by the parasympathetic system. Taken together, our studies suggest that lateralized salience network connections play specialized roles in regulating autonomic outflow and in shaping socioemotional behavior.

Funding: R01AG052496 and R01AG057204.

3:00 p.m.-4:30 p.m.
Symposium 6.3

FEAR AND LOATHING IN D.C.: THE PSYCHOPHYSIOLOGY OF VARIOUS REASONS OF MALADAPTIVE THREAT PROCESSING

Session Chairs: Erik Müller¹; Matthias Wieser²
¹University of Marburg, ²Erasmus University Rotterdam

Maladaptive threat responses can occur for various reasons: Learned threat cues may *overgeneralize* causing safe stimuli to evoke threat responses or previously extinguished threat stimuli may later again evoke fear due to *spontaneous recovery*. Individuals may just *imagine* threats when there actually are none, which may lead to threat responses in safe situations. Finally, exaggerated threat responses may be neurogenetically determined and associated with individual differences in *dispositional negativity*. In this interdisciplinary symposium we will bring together recent psychophysiological and translational approaches on the psychophysiology of maladaptive *threat processing*. Erik Müller will present EEG studies showing that imagined threat stimuli cause fear conditioning without aversive stimuli. Marta Andreatta will present startle data on how acute stress may stabilize fear memories and thus facilitate later return of fear even after successful extinction. Matthias Wieser will show that fear generalization in the visual cortex as indicated by ssVEPs seems to be characterized by a suppression of the stimulus most similar to the threat cue rather than by a facilitation. Chris Larson will show fMRI results on the role of specific neural circuits in overgeneralization and avoidance of threat. Finally, Alex Shackman will present translational studies on the neural circuits of dispositional negativity and extreme anxiety. Together, the presented studies provide fresh insights into various psychophysiological mechanisms contributing to maladaptive threat processing and anxiety.

FEAR CONDITIONING WITH AN IMAGINED UNCONDITIONED STIMULUS

Erik Müller; Christian Panitz; Matthias Sperl
University of Marburg

In classical fear conditioning, neutral conditioned stimuli that have been paired with aversive physical unconditioned stimuli eventually trigger fear responses. Here, we test whether aversive mental images systematically paired with a CS may also cause *de novo* fear learning in the absence of any external aversive stimulation. In the first two experiments, N=45 and N=41 participants were first trained to produce aversive, neutral, or no imagery in response to one of three different visual imagery cues. In a subsequent imagery-based differential conditioning paradigm, each of the three cues systematically co-terminated with one of three different neutral faces. Although the face that was paired with the aversive imagery cue was never paired with aversive external stimuli or threat-related instructions, participants rated it as more arousing, unpleasant, and threatening and displayed relative fear bradycardia and fear-potentiated startle. In a third experiment, two groups underwent fear conditioning with an imagined (N=24) vs. a real (N=24) electric shock while EEG and ECG were recorded. In general, the pattern of electrophysiological and cardiac fear responses was qualitatively similar for both groups, suggesting partially overlapping neurobiological mechanisms of imagery-based and classical fear conditioning. These results could be relevant for understanding the development of fear and related disorders without trauma.

SPONTANEOUS RECOVERY OF CONDITIONED FEAR SEEMS FACILITATED BY DISTAL STRESS

Marta Andreatta¹; Christopher Klinke¹; Dominik Fiedler²; Maren Lange²

¹University of Würzburg, ²University of Münster

Fear memories are quite stable as conditioned fear is spontaneously recovered after extinction when time has passed. Stress can strengthen fear memories. Thus, extinction of conditioned fear is impaired, when organisms are stressed prior fear learning. If stress strengthens fear memories, would it facilitate their spontaneous recovery as well? Seventy participants underwent a four-day protocol: Stress/Sham (Day1), Acquisition (Day2), Extinction (Day3) and Test (either Day4 or Day17). During acquisition, one cue (conditioned stimulus, CS+), but never a second cue (CS-) was associated with an electric stimulation (unconditioned stimulus, US). During extinction and test, both CS+ and CS- were presented, but no US. Two groups of participants underwent a socially evaluated cold-pressor test. One group (*stress-day4*) returned in the laboratory one day after extinction, while the other group (*stress-day17*) returned two weeks later. The third group (*sham-day17*) underwent a sham protocol and was tested two weeks after extinction. Ratings suggest successful fear acquisition (CS+ more aversive than CS-), extinction (comparable ratings for CS+ and CS-) as well as spontaneous recovery (CS+ returned more aversive than CS-), but no effects for stress. Strikingly, preliminary startle responses suggest weak acquisition, successful extinction and return of conditioned startle potentiation to CS+ vs. CS- only for the *stress-day18* group. In sum, stress seems to stabilize fear memories and, when enough time has passed, stressed individuals show facilitated return of conditioned fear responses.

A DISSOCIATION BETWEEN SUBJECTIVE AND VISUOCORTICAL INDICES OF FEAR GENERALIZATION

Matthias Wieser¹; Lea Ahrens²; Yannik Stegmann²; Paul Pauli²; Andreas Keil³

¹Erasmus University Rotterdam, ²University of Würzburg, ³University of Florida

Recent steady-state visual evoked potentials (ssVEPs) studies point at short-term visual cortex plasticity in aversive learning with cortical facilitation in response to stimuli which signal threat. In this study, we examined fear generalization, and asked whether the visuocortical activation shows the same generalization gradient as previously observed in psychophysiology and ratings. To this end, 67 subjects were differentially conditioned to two different faces flickering at a frequency of 12 Hz, one of which was always paired with a fearful face and a shrill scream. To test fear generalization, morphs of the two faces were presented which varied in their similarity to the original faces. The threat response was measured via ssVEPs as well as valence, arousal and threat expectancy ratings. As expected, analyses revealed linear generalization gradients in all ratings. In contrast, the generalization gradient of the ssVEP showed the highest amplitude for the CS+, but a strong suppression of the response to the stimulus most similar to the CS+, suggesting inhibitory interactions between visual neuronal populations. This observed dissociation among explicit and implicit measures points to different functions of behavioral and sensory cortical processes during fear generalization: While the ratings might reflect an individual's consciously increased readiness to react to threat, the lateral inhibition pattern in the occipital cortex might serve to maximize the contrast among stimuli with and without affective value and thereby improve adaptive behavior.

HIGH RESOLUTION IMAGING OF FEAR GENERALIZATION AND AVOIDANCE OF THREAT

Christine Larson¹; Ashley Huggins¹; Elizabeth Parisi¹; Greg Hajcak²; Vladimir Miskovic³

¹University of Wisconsin, Milwaukee, ²Florida State University, ³Binghamton University

Anxiety is characterized by context-inappropriate fear such as overgeneralization of conditioned fear, in which safe stimuli are perceived as threatening due to perceptual similarity with a conditioned fear cue. Such context-inappropriate fear contributes to maladaptive behavioral tendencies, such as excessive avoidance of stimuli that elicit anxiety, and this avoidance impedes safety learning. We used high resolution 7T fMRI to characterize the neural circuits implicated in overgeneralization of fear, along with avoidance of threat and the subsequent impact of avoidance on extinction of conditioned fear. We found that overgeneralization of fear was associated with engagement of the insula and midcingulate cortex, and this was particularly true for those with higher levels of trait anxiety. During active avoidance of a shock previously associated with a conditioned stimulus (CS+), greater activation was evident (compared to non-avoidance) in the periaqueductal gray, hippocampus, and reward-related structures such as the caudate. Avoidance of threat was also associated with a subsequent decrease in activation in the central nucleus of the amygdala and hippocampus during extinction, indicating potential interference with engagement of these structures critical for extinction learning. Together, these results highlight the role of specific neural circuits in overgeneralization and avoidance of threat. The findings will be discussed in the context of the consequences of poor regulation of fear and maladaptive anxiety-driven behaviors that maintain fear and anxiety.

NEUROGENETIC BASES OF DISPOSITIONAL NEGATIVITY AND EXTREME ANXIETY

Alexander Shackman
University of Maryland

Dispositional negativity—the tendency to experience and express more frequent, intense, or persistent negative affect—is a fundamental dimension of mammalian temperament. Individuals endowed with a more anxious, neurotic, or inhibited disposition are at risk for a wide range of adverse outcomes, from divorce to depression, imposing a staggering burden on public health and wealth, and drawing the attention of clinicians, researchers, and public policy makers. Yet, the neural systems underlying trait-like individual differences in dispositional negativity have only recently started to come into focus. Here, I will highlight data gleaned from studies of pediatric anxiety patients, adults, and monkeys. Using a combination of approaches—from neuroendocrine assays and genetic analyses to smartphone-based experience sampling and multimodal neuroimaging—this work provides fresh insights into the neural circuits underlying key features of the dispositional negativity and their relevance to extreme anxiety. More broadly, these observations provide an integrative framework for understanding how fearful and anxious states and traits are organized in the brain, for conceptualizing the development of internalizing disorders, and for guiding the development of improved intervention strategies.

**3:00 p.m.-4:30 p.m.
Symposium 6.4**

**THE PSYCHOPHYSIOLOGY OF UNDERSTANDING
OTHERS IN A SOCIAL CONTEXT: A MULTI-METHOD
APPROACH**

Session Chair: Marissa DiGirolamo
Brandeis University

Humans are innately social animals. Although social connectedness is an essential component of the human experience, much is still unknown about how the brain responds to and processes the complexity of social experiences. A promising approach to elucidate this question is to utilize a multitude of complementing methods to investigate the intra and interpersonal dynamics within an integrated neural and physiological system. The goal of this symposium is to highlight the different methodological approaches used to understand the neural and physiological basis of human interaction, with the hope to spark a discussion of how future research could integrate such approaches. Dr. Mina Cikara will present fMRI findings that provide insight into how we learn and form social group boundaries using latent structure learning models. Marissa DiGirolamo will discuss sensorimotor resonance, its relationship to empathic traits, and various analytic approaches informing researchers on the use of EEG mu suppression as a measure of resonance in a social context. Dr. Jennifer Gutsell will describe a dyadic approach to neurophysiology using EEG hyper scanning to show how sensorimotor resonance might contribute to an individual's ability to infer other's emotions. Dr. Katherine Thorson will present data on the impact of gender inequality and culture on group decision making and physiological linkage patterns. Together, findings presented by these researchers will emphasize the worthwhile opportunity to study the brain in relation to the body, specifically within complex social contexts.

**COMPUTATIONS UNDERLYING SOCIAL GROUP
STRUCTURE LEARNING: DISTINCT NEURAL
MECHANISMS FOR UPDATING SIMILARITY VERSUS
COALITION INFORMATION**

Mina Cikara; Tatiana Lau; Samuel Gershman
Harvard University

Humans form social coalitions in every society on earth, yet little is known of how we learn and represent social group boundaries. We derive predictions from a computational model of latent structure learning to move beyond explicit category labels and dyadic similarity as sole inputs to social group representations. Behavioral results indicate that people integrate information about agents' relationships to one another in addition to oneself to infer social group structure. Latent structures influence participants' choices with whom they want to align and trait attributions to agents (i.e., accounting for similarity, agents that cluster with participants are judged more moral, warm, competent). Using a model-based analysis of functional neuroimaging data, we find separate areas correlate with the dyadic similarity and latent structure learning models. In line with previous work on reflecting on oneself and similar others, trial-by-trial updating regarding dyadic similarity between participants and each agent recruited medial prefrontal cortex/pregenual anterior cingulate (pgACC). Trial-by-trial latent structure updating, on the other hand, recruited right anterior insula (rAI). A comparison of our rAI cluster with independently identified ROI of cluster structure updating revealed a 44.7 percent overlap. Variability in the brain signal from rAI improved prediction of variability in choice behavior, whereas variability from the pgACC did not. Results provide novel insights into psychological and neural underpinnings of how people learn to distinguish "us" from "them."

**IS SHARING REALLY CARING: CLARIFYING
THE RELATIONSHIP BETWEEN SENSORIMOTOR
RESONANCE AND EMPATHIC TRAITS**

Marissa DiGirolamo; Kristiana Hubley; Alek Kopulsky;
Jennifer Gutsell
Brandeis University

Sensorimotor resonance, vicarious activation of the sensorimotor system during observation of another's actions or somatosensory experiences, is thought to underlie important social functions such as empathy. Previous research has suggested that sensorimotor resonance, commonly measured by suppression of the electrophysiological (EEG) mu rhythm, is linked to trait empathy, but these studies are most likely underpowered. To clarify this relationship with a more adequately powered EEG study, we combined 6 smaller EEG studies (N=252) that all used the same paradigm - sensorimotor resonance measured through EEG mu-suppression, and the Interpersonal Reactivity Index (IRI), a well established measure of empathic traits. Our results indicate that sensorimotor resonance was not related to empathic concern or perspective taking. However, greater sensorimotor resonance at the Cz electrode was associated with reduced personal distress scores on the IRI. We used several common analytic approaches to calculate mu suppression in order to test for reliability across analyses, however, findings were not consistent based on analytic approach. Results emphasize that sensorimotor resonance specifically indexed by EEG mu suppression might not be linked to the traits we would normally associate with empathy, but future research should explore the personal distress facet. Our high powered findings provide rarely available information on the current debate concerning the relationship between sensorimotor resonance and empathy and EEG mu-suppression and empathy specifically.

**A DYADIC APPROACH TO STUDY THE LINK BETWEEN
SENSORIMOTOR RESONANCE AND FACE-TO-FACE
EMPATHY**

Jennifer Gutsell; Jeremy Simon; Siyu Liang
Brandeis University

People have a strong tendency to connect with and share others' experiences. The sensorimotor system seems to contribute to experience sharing, with similar neural networks active during experience and observation of experience. Evidence for the link between neural resonance and empathy, however, comes mainly from one-person observation focused studies that use relatively sparse and unrealistic stimuli. We describe a dual EEG study that measures neural resonance during naturalistic face-to-face first encounters. After baseline recording, dyads took turns executing and observing a motor task. Sensorimotor neural resonance was measured as suppression of EEG mu rhythm - oscillatory activation between 8-13Hz recorded over sensorimotor regions during action observation. Participants then shared positive and negative emotional experiences with each other and later re-watched video recordings of themselves and their partner, continuously rating how they believed they themselves or their partner had felt. Empathic accuracy was indexed as the correlation between their inferences and their partner's self-report continuous affect ratings. As predicted, mu-suppression did indeed predict empathic accuracy, independent of attention-related occipital neural activity. Findings provide novel insight into the suitability of EEG mu-suppression as an index of sensorimotor resonance in realistic social contexts and the role of sensorimotor resonance in correctly inferring others' emotional states.

CULTURAL INFLUENCES ON PHYSIOLOGICAL LINKAGE AMONG GROUP MEMBERS

Katherine Thorson
New York University

Physiological linkage—which occurs when one person's physiological response (the “sender”) predicts another person's physiological response (the “receiver”) at a future time point—has been shown in a variety of relationships and contexts. In this talk, I present new evidence showing that cultural-level variables are associated with the extent to which physiological linkage among group members occurs. Specifically, we examined how the gender inequality present in group members' home countries (using the Human Development Index) was associated with physiological linkage to other male and female group members. To do this, we conducted a study of 3- and 4-person groups (N groups = 31; N participants = 119) with participants from 54 different countries. Groups were tasked with completing a group decision-making exercise face-to-face, while we continuously measured group members' autonomic nervous system activity via cardiac interbeat intervals. We found a significant interaction between receiver gender, sender gender, and the gender inequality of the sender's home country on physiological linkage. Specifically, male receivers were less physiologically linked to female senders to the extent that the senders were from countries with more gender inequality. The gender inequality of a sender's home country was not associated with physiological linkage for female receivers or for male receivers with male senders. I will discuss implications of these findings for how males and females from a range of cultural backgrounds work together in group decision-making contexts.

SATURDAY, SEPTEMBER 28, 2019

8:30 a.m.-10:00 a.m.

Symposium 7.1

ELECTROCORTICAL RESPONSES IN EMOTION PROCESSING: INSIGHTS FROM HEALTHY PARTICIPANTS, AMYGDALA-RESECTION AND PSYCHOPATHOLOGICAL PATIENTS

Session Chair: Sebastian Schindler
University of Muenster

The human brain easily differentiates between emotional and neutral content, affecting different cognitive processes both at early and late stages. This series of talks focuses on electrophysiological correlates of emotion processing depending on the amygdalar functionality, psychopathology, and emotion regulation strategies. The first talk specifies the relationship between prototypical emotion-related modulations of event-related potentials (ERPs) and oscillations. Here, for emotional pictures a decrease in alpha and lower beta frequencies was found next to an enlarged Early Posterior Negativity (EPN) and Late Positive Potential (LPP). The second talk presents data on individual amygdala volume and heart rate variability, which differentially correlated with recorded steady state evoked fields (ssVEFs) during emotional picture viewing. The impact of the amygdala on emotional EPN and LPP modulations is targeted by the third talk, reporting data from epileptic patients after amygdala resection in comparison to matched controls. From a psychological perspective, the fourth talk shows how explicit and implicit emotion regulation differently affects frontal and parietal ERP responses. The last presentation focuses on EPN and LPP modulations for anxiety-specific and -unspecific emotional stimuli, comparing different anxiety disorders. Together, we present biological and psychological influences, specifying the role of the amygdala, biased-emotion processing in anxiety disorders, as well as data on how cognitive strategies modulate certain emotional responses.

EMOTION AND ATTENTION EFFECTS AS REVEALED BY BRAIN OSCILLATIONS

David Schubring; Harald Schupp
University of Konstanz

Neural oscillations are thought to represent a fundamental brain mechanism and are widely used to study cognitive processes. In comparison, less is known about emotion processing, which so far yielded an ambiguous pattern of findings. To further advance understanding, a series of experiments examined emotional stimulus processing in different task contexts. In the first experiment, 16 participants viewed erotic and romantic pictures, differing in stimulus arousal and inter-trial interval (~1 vs. ~8 s). In one condition, participants passively viewed the pictures, in the other, they performed an active picture categorization task. The processing of erotic compared to romantic images was associated with a decrease in power in the alpha- and lower beta-band in posterior and anterior sensor clusters between 600-1000 ms post-stimulus. The finding was confirmed across conditions, different quantifications of power, i.e., absolute and decibel change to baseline, and independent from baseline activity. Follow-up experiments revealed similar findings across studies including negative stimulus materials, i.e., mutilation pictures, and an explicit counting rather than reaction time task. These findings suggest that power decreases in the alpha- and lower beta-band are a reliable phenomenon of emotionally significant stimulus materials (pleasant and unpleasant). Results are discussed with respect to the hypothesis that alpha- and lower beta-band activity may reflect cortical activation associated with emotional stimulus significance and compared to established event related potentials.

MODULATION OF STEADY STATE VISUAL EVOKED FIELDS BY EMOTIONAL AROUSAL AND ITS RELATION TO AUTONOMIC RESPONSES AND AMYGDALA VOLUME

Javier Echegaray; Stephan Moratti
Complutense University of Madrid

Steady state visual evoked fields (ssVEFs) or potentials (ssVEPs) are increased for emotionally arousing pictures as reported consistently by various research groups. This finding has been interpreted as a facilitation of emotional picture processing in visual areas given the motivational relevance of these stimuli. One view is that orienting responses modulate ssVEFs during emotional picture viewing. Another perspective is that afferent projections from the amygdala to the visual cortex are responsible for the arousal modulation of steady state responses. Here, we use initial heart rate (HR) deceleration as an index for an orienting response and whole brain corrected amygdala volume as an estimate of individual differences of amygdala involvement. Importantly, initial HR deceleration to emotional picture onset does not correlate with amygdala volume, indicating that an orienting response does not depend on amygdala volume. However, HR deceleration predicts reliably ssVEF amplitude increases for arousing emotional pictures in primary visual cortex, whereas amygdala volume covaries with ssVEF arousal modulation in the right ventral visual stream. This is in line with the observation that amygdala local field potentials are modulated at late latencies for complex emotional pictures. This possibly reflects that complex emotional picture content processed by higher order visual areas interacts with the amygdala. In contrast, initial HR deceleration as an index of an orienting response correlates with primary visual cortex activity reflecting basic feature extraction.

EFFECTS OF RIGHT TEMPORAL LOBE RESECTION ON EVENT RELATED POTENTIAL (ERP) CORRELATES OF AFFECTIVE PICTURE PROCESSING

Malena Mielke¹; Alexandra Mehlmann¹; Lea Stieghorst²; Christian Bien²; Johanna Kießler¹

¹Bielefeld University, ²Epilepsy Centre Bethel

Temporal lobe structures, such as the amygdala are considered crucial for the processing of visually presented emotional stimuli (Sabatinelli, Bradley, Fitzsimmons, & Lang, 2005; Vuilleumier, 2005). In an ongoing EEG-study, we investigate the impact of absence of right temporal lobe structures on ERP components related to perceptual and emotional picture processing (P1, N1, EPN, LPP). Participants in our study passively viewed randomized blocks of negative and neutral pictures (IAPS; Lang, 2005) while 128-channel-EEG was recorded. So far, 13 patients with right medial temporal lobe resections (rMTLR) including amygdala and hippocampus and 13 age and gender matched healthy controls have participated in the study. In healthy controls, results show substantially higher amplitudes during processing of negative compared to neutral stimuli across P1, N1, Early Posterior Negativity (EPN), and Late Positive Potential (LPP) components. In patients, emotional modulation is absent in the P1, but intact for the N1 and EPN. Moreover, late components show significantly lower amplitudes for patients compared to controls, in particular a virtual absence of the late LPP (600-900ms), regardless of stimulus valence. These findings demonstrate specifically altered cerebral processing of affective pictures following rMTLR, whereby very early and late processing stages appear to depend on rMTL structures whereas mid-latency stages do not. Thus, results help to specify the role of integrity of rMTL structures for the processing of emotional stimuli.

INSIGHTS ON EXPLICIT AND IMPLICIT EMOTION REGULATION FROM ELECTROPHYSIOLOGY

Jason Moser¹; Ethan Kross²; Darwin Guevarra²

¹Michigan State University, ²University of Michigan

Electrophysiological measures are strong tools for examining the time-course of information processing in the brain. In this talk, I will argue that they have proven especially informative with regard to revealing the cognitive dynamics of implicit and explicit emotion regulation strategies. I will present findings from a set of studies demonstrating that frontal event-related potentials (ERPs) observed in anticipation of and during negative emotion picture processing reflect effortful control processes during explicit emotion regulation strategies whereas parietal ERPs observed during negative emotion picture processing reflect emotional intensity reappraisal processes achieved through both explicit and implicit regulation strategies. As such, ERPs help to reveal a taxonomy of emotion regulation strategies along a continuum of difficulty suggesting those that may have more or less broad translational success. Explicit strategies such as cognitive reappraisal, behavioral expressive suppression and distraction are characterized by increases in frontal control ERPs and decreases in parietal reappraisal ERPs whereas implicit strategies such as distanced self-talk, mindfulness, and non-deceptive placebos are characterized by decreases in parietal reappraisal ERPs without concomitant increases in frontal control ERPs. Future directions will be discussed as to how these ERP findings can be leveraged to promote a paradigm shift in how we think about what constitutes transportable and effective emotion regulation strategies for those who need them most.

A SELECTIVE EMOTIONAL MODULATION OF THE LATE POSITIVE POTENTIAL DEPENDS ON ANXIETY-SPECIFIC CONTENT ACROSS DIFFERENT ANXIETY DISORDERS

Sebastian Schindler; Thomas Straube
University of Münster

Frequently, studies report on biased emotion processing in anxiety disorders. However, its generalizability is under debate. This talk focuses on event-related potentials (ERPs) recorded from patients exhibiting posttraumatic stress disorder, panic disorder, social anxiety disorder, or dental phobia, and from matched healthy controls. Participants were shown anxiety-specific or -unspecific emotional stimuli in different tasks, while combined EEG and fMRI was recorded. While across all studies the prototypical emotion-related early posterior negativity (EPN) and late positive potential (LPP) were enlarged, specific modulations for patients exhibiting anxiety disorders were observed only for anxiety-specific emotional content. Importantly, these

selective amplifications were restricted to the LPP. Within patients, this emotional LPP differentiation correlated with differences in rated anxiety of negative versus neutral content. We did not observe interactions for emotional stimuli per se. In a similar vein, fMRI results showed larger activations for anxiety-specific content in patients. Together, we present evidence for biased emotion processing in anxiety disorders restricted to anxiety-specific content and correlated with individually rated anxiety. In line with considerations that the LPP reflects more elaborative and controlled processes related to attention, affective labeling, and stimulus evaluation, we find interactive effects only during late stages of processing.

8:30 a.m.-10:00 a.m.
Symposium 7.2

PSYCHOPHYSIOLOGY OF PAIN PROCESSING: MODULATION BY INDIVIDUAL-DIFFERENCE AND SITUATIONAL FACTORS

Session Chair: Jens Foell
Florida State University

The assessment of pain represents a unique challenge in the psychophysiological field. The same nociceptive stimulus can lead to a wide range of subjective pain responses, depending on the individual in question as well as on situational circumstances. This leads to diagnostic issues in the applied medical field and makes it necessary to identify reliable physiological indicators of nociception, and to quantify dispositional and situational factors that are able to modulate subjective pain responses in a research setting. The four presentations of this symposium will each illuminate different ways to address this by relating pain stimuli and reported pain responses to physiological variables. First, Perkins et al. will expand on recent findings showing that trait callousness modulates pain tolerance by measuring EEG responses to painful electric shock. In addition to measuring individual differences, Rainville et al. will then report on social factors, and discuss the interpretation of facial response in relation to cortical pain signal processing. Mauersberger and Hess will then use social context as an additional stressor for studies investigating the modulatory effect of the presence of dogs on subjective pain response. The last presentation by Rhudy will identify how modulatory effects can be explained and assessed via the interaction of spinal and supraspinal pain signal processing. Collectively, this symposium will report and discuss findings on several pain modulation factors, using a variety of pain stimuli as well as physiological outcome measures.

CALLOUSNESS AND STIMULUS INTENSITY MODULATE ELECTROCORTICAL PAIN RESPONSE

Emily Perkins¹; Keanan Joyner¹; Destiny Kruzel¹; Carson Jordan¹; Sarah Brislin²; Greg Hajcak¹; Christopher Patrick¹; Jens Foell¹

¹Florida State University, ²University of Michigan

Trait callousness is associated with increased pain tolerance as assessed via ratings of pain from a pressure algometer (Brislin et al., 2016). The current study sought to extend this finding to the electrocortical modality to establish whether callousness can be thought to modulate the experience of pain. We measured somatosensory P3 (Yamaguchi & Knight, 1991) following unpredictable electric shocks during inter-trial intervals of an affective task-switching paradigm. Shock intensity was calibrated to individual tolerance, given large variability in natural pain tolerance (Coghill, 2010). Contrary to hypotheses, shock-evoked P3 amplitude was not modulated by trait callousness. However, shock intensity and shock-evoked P3 amplitude interacted, such that shock-evoked P3 and callousness were negatively related, but only when more intense shocks had been administered. When less-intense shocks were administered, shock-evoked P3 and callousness were unrelated. Although qualified by the necessity of between-subjects shock titration, findings suggest that callousness modulates neural sensitivity to higher-intensity pain, perhaps reflecting an elevated neural threshold for pain. Results dovetail with other studies showing that callousness-related deficits in affective processing are not observed for low-intensity stimuli (Brislin et al., in press). Trait callousness may be related to a higher threshold for detecting and processing aversive input. Trait-related modulation of pain experience and its implications regarding one's willingness to inflict pain on others will be discussed.

Funding: Grant # W911NF-14-1-0018 (U.S. Army).

BRAIN REGULATION OF PAIN ENCODING IN FACIAL EXPRESSION: EFFECTS OF SUGGESTIONS

Pierre Rainville¹; Miriam Kunz²; Jen-I Chen¹
¹University of Montreal, ²University of Bamberg

The study of pain offers a unique perspective on the communication of affective states. The encoding of nociceptive processes and pain experiences in facial expression reflects brain activation during painful stimuli and largely depends on prefrontal regions thought to regulate the expression according to personal and situational factors. These include individual differences in expressiveness, the presence of chronic pain, and the immediate psycho-social context. In a recent study, we further observed that selectively increasing pain intensity by verbal suggestions produces distinctive changes in facial responses characterized by a stronger contraction of the orbicularis oculi muscle leading to a narrowing of the eye. These changes were associated with an increase in the response of the primary somatosensory cortex (SI) to the noxious stimulus and a decrease in medial prefrontal activity that may reflect a disinhibition. Importantly, this coupling of the facial response with SI activity was not explained simply by non-specific changes in expression involving other facial actions. These results are consistent with the notion that the facial expression of pain provides a complementary window on pain experiences that reflects partly the activity of the spino-thalamo-cortical pathway targeting the primary somatosensory cortex.

Funding: National Science and Engineering Research Council (NSERC) of Canada and the Canadian Institute of Health Research (CIHR).

THE SOOTHING EFFECTS OF PETS DURING CHALLENGING TIMES: THE PRESENCE OF PET DOGS REDUCES PHYSICAL AND SOCIAL PAIN

Heidi Mauersberger; Ursula Hess
 Humboldt University of Berlin

Dogs are loyal companions that are affectionate towards humans regardless of their personality, education or cultural background. Thus, due to the non-evaluative nature of dogs, we assumed that dog support is more beneficial during a painful situation compared to human support or no support at all. We tested our assumptions with two different types of pain stimuli: one physical and one social pain stimulus. Specifically, in Studies 1 and 2, participants performed a cold pressor task (i.e., a task that elicits a mounting physical pain of moderate intensity) either in the presence of a dog, in the presence of a human or alone. In Study 3, participants played Cyberball (i.e., a game that elicits social pain as a result of social exclusion) either in the presence of a dog, in the presence of a human or alone. In all three studies, we measured both psychological and bodily reactions to pain (such as skin conductance responses, heart rate acceleration and facial muscle contractions). Across the three studies, we could find that dogs modulate participants' pain responses. In Studies 1 and 2, participants reported less physical pain and demonstrated less physiological stress reactions during the induction of physical pain in the presence of a dog compared to the other conditions. Similarly, in Study 3, dogs buffered the self-reported and physiological stress responses to social pain. These findings promote the promising idea of introducing pet dogs in non-clinical and clinical settings to improve the well-being of individuals suffering from loneliness or (chronic) diseases.

Funding: Parts of the research were funded by Grant # II/85 161 (Volkswagen Stiftung).

USING THE NOCICEPTIVE FLEXION INDEX (NFR) TO ASSESS ENDOGENOUS FACILITATORY AND INHIBITORY PROCESSES AT THE SPINAL LEVEL IN HUMANS

Jamie Rhudy
 University of Tulsa

Endogenous modulatory processes can amplify and/or inhibit pain. Some of the circuits responsible for these processes are purely supraspinal (e.g., cortico-cortical), some are purely spinal, and yet others descend from supraspinal centers to modulate spinal nociception (pain signaling). Regardless, the relative balance between facilitatory and inhibitory processes shape our pain experience and may contribute to risk for chronic pain development. The nociceptive flexion reflex (NFR) is a spinally-mediated withdrawal reflex assessed via electromyogram (EMG) from the lower limb following electrical stimulation of the sural nerve at the ankle. Given that the NFR is evoked by A-delta (small, myelinated, nociceptive) fiber activation and requires no input from supraspinal centers, it is used as a non-invasive, albeit indirect, measure of spinal nociception. Although supraspinal centers are not necessary for its elicitation, supraspinal regions can exert descending, top-down control over its output. Given this, the NFR can be used to assess the effect of modulatory processes at the spinal level in humans. Indeed, studies from our lab and others have shown that NFR is reliably modulated by supraspinal processes (e.g., emotions, counterconditioning), but also can be amplified by repetitive nociceptive input to the spinal cord (i.e., temporal summation). This presentation will discuss our NFR and pain studies that assess how individual differences in endogenous modulatory processes may contribute to chronic pain risk in humans.

Funding: Aspects of Dr. Rhudy's research were supported by the National Institute on Minority Health and Health Disparities of the National Institutes of Health under Award Number R01MD007807. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

8:30 a.m.-10:00 a.m.
Symposium 7.3

TAME YOUR DESIRES: COGNITIVE CONTROL AND REWARD PROCESSING

Session Chairs: Barbara Schmidt¹; Daniela Pfabigan²
¹University of Jena, ²University of Oslo

Discussant: James Cavanagh, University of New Mexico

It is essential to know what is good for us. Therefore, we developed a sophisticated neuronal reward processing system. To make sure we do not only pursue immediate rewards but also long-term goals, cognitive control mechanisms come into play. In our symposium, we provide a broad perspective on recent scientific findings on reward processing and cognitive control. Darin Brown (University of New Mexico) presents results that help us understand the meaning of EEG markers involved in reward processing. Katharina Paul (Ghent University) shows how positive mood and approach motivation affect EEG markers of reward processing. Daniela Pfabigan (University of Oslo) investigated how rewards are processed in a social context and presents her recent MEG study conducted at Peking University. Barbara Schmidt (University of Jena) suggested participants during hypnosis to feel safe, which made monetary rewards less important, mirrored by ratings and EEG responses. Travis Baker (Rutgers University) finally presents evidence on the manipulation of EEG reward processing via TMS, applied on healthy and clinical populations. All results will be discussed by Jim Cavanagh (University of New Mexico), an expert in reward processing and cognitive control. Our symposium links researchers from multiple laboratories in four different countries, applying a broad variety of research methods like ERPs, time frequency analyses, MEG, hypnosis and TMS. Our aim is to give a broad perspective on reward processing and cognitive control mechanisms which are of great interest for psychophysiological research.

UNDERSTANDING THE REWARD POSITIVITY: PARSING REWARD, AFFECT, AND CONTROL

Darin Brown; James Cavanagh
University of New Mexico

The Reward Positivity (RewP) appears to reflect a core computational process in reinforcement valuation. Yet the RewP is also modulated by state and trait affect, suggesting that it has a more complex computational role than simple prediction error signaling. In this presentation, we will discuss experiments designed to disentangle the emotional aspects of reward processing, the nature of the interaction with control signals, and the interaction of these phenomena in the RewP. In the first experiment ($N = 30$) we occluded the RewP with an enhanced N2 component by presenting rewards alongside novel visual stimuli. Additionally, frontal midline theta was greater during novel conditions ($p = .013$), suggesting signals of control-evoking surprise supersede the detection of the RewP. In a follow up study, we parsed the reward predictability, novelty, and the experience of affective valence using a fully informative outcome indicator prior to reward receipt. Participants ($N = 30$) were able to win pleasant novel images or points, but before the onset of the rewarding stimulus, they were presented with a colored cue shape indicating whether or not they won and what type of reward they would receive. The RewP successfully migrated to the colored cue shape, without the confound of novelty-induced control responses. Comparisons between win conditions revealed a larger RewP for cues predicting pleasant images over points ($p = .015$). These findings suggest that the RewP reflects a combination of computational evaluation and affective valuation in the evaluation of reinforcement.

MODULATORY EFFECTS OF POSITIVE MOOD AND APPROACH MOTIVATION ON REWARD PROCESSING: TWO SIDES OF THE SAME COIN?

Katharina Paul¹; Gilles Pourtois¹; Eddie Harmon-Jones²
¹Ghent University, ²University of New South Wales

In a previous study, we found that positive mood substantially influenced the neural processing of reward. After a positive mood induction, participants showed alterations of the Reward Positivity (RewP) ERP component and fronto-medial theta activity (FMθ) in response to monetary feedback, possibly reflecting changed reward expectations or an optimistic bias. In another study testing the effects of reward magnitude on those components, we found surprisingly similar effects. These results questioned whether positive affect per se or if instead approach motivation might drive these neurophysiological effects. In the current study, we combined a mindset manipulation with an imagery procedure to create and maintain three different affective states: a neutral mood or positive mood with either high or low approach motivational intensity. Replicating our previous results, FMθ activity was larger for unexpected compared expected no-rewards. However, only participants in neutral mood showed a similar effect for reward FB (stronger FMθ response for unexpected compared to expected rewards), while this difference was absent for both positive mood conditions irrespective of approach motivational intensity. Intriguingly, high approach motivation mood lowered the RewP, compared to low approach motivation. These results suggest that positive mood, rather than approach motivation per se, is likely responsible for a systematic change in reward expectation during gambling, which could reflect the presence of an optimistic bias.

Funding: This work was supported by the Research Foundation – Flanders (FWO) [11U9216N, V410718N, 3G024716] and the Australian Research Council [DP180102504].

SOCIAL COMPARISON FEEDBACK IS NOT ALWAYS THE MOST SALIENT ONE: AN MEG STUDY

Daniela Pfabigan¹; Yuqing Zhu²; Shihui Han²
¹University of Oslo, ²Peking University

Individuals frequently compare their behaviour with their fellow men for self-evaluation, which acts as a strong behavioural motivator. Following up on our previous EEG results, this experiment set out to take advantage of the millisecond source imaging characteristics of MEG to replicate and extend our findings of early processing differences between social and non-social feedback signals. We recruited 22 Chinese volunteers to perform a time estimation task in which response-accuracy feedback was either delivered pertaining to participants' own performance (non-social feedback) or to the performance of a reference group (social feedback). Subjective ratings after the task suggested self-focused processing. A clear differentiation between correct and incorrect feedback was observed in sensor-space about 280-320ms after feedback onset, equivalent to the established EEG component FRN. Further supporting our previous results, source space analyses showed enhanced activation for non-social negative compared to social negative feedback in the right thalamus as sensory relay station prior to outcome evaluation (186-238ms) and in visual areas later on (424-438ms; both analyses $p < .05$, peak-level FWE-corrected). This suggests enhanced initial gating before stimulus evaluation and ongoing attentional support for these feedback stimuli. The MEG source-space results corroborate our previous interpretation that social comparison feedback may be a default processing mode in Chinese individuals, leading to less influence on brain activity than non-social (e.g., self-related) feedback.

Funding: This research was supported by the China Postdoctoral Science Foundation (2017M610670 to DMP) and the National Natural Science Foundation of China (projects 31661143039, 31470986, 31421003 to SH).

WHEN MONEY DOES NOT MATTER ANY MORE: THE SUGGESTION OF SAFETY DURING HYPNOSIS LEADS TO LESS IMPULSIVITY, INDICATED BY ERP AMPLITUDES AND RATINGS

Barbara Schmidt
University of Jena

The imagination of a safe place is a successful method in clinical therapy. In my EEG study, I combined this method with hypnosis to see how the feeling of safety affects economic decision-making. I selected 24 highly suggestible participants who played two decision-making paradigms in two conditions, a hypnosis condition including the induction of hypnosis combined with the suggestion of being at a safe place and a control condition. Supporting the general account of this study, participants felt significantly safer during the hypnosis condition. In the first paradigm, a risk game, participants' decisions were not affected by the induction of safety. But reduced P300 amplitudes following outcome feedback in the hypnosis condition showed that participants perceived all outcomes as less salient. In the second paradigm, a delayed gratification game, participants evaluated immediate rewards as less positive and future rewards as less negative compared to the control condition. In line with that, FRN amplitudes following outcome feedback in the hypnosis condition differentiated less between immediate and future rewards. This is a sign of less impulsive behavior in the hypnosis condition. Participants' stated afterwards that monetary rewards mattered less in the hypnosis condition with suggested safety. Past research shows that there are reward processing differences between participants. But this is the first study showing that reward processing can be massively altered by suggestions during hypnosis within participants.

Funding: This research was funded by the Milton Erickson Society for Clinical Hypnosis.

MODULATING COGNITIVE CONTROL FUNCTIONING IN HEALTH AND DISEASE USING COMBINED EEG-TMS METHODS

Travis Baker; Kathryn Biernacki; Mei-Heng Lin; Malte GÜth
Rutgers University

Over the past two decades, several event-related brain potentials (e.g. P200, N200, reward positivity) and time-frequency components (e.g. midfrontal theta, delta, frontal beta) have been proposed to reflect neural mechanisms underlying cognitive control functions. Such EEG-related signals have also been shown to be abnormal in several psychiatric conditions, including addiction, depression, and schizophrenia, underlining the importance of human electrophysiology in the study of cognitive control in both typical and atypical populations. As such, devising means to effectively modulate such EEG activity with noninvasive brain stimulation techniques could accelerate the pace of scientific progress and have a positive impact on mental health care. In this talk, I will first discuss the latest advancements in using robot-assisted image-guided TMS (Ri-TMS) for the purpose of modulating ERP components related to context updating (P200), control (N200), and reward processing (reward positivity). I will then demonstrate the utility of Ri-TMS in uncovering the relationship between post-feedback ERP waveforms and time-frequency components. Finally, I will discuss the application of combined EEG-TMS methods for improving cognitive control functioning in psychiatric populations. Our efforts point to a decisive role of integrating EEG-TMS methods to modulate cognitive control functioning, which constitute a major advance for scientific discovery with important translational implications.

Funding: Canadian Institute of Health Research, Rutgers BHI, RU-Newark, NJIT Pilot Grants Program in Neuroscience.

3:30 p.m.-6:30 p.m.
Symposium 8.1

“SO, WHAT'S NEW?” EMANUEL DONCHIN'S CONTRIBUTIONS TO THE COGNITIVE PSYCHOPHYSIOLOGY OF THE 21ST CENTURY

Session Chairs: Gabriele Gratton; Monica Fabiani
University of Illinois, Urbana-Champaign

Emanuel (Manny) Donchin (1935-2018) has had an enormous impact on psychophysiology as a discipline, and on the shaping of the Society for Psychophysiology Research into what it is today. His many contributions include his central role in creating the discipline of cognitive psychophysiology and placing it within the context of a growing and exciting new way of thinking about the mind; shaping the way in which researchers think about, interpret, and analyze event-related brain potentials (ERPs); developing important applications of this methodology; and educating generations of scientists. Approximately one year after his death, this memorial symposium will review these contributions and highlight current research inspired by Manny Donchin's work. A large number of investigators (including former students and colleagues) will present short talks. The talks will highlight Manny's contributions and transformational role and how his influence leads to enduring developments and innovations.

Poster Session Abstracts

WEDNESDAY, SEPTEMBER 25, 2019 POSTER SESSION I

Poster 1-001

WORKING MEMORY, SHORT TERM VISUAL MEMORY AND THE N400

Amy Lowe¹, Juniper Hollis¹, Jessica Roy¹, Tori Okabe¹, Cindy Bukach²,
Catherine Reed³, Jane Couperus¹
¹Hampshire College, ²University of Richmond,
³Claremont McKenna College

Descriptors: Language, Working Memory, Event Related Potentials

The N400 indexes operations in semantic memory and is typically observed when participants encounter an incongruent word at the end of a sentence. Research has suggested that those with higher working memory capacity have larger N400 responses to incongruent sentence endings than those with lower working memory capacity (Gunter et al., 1995). However little is known about the contributions of visual short term memory (VSTM) as typically another component, the SCPN, has been used to study language in relation to visual short term memory (Predovan et al., 2009). As working memory utilizes short term memory (Aben et al. 2012) it is possible that working memory effects on the N400 are driven by VSTM. Thus, this study examined individual differences in spatial working memory (SPWM) as a proxy for general working memory that doesn't rely on language and visual short term memory as they relate to the N400. Sixty-seven participants completed a semantic congruency task while event related potentials were recorded in addition to a SPWM and VSTM task. In addition to a main effect of congruency for the N400 ($F(1,64) = 4.11, p = .047$) there was a significant interaction with reaction times on the VSTM task ($F(1,64) = 5.18, p = .026$). In contrast, the N400 congruency effect was not significantly related to reaction times on the spatial working memory task ($p > .05$). These findings suggest that visual short term memory is an important contribution to semantic memory reflected in the N400 rather than working memory more generally.

Funding: Improving Undergraduate STEM Education Grant.

Poster 1-002

AGE-RELATED DIFFERENCES IN DEFAULT COGNITIVE PROCESSING STRATEGIES

Daniel Bowie^{1,2}, Kathy Low^{1,2}, Monica Fabiani^{1,2},
Gabriele Gratton^{1,2}

¹University of Illinois, Urbana-Champaign, ²Beckman Institute for
Advanced Science and Technology

Descriptors: aging, cognitive control, ERP

In cognitive control tasks, individuals change their information-processing strategy (or attentional scope) on a trial-to-trial basis based on the significance of contextual information (e.g., cues) in order to facilitate optimal task performance. However, younger and older adults may differ in how they weigh the relative significance of task-relevant cues, potentially reflecting different "default" processing strategies. To explore this possibility, we recorded ERPs while younger and older adults performed a cued Flanker task. One of 3 cues was randomly presented on each trial, indicating the probability that a congruent flanker array would follow (i.e., 75%, 50%, or 25%), and therefore inducing changes in processing strategies. At parietal electrodes, analyses revealed significant correlations between ERP amplitudes (350-500 ms post-cue onset) and inverse efficiency scores (IES; a composite measure of response time and accuracy), but the direction of these correlations differed between groups. For older adults, the difference in mean amplitude between 75% and 25% cues correlated positively with the difference in the IES congruency effect in these conditions (a behavioral index of cue utilization), while younger adults displayed a negative correlation. These results suggest that older and younger adults react differently to cues to change their processing strategy. This in turn implies that their default strategy is also different, with older adults using a narrow attentional scope and younger adults a broad attentional scope.

Funding: Seed grant on Mechanisms of Cognitive Control (MoCC) from the Beckman Institute for Advanced Science and Technology NIA grant R01AG059878 (M. Fabiani & G. Gratton, PIs) Title: Optical measures of cerebral arterial function as predictors of brain and cognitive aging.

Poster 1-003

ERP CORRELATES OF AGE-RELATED CHANGES IN INHIBITORY FUNCTION IN A COMBINED SIMON- FLANKER TASK

Olivia Stella; Rachel Scrivano; Paul Kieffaber
College of William & Mary

Descriptors: Conflict Processing, Conflict Adaptation, Aging

It has been argued that impoverished conflict processing conflict processing and inhibitory control may underlie a number of cognitive deficits that have been observed in older adults. However, there is evidence that some of the effects of age may depend on the type of task used to measure inhibitory control. In this experiment, conflict processing and inhibitory control were measured in a unique task that combines features of the Simon and Flanker tasks to measure conflict processing, inhibitory control, and conflict adaptation. Behavioral data analysis revealed that the two types of conflict processing are not completely dissociable, interacting with one another to produce exaggerated slowing when both conflict types are present in the same stimulus array and that this interaction effect is increased in high-functioning older adults. Moreover, ERP analyses revealed that both Flanker and Simon conflict effects are primarily limited to the fronto-central N200 component and a fronto-central P3 component that is more anterior in older adults. Importantly, the amplitude of the P3 component, like reaction times, demonstrated over-additivity in the context of combined Simon and Flanker conflict suggesting a common underlying neural mechanism. Finally, although conflict adaptation effects were similar between younger and older adults within each task type, only older adults demonstrated cross-adaptation effects wherein the presence of Simon conflict in trial N-1 was associated with Flanker-related adaptation.

Poster 1-004

CONNECTIVITY DYNAMICS BETWEEN THE RIGHT ANTERIOR INSULA AND THE ANTERIOR CINGULATE CORTEX DURING ANTICIPATION OF INTEROCEPTIVE RESPONSE

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Descriptors: SPN, Source Analysis, Connectivity

We aimed to depict the connectivity dynamics between the right anterior insula (rAI) and the anterior cingulate cortex (ACC) because they are key regions in the prediction of interoceptive responses. We conducted two separate electroencephalography (EEG) and functional magnetic resonance imaging (fMRI) experiments, and conducted connectivity analyses using Granger Causality Analysis (GCA). Participants were 29 and 31 healthy adults for the EEG and fMRI experiments, respectively. They performed a time estimation task, where they had to press a button 4 s after a cue stimulus. A feedback stimulus was presented 2 s after the button press to inform participants if the button press was correct or incorrect. In the fMRI analysis, the nine regions were identified as the sources of the EEG, and source potentials from 3.5s before until 1s after the feedback stimulus were calculated to depict brain activity during interoceptive prediction. The connectivities from the rAI to the ACC (rAI-ACC) and from the ACC to the rAI (ACC-rAI) were estimated using GCA on source potentials. Statistical analyses revealed that the connectivity in ACC-rAI showed significantly stronger connectivity than the rAI-ACC especially around -1250 ms before the feedback stimulus. Gu et al. (2013) have proposed a model where the ACC sends a command to the rAI to facilitate the process of interoceptive prediction. The present findings support their model, and suggest that the connectivity from ACC to the rAI is strengthened around -1250 ms before the stimulus that elicits interoceptive response.

Poster 1-005**HYDROCORTISONE AFFECTS WM PERFORMANCE AND THREAT-INTERFERENCE DURING PERFORMANCE UNDER ACUTE STRESS IN HIGH ANXIOUS PARTICIPANTS**

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Leiden University

Descriptors: Stress, Attention, Cortisol

Stress impairs performance in various aspects of life. This is partially explained by increased processing of emotional information, resulting in limited resources for goal-relevant behavior. Hydrocortisone (HC) administration is suggested to suppress the processing of emotional information. The aim was to test, for the first time, whether a 40 mg HC-administration affects WM performance and threat-interference under acute stress, and whether trait cognitive control and trait anxiety moderate this effect. Eighty highly anxious females were randomly assigned to placebo (PLC) or 40 mg HC ($n = 40$) groups. Resting-state EEG recording was conducted to assess theta/beta ratio (TBR) as a marker for trait cognitive control. An hour after drug administration, participants went through a stress procedure that was followed by an emotionally modified n -back task and an automated O-SPAN task. Trait anxiety, cognitive control, and threat-interference were also assessed with self-report measures. Participants with higher cognitive control or lower trait anxiety in the HC group reported less negative thoughts during WM performance. Furthermore, participants with higher cognitive control, and higher trait anxiety in the HC group, made less errors. Single administration of hydrocortisone can prevent the negative effects of stress on executive performance in highly anxious participants, depending on individual differences in trait cognitive control and/or trait anxiety. Future research should test the therapeutic effects of HC on executive performance under acute stress in clinical samples.

Poster 1-006**ACTIVATION OF THE VISUAL CORTEX BY A SALIENT SOUND MODULATES TEMPORAL ORDER JUDGMENTS**

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University of Montreal

Descriptors: Event-related potentials, Crossmodal, Attention

Previous ERP research showed that a salient lateral sound presented with speakers activates the contralateral visual cortex, reflected by the ACOP component (auditory-evoked contralateral occipital positivity). Interestingly, the amplitude of the ACOP correlated with an enhancement in perceptual processing on the side cued by the sound. We aimed to replicate the ACOP using earphones and to test if this auditory cuing can influence temporal order judgments (TOJ) for two visual stimuli (horizontal arrangement) as well as if the ACOP would predict the amplitude of this influence. We presented a 100 ms pink noise (0.5-15kHz, 80dB) stimulus synthesized to appear to originate 20° to the left or right of straight-ahead, via earphones, followed by a short (150 ms), or long (630 ms) delay. We then presented a grey disk 15° left or right of a fixation cross followed by a disk on the other side with an ISI of 0, 30, or 60 ms. The task was to indicate which disk appeared first or which disk appeared second (to control for response bias). We observed an ACOP at posterior electrode sites and confirmed our hypothesis that the lateral sound influenced TOJ by accelerating the perception of the disk presented on the cued side, even though the sound was irrelevant to the task. Furthermore, preliminary evidence suggests that a larger ACOP creates a greater acceleration of the perception of the disk presented on the cued side.

Poster 1-007**A PSYCHOPHYSIOLOGICAL INVESTIGATION OF THE INTERPLAY BETWEEN ORIENTING AND EXECUTIVE CONTROL DURING STIMULUS CONFLICT: A HEART RATE VARIABILITY STUDY**

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Steinunn Adolfsdottir¹; Julie Svendsen^{1,3}; Endre Visted^{1,3};
Thomas Eilertsen¹; Daniel Jensen¹; Helge Nordby¹;
Ole Bernt Fasmer^{1,3}; Per-Einar Binder¹; Julian Koenig^{4,5};
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Descriptors: Heart rate variability, cardiac vagal activity, attention network test

Background: It has been hypothesized that resting state cardiac vagal activity (CVA) - an indicator of parasympathetic nervous system activity - is a specific psychophysiological marker of executive control function. Here, we propose an alternative hypothesis - that CVA is associated with early stage attention orientation, promoting the flexible uptake of new information, on which the later operation of such executive control functions depends. We therefore hypothesized that CVA would be predicted by an interaction of executive control and orienting. This was tested using the revised version of the Attention Network Test (ANT-R) that was developed to distinguish between orienting and executive attention during a stimulus conflict task. Methods: Healthy adults ($N = 48$) performed the ANT-R and their resting CVA was measured over a 5 min period using ECG recordings. Results: Multiple regression analyses indicated that, when other factors were controlled for, CVA was more strongly associated with the interaction between the orienting and executive control terms than with any factor individually. Conclusion: Higher levels of CVA are specifically implicated in the modulation of executive control by intrinsic orientation operating at early stages of conflict detection.

Poster 1-008**COMPARING REWARD AND INSTRUCTIONAL RELEVANCE IN TARGET DETECTION**

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Descriptors: reward, P2, top-down attention

Instructional relevance and reward both enhance perceptual representations of stimuli, but while event-related potential (ERP) indices of reward and instructed targets from separate tasks are spatiotemporally similar (Soder et al., 2016), they have not been directly compared in the same design. In the current study ($N = 25$), we used a target detection design that manipulated stimulus (target, irrelevant nontarget, rewarded nontarget) and selection task (location, object). In the location task, participants were instructed to press a key when any symbol appeared in a specific location, while in the object task, they were to press a key when a specific symbol appeared in any location. Imperative stimuli varied by outcome: correct keypresses to targets, or non-responses to irrelevant nontargets were given accuracy feedback, while correct non-responses to rewarded nontargets were given monetary feedback. Instructed targets produced a larger frontal P2a regardless task, while target locations and objects produced larger dorsal and ventral N2b, respectively (Potts & Tucker, 2001). We hypothesized that reward would behave like instructed targets, such that the rewarded nontargets would elicit the same pattern of effects as targets. While the current design replicated the target effects from Potts & Tucker, the rewarded nontargets were not significantly different from irrelevant nontargets, suggesting that reward did not behave like instruction in the current design. Future work will parse out the reward and target contexts by blocking the reward and instruction outcomes.

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Poster 1-009**INVESTIGATING THE EEG ERROR-RELATED NEGATIVITY IN COLLEGE STUDENTS WITH ADHD, ANXIETY, AND DEPRESSION**

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Ethan Ashworth; Eric Sellers
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Descriptors: Error-related Negativity, Anxiety, ADHD

Error-related Negativity (ERN) is an event-related potential elicited by the commission of errors. It appears as a negative deflection peaking between 50ms and 100ms after an erroneous response. Previous literature demonstrated that individuals who suffer from either anxiety or depression display a higher ERN amplitude compared to a control group. It has also been shown that people with ADHD display a lower ERN amplitude. Based on these findings, we investigated the relationships between these three disorders and their effects on the amplitude of the ERN. We recruited thirty-one students at East Tennessee State University and gathered data on their level of anxiety, depression, and ADHD through completion of three surveys: the Beck Anxiety Inventory, Beck Depression Inventory, and the ADHD self-report scale. Subsequently, participants were asked to perform a modified Flanker task while their EEG was collected using a 32-channel EEG cap. ERN amplitude for error responses was significantly higher than ERN amplitude for correct responses. In contrast with previous literature, no significant influence on the ERN due to anxiety, depression, and ADHD was found. Additional research on the topic with larger sample size and different diagnostic procedures may be necessary to further investigate the phenomenon.

Poster 1-010**HIGH APPROACH-MOTIVATED VERSUS LOW APPROACH-MOTIVATED POSITIVE AFFECT FOLLOWING SELF-CONTROL: THE RELATION BETWEEN ERPS AND ATTENTIONAL BREADTH**

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Brock University

Descriptors: Attentional Breadth, Self-Control, Event-Related potentials
The Process model of self-control suggests that exercising self-control can result in greater subsequent approach motivation. The breadth of attention can narrow with greater approach motivation such that individuals show a greater focus on the "trees" relative to the "forest". However, our previous work showed that attentional breadth did not narrow following self-control when no images were shown afterward, but did show that individuals' narrowing of attention could be predicted based on P3 amplitudes to global/local stimuli following self-control. In this study, participants either viewed positive approach-motivating images (e.g., alcohol, desserts) or non-approach-motivating images (e.g., landscapes, animals) following self-control. We examined P3 ERPs while participants indicated target letters (i.e., H and T) presented within either the global and local levels of incongruent hierarchical Navon letter stimuli, both before and after self-control and subsequently-presented images. Attentional breadth narrowed in both the low and high approach image conditions. Similar to our previous findings, the narrowing of individuals' attentional breadth was associated with their residualized P3 amplitudes to post-self-control Navon stimuli in the low approach condition, such that greater P3 amplitudes to local stimuli relative to global stimuli predicted greater narrowing of attentional breadth. However, there was no relationship between P3 amplitudes and narrowing when high approach images were shown afterward, potentially suggesting a different neural mechanism.

Funding: NSERC.

Poster 1-011**ABNORMAL PRIMING IN EARLY-ONSET CANNABIS USERS: AN ERP STUDY**

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Descriptors: cannabis, N400, priming

Previous research has shown increased explicit attention to cannabis stimuli and abnormal semantic priming using neutral stimuli in cannabis users. However, to date there have been no studies using cannabis stimuli within a priming paradigm. ERPs were collected from 16 early-onset cannabis users and 22 controls in a lexical decision task. Cannabis and neutral images were presented briefly (24ms) followed by a mask and then non-words, cannabis or neutral, related or unrelated words. We analysed ERPs in response to words only. Mixed measures ANOVAs were conducted with Group as the between subjects factor and Relatedness (related, unrelated), and Target (cannabis, neutral) as the within subject factors on accuracy data and N400 difference peak amplitudes. Accuracy differed significantly between the two groups as a function of Target. The control group showed a higher error rate for cannabis words than the cannabis group and a higher error rate for cannabis words than for neutral words. The ANOVA conducted on the N400 showed a significant main effect of Target, which was qualified by a significant two-way interaction between Group and Target. The cannabis group showed reduced priming when a cannabis image preceded either a cannabis related or neutral unrelated word compared to when a neutral image preceded a neutral related or neutral unrelated word. Priming was very similar in the control group in both conditions. These results suggest that early-onset cannabis users can be vulnerable to masked cannabis cues and such vulnerability may impact processing of neutral stimuli.

Poster 1-012**REEXAMINING P300 AND SECONDARY TASK REACTION TIME ELICITED BY ELECTRICAL PROBES WHILE WATCHING EMOTIONALLY VARIED FILMS THROUGH INDIVIDUAL DIFFERENCES IN MOTIVATIONAL ACTIVATION**

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Descriptors: ERP, Secondary Task Reaction Time, Motivational Activation
This study attempts to investigate two main questions – the first question asks how P300 amplitude and secondary task reaction time (STRT) elicited by electrical probes during emotionally manipulated video clips are related to each other. Prior research often found smaller P300 amplitude (more resource allocation to the main task) and longer STRT elicited by probes while processing complicated or engaging information compared to easy or boring ones. However, this negative relationship between P300 amplitude and STRT needs to be tested based on a different paradigm of motivational cognitive processing (e.g. Lang A., 2006) as well. The second question asks whether the P300 amplitude and STRT would vary as a function of individual differences in motivational activation. To this end, the ERP and STRT elicited by electrical probes randomly applied (mean ISI = 10.75 sec) on the wrist of 24 Japanese college students and were measured during 2 minutes each of 12 video clips (neutral, highly pleasant, highly unpleasant (violent), and highly coercive). Overall, the results did not show a negative relationship between P300 amplitude and STRT. STRT was positively correlated to the P300 latency but not strongly correlated to the amplitude. Individual differences in motivational activation were found in the P300 latency. Risk Takers' (high appetitive, low aversive) latency was significantly shorter than Risk Avoiders' (low appetitive, high aversive) during highly unpleasant stimuli. The overall results are interpreted from theoretical framework of motivational cognitive processing.

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Poster 1-013

**QUIET EYE DURATION EVALUATED BY
ELECTROOCULOGRAM DURING ARCHERY
PERFORMANCE**

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Waseda University

Descriptors: quiet eye, archery, electrooculogram

We tested whether or not electrooculogram (EOG) can measure quiet eye (QE) during archery performance. QE is defined as the final fixation or tracking gaze on a specific location within 3° of visual angle (or less), lasting a minimum of 100 ms (Vickers, 2007). Thus far, two studies have applied EOGs to identify QE as an alternative to using eye tracking devices (Gallicchio et al., 2018; Gonzalez et al., 2017). Because these studies applied high-pass filters (i.e., relatively short time constant) to EOG recordings, it was unlikely that QE was properly evaluated. In this study, we evaluated QE duration through DC recording of EOGs. We tested if an intervention by computer-based training where the participants performed an archery-like shooting task with a joystick may improve archery performance in situ. Seventeen right-handed archers participated in this study (20.5 ± 1.23 years, eight females, mean archery experience: 6.0 ± 3.06 years). They performed the 70 m archery shot (18 trials), aiming at an archery target (ten multi-color rings, diameter 122 cm) during pre- and post-interventions and a pressure test. There was no significant correlation between shot scores and QE durations evaluated by EOGs. They exhibited significantly shorter QE durations in post-test compared to pre-test ($p = .048$). We found that EOGs were contaminated with head movements that might be responsible for the failure of replication of previous studies. Thus, future researchers should consider artifact rejection of head movements to obtain more valid QE duration.

Funding: This work was supported by JSPS KAKENHI Grant Number 17K20017.

Poster 1-014

**SELECTIVE STIMULATION OF EEG THETA, ALPHA,
AND BETA ACTIVITY BY A FREQUENCY-BASED
THERAPEUTICAL APPROACH**

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Descriptors: frequency-based therapy, EEG, alpha power

Effects of brain stimulation on brain activity, cognitive functions and the mental state have been studied extensively. To date, less is known on the effects of frequency-based therapeutical approaches that do not use transcranial electrical or magnetic stimulation but rely on application of natural frequencies. In the present study, we investigated the effects of the frequency-based therapeutical approach Colorbox12 that uses application of distinct sequences of colors and natural auditive frequencies on EEG brain activity and the mental state. Subjects were exposed to distinct frequencies in three experimental conditions (theta, alpha, beta), and one control condition (no frequency) by using the Colorbox12 system. High-density EEG was recorded continuously from 128 electrodes before, during, and after each experimental condition. Each experimental condition was tested for 10 minutes. Results on spontaneous EEG showed increased overall alpha power during and after application of the alpha frequency with subjects reporting increased relaxation. Overall theta and alpha activity increased when the theta frequency was applied. Here, subjects reported increased relaxation. Beta activity increased in frontal areas during application of the beta frequency with subjects reporting increased wakefulness and concentration. We discuss the results and possible fields of application in terms of activation of distinct neural circuits by application of the frequency-based therapeutical approach tested in the present study.

Poster 1-015

**ACUTE EXERCISE, ADIPOSITY AND BRAIN FUNCTION
IN PREADOLESCENT CHILDREN**

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Descriptors: P3 ERP, Cognitive Control, Brain Function

This study investigated the relationship between acute aerobic exercise and adiposity on task performance and P3 ERP indices of a Go-NoGo task, and academic achievement. In a sample of 22 children (ages 8-10; 10 females), demographic measures of age, sex, IQ, socioeconomic status and aerobic fitness were considered along with adiposity (whole body percent fat, as measured using dual energy x-ray absorptiometry). Children participated in a randomized crossover study, whereby they completed two different interventions; reading or walking, counterbalanced across participants. Results indicated that following the walking intervention, children with lower percent body fat demonstrated improved accuracy ($p \leq 0.01$), shorter reaction times ($p \leq 0.01$), and a trend for larger P3 amplitude ($p = 0.053$) during the Go Task, relative to children with higher percent whole body fat. Additionally, after the walking intervention, children with lower percent body fat demonstrated larger P3 amplitude ($p \leq 0.05$) during the NoGo Task. Results also indicated that children with lower percent body fat demonstrated improved performance on academic achievement tests of reading ($p \leq 0.01$) and math ($p \leq 0.01$). These findings indicate that the transient, beneficial effects following an acute bout of exercise on brain function and cognition may be blunted in children with higher whole body percent fat. Lastly, these results provide evidence to suggest that neuroelectric and behavioural indices of inhibition, as well as academic achievement, are influenced by aerobic exercise and adiposity in preadolescent children.

Poster 1-016

**NEURONAL CORRELATES OF ADAPTIVE CONTROL IN
WORKING MEMORY**

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Descriptors: Working Memory, Conflict Monitoring, EEG

The present study investigates mechanisms and neuronal correlates of adaptive cognitive control in working memory (WM). WM is conceived as a system for short-term maintenance, updating and manipulation of representations required for goal-directed action. Adaptive control refers to the finding of flexible adjustments of control processes in face of conflict. For instance, the conflict adaptation effect denotes that conflict on the previous trial leads to a higher level of cognitive control on the current trial. To investigate adaptive control in WM, we measured event-related potentials (ERPs) in a modified Sternberg paradigm. Participants memorized two differently colored lists of four digit items (i.e., 2 5 7 1) in which corresponding positions in both lists contained the same digits (congruent items) or different digits (incongruent items). Subsequent probe trials required participants to validate whether a given digit occurred at a specific position of a specific list. Behavioral data indicated a conflict adaptation effect, that is, responses to incongruent probe items were slower and this congruency effect was reduced following trials with incongruent probe items. Crucially, a similar pattern was revealed in ERPs at posterior electrode sites. These results demonstrate adaptive control in WM and links the respective mechanism to WM-related neural activity.

Funding: Grant from the Deutsche Forschungsgemeinschaft (DFG): STE 1708/5-1.

Poster 1-018**ACUTE EXERCISE EFFECTS ON INHIBITORY CONTROL AND THE PUPILLARY RESPONSE**

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Descriptors: Acute Exercise, Inhibitory Control, Pupillometry
Acute bouts of aerobic exercise have been found to improve executive function and its neural underpinnings. Moderate activation of the locus coeruleus–norepinephrine (LC-NE) system increases attention toward goal-directed behaviors, yet over/under activation may promote distractibility. Pupillary responses have been linked to the LC-NE system, and tasks requiring more inhibitory control modulate baseline (*tonic*) and task-evoked (*phasic*) pupil dilation. We examine the pupillary response as a LC-NE biomarker to understand the role of acute exercise on inhibitory control. Twenty-one participants (19.5 yr, 13 female) performed 20 min interventions (seated rest/moderate intensity exercise) followed by eye-tracked Simon and modified flanker tasks. RM-ANOVAs assessed intervention and inhibitory control (congruency/compatibility) effects on behavior and pupillary outcomes. Incongruent flanker trials resulted in longer reaction times and lower response accuracy, $p \leq 0.001$; an effect not found across Simon compatibility conditions, $p \geq 0.23$. While behavior in both tasks did not differ across the exercise vs. rest interventions, $p \geq 0.25$, peak phasic pupil dilation was greater in incongruent flanker trials, $p = 0.003$, and tonic pupil diameter was larger for the exercise intervention in both tasks, $p < 0.04$. Moderate exercise significantly increased tonic pupil dilation without influencing task performance, suggesting that the pupillary response may be a sensitive biomarker for examining changes in LC-NE activity as a function of exercise.

Poster 1-019**THE RELATIONSHIP BETWEEN EXPERIMENTALLY-INDUCED STRESS AND HIGH-CALORIE FOOD PROCESSING: A GO/NO-GO N2 ERP STUDY**

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James LeCheminant; Michael Larson
Brigham Young University

Descriptors: Stress, Trier Social Stress Task, Event-Related Potential
Diet has important implications for our physical, mental, and emotional health. Here we tested the relationship between stress and food-related inhibitory control. We induced stress by using the Trier Social Stress Task (TSST), and we measured food-related inhibitory control through the P3 and N2 ERP components during food-based (HGNG) and neutral (NGNG) go/no-go tasks. 97 total healthy participants were randomly assigned to stress (i.e., TSST; $n = 49$; 27 female) or control ($n = 48$; 34 female) conditions immediately followed by the two (HGNG, NGNG) go/no-go tasks. A 2-Group (stress, control) x 2-Task (HGNG, NGNG) x 2-Type (NoGo, Go) ANOVA on the P3 showed a significant main effect for task ($p < .001$) with the NoGo P3 having a larger amplitude than Go, and an interaction between task and type ($p = .004$). There were no main effects or interactions with group. For the N2, there was a significant main effect for group, with Trier having a larger overall N2 amplitude ($p < .001$). This was qualified by a significant interaction between group and type, with the Trier condition having a disproportionately increased N2 amplitude for the HGNG than NGNG tasks. Overall, findings suggest increased recruitment of inhibitory control when stressed as measured by the N2 amplitude being greater for high-calorie food than neutral. Thus, we conclude that increased inhibitory control is needed for food stimuli compared to neutral when experiencing experimental stress.

Poster 1-020**THE TIME COURSE OF COGNITIVE BENEFIT AND DEFICIT AFTER AN ACCESSORY STIMULUS SUPPORTS THE NOREPINEPHRINE THEORY OF THE ATTENTIONAL BLINK**

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Descriptors: norepinephrine, P3, Pupil dilation
Cognitive performance at multiple time points following an accessory stimulus was probed using the attentional blink task. The attentional blink refers to the phenomenon that when participants try to identify two targets embedded within a rapid serial presentation of distracter characters they exhibit a deficit for reporting the second target (T2) only within a very specific time-window relative to the first target (T1). The temporal profile of the attentional blink shows a striking similarity to the temporal profile of phasic norepinephrine (NE) release. We introduced an accessory stimulus to this paradigm, consisting of an irrelevant loud tone. An auditory accessory stimulus typically improves performance on targets presented at the same time as the tone, and previous work reported in *Psychophysiology* has implicated NE in this effect (Tona, Murphy, Brown, & Nieuwenhuis, 2016). Including a loud tone with T1 improved T1 performance, and improved T2 performance within 160 ms of tone onset. This benefit to T2 switched to a deficit by 480 ms after tone onset. This result is predicted by the theory that the locus coeruleus – norepinephrine system underlies both the attentional blink, and the accessory stimulus phenomenon. In addition, we recorded pupil size as well as the electroencephalogram. Pupil size and the P3 event-related potential, both putative correlates of norepinephrine activity, were affected by the accessory stimulus, and the effects were predictive of T2 performance.

Poster 1-021**TRANSCRANIAL ULTRASOUND INFLUENCES BEHAVIOR AND ELECTROENCEPHALOGRAPHY IN A GO/NO-GO TASK**

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Descriptors: Transcranial Ultrasound, Go/No-Go, Frontal Asymmetry
Previous findings on transcranial ultrasonic neuromodulation (TUS) in a virtual environment imply an increase in approach behavior during ambiguous situations following TUS induced inhibition of the DLPFC. The present study seeks to augment these results by investigating participant's behavior during a reinforced go/no-go task that comprised three different cues: a go-cue, a no-go cue and an ambiguous cue. During go and no-go trials, participant's reactions were positively or negatively reinforced with a 100% contingency following success or failure to respond correctly (button press in go-trials; no action during no-go-trials). In contrast, in ambiguous trials, participants had a 50% chance of receiving positive reinforcement following action, while no negative reinforcement was present following no-action responses. However, participants were not introduced to reinforcement rules of this condition, thus creating a situation in which individual differences in reinforcement sensitivity may set in, as participants, while being in uncertain circumstances, need to learn about positive reinforcement possibilities. Forty-one participants were tested in a double-blind randomized controlled cross-over design using TUS-modulation as a potentially trait-activating manipulation. Analyses of behavior during ambiguous trials revealed decreases in approach behavior following TUS in comparison to sham modulation implying TUS-induced reduction of the need for further reinforcement. The behavioral findings and related EEG measures concerning the ambiguous condition are presented and discussed.

Poster 1-022

MENTAL WORKLOAD ASSESSMENT DURING THE PERFORMANCE OF ECOLOGICALLY VALID TASKS UNDER VARIOUS COGNITIVE-MOTOR DEMANDS

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Descriptors: Mental workload, Dual-task walking

This study evaluated the utility of mental workload assessment, via EEG, as 12 uninjured individuals performed two ecologically valid tasks in a Computer Assisted Rehabilitation Environment (CAREN). In the first task, cognitive-motor demand was manipulated by having subjects perform three N-back tasks (0-, 1-, 2-back) implemented as a colored duck hunt in a virtual forest scene in the CAREN, repeated while seated and walking. The results revealed elevated mental workload as subjects walked (vs. seated) or as N-back task difficulty increased as indexed by increased theta and decreased alpha power, respectively. In the second task, cognitive-motor demand was manipulated by having subjects navigate a defined path within a virtual replica campus of Walter Reed National Medical Military Center in the CAREN, in the presence/absence of novel cognitive events (e.g., ambulance siren) and physical challenges (sloped terrain). The results revealed increased mental workload (increased theta power) under elevated physical challenges only when subjects walked through the scene in the absence of cognitive distractors. This study provides support for the utility of EEG in mental workload assessment during walking within ecologically valid environments.

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Poster 1-023

HYPER-FREQUENCY HYPER-BRAIN NETWORK TOPOLOGY DYNAMICS WHEN PLAYING GUITAR IN QUARTET

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Descriptors: Interpersonal interaction, Network topology, EEG
 Playing music in an ensemble is a highly coordinated form of social behavior requiring not only precise motor actions but also synchronization of different neural processes both within and between the brains of ensemble players. In previous analyses restricted to within-frequency coupling (WFC), we showed that different frequencies participate in intra- and inter-brain coordination and exhibit different network topology dynamics underlying coordinated actions and interactions. However, many of the couplings both within and between brains are likely to operate across the frequencies. Hence, to obtain a more complete picture of hyper-brain interaction when musicians play the guitar in quartet, cross-frequency coupling (CFC) has to be considered as well. Furthermore, WFC and CFC can be used to construct hyper-frequency networks (HFNs) integrating all the information flows between different frequencies oscillating at distinct cortical regions and providing important details about ensemble interaction in terms of network topology dynamics. We analyzed EEG (electroencephalogram) data obtained from the brains of the four guitarists while playing guitar in quartet. Our findings demonstrate that low-frequency oscillations (e.g., delta and theta) play an integrative role in such complex networks and that HFN topology dynamics are specifically related to the guitar quartet playing dynamics. We conclude that hyper-frequency hyper-brain networks capture neural mechanisms that support interpersonally coordinated action and behavioral synchrony.

Poster 1-024

ROUTINE ACTIONS MAY REDUCE PERFORMANCE MONITORING OF ATHLETES

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Descriptors: error-related negativity, routine, choking under pressure

To prevent choking during sporting games, some athletes perform pre-determined (i.e., routine) actions before critical movements. It has been hypothesized that inward attention may be responsible for choking under pressure because it disrupts the automaticity of movements and increases performance monitoring (PM). Thus, reducing PM during games might be a possible way to prevent choking. A previous study showed that error-related negativity (ERN) recorded from highly anxious athletes was increased when their task performance was being evaluated by an experimenter. However, it was not the case for less anxious athletes. We tested if PM, reflected in the ERN, would be attenuated by execution of a routine. The Sport Anxiety Scale (SAS-2) was used to classify athletes as high, medium, and low on sports anxiety. Participants were asked to practice a pre-determined routine for 5 days before the experiment. After they acquired the routine, we recorded ERN during execution of a spatial Stroop task. We compared ERNs among 4 conditions (combination of evaluation/no-evaluation and routine/no-routine). A 3-way ANOVA (2X2X3, routine/evaluation/group) revealed that the ERN tended to be smaller after executing routine actions ($p = .099$). In addition, a 3-way interaction (trend, $p = .059$) was observed. Simple effects analyses revealed that the ERN amplitude tended to be larger during performance evaluation in both the routine and no-routine conditions for high-anxious athletes (p 's $< .10$). These results suggested that routine interventions may decrease PM independent of performance evaluation.

Funding: This work was supported by JSPS KAKENHI Grant Number 17H02139'.

Poster 1-025

REDUCED N2 (AND ERN) IN A MODIFIED GO/NOGO TASK AS AN INDICATOR OF EXTERNALIZING PRONENESS: COHERENCE ACROSS ALTERNATIVE SCORING APPROACHES

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 Victoria Branchadell; Carlos Bayarri; Ángela Recio;
 Manon Rousselle; Javier Moltó
 Universitat Jaume I

Descriptors: N2/ERN, Modified Go/Nogo task, Externalizing

This study examined, in a sample of 130 undergraduates (102 women), the relationship between externalizing proneness (operationalized as the shared variance among different self-report measures of disinhibitory tendencies) and N2 amplitude in a modified Go/Nogo task that allows to isolate neural activity related to response inhibition from that related to novelty processing (60% frequent-Go, 20% infrequent-Go, and 20% Nogo stimuli). Regardless of N2 scoring method—classic windowed or temporal PCA—analyses revealed larger frontocentral N2 amplitudes for infrequent vs. frequent stimuli, and a significant Stimulus type x Externalizing interaction, $F_s(2, 127) > 4.81$, $p < .02$. Follow-up correlational analyses revealed that higher externalizing scores were related to diminished isolated N2 activity for Nogo and infrequent-Go stimuli (relative to frequent-Go stimuli), both when using difference scores (r s range = .16-.24, p s range = .06-.01) and residual scores (r s range = .17-.25, p s range = .04-.01). N2 scores also showed robust positive associations with the error-related negativity (ERN) in the same task (r s range = .24-.41, all p s $< .02$), which was also reduced in participants scoring high in externalizing, $r = .18$, $p < .05$ (one-tailed). Coherence of results across scoring methods and across ERP components suggests that participants high in externalizing features show a general diminished reactivity during early stages of stimulus-response conflict processing (i.e., diminished Nogo-N2, infrequent-Go-N2, and ERN amplitudes) once engaged in a dominant 'Go' response set.

Funding: MINECO (PSI2015-66798-P), UJI-B2017-40.

Poster 1-026**ESTRADIOL LEVELS MODIFY THE FUNCTIONAL ROLE OF THE ERN IN POST-ERROR ADAPTATION**

Courtney Louis; Jason Moser
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Descriptors: ERN, Estradiol, Post-Error Behavior

Theories of the error-related negativity (ERN) suggest that it reflects a dip in phasic midbrain dopamine (DA). Tonic DA, however, influences the responsiveness of phasic DA, such that those with low tonic DA evidence enhanced reactivity toward immediate responses rather than sustained goal maintenance. Importantly, high levels of circulating estradiol increase tonic DA. However, it is unclear how high estradiol might interact with tonic DA to influence the ERN's role in task performance. To test this, the current study examined the moderating role of estradiol fluctuations on associations between ERN and post-error adaptations, specifically, post-error reaction time (PERT) and post-error accuracy (PEA), in naturally cycling young adult women. Across four timepoints, a sample of 88 women completed a Flanker task and provided saliva samples from which estradiol was extracted. Two multi-level models with person-mean centered ERN and estradiol were entered as predictors of (1) PERT and (2) PEA. The first model revealed no effect of the ERN, estradiol or their interaction on PERT. The second model revealed an interaction between the ERN and estradiol ($p = .02$). Simple slopes analysis showed that when estradiol levels were low, a larger ERN predicted higher PEA ($b = -.02, p < .001$). There was no relationship when estradiol levels were high ($p = .84$). These results indicate that the functional significance of the ERN depends on fluctuating levels of estradiol, perhaps as a function of estradiol's effect on tonic DA levels.

Funding: This research is supported by the National Institute of Health (Project # 1R01MH108511-01; "Cognitive Control in Anxiety: The Role of Ovarian Hormones").

Poster 1-027**EFFECTS OF E-CIGARETTE USE ON BRAIN POTENTIALS DURING A REINFORCEMENT-CUED FLANKER TASK**

Zachary Levy; Eric Rawls; Connie Lamm
University of Arkansas

Descriptors: e-cigarette, reinforcement, conflict monitoring

Smokers show reduced N2 activation during conflict monitoring, suggesting that the N2 can be a measure of monitoring deficits in smokers (Buzzell, Fedota, Roberts, & McDonald, 2014). Additionally, Evans et al. (2009) indicated that moderately addicted smokers show smaller P3 amplitudes than non-smokers, and suggested this difference was tied to potential attentional or working memory deficits in smokers. However, neither of these ERP components have been analyzed in e-cigarette users. We collected EEG from 56 participants who completed a reinforcement-cued flanker task. Participants were cued with either positive or negative reinforcement predictors and had to respond to a congruent or incongruent flanker stimulus. Participants also completed the WHO ASSIST survey, which we used to group participants into users ($n = 19$) and non-users ($n = 37$). E-cig users showed more negative N2s in trials cued by negative reinforcement compared to positive reinforcement, but non-users did not show this difference. This might reflect the importance of negative reinforcement in developing and maintaining addiction (e.g. using to eliminate aversive withdrawal symptoms). This suggests e-cigarette users require more neural resources to process response requirements following negative reinforcement compared to positive. E-cigarette users also showed smaller P3s overall compared to non-users. This study characterizes e-cigarette users using brain potentials previously validated in cigarette smokers, and demonstrates remarkable consistency between e-cigarette and cigarette use.

Funding: This work was supported by the Arkansas Biosciences Institute 0402-27504-21-0216 to CL.

Poster 1-028**THE SERIAL ARCHITECTURE OF PROACTIVE CONTROL AS REVEALED BY TIME-GENERALISED MULTIVARIATE PATTERN ANALYSIS OF EVOKED EEG ACTIVITY**

José García Alanis; Martin Peper
Philipps-Universität Marburg

Descriptors: Event-related potentials, Multivariate pattern analysis, Time-frequency

In recent years, the neural mechanisms that underlie the exertion of proactive control are becoming increasingly understood. Here, Event-Related Potentials provide insights in the cognitive mechanisms engaged along the information processing stream. However, testing the specific temporal sequence of these processes is often complicated by component overlap and unstandardised time-windows for component identification. Here, we analysed evoked (phase-locked) oscillatory activity using time-generalised multivariate pattern analysis. Data was gathered from 32 participants during performance of the Dot-Pattern Expectancy Task. Here, active maintenance of cue information was crucial to predict upcoming probe configurations. Thus, participants needed to balance between a stable preparatory control (cue-locked) and fast corrective behavioural adaptations (probe-locked). Time-generalised decoding results indicate that early and late evoked activity were distinct in their neural substrate but shared a functional correlation during the exertion of proactive control. Furthermore, our results revealed early evoked frontal/occipital theta-band activity ($< .3$ s) followed by parietal delta and alpha band oscillations fluctuations ($> .3$ and < 1 s) supporting the maintenance of cue information. These results suggest that proactive control arises from a serially organised activation of cognitive modules, indexed by the oscillatory dynamics of a fronto-parietal network. We discuss the functional significance of these evoked oscillatory patterns, as well as their relation to behavioural performance.

Poster 1-029**CONTRASTING TIME AND FREQUENCY DOMAINS: TRANSIENT FRONTAL MIDLINE THETA PREDICTS ADAPTIVE POST-ERROR COMPENSATIONS**

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Craig McDonald¹

¹George Mason University, ²University of Maryland

Descriptors: Errors, Cognitive Control, EEG

Over the past few decades, there have been extensive investigations as to how neural indices of error monitoring relate to behavior and whether they capture adaptive or maladaptive cognitive control processes. The present study investigated error-monitoring using measures of both evoked and induced neural activity. These neural indices of error monitoring were evaluated in relation to behavioral performance on a task known to induce response conflict, the Simon Task. We found that induced theta, but not the error-related negativity (ERN), predicted increased post-error slowing (PES) as well as greater post-error accuracy (PEA) at the single trial level. Furthermore, theta onset latency and the magnitude of theta were linked to the time-course of conflict processing for correct responses and error commission. Our findings support previous work suggesting that, although action-monitoring ERPs and theta index functionally related underlying cognitive processes, they are not simply the same process manifested in different domains. Overall, our data are consistent with the notion that frontal midline theta is a more robust predictor of post-error behavioral adjustments and provide support for an adaptive perspective on post-error slowing.

Poster 1-030**OSCILLATORY AND HEMODYNAMIC CORRELATES DURING GOAL-DIRECTED NAVIGATION: A COMBINED EEG-FMRI STUDY USING A VIRTUAL T-MAZE TASK**

Malte Gueth; Ravi Mill; Michael Cole; Travis Baker
Rutgers University

Descriptors: EEG-fMRI, spatial navigation, reinforcement learning
Maze learning presents an interesting investigative domain due to its reliance on aspects of spatial navigation, mediated by the medial temporal system, and reinforcement learning, mediated by the midbrain dopamine system. Previous EEG studies have shown that phase-locked theta oscillations recorded over the right-posterior scalp locations are sensitive to navigational trajectories, while phase-locked theta oscillations recorded over fronto-central areas encode the valence of the feedback. Recent work has also shown that the integration of this information was reflected by induced frontal theta-gamma coupling. In parallel, fMRI data indicate the right parahippocampal cortex as the source of the spatial-related theta effect and the anterior cingulate cortex as the reward-related theta effect. While this evidence independently delineates the spectral and spatial architecture of goal-directed navigation, it remains unclear whether these findings complement each other. Here, we present a comprehensive analysis of simultaneously recorded oscillatory and hemodynamic responses to reinforcement in a virtual T-maze paradigm, providing new evidence for this high-level integration of spatial and reinforcement information in humans. These associations unify past findings and point towards a network of goal-directed navigation connecting spatial memory with prefrontal feedback processing.

Poster 1-031**THE EFFECTS OF ACUTE HIGH-INTENSITY INTERVAL TRAINING ON WORKING MEMORY AND CONTRALATERAL DELAY ACTIVITY**

Caroline Meadows; Eric Drollette
University of North Carolina, Greensboro

Descriptors: Exercise, Physical activity
Previous investigations are mixed regarding the transient after-effects of acute bouts of physical activity on working memory. However, recent evidence suggests that high-intensity interval training (HIIT) may serve as an effective modality for enhancing aspects of cognitive control and associated underlying neurocognitive operations. The present investigation examined the effects of a single bout of aerobic and aerobic-resistance HIIT on behavioral and neuroelectrical indices of working memory. Young adults ($n = 24$) performed six blocks (45 minutes) of a working memory change detection task (trials included set size 2, 3, 4, and 5 memory items) while ERPs (contralateral delay activity; CDA) were collected following three separate counterbalanced sessions (9-minutes of seated rest, aerobic HIIT, and aerobic-resistance HIIT). Results revealed greater overall accuracy and K-score accuracy for set sizes 2, 3, and 4 following both aerobic and aerobic-resistance HIIT compared to seated rest. Further, these differences were only observed during the first two blocks of the working memory task with diminishing trends observed across the remaining four blocks. Additionally, CDA results revealed a similar trend with greater amplitude (change in amplitude from set size 2 to 5) observed for both HIIT conditions compared to seated rest only in the first two blocks of the task. Together, these findings suggest that short acute bouts of HIIT may serve as an effective modality for temporary improvements in behavioral and neuroelectrical indices of working memory capacity.

Poster 1-034**THE ROLE OF PHYSIOLOGICAL AROUSAL IN APPETITIVE CUE EFFECTS ON INTERTEMPORAL CHOICE**

Kilian Knauth; Jan Peters
University of Cologne

Descriptors: intertemporal choice, emotional arousal, pupil dilation
Delay discounting, which describes the tendency to favor smaller but sooner rewards over larger but later ones, is common in humans. Increased discounting is associated with a variety of psychiatric conditions and problematic behaviors, including gambling addiction and substance abuse. Despite a high intra-individual stability of delay-discounting behavior, various studies suggest that arousing cues and mood inductions might modulate such decision-making processes. Nevertheless, the physiological foundations of such a modulation remain poorly understood. Here we investigated the trial-wise effect of neutral, negative and positive arousing (sexual) images on choice impulsivity, measured by a delay-discounting-task. Simultaneously, we recorded electrodermal activity, heart rate and pupil size as proxies for sympathetic and parasympathetic nervous system activity. We observed differential effects of image condition on physiological arousal. Heart rate decreased transiently in response to both positive and negative cues, and pupil size increased in response to positive stimuli. Increased phasic electrodermal activity for negative images reached trend level. Choice behavior was analysed via hierarchical Bayesian modelling, comparing group-level parameter estimates for the discount rate ($\log(k)$) and decision noise (softmax inverse temperature) across conditions. Neither positive nor negative arousing cues induced changes in discounting behavior. Data suggest that phasic alterations of physiological arousal might be insufficient to induce changes in choice impulsivity.

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Poster 1-035**THE NEURAL AND COMPUTATIONAL BASIS OF CREDIT ASSIGNMENT IN ENVIRONMENTS WITH MULTIPLE FEEDBACK**

Franz Wurm; Benjamin Ernst; Marco Steinhauser
Catholic University of Eichstaett-Ingolstadt

Descriptors: reinforcement learning, credit assignment, EEG
Credit assignment describes the process by which an agent links its actions to corresponding outcomes. While we know that humans are able to solve the credit assignment problem even in probabilistic and volatile environments, little is known about the underlying mechanisms. In the present study, we investigated these mechanisms by considering event-related potentials in a probabilistic learning task comprising two independent decisions. Two feedback stimuli, one for each decision, were presented without explicitly indicating which feedback was linked to which decision. Successful credit assignment was indicated on a behavioral level by both decision behavior in the learning task and a subsequent transfer task in which participants had to explicitly act on their acquired decision-feedback assignment due to devaluation instructions. Neural markers of feedback processing (FRN and feedback-P3) indicated the formation of expectations based on the valid decision-feedback assignment. Crucially, behavioral and neural data could be explained by a reinforcement learning model, which assumes that credit assignment is solved within a hierarchical task representation in which reward prediction errors based on alternative decision-feedback assignments are comparatively evaluated.

Poster 1-036**FROM ELECTRO-DERMAL ACTIVATION TO INTEROCEPTIVE AWARENESS: DOES METACOGNITIVE EVALUATION RELY ON BODY AROUSAL?**Mandy Rossignol^{1,2}; Khira El Bouragui^{1,2,3,4}; Erika Wauthia^{1,2,4}; Romane Besin¹; Coralie Rouge¹; Chrystel Besche-Richard³¹University of Mons, Cognitive Psychology and Neuropsychology Lab PCN, ²CIPsE Center for Interdisciplinary Research in Psychophysiology and Electrophysiology of Cognition, ³University of Reims Champagne-Ardenne, Cognition, Health and Society Lab C2S, ⁴FRESH Human Sciences Research Fund*Descriptors:* Interoception, Physiology, Empathy

Interoception refers to the ability to be aware of own body sensations. Some empirical studies showed higher self-rated arousal in participants with high interoceptive awareness. The purpose of this study is to determine if interoceptive awareness and emotional self-reported reactivity (subjective measures) rely on behavioural and physiological activation (objective measures). To this aim, we recruited a sample of 46 women (M=19.8). Emotional reactivity was assessed with the ERS (*Emotion Reactivity Scale*, Lannoy et al., 2014) and interoceptive metacognition skills with the MAIA (*Multidimensional Assessment of Interoceptive Awareness*, Mehling et al., 2012). To assess behavioural and physiological activity, participants performed the MET (Multifaceted Empathy Test, Dziobek, 2008), which consists of pictures from IAPS test battery (International Affective Picture System, Lang et al., 1997) depicting people in emotionally charged situations (anger, sadness and happiness). EDA (Electro-Dermal Activity) was recorded during simple viewing condition. During assessing condition, participants had to rate their level of arousal when watching pictures. Results showed that the amplitude of EDA response facing positive situations negatively predicts MAIA not-worrying (about body sensations) dimension while it positively predicts MAIA not-distracting (from body sensations) dimension. Moreover, MAIA noticing and emotional consciousness dimensions were predicted by behavioural arousal. These results will be discussed in regard with somatic markers hypothesis and previous empirical studies.

Funding: FRESH (Human Sciences Research Fund), Belgium.**Poster 1-037****THREAT OF SHOCK-INDUCED ANXIETY REDUCES WORKING MEMORY CAPACITY**Richard Ward; Hannah Sallmann; Carter Ginter; Salahadin Lotfi; Han Joo Lee; Christine Larson
University of Wisconsin, Milwaukee

Descriptors: Anxiety, Working Memory, Contralateral Delay Activity (CDA) Anxiety adversely affects cognitive domains, such as working memory. Current theories propose that anxiety reduces working memory capacity and is associated with inefficient filtering of task-irrelevant stimuli. Based on this view, we aimed to investigate the effects shock-induced anxiety has on working memory capacity and the ability to filter task-irrelevant neutral stimuli. We incorporated the contralateral delay activity (CDA), an event-related potential (ERP) that indexes the number of items retained in working memory, to serve as an electrophysiological marker of working memory capacity. Electroencephalography (EEG) was recorded from fifty-one undergraduates as they completed a lateralized change detection task under two contexts: Threat of shock and safe. The task consisted of three conditions: Two neutral targets, two neutral targets and two neutral distractors, and four neutral targets. The distractor condition was incorporated to calculate filtering efficiency. CDA was calculated by computing the difference between contralateral and ipsilateral waveforms for occipital/parietal channel clusters. We observed a significant interaction, in which there was a reduced CDA for the four neutral targets condition in the shock compared to the safe context. However, we did not find differences in CDA filtering efficiency between the two contexts. These results suggest that shock-induced anxiety reduces working memory capacity for larger set sizes, but individuals still maintain the ability to filter out distracting neutral information from working memory.

Poster 1-038**ALTERED N170 RESPONSE IN A FACIAL ODDBALL TASK IN PERSONS WITH HIGH DEPRESSIVE SYMPTOMS**Korbinian Riepl^{1,2}; Patrick Mussel³; Johannes Hewig¹; Christopher Beevers²; David Schnyer²¹University of Würzburg, ²The University of Texas, Austin, ³Freie Universität Berlin*Descriptors:* Depression, Negative Attention Bias, Oddball

Two of the main symptoms of depression are depressed mood and a loss of interest or pleasure. Our goal was to find an early neuronal correlate of these alterations by investigating the event-related potential N170, which presumably indicates the first time point where faces are reliably detected by the brain. Our participants performed a facial oddball task: They saw 300 faces in a row for 150 ms each and indicated after every face by a button press whether this face was happy, neutral, or sad. Eighty percent of the faces were in one gender (e.g., male), while the other 20% of the faces were in the other gender (e.g., female). There were no significant differences, between extreme groups of very low and very high depressive symptomatology, regarding reaction times or error rates. Regarding neurophysiology, we found, as expected, increased N170 amplitudes after rare faces, compared to frequent faces. Importantly, participants with low depressive symptoms reacted to rare faces with increased N170 amplitudes only after happy and neutral faces, while the same was true in the group with high depressive symptomatology only after sad faces. Additional analyses revealed that high depressive symptomatology can be predicted by low N170 differences between rare and frequent faces when the faces are happy or neutral. Our results indicate that persons with high depressive symptoms show a strong negative bias already after around 200 ms for automated processing of rare faces. The findings are discussed with regard to the negative attention bias and mechanisms of anhedonia.

Poster 1-039**THE SOCIAL INFLUENCE OF AFFECTIVE FACES AND EMOJIS ON DECISION MAKING AND ITS PSYCHOPHYSIOLOGICAL CORRELATES**Martin Weiß¹; Patrick Mussel²; Johannes Hewig¹¹Julius-Maximilians-Universität Würzburg, ²Freie Universität Berlin*Descriptors:* Emoji, Emotional feedback, Decision-making

Emotional feedback is a crucial part of human social interaction, since it may indicate motivations, intentions and thus future behavior of interaction partners. Nowadays, social interaction has been enriched by artificial emotional feedback provided by emojis, which are the means of emotion transportation in many mobile messengers. In this study, we aimed to examine the influence of emotional feedback by emoji identities as compared to real-face identities on decision-making and its psychophysiological correlates. We modified the Ultimatum Game by including several proposer identities represented both by emojis and by human faces who reacted specifically towards acceptance or rejection of an offer. We show that identities that reward acceptance with a smile cause the highest acceptance rates. Interestingly, acceptance rates did not differ between the identities represented by human faces versus emojis. Regarding electrophysiology, emojis evoked more negative N170 and N2 brain potentials compared to human faces both during a mere presentation and as feedback stimuli within the Ultimatum Game. As emotional feedback, identities reacting emotional evoked greater N170 amplitudes compared to a neutral control condition. The comparison of emoji identities with real-face identities in this paradigm provides new insight into how relevant social cues influence behavior and its neural underpinnings.

Funding: European Union project "Individualisierung Digital" (Fonds 823881) in the Europäischer Fonds für regionale Entwicklung (EFRE).

Poster 1-040**ACTIVATION IN THE AMYGDALA IN A SIMPLE AND SHORT PICTURE VIEWING TASK FOR CLINICAL APPLICATION**

Yasunori Kotani¹; Yoshimi Ohgami¹; Nobukiyo Yoshida²;
Akira Kunimatsu²; Shigeru Kiryu³; Yusuke Inoue⁴

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Descriptors: amygdala, picture viewing task

Recent studies suggested that amygdala response to emotive stimuli can be employed as a biomarker for mental disorders. However, the amygdala response can be affected by methodological factors such as activation tasks or content of emotive stimuli. In the present functional magnetic resonance imaging (fMRI) study, we manipulated the order and the number of emotive stimuli to confirm if the amygdala can be activated even in a simple and easy experimental paradigm that is suitable for clinical application. Participants were 19 healthy adults. They performed a picture viewing task where they were asked to see emotionally neutral, negative, and positive pictures. There were two experimental conditions: a simple condition (Simple) and a complex condition (Complex). In the Simple, the order of emotive pictures was fixed (neutral – negative – neutral – positive – neutral), and the number of pictures in one emotional category (e.g. negative) was ten pictures. In the Complex, the order of negative and positive category was counterbalanced between participants, and the session was repeated two times. The number of pictures in one category was 30 pictures. Analyses showed that the bilateral amygdala was significantly activated in the Simple and the Complex, and its activation in the Simple did not show any difference compared with the Complex. As mentioned above, the amygdala response can be employed as a biomarker for mental disorders. Present findings suggest that the amygdala can be activated by a simple and short picture viewing task that is suitable for clinical application.

Poster 1-041**PHYSIOLOGICAL AND EMOTION REGULATION IN EARLY CHILDHOOD**

Alyssa Palmer; Daniel Berry; Rebecca Distefano; Ann Masten
University of Minnesota

Descriptors: Emotion, Homelessness, Physiology

The ability to recognize and regulate your emotions in accordance with contextual demands - emotion regulation - is a central developmental task. Respiratory sinus arrhythmia (RSA) is a cardiac indicator of regulatory capacity. Further, experiences like homelessness, may increase the likelihood of exhibiting more regulatory difficulties (Labella et al., 2017). The current study included 85 preschool-aged children and their primary caregivers from two different populations (community sample and children experiencing homelessness). The children participated in a frustrating transparent box task (Goldsmith et al., 1999) which was behaviorally coded for negative reactivity (e.g. negative vocalizations) and regulation (e.g. distraction). A latent class analysis used these codes and a three-class model consisted of an actively regulating profile (48%), a regulated profile (42%) and a dysregulated profile (10%). Children experiencing homelessness were more likely to be in the dysregulated profile. RSA was calculated during the task using second-to-second estimates (Gates et al., 2015). Consistent with previous findings, children in the dysregulated group had less RSA withdrawal during the transparent box task. Further, large deviations in RSA across a challenging task may suggest more reactive profiles, so we examined RSA standard deviation. On average, children in the regulated group had less within-person variability compared to the other two groups. Utilizing more dynamic metrics of the PNS may be important to understand the dynamic functioning of the physiological system.

Funding: National Institute of Health (T32 MH015755).

Poster 1-042**ACUTE AEROBIC EXERCISE BOOSTS EMOTIONAL REACTIVITY TO PLEASANT IMAGES BUT DOES NOT IMPACT REWARD PROCESSING**

Christopher Brush¹; Dan Foti²; Matthew Miller³;
Anthony Bocchine⁴; Kristina Muniz⁴; Matthew Gooden⁴;
Brandon Alderman⁴

¹Florida State University, ²Purdue University, ³Auburn University, ⁴Rutgers, The State University of New Jersey

Descriptors: Exercise, Reward Positivity, Late Positive Potential

The “feel better” phenomenon of exercise is well established, yet little is known regarding the mechanisms of exercise on affective responses. Two objective neural markers that can be used to examine affective responses to exercise include the reward positivity (RewP) and late positive potential (LPP) components, which reflect reward sensitivity and emotional reactivity to salient environmental events, respectively. Given evidence suggesting RewP and LPP are disrupted in depression, it is important to determine whether these neural markers are modifiable through brief intervention. Using a within-subjects design, 66 young adults completed one session of moderate-intensity aerobic exercise and seated rest on separate days. Greater self-reported pleasure ($d = .28$) and larger Δ LPP to pleasant images was found following exercise relative to seated rest, $t(65) = 2.6, p < .02$. Following exercise, increased pleasure was associated with a smaller Δ LPP to unpleasant images, $r(64) = -.30, p < .05$. No effects of exercise on Δ RewP were observed; however, there was a trend between Δ RewP and Δ LPP to pleasant images following exercise, $r(64) = .24, p = .06$. Depressive symptom severity was explored as a moderator of these effects, but did not moderate any of the effects, indicating generalizable effects of acute exercise across depressive symptom profiles. These findings suggest that acute exercise increases emotional engagement to pleasant stimuli, which may have implications for protecting against the development of anhedonia or resolving blunted emotional reactivity to positive stimuli in depression.

Funding: This work was supported by the Society for Psychophysiological Research Training Fellowship awarded to CJB.

Poster 1-043**ASSESSING THE RELATIONSHIP BETWEEN ALPHA POWER AND HEMODYNAMIC ACTIVATION DURING MENTAL IMAGERY**

Maeve Boylan; Wendel Friedl; Harold Rocha; Andreas Keil
University of Florida

Descriptors: imagery, concurrent EEG-fMRI

Mental imagery is a critical factor in the etiology and maintenance of many psychiatric disorders, as well as a component in gold-standard treatment options. The neural underpinnings of mental imagery are however poorly understood. At the level of hemodynamics, research has demonstrated that mental imagery activates emotion networks of the brain. Scalp-recorded EEG has also shown an increase in endogenous activity in the alpha band during mental imagery tasks. To define the neurophysiology of mental imagery, we combined the information from blood oxygen level-dependent (BOLD) signals with concurrently recorded EEG alpha-band power during a visual script-driven mental imagery task in a sample of 20 healthy participants. Ongoing analyses demonstrate that established BOLD activation patterns during mental imagery were replicated with the addition of EEG recordings: BOLD was selectively enhanced during emotional, compared to neutral imagery, in medial prefrontal cortex, precuneus, and hippocampus. These changes were associated with alpha-power changes, assessed on a trial-by-trial basis, as well as related to the level of alpha-power change across trials. Together, findings suggest that alpha-power changes in the scalp-recorded EEG may represent a sensitive index of emotional imagery.

Poster 1-044**RETURNING A SMILE: THE IMPACT OF SOCIAL INTERACTION ON THE PROCESSING OF FACIAL EMOTIONS**

Leon Krocze; Andreas Mühlberger
University of Regensburg

Descriptors: Mimicry, Social context, EMG

Facial emotions are a fundamental part of social interaction. Here, we investigate how interactive context influences emotional processing. Thirty-six participants were cued to direct a facial expression (happy, angry, neutral) towards a virtual agent in front of them. The virtual agent responded with another emotional expression (angry vs. happy). Processing of that returned emotion was measured by means of ratings and EMG activity of the *M. corrugator supercilii* and the *M. zygomaticus major*. Results revealed significant interactions between interactive context (own expression) and emotion of the virtual agent. EMG activation of the *zygomaticus* showed a greater difference between happy and angry expressions of the virtual agent in positive interactive contexts compared to neutral and negative contexts. In general, *zygomaticus* activity was increased for happy vs. angry expressions of the agent. With respect to the *corrugator* there was increased activation for angry vs. happy expressions, but no modulation by interactive context. Furthermore, valence ratings of happy but not angry expressions of the agent were affected by interactive context. Valence ratings for happy expressions were highest in positive context, lowest in negative context and intermediate in neutral context. Thus, processing of emotional faces is affected by the interactive context in which they appear. Context effects were pronounced for positive expressions, suggesting an important role of positive emotions in social interaction. These results highlight the interactive nature of emotional expressions.

Poster 1-045**FUNCTIONAL BRAIN ACTIVITY DURING EMOTIONAL IMAGERY AND PERCEPTION: A WITHIN-SUBJECT ASSESSMENT**

Nicola Sambuco; Margaret Bradley; Katja Hillbrandt; Peter Lang
Center for the Study of Emotion and Attention, University of Florida

Descriptors: imagery, perception, fMRI

Inferences regarding the neural bases of emotion have often been made by comparing data acquired in very different emotional contexts such as anticipating a shock, looking at a bloody picture, imagining a snake attack, giving a speech, or viewing a film, with a goal of identifying shared regions. In this study, we compared blood oxygen level dependent (BOLD) signal using fMRI in the same 60 participants during emotional imagery and emotional perception. During emotional imagery, participants imagined a series of emotional (pleasant or unpleasant) and neutral events, cued by a written script. During emotional perception, pictures representing a variety of emotional (pleasant or unpleasant) and neutral contents were presented in a rapid serial visual presentation (RSVP) task. Enhanced BOLD activity during emotional, compared to neutral, imagery was found in the lateral cerebellum, vermis, hippocampus, caudate, and dorso-medial prefrontal cortex. On the other hand, during emotional perception, enhanced functional activity was found in the amygdala, thalamus, dorsal and ventral visual cortex, parietal cortex, and inferior frontal gyrus. There was very little overlap in regions showing heightened activity during emotional, compared to neutral, processing in imagery and perception. Taken together, the data support the hypothesis that the underlying neural basis of emotional processing varies in the specific context of its instigation.

Poster 1-046**SPATIAL FILTERING ATTENUATES THE EARLY POSTERIOR NEGATIVITY IN RESPONSE TO SNAKE STIMULI**

Jan Van Strien; Nikolaos Beligiannis
Erasmus University

Descriptors: early posterior negativity (EPN), phylogenetic threat, spatial frequencies

The relative importance of low and high spatial frequencies for visual threat detection is much debated. Here we examined the influence of spatial frequencies on the early posterior negativity (EPN) in response to snake, spider, and bird pictures. In the first study ($n = 30$), we employed the rapid serial visual presentation (RSVP) of blurred and non-blurred pictures. We found the typical enhanced EPN at occipital electrodes (PO3, PO4, O1, Oz, O2) in the 225–300 ms time window after picture onset in response to non-blurred snake pictures. This EPN snake effect was greatly reduced for blurred pictures. In the second study ($n = 28$), we employed the RSVP of low- and high-pass filtered and full-spectrum brightness-equalized grayscale pictures. The EPN snake effect was found for the full-spectrum pictures, but was attenuated in response to both high- and low-pass filtered pictures. These outcomes suggest that the EPN snake effect is not exclusively driven by low or high spatial frequencies as such. We propose that both local (i.e., skin patterns and scales) and global (i.e., curvature) features elicit the EPN snake effect.

Poster 1-047**PATTERNS OF ACTIVATION OF THE AUTONOMOUS NERVOUS SYSTEM UNDER WATCHING TO THE EMOTIONALLY ACCENTED TV NEWS**

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National Taras Shevchenko University of Kyiv

Descriptors: TV news, emotion, Heart Rate

The pattern and nature of autonomic nervous system responses largely depend on the type of emotion. The study is aimed to define the shifts in the autonomic nervous system that accompanied the emotional activation under the influence of emotionally accented TV news. 53 healthy right-handed volunteers (33 women and 20 men) participated in this study. The recorded ECG data array was processed using algorithms for heart rate variability. We used two sets of videos, five items in each set with emotionally negative and neutral news stories. We observed a heart rate deceleration in a few minutes after watching the neutral video set. At the same time throughout the viewing of the video, the activity of the parasympathetic system and the stress index have decreased. Negative accented TV news caused more complex changes. In men, significant changes in heart rate were recorded only during the first TV news. The most significant changes in the influence of the parasympathetic system and the stress index occurred in the middle of negative TV news set. The influence of negative TV news stories was more significant and complex for women and consisted of a decrease in heart rate during watching of TV news stories and heart rate accelerations in the pause between them. A significant decrease in the activity of the parasympathetic system occurred after watching negative TV news sets. Regarding all the parameters negative TV news stories exert a more significant influence on the psychophysiological condition of the volunteers.

Poster 1-048**SEXUAL MINORITY STATUS AND MOOD INDUCED PHYSIOLOGICAL RESPONSE IN FEMALES WHO ENGAGE IN NONSUICIDAL SELF-INJURY**

Allison Daurio; Chelsea Ennis; Jeanette Taylor
Florida State University

Descriptors: Sexual minorities, nonsuicidal self injury, skin conductance. Minorities experience chronic stress which leads to increased risk for physical (e.g., cardiovascular) and mental health problems (Meyer, 2003). Sexual minorities are at 3-fold risk to engage in nonsuicidal self-injury (NSSI) compared to heterosexuals. There is a dearth of research on risk factors related to NSSI in sexual minorities. Research suggests sexual minority related stress may undermine emotion regulation tactics, and emotion dysregulation may mediate the relationship between sexual minority status and NSSI. It is unclear whether there are physiological components contributing to this disparity. Thus, we examined whether sexual minorities have increased physiological reactivity during mood induction compared to heterosexuals. Females who engage in NSSI ($N = 46$; 48% sexual minority) underwent a relax and mood (anger or neutral) induction where heart rate and skin conductance were measured. No relationship was found between sexual minority status and physiological response to mood conditions. These results may suggest sexual minorities do not experience heightened autonomic nervous system reactivity in negative moods. Alternatively, sexual minorities' experience of chronic stress may increase their physiological reactivity and thus place them at higher risk for NSSI. However, physiological reactivity may be similar among all individuals that engage in NSSI. Further research using a full factorial framework is needed to clarify these null results.

Poster 1-049**PARENTAL COHERENCE AND DIVERGENCE IN ENACTED AND REPORTED REACTIONS TO CHILD DISAPPOINTMENT PREDICTS CHILD RSA REACTIVITY**

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Descriptors: emotion regulation, respiratory sinus arrhythmia, development. Parents are important socialization agents, particularly in terms of shaping children's emotion regulation. Respiratory sinus arrhythmia (RSA) is a non-invasive psychophysiological measure of parasympathetic functioning that is often used as an index of emotion regulation. The current study examined the relation between parental reported versus enacted socialization strategies and child RSA reactivity during an emotion-eliciting task that afforded children multiple opportunities to regulate distress across distinct social contexts. 181 4- to-11-year-olds participated with one parent. Children ranked prizes and were later given their least-favorite prize. Children's reactions to the disappointing gift were assessed while with an experimenter, alone, and with their parent. RSA was assessed continuously. Parents completed the Coping with Children's Negative Emotions Scale, which presents vignettes of emotional situations with their child for parents to endorse various emotion regulation strategies (e.g., punishing, minimizing, problem-focused, and emotion-focused reactions). Parents' enacted strategies were coded offline. Coding and data processing are ongoing; preliminary analyses indicate divergence in reported versus enacted strategies. Parental consistency in punishing strategies was specifically related to children's RSA reactivity while alone, suggesting the importance of social context. Taken together, results suggest that child RSA reactivity could be a protective aspect of emotion regulation that develops in concert with parenting.

Poster 1-050**PHOBIC FEAR DOES NOT PREDICT SENSITIZATION TO STARTLE STIMULI DURING HABITUATION**

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Virginia Polytechnic Institute and State University

Descriptors: Fear, startle, sensitization

Startle reflex habituation has proven to be a useful biological marker for individual differences in emotional learning and regulation. For many, habituation occurs immediately after exposure to the first stimulus. However, some respondents show sensitization between the first and second stimuli, particularly when this stimulus is aversive. Because sensitization of the startle reflex is mediated by neural projections between the amygdala and the startle center, the degree of sensitization or habituation early in a presentation block may relate to how people regulate feelings of fear. The present project tested whether scores on the Fear Survey Schedule (FSS), a measure of phobic severity, predicted change in startle eyeblink electromyographic (EMG) magnitude between the first and second habituation trials of a fear learning paradigm, using data from a sample of 45 undergraduate students from the second study of the Physiology of Stress and Trauma (POST) project at Virginia Tech. As observed previously, startle magnitude showed overall equal levels of sensitization and habituation between these trials, reflected by a null effect of trial number ($\beta = .101$, $T = .494$, $p = .345$). Contrary to expectation, the direction of this change (habituation or sensitization) was not impacted by FSS score ($\beta = .078$, $T = .727$, $p = .469$). This suggests that the presence and severity of fearful pathology (and particularly phobia) do not impact startle reflex sensitization.

Poster 1-051**ELECTROPHYSIOLOGICAL RESPONSE TO HIGH AND LOW AROUSING EMOTIONAL IMAGES IN COCAINE USERS**

Heather Soder¹; Francesco Versace²; Margaret Wardle^{1,3};
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Descriptors: emotion, cocaine, addiction

The late positive potential (LPP) is considered a reliable measure of motivational relevance: emotional images prompt larger LPPs than neutral images. For drug users, drug-related cues hold high levels of motivational relevance because of their pairing with drug delivery, and drug cues produce LPPs larger than those evoked by neutral images. However, it is unknown how LPPs evoked by drug-related cues compare to those evoked by (low/high arousing) emotional images. The current study aimed to compare the LPP to cocaine, neutral, and emotional images in cocaine users. We collected EEG data from 17 male cocaine users while they viewed pleasant (erotic, romantic, sweet food), unpleasant (mutilations, violence, unpleasant objects), cocaine, and neutral images. We analyzed the LPP amplitude over centro-parietal electrodes from 400-800ms. The results indicated a significant ($p < .05$) quadratic effect indicating that more arousing images prompted larger LPPs. There was a significant ($p < .01$) linear trend for pleasant contents (erotic > romantic > sweet food). The linear trend for unpleasant contents was not significant ($p = .7$). Erotic images were the only category significantly different from neutral. The LPP in response to cocaine images did not differ from neutral or low arousing emotional images. While preliminary, these results suggest that cocaine users may have a blunted reaction to emotional stimuli in general, as only high arousing pleasant images were different than neutral. Future directions include comparing these results to female users and a non-cocaine using control group.

Funding: This work was supported by the National Institute on Drug Abuse (P50 DA009262, PIs: Schmitz, Lane, & Green) and the National Institute of Health (R01 DA039125, PI: Schmitz).

Poster 1-052**THE LATE POSITIVE POTENTIAL IS A MARKER OF HYPERVIGILANCE IN ANXIETY**

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University of Arkansas

Descriptors: late positive potential, emotion, anxiety

Anxiety disorders are among the most prevalent mental health disorders (Craske, 2016). Anxious individuals show heightened neural activation in response to emotional facial stimuli relative to non-anxious individuals, as indicated by Hum et al. (2012), who used a modified go/nogo task. The current study elaborates on these findings by investigating whether trait level anxiety modulates the impact of emotional distraction during conflict monitoring. We sampled EEG while 28 participants completed a modified flanker task. Stimuli consisted of a congruent or incongruent arrow flanker stimulus overlaid on IAPS images. Participants completed the State-Trait Anxiety Inventory, which we used to rate participants on level of trait anxiety. For group-level analysis, we conducted a median split on anxiety. Results indicated that anxious individuals showed elevated late positive potential (LPP) amplitude compared to non-anxious individuals in *all* trial types, which is in line with research indicating hypervigilance in anxious individuals regardless of emotion. Counter to previous research, anxious individuals did not differ from non-anxious individuals in N2 amplitudes, suggesting vigilance may be more prominent in late processing stages. In support of this hypothesis, LPP amplitude is significantly correlated with anxiety but N2 amplitude is uncorrelated with anxiety. This study builds on previous work that characterizes hypervigilance in anxious individuals, as well as indicating that the LPP might provide a sensitive marker of these cognitive appraisals.

Funding: This work was supported by the Arkansas Biosciences Institute 0402-27504-21-0216 to CL.

Poster 1-053**EFFECTS OF LEFT VERSUS RIGHT TEMPORAL LOBE RESECTION ON EMOTIONAL STIMULUS PROCESSING: AN EEG STUDY**

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Christian Bien²; Johanna Kissler¹
¹Bielefeld University, ²Bethel Epilepsy Center

Descriptors: EPN, LPP, Temporal lobe resection

Intact medial temporal lobe structures are considered vital for the processing of emotional stimuli. In an ongoing EEG-study, we investigate the impact of left and right medial temporal lobe resections on visual processing of emotional pictures, faces, and words. Emotional modulation of neural activity is typically reflected in larger amplitudes on the occipito-temporal early posterior negativity (EPN, 200-300ms) and the centro-parietal Late Positive Potential (LPP, from around 400ms). Here, we compare recordings from 9 patients with right (rTLE) and 9 with left temporal lobe ectomy (lTLE) and 9 age and gender matched controls, all of whom passively viewed blocks of negative and neutral pictures, faces, and words while 128-channel-EEG was recorded. We found stable main effects of type (picture>face>word) and valence (neg>ntr) for both components. However, regarding the EPN, rTLE patients showed reduced emotional modulation of face processing, whereas lTLE patients showed a contralateral displacement of word processing from left to right hemisphere. For the LPP, both patient groups showed generally reduced amplitudes. Emotional LPP modulation was particularly reduced for pictures. These results suggest that differences in evoked potential amplitudes and emotional modulation between rTLE patients, lTLE patients, and controls are highly material- and time-window specific. Thus, while medial temporal lobe lesions do have specific effects, emotional modulation cannot be exclusively attributed to the medial temporal lobe structures of either hemisphere.

Funding: German Research Foundation grant KI1286/8-1.

Poster 1-054**ATTENTION BIAS MODIFICATION TRAINING TOWARDS POSITIVE STIMULI POTENTIATE REWARD-RELATED POSITIVITY**

Rourke Sylvain; Hayley Gilbertson; Jeremy Andrzejewski;
Joshua Carlson
Northern Michigan University

Descriptors: Reward-Related Positivity, Attention Bias Modification, Event Related Potential

The Reward-related Positivity (RewP) is an event-related potential elicited by positive outcomes. RewP is posited as an index for reward processing in the mesocortical dopamine system. Studies have shown that increased risk for depression is linked to blunted reward sensitivity—including blunted RewP amplitudes. Attention bias modification training (ABM) can alleviate symptoms of depression and anxiety. The aim of the study was to determine if RewP amplitude could be used as an efficient target measure of ABM outcome. It was hypothesized that participants trained to attend to positive stimuli would have a larger RewP in comparison to participants trained to attend to neutral stimuli. We used the well-defined modified dot-probe based ABM to train participant to either attend to positive or neutral information in a between-subjects design. Following training, reward sensitivity (i.e., RewP amplitude) was measured during a simple gambling task containing reward and non-reward feedback. Participants were told to choose between two doors. Behind the doors, there was either a gain of points (represented by a green upward arrow) or a loss of points (represented by a red downward arrow). Behaviorally, attentional bias to positive stimuli was greater in the attend positive (relative to the attend neutral) group. In addition, RewP amplitudes tended to be larger following ABM in the attend positive group. This study provides evidence that RewP amplitude may be an effective outcome measure of ABM designed to enhance sensitivity to positively valent information.

Poster 1-055**BI-DIRECTIONAL INFLUENCE OF MOTOR-ACTION PREPARATION: GREATER MOTOR BETA SUPPRESSION INCREASES N1 AMPLITUDES TO APPETITIVE STIMULI**

Hunter Threadgill; Philip Gable
University of Alabama

Descriptors: Approach Motivation, N1, Beta Suppression

High intensity approach-motivated positive affects increase neural activity associated with motor-action preparation, such as beta suppression over the motor cortex. This likely arises because these approach-motivated affective states occur during tenacious goal pursuit. The current study was designed to extend this work by examining whether motor-action preparation, manipulated independent of motivation, would elicit differences in emotional responding. On each trial, participants were required either to make a quick response to a target stimulus (movement trials) or hold a tonic state by remembering features of the target stimulus (memory trials). Before the target stimulus appeared, rapid motivational responses were then measured toward appetitive and neutral pictures indexed by the N1 ERP component. Results indicated that movement trials elicited greater beta suppression than memory trials. These results suggest that planned movement increased motor-action preparation, independent of motivation. Furthermore, movement trials increased N1 amplitudes toward appetitive images as compared to memory trials. These results suggest that emotional responding to appetitive stimuli can be modulated by increasing motor-action preparation.

Poster 1-056

SEX DIFFERENCES IN THE RELATIONSHIP BETWEEN ERROR-RELATED ELECTROCORTICAL ACTIVITY AND ANXIETY

Natalie Strand; Ryan Watling; Jeremy Andrzejewski;
Joshua Carlson
Northern Michigan University

Descriptors: Error Related Negativity, Trait Anxiety

The Error Related Negativity (ERN) is a negative ERP that occurs immediately after an error is committed. Individuals with anxiety tend to have a stronger sensitivity to errors, which is reflected in higher ERN amplitudes. Recent meta-analytic work indicates that the relationship between anxiety and ERN amplitude is moderated by participant sex such that the relationship is stronger in women compared to men. This study further investigates the effect of sex on the relationship between error-related electrocortical activity and anxiety symptoms in a sample of high trait anxious individuals. Participants completed the State-Trait Anxiety Inventory (STAI), a questionnaire that measures state and trait anxiety. This study selected for high trait-anxious individuals with a score greater than 40. While collecting EEG data, participants completed the Eriksen Flanker Task. The task included congruent trials with arrows facing the same direction (e.g., <<<<<<), and incongruent trials with arrows facing different directions (e.g., <<<><<). Participants were instructed to indicate the direction of the middle arrow. The ERN was measured by calculating the amplitude difference between incorrect and correct responses. The results indicate that females with higher trait anxiety scores tend to exhibit larger ERN amplitudes, whereas there is no significant relationship for males. Thus, the moderating effect of sex on the relationship between anxiety and ERN is maintained even in the higher levels of the trait anxiety continuum.

Funding: A grant (R15MH110951) was awarded to Principal Investigator Joshua M. Carlson.

Poster 1-057

POSITIVE EMOTION REGULATION: THE NEURAL CORRELATES OF SAVORING

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Descriptors: Positive Emotion Regulation, Savoring, Positive Affectivity

Frequent experience and regulation of positive emotion are critical for deriving vitality from our lives. The neural correlates of savoring may provide insight into mechanisms of upregulating positive emotion. Neural response to visual affective stimuli can be measured with EEG via the late positive potential (LPP) as an index of evaluative valence and arousal. Savoring involves the use of cognitive or behavioral strategies to upregulate positive emotion. We anticipated that beliefs about savoring capability would correlate with enhanced LPP to amplifying positive affect. The present study evaluated relations between savoring, positive affectivity, and regulation of positive Open Affective Standardized Image Set (OASIS) stimuli, a new open access image set with normed valence and arousal ratings for affective science research. Hypotheses were pre-registered: <https://osf.io/p5ba9/>. EEG data were recorded from 48 individuals while passively watching or increasing/decreasing emotional intensity in response to OASIS images. The trait Positive and Negative Affect Schedule and Savoring Beliefs Inventory were administered. Results showed enhanced LPP in response to positive ($b = 1.38$, $SE = 0.39$, $t(244.96) = 3.52$, $p < .001$, $R^2 = .03$) and negative ($b = 2.12$, $SE = 0.42$, $t(249.05) = 5.10$, $p < .001$, $R^2 = .06$) OASIS stimuli. Positive affectivity and savoring did not moderate the relationships between watching or increasing emotional intensity to positive images and LPP. This research underscores the feasibility of the OASIS and contributes to neuroscience-informed interventions.

Poster 1-058

APPLICATION OF A BLUETOOTH HEADSET, CABLE HEADSET, AND A SMARTPHONE CHIP ON THE SMARTPHONE: DO THESE DEVICES REDUCE EFFECTS ON EEG BRAIN ACTIVITY INDUCED BY SMARTPHONE-EMITTED ELECTROMAGNETIC FIELDS?

Diana Henz
University of Mainz

Descriptors: electromagnetic fields, smartphone, EEG

Current research demonstrates adverse effects of mobile phone-emitted electromagnetic fields (EMFs) on EEG brain activity and brain health. Technical solutions are developed to reduce these effects such as bluetooth headsets, cable headsets, and smart phone chips that are applied on the surface of the smartphone. In the present study, we investigated whether these technical devices reduce effects of smartphone-emitted radiation on EEG brain activity. Subjects were exposed to smartphone (iPhone X) EMFs in three experimental conditions (bluetooth headset [AirPods], cable headset, smartphone chip [Gabriel-Tech]), and one control condition (no device) in a within-subjects design. Each experimental condition was tested for 20 minutes. High-density EEG was recorded from 128 electrodes before, during, and after each experimental condition. High-frequency EMFs were measured continuously as a control variable. Results show increases in EEG beta and gamma power when subjects are exposed to smartphone-emitted EMFs in frontal, central, temporal, and parietal areas. Further, data of source localization showed increased activity in the hippocampal area when exposed to smartphone-emitted EMFs. Application of the smartphone chip lead to a significant reduction of increases in beta and gamma power. In contrast, application of the bluetooth headset and cable headset lead to increases in overall beta and gamma power in both hemispheres. Results confirm findings from previous studies on the effects of mobile phone-emitted EMFs on brain activity, and effects of mobile phone chip application.

Poster 1-059

POST MEDITATION CHANGES IN EEG SPECTRUM OF LONG-TERM BRAHMAKUMARIS RAJAYOGA MEDITATORS

Kanishka Sharma¹; Ronnie Daniel²; Sushil Chandra²; Ramakrishnan AG¹

¹Indian Institute of Science, ²Institute of Nuclear Medicine and Allied Science, Defence R&D Organization

Descriptors: Long term meditation, EEG Spectrum, Resting state

Rajayoga meditation, taught by Brahmakumaris, is a versatile meditation tradition, performed with open eyes and practiced by more than a million people globally. It employs contemplation with an abundance of positive thoughts and directed thinking in order to reach experiential states for self-development. The present study explores the differences in the spectral properties of long-term meditators. During meditation and post meditation baseline resting, 64 channel EEG was recorded in a silent room with minimal interference. Different frequency bands were selected between 0.5-45 hertz. to determine the average power in different frequency ranges, a modified periodogram approach used after multiplying the signal with a Hamming window prior to computing the digital fourier transform. Percentage of total power was then calculated. Only lower band (0.5-3 and 3-7 hertz) were affected due to post meditation resting. An interesting finding like cross frequency coherence was observed between these bands. Overall frequency spectrum was uniformly distributed in meditation as compared to post condition. This uniform distribution in reduced activity is unique with meditation and dissolved post meditation. Findings are important to understand the sensory deprivation during meditation as well as the state of mental silence in long term practitioners. The synchronization in reduced activity between hemispheres might indicate greater balance in the activity of the two hemispheres. This may lead to more integrated and optimizable functional system to balance emotional and mental health.

Funding: SpARC wing of Brahmakumaris for EEG system.

Poster 1-060

CYNICAL HOSTILITY AND THE RELATIONSHIP TO PHYSIOLOGICAL HABITUATION TO RECURRENT STRESS

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Descriptors: Cardiovascular Reactivity, Hostility, Stress

Cynical hostility is associated with increased risk for cardiovascular disease. Heightened cardiovascular reactivity (CVR) to psychological stress has been proposed as a potential mechanism. Recent work has emphasized a need to measure CVR across multiple exposures to assess potential habituation over time. The aim of this study was to examine the relationship between cynical hostility and habituation of CVR to multiple exposures using data from the Pittsburgh Cold Study 3. One hundred and ninety-eight participants (Mean (SD) age = 29.9 (10.8) years, 42.4% female, 67.7% Caucasian) completed 2 separate laboratory sessions, consisting of a 20-minute baseline and 15-minute stress (Trier Social Stress Test). Heart rate (HR) and systolic/diastolic blood pressure (SBP, DBP) were recorded throughout. Reactivity was calculated separately for HR, SBP, and DBP (stress – baseline). Habituation was calculated as the differences in CVR between times 1 and 2. Participants also completed the Cook-Medley Hostility Scale. Multivariate cluster analysis using HR, SBP, and DBP habituation values revealed a two-cluster solution. Cluster 1 had increased CVR to stress at time 2 compared to time 1 (sensitizers), while cluster 2 had decreased CVR at time 2 compared to time 1 (habituated). There were significant differences between clusters in cynical hostility ($F = 9.58, p = .002, \eta^2 = .047$); sensitizers displayed greater levels of cynical hostility. Results suggest that hostility is associated with CVR sensitization, which may help clarify how hostility contributes to disease risk.

Poster 1-061

INTOLERANCE OF UNCERTAINTY ASSOCIATED WITH REDUCED HEART RATE VARIABILITY IN ACUTE TRAUMA SURVIVORS

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Descriptors: intolerance of uncertainty, heart rate variability, PTSD

Intolerance of uncertainty (IU) is a transdiagnostic construct shown to indicate risk for and maintain various psychopathological disorders, such as anxiety. Individual differences in IU have also been shown to have physiological correlates, including reduced heart rate variability (HRV). As an index of vagal tone, reduced HRV could have negative consequences on mental health outcomes following a severe stressor – i.e., trauma – by impacting physiological adaptability. Understanding how dispositional (IU) and physiological (HRV) factors are related acutely post-trauma may help clarify those most at risk for poor outcomes. Adult traumatic injury survivors ($n = 47$) were recruited from the emergency department of a Level I trauma center and completed self-report measures of IU (Intolerance of Uncertainty-12) and posttraumatic stress disorder symptoms (PTSD Checklist-5). Respiratory sinus arrhythmia (RSA), an index of HRV, was calculated from peripheral pulse oximeter data collected during a resting-state fMRI scan. Results indicated that IU was significantly correlated with RSA ($r = -.34, p = .02$) and PTSD symptoms ($r = .45, p < .001$). RSA was not correlated with PTSD symptoms ($r = .04, p = .80$). These findings suggest decreased HRV is more associated with trait-like dispositional factors, such as IU, rather than acute psychological distress to a traumatic stressor; however, given high IU and low HRV may confer risk for psychopathology, research should aim to examine how these factors are associated with or possibly predict chronic symptoms of trauma-related pathology.

Funding: NIMH grant R01 MH106574 (PI: Christine Larson).

Poster 1-062

SUBSTANCE MISUSE AND EEG/BEHAVIORAL CORRELATES OF RESPONSE INHIBITION: ETIOLOGICAL INSIGHTS FROM A COTWIN CONTROL DESIGN

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University of Minnesota, Twin Cities

Descriptors: Midfrontal theta, Cotwin control design, Alcohol/nicotine use

Deficits in inhibitory control are a core component of substance misuse and addiction. Alcohol and nicotine use are negatively associated with midfrontal theta during response inhibition. It is unclear whether these relationships reflect a premorbid determinant or potential consequence of substance misuse. We assessed the relationship between problematic alcohol/nicotine misuse across emerging adulthood and theta-band EEG dynamics during a Go/Nogo task in a sample of 638 same-sex twins (age: M [SD] = 24.4 [0.8]; 346 women). Capitalizing on within-twin-pair differences in substance use, a cotwin control (CTC) analysis was used to differentiate alcohol/nicotine exposure effects from preexisting risk. Decreased nogo midfrontal theta power was associated with greater drinking, number of hangovers/blackouts/binges, and cigarettes per day (CPD). As hypothesized given prior work, effects were only significant in women. The CTC analysis indicated that within a twin pair, the heavier-using twin had lower theta compared to her lesser-using cotwin, suggesting an exposure-related effect of alcohol and nicotine misuse on nogo-related theta. There was also evidence of familial confounding between theta and drinking. Worse task performance, including lower d-prime scores and greater false alarms, was linked to increased CPD in men and women; these effects likely reflect a premorbid vulnerability. Results offer evidence that problematic alcohol and nicotine use during emerging adulthood may have sex-specific substance exposure-related effects on frontal inhibition-related theta dynamics.

Funding: DA036216; Eva O. Miller Fellowship (University of Minnesota).

Poster 1-063

FIREFIGHTERS WITH GASTRIC ULCER REACT STRONGER TO THE ACUTE STRESS EXPOSURE

Olga Dorogina; Yuri Pavlov; Dauren Kassanov
Urals Federal University

Descriptors: stress, EEG, galvanic skin responses

Under prolonged exposure to stress gastric ulcer can develop. However, it is unclear how acute stress affects central and peripheral physiological mechanisms of stress reaction in such condition. In this study we examined the relationship between the presence of gastric ulcer and psychophysiological reactivity to acute stress. 43 male (aged 36-38 years) firefighters participated in the study. The participants were divided into 2 groups: the experimental group ($N = 20$) of firefighters with gastric ulcer in remission and the control group of healthy individuals ($N = 23$). The participants underwent the Trier Social Stress Test. Before and after the test 5 min of EEG and galvanic skin responses (GSR) were recorded. EEG and GSR were no different in the baseline period. After the test in comparison with control group the experimental group demonstrated a decrease of the power of alpha oscillations in the range of 10–13 Hz. Furthermore, mean amplitude of GSR was significantly larger in the experimental group. We can conclude that exposure to acute stress in previously chronically stressed individuals generates larger central as well as peripheral psychophysiological responses.

Poster 1-064
THE INFLUENCE OF PHYSICAL ACTIVITY AND PHYSICAL FITNESS ON THE P300 COMPONENT: RESULTS OF A SYSTEMATIC LITERATURE REVIEW

Kelsey Piersol; Daniel Berkowitz; Abigail Shieh; Branden Wright;
Brandon Alderman
Rutgers, The State University of New Jersey

Descriptors: Systematic Review, Exercise, Cognitive Function

The literature surrounding the relationship between exercise and cognitive function has grown significantly. In terms of ERPs, the P300 component has received the most support as a measure of cognition between active/fit and inactive/less fit individuals. We conducted a systematic review of the literature related to physical activity and physical fitness and the P300 component. 41 of 607 research articles met the inclusion criteria. In the spirit of scientific rigor and transparency, we examined each article for: (1) explicit directional hypotheses for P300 based on fitness or activity level; (2) overall conclusions reached (support for or against physical activity/physical fitness); and (3) overall direction of the findings. 41% of the articles provided directional hypotheses for P300 amplitude and/or latency while 49% did not provide directional hypotheses. 78% of articles were found to be in support of physical activity or fitness promoting improvements in cognition; however, results across studies were difficult to interpret. We were unable to determine the overall direction of the findings due to the large variety of tasks used to elicit P300, inconsistent approaches for measuring amplitude and latency, differing definitions of physical activity and physical fitness, and the large number of statistical analyses performed per study. Overall, the lack of consistency and large number of analyses performed per study likely increases the false positive rate and prevents a clear picture of the relationship between physical activity/fitness and the P300.

Poster 1-065
THE ASSOCIATION BETWEEN PATHOLOGICAL SMARTPHONE USE AND FEEDBACK PROCESSING

Robert West; Ashley Dapore; Carl Ash; Kaitlyn Malley
DePauw University

Descriptors: feedback processing, smartphone addiction, reward
Smartphones have become a ubiquitous part of everyday life, allowing us to keep in touch with friends and family, stay up to date on current events, and fill our leisure time. The proliferation of smartphones has been accompanied by the emergence of the pathological use of these devices (i.e., smartphone addiction), with some studies revealing that as many as 20%-40% of users may meet the criteria for smartphone addiction. In the current study, we sought to examine the relationship between pathological smartphone use and the processing of gains and losses in a modified 2-doors gambling task wherein for each trial either the participant or computer selected one of two doors based upon a cue presented at the beginning of the trial. In a screening sample for our participant pool, 22% of individuals qualified for smartphone addiction. For the ERP data from the 2-door task: the amplitude of the feedback negativity was insensitive to smartphone pathology, while the amplitude of the frontal P3 decreased as smartphone pathology increased; the amplitude of the reward positivity also decreased as smartphone pathology increased; and the parietal P3 revealed an interaction between outcome and smartphone pathology. Our data reveal a dissociation in the relationship between pathological smartphone use and the processing of gains and losses, wherein the ERPs for gains were attenuated in high pathology individuals regardless of choice condition, while the ERPs for losses were only sensitive to pathology for participant choice trials.

Poster 1-066
GROWTH-CURVE ANALYSIS OF STARTLE MAGNITUDE AND MODERATING ROLE OF TRAIT-FEAR, EMOTIONAL VALENCE, AND AROUSAL

Keenan Roberts; Keanan Joyner; James Yancey; Emily Perkins;
Christopher Patrick
Florida State University

Descriptors: Startle, Threat Sensitivity, Multilevel modeling

A consistent finding in the literature is that startle blink reactivity to abrupt noise probes during picture viewing varies as a function of the affective valence (pleasantness) of picture images; unpleasant pictures elicit enhanced startle reactivity, and pleasant pictures reduced startle reactivity, in comparison to neutral (Lang et al., 1990). Research using this picture-startle procedure has found that *aversive* (unpleasant versus neutral) *startle potentiation* (ASP) is moderated by dispositional threat sensitivity (THT) – i.e., ASP is enhanced for subjects higher in scale-assessed THT (Yancey et al., 2016). An interesting unexamined question is whether dispositional THT moderates the *extent to which* startle potentiates as picture aversiveness continuously increases (from the most pleasant to the most unpleasant). Here, we applied multilevel modeling to picture-startle data for 497 adults ($M_{age} = 29.4$) to test for THT-related differences in growth curves for startle response quantified in relation to rated picture valence. Picture images were from the IAPS stimulus set (Lang et al., 2008); each image was quantified for rated valence using IAPS norms and raw startle magnitude was quantified for each trial. Extending prior research, THT moderated the *slope of startle response* across increasing levels of rated picture unpleasantness, with high-THT subjects showing a steeper trajectory of startle magnitude increase. This work provides evidence for slope of startle magnitude as a novel indicator of individual differences in physiological defensive (fear) reactivity.

Poster 1-067
NEURAL OSCILLATORY DYNAMICS SERVING ABSTRACT REASONING IN TYPICALLY-DEVELOPING CHILDREN AND ADOLESCENTS

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Descriptors: Magnetoencephalography (MEG), Intelligence, Development
Fluid intelligence (Gf) is broadly defined as the ability to reason and problem solve in novel situations. MRI-based studies on the development of neural mechanisms underlying Gf show regional changes in brain structure and function; however, there is a paucity of research examining the trajectory of the spectro-temporal dynamics of neuronal activity during Gf tasks. The present study investigates the neural oscillatory dynamics that underlie Gf performance in a group of 63 youth (range: 10-16 years, $M = 12.79$, $SD = 1.61$). All participants underwent magnetoencephalography (MEG) during an abstract reasoning task and completed high-resolution structural MRI. Time-frequency spectrograms indicated significantly decreased alpha/beta activity (8-22Hz, 475-1000ms), and significantly increased theta (4-8Hz, 100-500ms) and gamma activity (64-92Hz, 175-975ms) during the task period relative to baseline. Source reconstruction of each time-frequency window was performed using a beamformer and examined for correlations with chronological age. Results indicated a significant positive correlation between age and alpha/beta activity in the left superior temporal gyrus ($r = .35$), and between age and theta activity in the left cuneus ($r = .51$). There was also a significant negative correlation between age and gamma activity in the right superior parietal lobule ($r = -.37$). These data suggest that while youth are recruiting brain regions known to serve Gf in mature adults, specific neural oscillatory responses are still developing throughout adolescence.

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Poster 1-068

ADJUSTING ADJUST: OPTIMIZING THE ADJUST ALGORITHM FOR CHILD DATA USING GEODESIC NETS

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Descriptors: EEG Artifacts, ADJUST, Geodesic Nets

A major challenge for EEG studies of infants and young children is that large amounts of data are lost due to artifacts (movement, blinks). Independent Component Analysis can separate artifactual and neural activity. However, manual identification of artifactual components takes time and requires subjective judgment. Automated algorithms, like ADJUST, have been validated on adults using the 10/20 system, but to our knowledge no such algorithms exist for geodesic nets used with infants and children.

In order to improve ADJUST's performance on child data, we modified the ocular artifact selection algorithms to use the geodesic layout. Moreover, we added an algorithm to ensure no components likely reflecting neural data (e.g., alpha peak) were rejected. Two expert coders classified 1201 components (50% child and 50% adult data) as artifact or neural. The mean percent agreement (PA) between the Updated ADJUST (UA) and expert coders was higher than the mean PA between the Original ADJUST (OA) and expert coders for ocular (95% vs 68%; $p < .01$) and all artifact types (92% vs 79%; $p = .04$). Furthermore, the proportion of trials retained after artifact rejection was marginally higher for UA than for OA (91% vs 80%; $p = .07$) and significantly higher for UA than for no correction (91% vs 52%; $p < .001$). Importantly, algorithm performance did not differ between children and adults. These results suggest that it is possible to optimize existing algorithms for data collected with geodesic nets to improve artifact selection and retains more trials, potentially facilitating child EEG studies.

Funding: NIH UH3OD023279.

Poster 1-069

INVOLVEMENT OF THE MIRROR NEURON SYSTEM IN AUTOMATIC IMITATION IN CHILDHOOD

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Descriptors: Imitation, Mu desynchronization, EEG

Humans automatically imitate others' actions, and one of the proposed mechanisms of automatic imitation is the mirror neuron system (MNS; Cracco et al., 2018). Studies examining automatic imitation have focused on behavioral and fMRI measures, leaving the temporal dynamics unexplored. In the current study, we provide a novel investigation of the temporal dynamics of automatic imitation by using EEG mu event-related desynchronization, an index of MNS activation (Fox et al., 2016). Children ($N = 26$; $M_{age} = 8.2$; $SD = 1.1$) performed a variant of the inhibition of imitation task (Brass et al., 2000). Participants responded to an imperative cue while observing an action that was congruent or incongruent with their response. Crucially, our paradigm included a condition to control for spatial compatibility (i.e., the Simon effect), in which participants responded to the same imperative cue while a non-action cue (i.e., a circle) appeared in place of the action. Behavioral results showed no difference between the automatic imitation and the spatial compatibility conditions—in both, participants were slower and less accurate for incongruent trials compared to congruent trials. However, time-frequency analyses over motor cortex revealed significantly greater mu desynchronization immediately following observation of the action cue, compared to the spatial cue, implying MNS activity. The findings suggest that although automatic imitation and spatial compatibility effects could not be distinguished behaviorally, automatic imitation may arise from distinct neural process involving the MNS.

Funding: This work was supported by the National Institutes of Health (P01 HD064653 to NAF).

Poster 1-070

CHILDHOOD MUSIC TRAINING, VERBAL ABILITY, AND THE COHERENCE OF AXONAL FIBERS IN WHITE MATTER PATHWAYS

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Descriptors: Childhood, Music activities, Cognitive abilities

The superior longitudinal fasciculus (SLF) is a white matter tract that connects lateral frontal and superior temporal lobes, regions that are important for functions involving auditory perception and action such as speech and music. We hypothesized that children who have musical training will have greater integrity and coherence in the SLF. 100 children aged 7.9 to 9.9 (mean age 8.7) were surveyed for their musical activities, completed neuropsychological testing for general cognitive abilities, and underwent DTI as part of a larger study. Children who play a musical instrument for more than 0.5 hours per week ($n = 34$) had higher Fractional Anisotropy (FA) in the Right SLF than those who did not play a musical instrument ($n = 66$) ($F(1,98) = 4.25$, $p < .05$). Furthermore, the intensity of musical practice, quantified as the number of hours of music practice per week, was correlated with Axial Diffusivity (AD) in the Left SLF ($r = .36$, $p < .01$). Verbal ability (standardized scores from Woodcock Johnson Test) was also significantly correlated with musical practice intensity, ($r = .35$, $p < .01$), and also with AD of the Left SLF ($r = .35$, $p < .05$). These associations remained significant after controlling for differences in age and socioeconomic status (partial correlations: both $r_{partial} > .35$, $p_{partial} < .01$). Results suggest that the relationship between musical practice and verbal ability is related to the coherence of axonal fibers in white matter pathways in the auditory-motor system.

Funding: Support for this project was provided by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under award number 2011-67001-30101; the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) grant R01 HD069381.

Poster 1-071

CHILDREN'S PHYSIOLOGICAL REACTIVITY TO FRUSTRATION PREDICTS SOCIAL SUCCESS WITH PEERS

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The Pennsylvania State University

Descriptors: Frontal EEG Asymmetry, Sympathetic Arousal, Peer Relations

Kindergarten represents an important transition with increased demands on children's behavioral and emotional regulation in a new social context. This study examined if physiological reactivity to a frustration task predicted children's success with peers later in the school year. We assessed frontal EEG asymmetry (sites F3/F4), a measure of lateralized neural activity thought to reflect approach-avoidance orientation, and skin conductance response (SCR), a measure of sympathetic arousal. A total of $n = 291$ children (64% male, 68% African American) completed an incentivized go/no-go task with reward and frustrative non-reward blocks. Peer sociometric ratings were collected in the Spring. Two regression models examined if children's physiological function during frustration was associated with the proportion of peers who indicated not liking to play with them. Models controlled for child sex and physiological function during the preceding reward block. Results indicated that being nominated by more peers as someone they don't like to play with was associated with greater left asymmetry ($\beta = .07$, $p = .05$) in response to frustration ($F(3,268) = 214.7$, $p < .001$). A comparable effect emerged for greater sympathetic arousal ($\beta = .08$, $p = .05$; $F(3,235) = 141.6$, $p < .001$). These physiological response patterns may reflect a tendency to become emotionally aroused in the context of frustration, and to be inclined to direct that arousal outward, as reflected in the approach-oriented left asymmetry. These findings give insight into how some children's reactivity may impede friendship formation.

Poster 1-072

EVENING ROUTINES EFFECTS ON OVERNIGHT CARDIAC VAGAL ACTIVITY AND SUBJECTIVE SLEEP QUALITY: SLOW PACED BREATHING VS. SOCIAL MEDIA USE

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Descriptors: Heart rate variability, Parasympathetic nervous system, Sleep Relaxation techniques based on slow paced breathing used as evening routines have been suggested to improve sleep quality. However, so far long-term interventions testing these effects are lacking. Consequently, the aim of this study was to investigate the influence of a 30 day slow paced breathing intervention compared to social media use on subjective sleep quality and cardiac vagal activity, the activity of the vagus nerve regulating cardiac functioning. Healthy participants ($N = 80$) were randomly allocated to an experimental or control group. In the experimental group, they had to perform slow paced breathing for 15 minutes each evening across a 30 day period. This was administered through a smartphone application. The control group used social media (e.g., Facebook, Instagram, Whatsapp) for the same duration. The night before and after the 30 day intervention, their cardiac vagal activity was assessed via a light portable ECG device, and they had to fill out the Pittsburgh Sleep Quality Index questionnaire. Results showed that in comparison to the use of social media, the slow paced breathing technique improved subjective sleep quality and increased overnight cardiac vagal activity. Slow paced breathing appears a promising cost-effective technique to improve subjective sleep quality and cardiovascular function during sleep in young healthy individuals.

Funding: German Sport University Cologne, HIFF 920157.

Poster 1-073

MAPPING CAUSAL RELATIONSHIP OF BRAIN CONNECTIVITY PATTERNS FOLLOWING RELAXATION TRAINING

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Texas Tech University

Descriptors: mental training, causal relationship, EEG Relaxation training (RT) is one form of body-mind intervention and has been widely used in stress reduction and anxiety related disorders. RT has shown to affect resting-state brain activity. However, it remains unclear about the causality of the resting connectivity following RT. Among EEG frequency bands, the alpha band is involved with a stable coupling for body-mind interventions. Here, we applied an adaptive directed transfer function to examine the granger causality in pre-defined region of interests (ROIs) after 4 weeks of RT in 20 college students. Resting-state EEG was taken one week before and after RT. Standard preprocessing steps were completed using EEGLAB. Source reconstruction was used to extract time series of our ROIs, the posterior cingulate cortex (PCC), medial prefrontal cortex (mPFC), ventral anterior cingulate cortex (vACC) and dorsal anterior cingulate cortex (dACC). Adaptive directed transfer function and surrogate testing were applied over alpha frequency band. We found increased connectivity between the mPFC and dACC after RT. The mean connectivity strength of mPFC to other ROIs decreased after training. Our SVM classifier reached 65% accuracy rate using 10-fold cross validation, highlighting the importance of mPFC and vACC in RT. These results may suggest relaxation training reduces stress and improves emotion through self-control networks. BJ and WY had equal contribution.

Funding: This work was supported, in part, by the NIH R61AT010138.

Poster 1-074

THE EFFECT OF SUSTAINED ANXIETY ON PHASIC FEAR RESPONSES IN A NEW ORTHOGONAL CUE AND CONTEXT CONDITIONING PARADIGM

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Descriptors: Fear, Anxiety, ssVEP

Recent research proposes a distinction between fear and anxiety, such that fear is elicited by imminent threat, leading to phasic defensive responses, whereas anxiety is a sustained state of hypervigilance due to unpredictable danger. It is unclear however whether fear and anxiety are mutually exclusive or modulate each other. Therefore, we used an orthogonal combination of cue and context conditioning, in which we independently presented cues indicating imminent danger (CS+) vs safety (CS-) during contexts that are either safe (CTX-) or in which additional unpredictable aversive stimuli could occur (anxiety context; CTX+) to systematically investigate differential processing of fear cues during anxiety vs neutral contexts. Visual stimuli were presented in flicker mode to record steady-state visual evoked potentials (ssVEPs) in addition to skin conductance responses (SCRs). Affective ratings were collected separately for contexts and central cues and each of their combination (e.g., CS+ in CTX-). The CTX+ and CS+ onset elicited increased SCRs and higher threat ratings than the CTX- and CS- respectively, indicating successful conditioning. In addition, CS ratings were increased during CTX+ compared to CTX-. SCR analysis revealed stronger CS-differentiation during CTX+ compared to CTX-. There were no significant effects for ssVEPs. These results provide preliminary evidence for potentiated fear responses during anxiety inducing contexts, suggesting that anxiety can potentiate defensive responses to imminent threat and therefore enhances adaptive reactions to potential danger.

Funding: This study was funded by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) – TRR 58 (project B01).

Poster 1-075

CHANGES IN THE STIMULUS PRECEDING NEGATIVITY DURING MOTOR LEARNING

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Descriptors: Stimulus Preceding Negativity, Motor Learning

The stimulus preceding negativity (SPN) is a slow cortical potential that reflects anticipation of motivationally relevant stimuli, including response outcomes (e.g., reward, task feedback). Current theory assumes that learning from outcomes can be model-free (habitual, striatal) or model-based (goal-directed, hippocampal/prefrontal). The latter dominates when feedback is delayed (e.g., 7 s in a perceptual task, Foele & Shohamy, 2011, *J. Neurosci.*, 31: 13157-13167). Using a motor task (Ren, Valle-Inclán, Tukaiev, & Hackley, 2017, *Psychophys.*, 54: 969-981) we found SPN to decline in amplitude over the course of learning with a 2.5-s but not an 8-s feedback delay. The current study reexamined that null effect using a single delay (to reduce context effects), more trials per condition (to augment power), and a slightly shorter delay (6 s, to enhance attentional focus). Sixty-six young adults performed the same motor task as in Ren et al. (2017), with new variants to be learned in each of 9 blocks (30 trials/block; 10 trials/subblock). Participants reproduced a pattern of four brief key presses using either their right or left hand. After a 6-s delay, they received visual feedback. Error rate, reaction time, and EMG amplitude declined across subblocks. Unexpectedly, a similar learning effect was evident for the SPN at frontal sites: Its amplitude also declined across subblocks. Further research will be needed to determine whether such changes are relevant to distinguishing model-free from model-based learning.

Poster 1-076**ASSOCIATION OF CONDITIONED FEAR GENERALIZATION WITH ANXIETY METRICS IN AN EPIDEMIOLOGIC SAMPLE OF ADOLESCENTS AND YOUNG ADULTS**

Scott Vrana¹; Christina Sheerin¹; Ashlee Moore¹; Jason Burchett²; Jennifer Cecilione¹; Shmuel Lissek³; Roxann Roberson-Nay¹

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Descriptors: fear generalization, anxiety, startle probe

Psychophysiological studies have identified conditioned overgeneralization, measured through fear-potentiated startle (FPS) in individuals with panic and generalized anxiety disorders, but the relation between conditioned generalization and anxiety process more broadly remains unknown. This study examined fear generalization in a large, epidemiologically-informed sample of adolescents and young adults ($n = 450$; $Mage = 16.86$; 27% male) using a classical conditioning paradigm. FPS magnitude was measured with orbicularis oculi electromyography (EMG). A series of risk ratings (RR) was presented during the task. Self-report measures of anxiety were also completed. Magnitude of fear generalization was captured using area under the curve increase (AUCi) for EMG and RR data, with larger areas indicative of stronger generalization. Preliminary findings indicated EMG AUCi was correlated with FPS to the CS+ during acquisition ($r = .39$). AUCi for RR, but not EMG, was associated with post-task ratings of anxiety ($r = .18$), arousal ($r = .12$), and unpleasantness ($r = .12$) to the task overall. EMG AUCi was associated with the Depression Anxiety and Stress Scale (DASS) total ($r = .21$), but this was specific to the anxiety subscale. There were no associations with other anxiety metrics. Results suggest that subjective distress ratings of the task were associated with stronger generalization measured by risk ratings, but not EMG. The specific association of EMG with DASS anxiety aligns with existing interpretations of overgeneralization processes.

Funding: This study was supported by the National Institute of Mental Health (R01MH101518) to RRN.

Poster 1-077**SINGLE-TRIAL EEG REGRESSION SUPPORTS SALIENCE CODING IN THE FEEDBACK-RELATED NEGATIVITY**

Eric Rawls; Connie Lamm
University of Arkansas

Descriptors: prediction error, feedback-related negativity, single-trial

We encode rewarding and aversive experiences through reinforcement learning, capitalizing on prediction errors (PEs). Classically, dopamine (DA+) PE signals were thought to increase when outcomes are better than expected and decrease when outcomes are worse than expected. However, ~40% of DA+ cells in VTA increase signaling for aversive or rewarding outcomes and project to prefrontal cortex (PFC). This calls into question the notion that DA+ conveys a signed PE in PFC. We recorded EEG while participants completed a novel reinforcement task in which PE was varied linearly on a trial-by-trial basis. Using single-trial robust regression of theoretical PE quantities with EEG, we observe a biphasic response in the ERP. The effect of unsigned PE was greatest over mediofrontal sensors at 288 ms, resembling in distribution and timing the feedback-related negativity (FRN), an ERP component thought to convey a PE. ERP activity during traditional FRN time windows and over frontal sensors is responsive to better-than-expected and worse-than-expected outcomes with opposite slopes, indicating that this activity represents an unsigned (salience) PE but not signed (value) PE. We also observe an apparently novel mediofrontal signed PE that is only apparent for positive reinforcement trials, maximal at 128 ms. This study indicates data-driven evidence that the FRN is sensitive to unsigned prediction errors using a single-trial, component-free method which requires no *a priori* assumptions about the time window or scalp location of measurement.

Funding: This work was supported by the Arkansas Biosciences Institute 0402-27504-21-0216 to CL.

Poster 1-078**ERROR-RELATED NEGATIVITY AND FEEDBACK-RELATED NEGATIVITY ON A REINFORCEMENT LEARNING TASK**

Elizabeth Ridley; Marissa Jones; Ethan Ashworth; Eric Sellers
East Tennessee State University

Descriptors: Error-related Negativity, Learning, Memory

Specific ERPs such as error-related negativity (ERN) and feedback-related negativity (FRN) reflect error processing/performance monitoring. The reinforcement learning theory of error processing suggests that ERN reflects the first detection of error commission. In order to elicit ERN, participants must perceive a response as erroneous. This implies that as learning occurs, ERN amplitude increases. A previous study (Horst, Johnson, & Donchin, 1980) examining the P300 component on a learning task demonstrated increased amplitude in response to violations of participants' expectations about task events. The current study sought to replicate this finding while extending the analysis to include ERN and FRN amplitudes on incorrect trials. Participants completed a complex learning task in which they were required to learn 3 lists of paired nonsense syllables. Participants viewed a stimulus syllable, typed what they believed to be the correct response, then indicated their confidence level on a scale from 0-100. Feedback was then presented regarding response accuracy. Each list was considered learned after 10 consecutively correct trials. Data from electrodes Fz, Cz, Pz, and Oz showed an increased ERN amplitude 50ms after error commission on incorrect trials. The ERN and FRN amplitudes were greater for incorrect trials than for correct trials. Larger P300 amplitudes were observed for trials in which participants' outcome expectation was violated. This extension of previous findings provides further insight into the role of error processing in the context of reinforcement learning.

Poster 1-079**FEAR INHIBITION AS A LEARNING MEASURE OF GENERALIZED UNSAFETY**

Alisa Huskey; Bruce Friedman
Virginia Tech

Descriptors: fear inhibition, safety learning, generalized stress

Individual differences in defense responding suggest neural changes that distinguish chronic and acute threat. The Generalized Unsafety Theory of Stress states that physiological markers of stress impair learning of safety cues under chronic stress. Learning to inhibit defense reflexes in response to safety is a potential mechanism that may promote the development of generalized unsafety. Pavlovian conditioning provides an apt means of examining learning of safety cues in threatening contexts. Eyeblink startle capitalizes on reflex physiology influenced by higher CNS structures that inhibit defense reflexes. A study was conducted to determine the differential effects of threat versus safety on fear inhibition, using fear-potentiated startle in a Pavlovian learning paradigm. Twelve undergraduates (1 man/11 women; mean age = 19.5) participated in a discriminant-conditioning study in which geometric shapes gained contingencies to an aversive stimulus (A) and omission of the aversive stimulus (B). Fear inhibition was derived by subtracting SR response to a combined threat/safety cue from initial threat-cue response. Startle response to threat and safety cues were added as predictors of fear inhibition. Safety learning ($\beta = -.021$, $p = .008$), but not threat learning ($\beta = -.027$, ns), during acquisition predicted fear inhibition ($R^2 = .67$, $F = 9.4$, $p = .006$). These findings have treatment implications for anxiety disorders. For example, models of exposure therapy emphasize inhibitory learning throughout exposures, in contrast to habituation or extinction models (Craske et al., 2014).

Funding: Dean's Discovery Fund, Faculty Seed Grant, Virginia Tech.

Poster 1-080

DOES REWARD PREDICTION ERROR (RPE) MODULATE PHASE CONNECTIVITY DURING A DECLARATIVE LEARNING TASK?

Kate Ergo; Esther De Loof; Tom Verguts
Ghent University

Descriptors: reward prediction error, declarative learning, EEG connectivity
For proper cognitive functioning, the (human) brain must continuously make predictions. One of the features we make predictions about, is reward. Whenever a mismatch occurs between predicted and obtained reward, we experience a reward prediction error (RPE). Recent studies from our lab, using a Swahili-Dutch declarative memory (word-pair learning) paradigm (De Loof et al., 2018; Ergo et al., 2019), showed that signed RPEs (SRPEs) enhance recognition. Time-frequency analysis revealed that SRPEs were accompanied by alpha frequency suppression and theta and beta frequency increase, both immediately and after a one-day delay. SRPEs thus seem important for the formation of declarative memories, on both behavioral and neural levels. In the current EEG study, we investigated if SRPE modulates phase reset, and in which frequency band. During reward feedback encoding, we found that inter-trial phase clustering (ITPC) correlated with SRPE in the delta and alpha frequency band (cluster-corrected). This pattern suggests a modulation of phase reset by SRPE, and might imply that SRPE enables coordinated transfer of information between brain regions. Furthermore, the data showed increased inter-site phase clustering (ISPC) between frontal (FCz) and motor cortex (C5/C6) during reward feedback encoding. Together, these findings suggest that RPEs enable the brain to learn more efficiently by synchronizing relevant cortical areas.

Funding: This work was supported by the Research Foundation Flanders grant number 1153418.

Poster 1-081

ACTIVATION OF V4 AND VO1 AREAS DURING RETRIEVING OF COLOR AND SHAPE INFORMATION FROM VISUAL WORKING MEMORY

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Descriptors: V4, VO1, visual working memory
The role of human visual cortex in retrieving of color and shape information from visual working memory was studied. Participants (N = 22, mean age = 19.6, SD = 1.8, 13 females) were being presented with a picture of the color blot (8 different shapes and 9 colors) for 400 ms time period. After a delay of 900 ms the matrix of 4 different color blots was presented for 900 ms. The instruction was to recognize the stimulus. The experiment consisted of 3 series. Participants were asked to remember either color or shape, or both. Stimuli were presented 100 times in each series. A 19-channels EEG was recorded and visual evoked potentials were calculated for each stimulus in all trials. To reveal sources of activation in 25 visual cortex areas (Wang et. al, 2015) in each hemisphere the dSPM algorithm (Dale, 2000) and Brainstorm software (Tadel, 2011) were used. Activation of left and right hV4 areas of visual cortex was revealed in all tests requiring color information retrieval after 200 ms from the start of the blot matrix presentation. This type of activation was not found in any other series. Activation of VO1 area (anterior to V4) in both hemispheres was also presented during shape recognition after 200 ms from the stimulus onset. This type of activation was absent at the same latency in other series. We suggest that color and shape characteristics of visual image are processed independently in working memory in areas hV4 and VO1, respectively.

Funding: The research was financially supported by the Russian Science Foundation, project No 19-18-00474.

Poster 1-082

HIGH RUMINATORS USE DIFFERENT NEURAL PROCESSES DURING A RECOGNITION MEMORY TASK

Nicole Forner; Robert Ross
The University of New Hampshire

Descriptors: Episodic memory, Brain oscillations, Cognitive flexibility
Rumination occurs when an individual becomes “stuck” and cannot navigate away from an unwanted thought. A high tendency to ruminate is linked to altered functioning of oscillations in the alpha (8-12Hz) and beta (13-30Hz) bands. Alpha and beta power dynamics are crucial for various cognitive functions, including episodic memory. Our study uses EEG recorded during a source memory task to assess how oscillatory dynamics in alpha and beta may change as a function of tendency to ruminate along with memory for contextual details (n = 43). The task instructs participants to remember an object and the side of the screen the object is presented on during study. They are then tested for their memory of the object and the context. Analysis of accuracy reveals that memory for contextual details is lessened for participants with a high tendency to ruminate paired with higher anxiety. During retrieval high ruminators exhibit less power decrease in the beta band 250-1500ms post cue over right posterior parietal areas when successfully remembering just the object or both the object and context in comparison to low ruminators. Alpha power shows less power decrease 1000-1250ms post cue over parietal areas when a high ruminator recalls the object and context, but there is a greater power decrease when they remember the object, but not the context. Similar dynamics are observed during encoding. These oscillatory differences suggest that high ruminators may encode a less detail rich memory trace and they may recruit more neural resources to focus retrieval when an attempt appears to be failing.

Poster 1-083

ALPHA ACTIVITY IS NOT REQUIRED FOR MAINTENANCE OF INFORMATION IN WORKING MEMORY

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Descriptors: working memory, EEG, alpha activity
Sustained neural firing during delay periods is widely considered as the neurophysiological basis of short-term maintenance of information in working memory (WM). However, mounting evidence suggest that information can be retained in WM in the absence of detectable neural activity related to the maintained information. I hypothesized that the time is a crucial factor to activate either sustained neural firing or activity-silent mechanisms to support maintenance of WM content. In a verbal WM paradigm the participants (N = 198) had to memorize sets of letters. Despite continuous and growing interest to the topic of neural correlates of WM, the number of verbal WM studies using delay periods longer than 4 s is limited. I used a longer delay period of 6 s. EEG alpha power in posterior sites in the first 3 s, second 3 s of the delay period and encoding interval was compared. Similarly to the previous studies, I found a decrease of alpha during encoding and an increase during first 3 seconds of the delay period. However, after the first 3 s the level of activity returned to the baseline level. The effect was extremely strong ($F(2, 266) = 263.46$, $\eta^2 = .63$, $p = 2.2 \times 10^{-58}$). It did not depend on the WM load, type of the task (simple maintenance task or maintenance with manipulations) or individual differences in performance. I can conclude that alpha activity is important for encoding and consolidation but not for continuous maintenance of information in WM. The results support the hypothesis of the time related differentiation between the two proposed mechanisms of WM.

Funding: Study was supported by Russian Foundation for Basic Research #19-013-00027.

Poster 1-084
EXPOSURE TO ALCOHOL CUES AFTER EXERTING SELF-CONTROL INCREASES RELATIVE LEFT FRONTAL CORTICAL ACTIVATION AMONG INDIVIDUALS LOWER IN ALCOHOL SENSITIVITY

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Descriptors: Self-control, Alcohol sensitivity, Approach motivation
 Individuals with lower alcohol sensitivity (i.e., having higher tolerance to alcohol's acute effects) exhibit greater motivational reactivity toward alcohol-related cues compared to individuals with higher alcohol sensitivity. Relatedly, exerting self-control is linked to greater alcohol use and approach motivation (i.e., orientation toward rewarding cues). The present research examined the interaction between alcohol sensitivity and exerting self-control on levels of approach motivation toward alcohol, as measured by greater left over right frontal cortical activation. Participants ($N = 71$) were randomly assigned to exert self-control (or not) and then viewed alcohol and neutral advertisements while electroencephalographic (EEG) activity was assessed. No differences in frontal cortical activation emerged between self-control conditions, $F(1, 69) = 0.51, p = .476$. However, the interaction between self-control conditions and alcohol sensitivity was significant in predicting frontal cortical activation while viewing alcohol advertisements, $F(1, 66) = 11.17, p = .001$. Among participants instructed to exert self-control, lower alcohol sensitivity predicted greater left over right frontal cortical activation, $t(66) = -3.69, p < .001$. Alcohol sensitivity did not predict frontal cortical activation among those who did not exert self-control, $t(66) = 0.95, p = .346$. Results suggest exerting self-control may temporarily increase approach motivation toward alcohol-related cues, particularly among individuals with lower alcohol sensitivity.

Funding: Dissertation award provided by the Department of Psychological Science at University of Missouri – St. Louis.

Poster 1-085
MOTIVATIONAL CONTROL, BUT NOT WITHDRAWAL MOTIVATION, IS LINKED WITH GREATER RIGHT FRONTAL CORTICAL ACTIVITY

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Descriptors: Motivation, Emotion

Past models of frontal asymmetry have theorized that greater relative right frontal cortical activity should be associated with greater withdrawal motivation. However, much experimental research has failed to find this association. Recent research suggests motivational control processes may instead be linked to greater relative right frontal activation. The current studies sought to test these competing models by examining whether motivational control or withdrawal motivation would be more closely associated with greater relative right frontal activation. In Study 1, participants ($N = 83$) were asked to suppress their motivational and emotional responses to negative stimuli. Greater relative right frontal activation was associated with participants' reported effort while suppressing their affective responses to the negative stimuli, but not with experiencing negative affect. This pattern did not emerge for neutral stimuli. In Study 2, participants ($N = 68$) were given the opportunity to choose to engage with negative stimuli for monetary reward, or to disengage with the stimuli for no reward. When the possibility of reward was present, greater relative right frontal activation was associated with sustained engagement with negative stimuli. This relationship did not emerge when the possibility of reward was absent. Together, these studies suggest that it is the affective control of emotion rather than negative affect driving greater relative right frontal asymmetry.

Poster 1-086
DEVELOPMENT OF A STRESS PARADIGM FOR RETT SYNDROME

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Descriptors: Rett syndrome, salivary biomarker, beta-endorphin

Rett syndrome (RTT) is a neurodevelopmental disorder associated with severe communication and motor impairments, and comorbid health problems. Studies in animal models of RTT have shown abnormal stress responses, particularly elevated cortisol responses. There is limited information on stress physiology in the clinical population, however, as identifying stress paradigms for this population is challenging due to ethical and practical limitations. In the current study, we investigated changes in three salivary biomarkers (cortisol [CORT], alpha amylase [sAA], and beta-endorphin [BE]) and concurrent changes in heart rate (HR) and heart rate variability (HRV) during a research visit consisting of two standardized physical examinations. The goal of the study was to determine whether this protocol would elicit detectable physiological responses in this population. Data from 22 participants with RTT (aged 4-38 years) were included. Saliva samples were collected at three timepoints and HR/HRV were collected continuously. The results showed that CORT and BE increased significantly during the visit, whereas sAA did not show consistent changes. Changes in CORT, but not BE, differed significantly by age. Changes in CORT were significantly associated with changes in HR, whereas changes in BE were significantly associated with changes HRV. These preliminary results show that this protocol may be a useful tool for evaluating stress physiology in RTT. Additional work is needed to replicate these effects and to determine the independent effects of the two examinations.

Funding: Grants from RettSyndrome.org and the Mayday Fund.

Poster 1-087
A NONINVASIVE MEASURE OF THE P300 IN RATS SELECTIVELY BRED FOR DISPARATE ALCOHOL PREFERENCE DURING AN AUDITORY ODDBALL TASK

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Descriptors: P300, alcohol, rat

The utility of genetics for predicting alcohol-use disorders (AUDs) is limited given the finite understanding of all genetic contributors. This has led to interest in biomarkers for classifying individuals at heightened risk for developing AUDs. The P300 has been reported to have reduced amplitude and increased latency in humans and animals with a genetic predisposition for alcohol use. We used an auditory oddball task to examine the N2-P3 complex in alcohol-naïve, alcohol-preferring (P) and non-preferring (NP) rats. One goal was to determine whether the N2-P3 amplitude would be lower in P rats, as this line meets proposed criteria for an animal model of alcoholism. Electroencephalography was measured using surface electrodes after rats were trained to press a lever for food after presentation of a rare, "target" tone, but not after a more frequent, "standard" tone. We found a significant Line x Tone interaction on the amplitude of the N2-P3 complex. Post-hoc analysis revealed a moderately (but not significantly) lower N2-P3 amplitude in P than NP rats to the target tone. Surprisingly, while the N2-P3 amplitude was larger to the target than the standard in NP rats, the amplitude of the standard was slightly larger than the amplitude of the target in the P rats. These results suggest the N2-P3 complex may have utility as a biomarker for AUDs and further investigation of the mechanisms driving the amplitude decrease to the rare tone in the P line is warranted.

Poster 1-088

CHANGE OF NEURAL ACTIVITY TOWARD AWARENESS OF MIND WANDERING: AN ERP STUDY

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Descriptors: mind wandering, EEG, P300

Mind wandering (MW) is a shift in the contents of thought away from ongoing tasks and/or events in the external environment to self-generated thoughts and feelings. The awareness of MW could be essential to support for returning to the ongoing tasks. However, actual factorial components related to the awareness of MW remain fully unidentified. In the present study, we investigated the change of neural activities associated with attentional allocation over time before self-reports of MW, and the timing when the change started. Electroencephalograms were recorded while participants were performing a simple task that required them to press a key to the presented pure tones, that is likely to induce MW. They were also asked to stop pressing a key whenever they noticed their own MW during the task. We focused on the P300 component of the event-related potentials, reflecting attention allocation, to the auditory stimuli. The P300 components of each last five note before the self-reports of MW were analyzed. The state-space model was recruited to detect a changing point of attentional allocation during the five tones presentations. The results showed that the peak amplitude of P300 significantly increased between the third and the second tone before the self-reports of MW. It suggests that the awareness of MW is related to the change of attentional allocation from MW to the task related stimuli. Our study highlights on the state related awareness before self-reports of MW, so we should not define the time just before these reports as a MW state.

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Poster 1-089

AFFECTIVE MODULATION OF SPINAL, SUPRASPINAL, AND PERCEPTUAL MARKERS OF PAIN

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Descriptors: pain, emotion

Affective valence modulates spinal (nociceptive flexion reflex; NFR), supraspinal (N2 pain-evoked potential), and perceptual markers of pain. Specifically, viewing pleasant pictures decreases spinal nociception, supraspinal nociception, and pain, whereas viewing unpleasant pictures increases them. To date, no single study has measured all 3 outcomes simultaneously to understand their relationships. This study examined this issue using a well-validated affective picture viewing paradigm. 24 IAPS pictures (8 mutilation, 8 neutral, 8 erotica pictures) were presented and painful electric stimulations were delivered during 50% of pictures (equally balanced across picture valence). Healthy, right-handed, pain-free men ($n = 8$) and women ($n = 12$) participated. The spinally-mediated NFR (assessed from biceps femoris EMG) was used as a marker of spinal nociception and the N2 pain-evoked potential (assessed from EEG) was used as a marker of supraspinal nociception. Immediately after each electric stimulation, participants rated their perceived pain intensity on a visual analog scale (no pain, most intense pain imaginable). As expected, all 3 outcomes were modulated by affective valence. Moreover, N2 modulation significantly correlated with both NFR and pain modulation, but NFR modulation was not significantly correlated with pain modulation. This provides additional evidence that spinal and perceptual markers of pain are independently modulated, but are linked through cortical activity. These methods can be used to assess nociceptive processes that contribute to chronic pain.

Funding: awarded \$500 by Student Research Grant - Office of Research and Sponsored Programs, University of Tulsa.

Poster 1-090

THE PSYCHOPHYSIOLOGICAL REACTIVITY OF HYPERACTIVATED AND DEACTIVATED CAREGIVING SYSTEMS IN PARTNERS OF PATIENTS WITH CHRONIC PAIN

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Descriptors: Chronic pain, Caregiving, Couples

A romantic partner's ability to provide comfort can promote well-being in patients with chronic pain, but caregiving is not always optimally provided. Non-optimal caregiving involves hyperactivation strategies (e.g., controlling or compulsive) and deactivation strategies (e.g., insensitive and distant). Individuals who provide non-optimal caregiving can experience negative emotions such as anxiety when providing support (e.g., George-Levi et al., 2017), but little is known about their psychophysiological experience. The goal of the present study was to examine the association between self-report caregiving behaviors, as measured by the Caregiving Questionnaire (Kunce & Shaver, 1994), and psychophysiological reactivity. We predicted that electrodermal activity (EDA) would be higher in partners of patients with chronic pain who report higher use of hyperactivation strategies, and lower in partners who report higher use of deactivation strategies, when providing contact comfort during a stressful condition. A single-case repeated measures design was used where 6 couples watched a stressful chronic pain video during which the partner alternated every 2.5 minutes between holding and not holding the patient's hand. EDA was recorded throughout the experiment. Qualitative analysis revealed participants with elevated scores on dimensions of deactivated and hyperactivated caregiving had lower EDA when holding the patients' hand during the stressful video. These results suggest that the psychophysiology of caregiving may be nuanced, and are discussed in light of potential moderators.

Poster 1-091

A STRATEGY FOR INTERFACING TRAIT DIMENSIONS OF THE DSM-5 ALTERNATIVE MODEL FOR PSYCHOPATHOLOGY (AMPD) WITH NEUROBIOLOGY

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Descriptors: alternative model for personality disorders, neurobehavioral, disinhibition

The new AMPD in DSM-5 organizes PD-relevant traits around 5 broad dimensions. These PD trait dimensions were identified through structural analyses of symptom data and can be viewed as pathological variants of normative dimensions of the five factor model (FFM). As such, these PD dimensions do not interface clearly with neurobiological measures. A means to improve this interface could be to align the dimensions of the AMPD more closely with counterpart *neurobehavioral* (NB) trait dimensions. The current study evaluated whether associations of the AMPD's Disinhibition domain (AMPD-dis) with ERP indicators of externalizing proneness could be enhanced by shifting this AMPD dimension toward a neurobehavioral trait dimension of disinhibition (NB-dis). Using data for a sample of 350 adults, a structural model was first specified in which questionnaire-scale measures and brain-ERP measures of NB-dis were used to define latent factors for each modality (scale, ERP), which loaded in turn onto a higher-order, cross-modality NB-dis factor. Next, traits from the AMPD-dis domain, operationalized using the Personality Inventory for DSM-5 (PID-5), were each examined for convergence with the scale subfactor of the NB-dis model. Based on prior empirical findings, two traits from other AMPD domains, hostility and deceitfulness, were also examined for convergence. A composite was created from those traits that converged most with the scale factor of the NB-dis model, and as predicted, correlations for the AMPD/NB-dis factor appreciably and significantly exceeded those for the AMPD-dis factor.

Poster 1-092
DIFFERENT FORMS OF ANXIETY IN RELATION TO THREAT AND COGNITIVE CONTROL

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Descriptors: Anxiety, Threat, Cognitive Control

Exposure to threat has been linked to cognitive control disruptions, and threat-induced disruptions of this kind have been implicated in different types of anxiety (e.g., anxious apprehension, anxious arousal). Compared to anxious arousal, anxious apprehension has been associated with more emotion-induced cognitive interference. However the impact of threat predictability on cognitive control on these different subtypes of anxiety is not well understood. The present study used ERPs to examine the associations between threat-related disruptions in cognitive control and different forms of anxiety in a diverse community sample (N = 109). Participants completed a flanker task under predictable, unpredictable, or no threat of shock. Interestingly, different forms of anxiety displayed distinct patterns of neurocognitive and behavioral correlates. Specifically, anxious arousal was characterized by heightened conflict processing (enhanced congruence N2) and improved accuracy during threat conditions relative to no threat conditions, whereas anxious apprehension was characterized by enhanced engagement to flanker stimuli (enhanced N2) and disruptions in later-stage processing of flanker stimuli (decreased P3) during predictable relative to other threat conditions. These results suggest a nuanced relationship between anxiety and threat-related disruptions of cognition under different types of threat and provide a more precise understandings of the neurocognitive systems involved in threat and cognitive processing in individuals with anxiety disorders.

Funding: This project was supported by the National Institute of Mental Health Grant (R21MH109853-01).

Poster 1-093
STRESS MODERATES THE RELATIONSHIP BETWEEN REWARD PROCESSING AND PROSPECTIVE INCREASES IN DEPRESSION

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Descriptors: Reward Processing, Stress, Depressive symptoms

Blunted neural reward processing is postulated to be an etiological factor for increases in depressive symptomatology. Research has shown that reduced reward-related brain activity measured with event-related potentials relates to increased depressive symptoms and major depressive disorder (MDD) and prospectively predicts depressive diagnoses and increase in symptoms. Stress is an important environmental factor that has also been linked to the etiopathogenesis of depression. The current study examined how stress and reward processing measured at baseline interacted to predict depressive symptoms one year later in a large and longitudinal sample of 317 adolescent females between the ages of 8 and 14. Stressful life events were measured using the Adolescent Life Events Questionnaire (ALEQ) and depressive symptoms were measured using the Children's Depression Inventory (CDI) at baseline. Reward processing was indexed by the Reward-related Positivity (RewP), elicited using a simple monetary reward paradigm (i.e., Doors task). At follow-up, participants completed the CDI. The RewP and ALEQ stressful life events at baseline interacted to predict prospective depressive symptoms: a blunted RewP at baseline predicted elevated depressive symptoms at follow-up in adolescents who reported an average or high (but not low) number of stressful life events at baseline. These results suggest that adolescent females with blunted reward processing and increased levels of stress are at the greatest risk for developing increased depressive symptoms.

Poster 1-094
IMPAIRED LTP-LIKE VISUAL CORTICAL PLASTICITY IN SCHIZOPHRENIA: AN EEG TIME-FREQUENCY ANALYSIS

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Descriptors: schizophrenia, long-term potentiation

Impaired neuroplasticity is implicated in the pathophysiology of schizophrenia (SZ). Long-term potentiation (LTP), a form of experience-dependent synaptic plasticity, has been demonstrated in humans by showing that repeated visual stimulation results in enhancement of visual evoked potentials (VEPs). Using this paradigm, we previously showed that high frequency stimulation (HFS) produced sustained VEP potentiation in healthy controls (HC), but not in SZ. Here, we extend this work by examining EEG oscillatory activity following HFS. EEG data were recorded from 19 SZ and 21 HC during a visual LTP paradigm. VEPs were elicited by a checkerboard stimulus (~83Hz, several 2-min blocks) before and after exposure to visual HFS (~8.8Hz, 2 min). A permutation testing approach was applied to time-frequency data to examine LTP-like effects (i.e., potentiation after HFS). A mixed model of mean inter-trial coherence (ITC) of phase in the identified cluster (0-496ms, dominated by theta activity at occipital electrodes) showed a Group x Time interaction ($p < .0001$). Post-hoc tests showed mean ITC enhancement in HC compared to SZ at early post-stimulation blocks relative to baseline ($ps < .005$). Similarly, a mixed model of mean total power in its cluster (0-450ms, theta activity only) revealed a Group x Time interaction ($p < .0001$); total power was enhanced in HC but not SZ across post-stimulation blocks ($ps < .0005$). Visual HFS enhanced theta power and phase consistency in HC only, demonstrating LTP-like plasticity alterations in SZ that are consistent with hypothesized NMDA receptor dysfunction.

Funding: NIH-NIMH Grant #1R01MH06508 VA Schizophrenia Biological Research Center.

Poster 1-095
INVESTIGATION OF THE APPLICABILITY OF THE ATTENTIONAL CONTROL THEORY TO THE UNDERSTANDING OF ATTENTION BIASES TO THREAT IN SOCIALLY ANXIOUS CHILDREN: EVIDENCES FROM ELECTROPHYSIOLOGICAL DATA

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Descriptors: Social anxiety disorder, Attention bias, Attentional control
Cognitive models of social anxiety disorder suggest that the pathology is caused and maintained by a biased attentional processing in favor of threat. These attention biases (AB) are thought to arise from deficits in attentional control that may not be behaviorally observable due to a compensating recruitment of cognitive resources. This research aimed to evaluate the applicability of this theory to high (HSA) and low (LSA) socially anxious children aged between 8 and 12. Children completed (i) a dot probe task (DPT), (ii) an emotional spatial cueing task (SCT) and (iii) an antisaccade task (AST), all requiring them to detect targets following neutral and emotional faces. Reaction times (RTs) and event related potentials (ERPs) were recorded throughout the tasks. Results failed to demonstrate effects of social anxiety on RTs. However, principal components analyses (PCA) on EEG data revealed for HSA children: (i) increased P2 ($p = .045$), P3a ($p = .035$), P3b ($p = .001$) for disgusted faces in the DPT; (ii) increased N2 and P3a amplitudes for disgusted faces in the SCT, (iii) increased P2 ($p = .001$) and P3 ($p = .026$) for angry faces, particularly in the antisaccade condition during the AST. Our results allow to confirm the assumption of the attentional control theory stating that HAS children would recruit more neural resources to achieve an attentional task involving threatening information similarly as their healthy peers. They also confirm the idea of attentional control deficits in this population leading to impairments in attentional disengagement from threat and inhibition.

Funding: This research was funded by a National Fund for Human Research (FNRS/FRESH) Credit (number: 27006922) granted to Erika Wauthia.

Poster 1-096**DECREASED FEEDBACK P300 AND THE DEVELOPMENT OF ADHD SYMPTOMS IN ADOLESCENT FEMALES**

Alexander Kallen; Julia Klawohn; Alexandria Meyer;
Greg Hajcak
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Descriptors: P300, Development, Externalizing

Symptoms of Attention Deficit Hyperactivity Disorder (ADHD), such as impulsivity and distractibility, have been linked to an attenuated P300. In the current study, we examined cross-sectional and prospective relationships between the feedback-elicited P300 in a reward task and both parent-reported and interview-based measures of ADHD symptoms in 303 female adolescents aged 8 to 14. The P300 was scored at Pz and was quantified using the average of gain and loss feedback. Cross sectional analyses indicated that a decreased P300 related to both more interview-based ADHD symptoms and increased parent-reported ADHD symptoms on the Child Behavior Check List (CBCL). Moreover, a smaller baseline P300 predicted increases in interview-based symptom counts two years later, even when controlling for baseline symptoms of ADHD in a linear regression. These findings suggest that a blunted P300 may relate to both current ADHD symptoms and risk for the exacerbation of ADHD symptoms.

Funding: National Institute of Mental Health [5R01MH097767-04].

Poster 1-097**CONCORDANCE OF FRONTAL EEG ALPHA ASYMMETRY BETWEEN REFERENCE MONTAGES**

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Descriptors: EEG, Asymmetry, Methods

Frontal EEG asymmetry has been measured at a variety of sites using a variety of reference montages. Building on previous work examining similarities between these permutations, we examined the degree of concordance across four homologous electrode pairs (F2F1, F4F3, F6F5, F8F7) using four reference montages: (a) average of all EEG leads (AVG), (b) current source density (CSD), (c) Cz, and (d) averaged ("linked") mastoids (LM). Analyses focused on total alpha (8-13Hz) as well as low alpha (8-10.5Hz). Participants were 306 right-handed individuals aged 17-34, (143 with a lifetime history of major depressive disorder). This study's sample is reported in full in Stewart et al. (2010). Correlation between reference montages ranged from -0.33 to +0.84. The average and linked mastoids (AVG-LM) references showed the greatest correspondence with one another (a replication of the previous findings). The AVG reference showed the greatest levels of correlation with other references, regardless of alpha band or channel pair. CZ was an outlier, as might be expected, frequently demonstrating significant negative correlation with other reference montages, particularly LM. Current source density transformed data showed intermediate levels of overlap with other references. F2F1 was revealed to have the highest similarity across reference montages, followed by F8F7, and finally both F4F3 and F6F5.

Poster 1-098**AN EXAMINATION OF THE RELATIONSHIP BETWEEN OVERPROTECTIVE PARENTING AND THE ERROR-RELATED NEGATIVITY (ERN)**

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Florida State University

Descriptors: error-related negativity, overprotective parenting, anxiety

Parenting styles have been shown to impact the development of anxiety disorders in childhood and adolescence. Furthermore, event-related potentials (ERPs) have been related to both parenting styles and risk for anxious trajectories. The error-related negativity (ERN) is an ERP that is maximal at fronto-central sites (i.e., FCz) and is elicited when individuals make errors on speeded, reaction-time tasks in the lab. The ERN has been shown to be increased in anxious individuals and is associated with risk for future onset of anxiety disorders. Moreover, a heightened ERN has been found amongst children with authoritarian parents (high control, low warmth). While overprotective parenting has also been associated with anxiety, no previous study has examined this parenting style in relation to the ERN. In the current study, we examined the relationship between the ERN measured during a Go/NoGo task and overprotective parenting styles in 78 children aged 5 to 7 years-old. Parent-reported overprotective parenting styles on the Parenting Dimensions Questionnaire (PSDQ) was significantly related to a more negative ERN. These findings suggest that overprotective parenting may impact the neural risk for anxiety by shaping children's processing of errors through environmental learning experiences, leading to an increased sensitivity to threat.

Poster 1-099**USING TWINS TO TEST FOR CONSEQUENCES OF ALCOHOL USE ON NARROWBAND OSCILLATORY AND BROADBAND POWER-SCALING BRAIN DYNAMICS**

Scott Burwell; Stephen Malone; William Iacono
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Descriptors: alcohol, electroencephalogram, resting-state

Heavy drinkers exhibit elevated power in high-frequency (>13 Hz) resting-state electroencephalogram (rsEEG) but it is unclear whether such effects are driven by *narrowband oscillations* or *broadband 1/f^α power-scaling* brain dynamics, which may uniquely inform cortical excitability. Moreover, it is unknown whether altered rsEEG power reflects neuroadaptive effects of drinking or familial risk (e.g., genes, rearing environment). Using dense-array rsEEGs from 318 twin-pairs (age $M = 24.5$ years, 45% men), we quantified narrowband oscillatory power in classical frequency bands (1-3 Hz delta, 3-8 Hz theta, 8-13 Hz alpha, 13-30 Hz beta, and 30-80 Hz gamma) and broadband power-scaling exponents (α in $1/f^{\alpha}$, 1-80 Hz) from Laplacian transformed channels, and separately regressed these quantities onto cumulative drinking (summed across ages 11, 14, 17 and 24). Drinking was linked to significantly more narrowband beta oscillatory power over frontoparietal cortex and smaller scaling exponents (reflecting gentler decline in broadband power across 1-80 Hz) over prefrontal cortex. In monozygotic co-twin control analyses that enable testing for possible causal effects of drinking unconfounded by risk factors, we found significantly smaller scaling exponents for twins who drank more than their co-twins, consistent with neuroadaptive effects. Collectively, findings suggest that drinking may cause imbalanced prefrontal inhibition/excitation reflected by altered broadband rsEEG power-scaling, whereas familial risk for alcohol use may be reflected in narrowband beta oscillations.

Funding: DA036216, DA05147, DA037183.

Poster 1-100
THE ASSOCIATION BETWEEN PARENTING AND THE ERROR-RELATED NEGATIVITY ACROSS CHILDHOOD AND ADOLESCENCE

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Descriptors: error-related negativity, parenting, anxiety
Anxiety is a common, chronic, and impairing form of psychopathology that begins early in development. Researchers have begun to identify core neural markers that confer risk for anxious outcomes. An elevated error-related negativity (ERN) has been shown to be increased in anxious individuals and to prospectively predict new anxiety disorders across development. While prior work has found that harsh parenting styles are linked to an increased ERN in children, there have been no studies examining this relationship across various developmental periods. In the current study, we used a large sample of 196 female adolescents between the ages of 9 to 17 to examine whether parenting impacts the ERN differentially across development. We found that authoritarian parenting was related to an increased ERN in offspring, but only amongst younger children. Moreover, the ERN mediated the relationship between parenting and anxiety diagnostic status – and this overall model was moderated by age. This study replicates previous findings and extends this work to suggest that the parenting/ERN relationship is more robust in young children compared to adolescents.

Funding: This is an NIMH R01 MH097767 funded study.

Poster 1-101
PSYCHOPATHY SUBDIMENSIONS AND AUTONOMIC REACTIVITY TO AVERSIVE PICTURE STIMULI: EVIDENCE FROM AN INCARCERATED SAMPLE

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Descriptors: Psychopathy, Autonomic, Incarcerated
Deficits in emotional reactivity are considered important to the expression of psychopathic traits. Two key autonomic indicators of emotional response are heart rate (HR) and skin conductance (SC). Prior studies with incarcerated and community participants have consistently found reduced SC reactivity to aversive stimuli in relation to the affective-interpersonal (Factor 1 [F1]) features of psychopathy (e.g., Benning et al., 2005; Dindo & Fowles, 2011). Findings for HR have been less consistent, both in terms of the direction of effects when observed and associations with F1 versus Factor 2 (F2) features. The current study examined deviations in autonomic reactivity to emotional picture stimuli in male prisoners ($N = 196$) assessed for psychopathy using Hare's (2003) PCL-R. Higher F1 scores were associated with reduced SC reactivity to unpleasant (versus pleasant) pictures, with both F1 facets contributing. The correlation for F2 was nonsignificant, but robustly negative for the Antisocial facet. Intriguingly, higher F1 was associated with *enhanced* initial HR deceleration to aversive (versus pleasant) pictures, with the Interpersonal facet contributing more. Higher F1 was also related to *reduced* secondary HR acceleration to aversive (versus pleasant) pictures, with the Interpersonal facet predominating. By contrast, the Impulsive and Antisocial facets predicted enhanced versus diminished HR deceleration to aversive scenes. Implications of these findings for our understanding of the nature and bases of emotional response deviations in criminal psychopathy will be discussed.

Poster 1-102
WORKING MEMORY PROCESSING OF EMOTIONAL STIMULI IN YOUNG INDIVIDUALS WITH HIGH GENETIC RISK OF SCHIZOPHRENIA

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Descriptors: schizophrenia, working memory load, fMRI
Working memory (WM) impairment has been proposed as an endophenotypic marker in patients with schizophrenia and their unaffected high-risk relatives (HR). However, the influence of intervening factors such as WM load and the emotional salience of the stimuli has not been studied yet. The underlying anatomical and neurofunctional correlates of this type of processing also remain unclear. The present study assessed fifteen HR and fifteen healthy controls while performing two WM tasks with different cognitive load using facial emotional stimuli. Participants performed two n-back tasks detecting the repeated presentation of angry faces -among neutral and happy ones- using a block design for fMRI. Both groups showed similar behavioral accuracy, but they differed in their reaction times. HR showed a significantly higher activation on the angular and supramarginal gyri, also involving the superior parietal lobule in the 2-back > 1-back contrast. The maximal activation of the angular gyrus in HR was significantly higher only during the 2-back task, while the supramarginal gyrus was activated during both WM load levels. Results suggest that during higher WM load, HR individuals do not benefit enough from the emotional salience of the stimuli and supplementary parietal activations are needed, implying inefficiency of central executive mechanisms.

Funding: Neuroscience Institute. Guadalajara University.

Poster 1-103
DOES AEROBIC FITNESS PROTECT AGAINST IMPAIRED COGNITION IN FIRST-EPISODE PSYCHOSIS? EVIDENCE FROM THE P3 AND LATERALIZED READINESS POTENTIAL

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Descriptors: Schizophrenia, cognition, event-related potential
Schizophrenia is accompanied by impaired cognition, spanning several domains including attention, processing speed, and executive function. Delayed reaction times have also been observed in schizophrenia and have been related to impairments in response selection and preparation processes (LRP) that follow perception and categorization (P3). It is unknown whether impaired P3 and/or LRP are observed in first episode psychosis (FEP) schizophrenia and whether aerobic fitness may protect against early cognitive impairment in schizophrenia. We assessed the P3 and LRP components using a visual oddball task among 19 FEP patients and 19 age and sex-matched healthy controls. Aerobic fitness was also determined from oxygen exchange during a submaximal fitness assessment. P3 (rare-frequent) and LRP (contralateral-ipsilateral) difference waves were constructed. Significantly delayed RT and lower fitness levels were found in FEP patients compared to healthy controls, $ps < .05$. ERP findings indicated significantly blunted P3, $t(35) = 2.8$, $p < .05$, and LRP, $t(28) = -2.2$, $p < .05$, amplitudes in FEP relative to controls. Across the sample, a trend between aerobic fitness and P3 amplitude, $r = .26$, $p = .12$, was observed, such that greater aerobic fitness was related to a larger P3. These findings replicate previous research on global cognitive impairments in FEP. Although nonsignificant, the relationship between aerobic fitness and P3 amplitude suggests that future work should continue to assess the potential influence of individual difference factors that may protect against cognitive decline in FEP.

Poster 1-104

**DEPRESSOGENIC SELF-REFERENTIAL PROCESSING
BIASES IN REMITTED DEPRESSED ADULTS**

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Descriptors: Depression, Self-Reference, Event-Related Potentials
Depressogenic self-referential processing biases play a key role in Major Depressive Disorder (MDD), but it is unclear whether these deficits persist into remission. In the present study, healthy control (HC = 31) and remitted depressed (remMDD = 32) adults completed a Self-Referential Encoding Task while EEG data were recorded. In the task, participants indicated whether negative and positive adjectives described themselves. After a brief distractor, participants were asked to recall these words. Both groups endorsed and recalled more positive than negative words ($p < .001$); however, remMDD endorsed more negative words than HC ($p = .002$). Compared to remMDD, HC exhibited a greater positive processing bias (positive words that were both recalled and endorsed/total number of words endorsed) at trend level ($p = .052$). ERP analyses indicated no significant group differences for the P2 (225–275 ms), early LPP (300–500 ms) or late LPP (500–1200 ms; $p > .25$) when examining responses to all words. However, for endorsed words only, remMDD showed a reduced late LPP to positive words at left ($p = .010$) but not central ($p = .070$) or right ($p = .60$) electrode sites relative to HC, highlighting interesting laterality effects. Taken together, behavioral and neurophysiological deficits persist in remitted individuals suggesting that depressogenic biases may remain stable over time.

Poster 1-106

**VISUAL PERCEPTION OF SELF- AND OTHERS-
DESTRUCTIVE BEHAVIOR IMAGES**

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Descriptors: destructive behavior, eye-tracker, visual perception
In the current study we propose a method to evaluate the impact of violent information on perception. We studied eye-gaze patterns of individuals within observation of destructive behavior: self-destruction and others-destruction (aggression to other people). For this purpose, 8 images (3 pictures of self-harm; 3 pictures of harm to other people; 2 neutral pictures) were presented in a random order to 22 participants (11 female; mean age = 20.21, SD = 0.37). Stimuli were presented with an inter-stimulus interval of 10 seconds with SMI RED 500 remote eye-tracking system. Significant differences for perception of self- and others-destructive behavior were found for the following parameters: 1. duration of blinks, which was in average shorter for self-harm stimuli compared to the others-harm (mean value = 175 ms and 310 ms respectively, $p < .05$); 2. fixation duration (mean value = 235 ms and 245 ms, $p < .05$); 3. pupil diameter (mean value = 4.10 mm and 4.06 mm, $p < .05$). Obtained results demonstrate psychophysiological differences in visual perception of destructive images with varied focus (self- or others- oriented). It is suggested that self-destructive images are prone to give rise to emotional stress, meanwhile images of others-destructive behavior are prone to enhanced exploratory activity. Shorter blink intervals and pupil dilation within perception of self-harm pictures as well as longer gaze fixations at a perception of harm to others are in favor of this outline.

Funding: This study was prepared under financial support of the Russian Science Foundation (RSF), project 17-18-01278.

Poster 1-107

**ELECTROPHYSIOLOGICAL EFFECTS OF TRAFFIC-
LIGHT COLORS AS PRIMING CODES ON THE
MOTIVATIONAL SALIENCE OF SALTY AND SWEET
ULTRA-PROCESSED FOOD PICTURES**

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Santaella⁴; Neha Khandpur⁵; Mirtes G. Pereira⁴; Letícia Oliveira¹;
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Paulo, ⁶Federal University of Rio de Janeiro

Descriptors: motivation, EEG/ERP, ultra-processed food
Front-of-package (FOP) labels are a recommended approach to help consumers reduce intake of ultra-processed food products (UPP) that are high in salt, sugars and fat. The multiple traffic-light label is one such FOP label that rate the healthiness of a food by using a red, amber and green color-coding. However, increasing evidence suggests clear disadvantages of multiple traffic-light. It is likely that the traffic-light colors may have implicit cross-modal influences on taste perception. We investigated whether priming cues of traffic-light colors would differently modulate the visual motivational salience of salty and sweet UPP. Twenty-four college students (18 female, mean age = 21.4 years, SD = 3.39) passively viewed red, amber or green circles followed by UPP pictures while we recorded electrocortical activity (EEG). Previously, we performed an explicit association between the color codes (red, amber or green) and health-related meanings. The early posterior negativity (EPN) indexed the motivational salience of food products pictures. We found that the EPN mean amplitude (i.e. 200–300 ms) was enhanced for sweet taste products relative to salty products when primed with red circles, but not when primed with green or amber circles. This suggests that the red priming code, in the context of food, selectively increases the motivational relevance (through implicit approach motivation) elicited by viewing sweet taste UPP. Health policy makers should consider these implicit cross-modal associations of the multiple traffic-light label that may lead to unintended consequences.

Funding: Funding for this project was provided by the National Council for Scientific and Technological Development (CNPq, Brazil), the Coordination for the Improvement of Higher Education Personnel (CAPES, Brazil), and the Carlos Chagas Filho Foundation for Research Support of the State of Rio de Janeiro (FAPERJ, Brazil).

Poster 1-108

**EFFECTS OF STIMULATED BODY PART AND SIDE
OF DEVIANT PRESENTATION ON SOMATOSENSORY
ODDBALL-RESPONSES: AN EVENT-RELATED-
POTENTIAL STUDY**

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Excellence - Cognitive Interaction Technology CITEC, Bielefeld University

Descriptors: somatosensory, ERP, vibrotactile
Somatosensory oddball responses are considerably less well studied than auditory ones. To expand knowledge in this regard, here, we investigate effects of stimulated body part (fingers vs. cheek) and side of deviant presentation (ipsilateral or contra-lateral deviant) on the attention-sensitive N140 and P300 components. Several blocks of standard and intensity-deviant vibrotactile stimuli were presented in an oddball paradigm, where participants had to count the deviants. Scalp potentials were recorded using a 128-channel-EEG. For frontal N140 amplitudes, results showed a significant main-effect of deviant presentation side: Ipsilateral deviants caused higher amplitudes than contralateral deviants. Moreover, a significant interaction between stimulated body side and activated cerebral hemisphere was found, reflecting hemispheric lateralization of N140 with significantly higher amplitudes in contralateral frontal brain areas. For central P300 amplitudes, stimulated body part interacted with side of oddball presentation. Contralateral deviants presented at the fingers elicited higher P300 amplitudes than contralateral deviant stimulation at the cheeks, whereas ipsilateral deviant stimulation at the cheeks elicited earlier and higher P300 amplitudes than ipsilateral stimulation at the fingers. In line with other recent reports, results indicate differential roles of cortical representation and distance between stimulated body parts on N140 and P300 oddball responses. This may have implications for future applications such as for the design of somatosensory-based BCI systems.

Funding: BMBF: NeuroCommTrainer - A training- and communication system for severely brain-injured patients.

Poster 1-109

BRAIN ACTIVATION DURING VECTION ILLUSION PERCEPTION

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Descriptors: Vection, Virtual reality, EEG

Vection describes the sensation of ego-motion induced by moving visual stimuli that cover a large part of the visual field. The research was aimed to study whether perception of visually induced circular vection is changed if rotational velocities of 30, 45 or 60 % of stimuli are used, and what are the underlying brain mechanisms. We used the eye tracking to examine parameters of optokinetic nystagmus to identify vection perception periods and to analyze the brain activity during these periods. Vection was provoked by the rotating optokinetic drum with black and white stripes in CAVE virtual reality system. 17 volunteers with healthy vestibular systems took part in this study. Subjects passively observed rotating stimulation and pressed the button to indicate the vection onset. 18 trials (3 velocities x 2 directions (left and right) x 3 repetitions) were presented in pseudorandom order. The duration of each trial was 2 min. For all stimuli rotation velocities slow phases of nystagmus were significantly longer compared to non-vection periods ($F = 44.5, p < 0.01$). During vection perception we found the decrease in alpha-band activity in parietal and central areas of left hemisphere. Thus we revealed the temporal relationship between optokinetic nystagmus dynamic, brain activity and vection perception. It is suggested that the increase in slow phases duration and decrease in alpha band power revealed the sensory conflict between visual and vestibular sensory channels. The research was supported by the grant from Russian Foundation of Basic Research, project # 17-36-01101.

Funding: The research was supported by the grant from Russian Foundation of Basic Research, project # 17-36-01101.

Poster 1-110

THE RELATIONSHIP BETWEEN MID ALPHA (8.8 – 10.7HZ) POWER (μ V2) AND SINGLE ITEMS ON THE PSQI

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Descriptors: Sleep, Middle Alpha, EEG

Sleep dysfunction is associated with medical and psychological concerns, and is a major focus of research. Recently, there is increased emphasis on understanding the relationship between neurophysiology and dysfunctional sleep. This study examined the relationship between specific items on the Pittsburgh Sleep Quality Index (PSQI) and mid alpha power EEG baseline recordings. The PSQI is a 9-item self-report measure of sleep quality that assesses sleep characteristics such as time spent in bed, time asleep, and sleep efficiency. Electroencephalography (EEG) was recorded from 58 college students (39 women). Mid alpha power was related to specific items on the PSQI at several different scalp sites. Time asleep was correlated with mid alpha power at F7 ($r^2 = .418, p = .001$), FT7 ($r^2 = .303, p = .021$), FC3 ($r^2 = .265, p = .049$). Hours spent in bed was correlated with numerous frontal sites and several other sites. Sleep efficiency was also correlated with mid alpha power at several sites, FP2 ($r^2 = .268, p = .042$), FT7 ($r^2 = .269, p = .041$), T4 ($r^2 = .300, p = .023$). Frontal mid alpha asymmetry was also related to specific questions on the PSQI. Hours in bed was correlated with greater left frontal activity at the F4/F3 sites ($r^2 = .332, p = .012$), and F8/F7 ($r^2 = .376, p = .004$). Sleep latency was correlated with left frontal activity at F4/F3 ($r^2 = .266, p = .045$). These results indicate that there is a relationship between mid alpha power and self-reported sleep dysfunction. The implications for approach/withdrawal related behavior and neurophysiology and sleep are discussed.

Poster 1-111

EFFECTS OF VIEWING TWO KINDS OF PLEASANT AFFECTIVE PICTURES ON SLEEP PARAMETERS IN SUBSEQUENT NIGHTTIME SLEEP: A RELATIONSHIP OF LATENCY TO EACH SLEEP STAGE WITH MOOD CHANGES AFTER PICTURE VIEWING

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Descriptors: Latency to sleep stages, Mood changes, Affective pictures

Emotional arousal often disturbs nighttime sleep, regardless of its valence (i.e., whether an emotion is pleasant or unpleasant), but how emotional arousal affects nighttime sleep is less understood. Emotional arousal may cause changes in one's psychological state; for example, both emotional valence and arousal may change after viewing pleasant stimuli. This study aimed to determine the relationship of latency to each sleep stage with mood changes after picture viewing. Twelve participants underwent four all-night polysomnographic measurements in a sleep laboratory. Following the first night for adaptation, one of three picture-viewing tasks—viewing arousing pleasant, relaxing pleasant, or neutral pictures—was randomly assigned for the second, third, or fourth measurements performed over three consecutive nights. Participants engaged in the task one hour before bedtime on each night, where they were presented 20 pictures one by one and were asked to rate each picture on both the affective valence and arousal scales. The pictures were drawn from the International Affective Picture System. Mean values of affective valence and arousal were calculated individually as subjects assessed 20 pictures each measurement night, and 8-hour polysomnographic measurements obtained after the tasks revealed that latency from lights off to the first episode of NREM stage 2 was moderately correlated with the difference value of valence of the score after viewing neutral pictures to that after viewing both arousing and relaxing pleasant pictures, but not with the value of the arousal.

Poster 1-112

WHITENASHED EMOTION: THE CNV IN BOTH BLACK AND WHITE PARTICIPANTS IS MORE SENSITIVE TO EXPRESSION IN BLACK THAN WHITE FACES, BUT IN OPPOSITE DIRECTIONS

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Descriptors: CNV, race, bias

Event-related brain potentials can provide useful insights into expectations about racially- and emotionally-laden stimuli. In this study, Black and White participants viewed warning stimuli (+b, +w, -b, or -w) which indicated whether a happy or angry, Black or White face would be presented 5 seconds later. When each face appeared, participants indicated whether or not they would like to work with the individual shown. We measured the contingent negative variation (CNV) between the warning stimuli and the faces (i.e., the response to the cue, not to the face). In White participants, the cue for angry, Black faces elicited the largest CNV, while the cue for happy, Black faces elicited the smallest CNV. The CNV to cues for both types of White face were similar. However, in Black participants, the cue for happy, Black faces elicited the largest CNV and the cue for angry, Black faces elicited the smallest. As in White participants, Black participants had relatively little difference between the CNV to cues for happy and angry, White faces, respectively. This pattern of responses produced a significant three-way interaction between participant race, stimulus race, and stimulus expression. These findings indicate that the CNV may be useful in assessing racial biases that precede overt behaviors.

Funding: This work was supported by NSF award BCS 1429263 to JJS.

Poster 1-113
THE ASSOCIATIONS BETWEEN INCIDENTS OF HOMELESSNESS, EXECUTIVE FUNCTIONING, AND RESPIRATORY SINUS ARRHYTHMIA IN PRESCHOOL AGED CHILDREN

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Descriptors: Homelessness, Respiratory Sinus Arrhythmia, Executive Function
Experiences of adversity, and specifically chronic adversity, are related to dysregulated parasympathetic nervous system (PNS) functioning (e.g. Friedman & Thayer, 1998). Further, research also suggests that lower executive function skills (e.g. the ability to orient and inhibit attentional processes) are related to dysregulated PNS functioning (e.g. Porges et al., 1994; Calkins, Graziano, & Keane, 2007). The PNS can be measured via Respiratory Sinus Arrhythmia (RSA). The current study ($N = 66$) investigated the specific effect of housing instability on RSA in children currently experiencing homelessness as well as their joint effect on executive function (EF). We had children participate in a resting baseline measure, as well as the NIH developmental extension of the Flanker Inhibitory Control task to measure EF. We hypothesized that higher rates of homelessness would correlate with lower RSA rates during baseline. Further, we hypothesized higher rates of homelessness to show fewer decreases in RSA during the EF task. There were no effects of number of homeless incidents, number of child addresses, or cumulative adversity (e.g. exposure to violence) on RSA. RSA difference scores from baseline to EF task were positively correlated with EF. When controlling for child age, this effect went away. Results suggest that children do better on the EF task as age increases and increases in age also indicate less RSA withdrawal to the task. This may suggest that children need to regulate less to engage in the EF task as they age.

Poster 1-114
LONGITUDINAL EXAMINATION OF ASSOCIATIONS BETWEEN HEART RATE VARIABILITY AND TEAM PERFORMANCE: THE IMPORTANCE OF TEAM ROLE

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Descriptors: Heart Rate Variability, Team Performance
Vagally mediated heart rate variability (HRV) can be computed from wearable physiological sensors to potentially estimate team performance in real-world settings. However, little research has investigated: (i) associations between HRV and team performance using ecologically valid tasks, and (ii) whether these associations are stable across time and team roles. To this end, eight participants (two four-member teams) completed a series of timed bomb defusal games across nine weekly sessions. Across sessions participants switched between the roles of bomb defuser and bomb solver, who must regularly exchange information in order to solve the bomb. ECG and strain gauge respiration were continuously measured during each session in order to compute RMSSD (i.e., HRV) and respiration rate on a trial-to-trial basis. Team performance was measured as the proportion of bombs successfully defused within each trial. Multilevel modeling was used to estimate trial-to-trial fluctuations in team performance with concomitant fluctuations in team members' RMSSD. Results indicate that bomb solvers' RMSSD was relatively lower during trials with better team performance. The association between solver RMSSD and performance became stronger across sessions. RMSSD of the bomb defusers was not associated with team performance for any of the sessions. Suppression of HRV among solvers might reflect adaptive regulation of physiology to effectively communicate and problem-solve. Results suggest that HRV-performance relations are sensitive to team roles as well as the evolution of team processes over time.

Poster 1-115
THE N400 INDEXES ACQUISITION OF NOVEL EMOTION CONCEPTS VIA CONCEPTUAL COMBINATION

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Memorial Veterans Hospital, ⁴Massachusetts General Hospital,
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Descriptors: concept learning, prediction, event-related potentials
The ability to learn new emotion concepts is adaptive and socially valuable, yet little work has examined underlying mechanisms. One such mechanism may be conceptual combination, or the ability to form novel concepts by flexibly combining previously acquired knowledge. In this study, we used event-related potentials (ERPs) to investigate the electrophysiological correlates of novel emotion concept acquisition via conceptual combination. Participants ($N = 23$) were briefly trained on 30 novel emotion combinations, each consisting of two English emotion words (the components; e.g., 'sadness' + 'fatigue') and a pseudoword (the target; e.g., 'calip'). Participants then completed a semantic congruency task while ERPs were recorded. On each trial, two components were presented serially, followed by a target; participants judged whether the target was a valid combination of the preceding components. Targets could be correct or incorrect trained pseudowords, or new untrained pseudowords. Further, components could be presented in reverse order (e.g., 'fatigue' then 'sadness') or as synonyms (e.g., 'exhaustion' for 'fatigue'). Consistent with our hypotheses, we found a main effect of target ($F(2,44) = 14.95, p < .001$) such that correct combinations showed reduced N400 amplitudes when compared to both incorrect and untrained pseudowords. Critically, this effect held regardless of how the preceding components were presented. These results extend prior ERP findings on conceptual combination and novel word learning, and are congruent with predictive processing accounts of brain function.

Funding: This research was supported by the National Heart, Lung, and Blood Institute (1 F31 HL140943-01) and a Northeastern University Office of the Provost, Graduate Dissertation Research Grant awarded to K. Hoemann.

Poster 1-116
SWEDISH VS. SPEEDISH: MUSICAL ABILITY RELATES TO EARLY ERP EFFECTS DURING SECOND LANGUAGE LEARNING

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Descriptors: musical ability, second language learning
Musical ability is associated with the ability to learn a second language (L2). Previously, we observed that higher-musical ability participants processed newly-learned L2 Swedish stimuli differently from lower-musical ability participants, as evidenced by early ERP differences (Narzikul, et al., 2015, SPR), suggesting that higher-musical ability participants may have recoded visual stimuli into verbal stimuli. Here, we taught 20 native English speakers a subset of Swedish vocabulary and grammar. We aimed to disrupt the ability to verbally recode words by teaching some participants backward Swedish (henceforth "Speedish"). Although all participants saw the same stimuli, participants who learned Speedish heard the words played backward, which made the language more difficult to learn. We examined the relationship between musical ability/experience and L2 learning under conditions that did or did not encourage mapping orthography to phonology. Session 1 included grammar/vocabulary training, and musical ability and musical experience measures. Session 2 included a vocabulary test, vocabulary/grammar training, and a grammaticality judgment task (GJT) while ERPs were recorded. Session 3 included a GJT while ERPs were recorded. Musical ability, as measured by the Musical Ear Test (Wallentin et al., 2010), interacted with grammaticality on Sessions 2 and 3 GJTs, indicating that musical ability relates to one's ability to learn an L2. As in the prior study, this difference was observed in an early ERP component (P2)—similar to past reports with highly constrained sentences.

Poster 1-117

**ERP PATTERNS IN MINIMALLY CONSCIOUS STATE:
HIERARCHICAL APPROACH**

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Oldendorf

Descriptors: minimally conscious state (MCS), ERPs, CRS-R

Patients in minimally conscious state (MCS) demonstrate weak and inconsistent behavioral signs of awareness. Most of the previous studies employing cognitive event-related brain potentials (ERP) in MCS have focused only on a single measure of cognitive processing (e.g., P300, mismatch negativity (MMN) or N400). This might have resulted in missing the full picture of the information processing in MCS. In the current study we applied a hierarchical approach to cognitive assessment by means of a battery of ERP paradigms. The complexity of stimulation varied in multiple dimensions. The ERP data were collected from 17 MCS patients (age range 30-56 years, 9 males). ERPs were recorded on morning sessions in 6 paradigms: multi-feature MMN, P300 in passive and active conditions, N400, semantic oddball (SOB) and name conditioning (SON: Kotchoubey and Pavlov, 2017). The presence or absence of ERP effects was assessed (1) visually by 2 experts, (2) by application of a cluster-based permutation test to global field power, (3) by t-CWT (Bostanov and Kotchoubey, 2005). Although each of 17 patients responded in at least one paradigm, nobody showed all ERP effects in all paradigms. Most frequent responses were the MMN and P3a in passive and active P300 paradigms (88%, 76% and 59% of participants correspondingly). The N400, SOB, SON were found only in 12%, 18% and 35% of patients respectively. The number of significant ERP effects per patient positively correlated with the score on the auditory scale of Coma Recovery Scale - Revised ($r = 0.483$, $p = 0.025$).

Funding: The BMBF (Bundesministerium für Bildung und Forschung) CoMiCon (16SV7701).

Poster 1-118

**THE NEURAL CIRCUITRY OF SWEATY PALMS: A
NEUROIMAGING META-ANALYSIS**

Sydney Toler; Derek Wenger
University of Tennessee

Descriptors: skin conductance, autonomic, sympathetic nervous system
Emotion and cognitive processes often cause autonomic nervous system responses. A common example is when the palms of your hands become sweaty before giving a speech or when a police officer is driving behind you. Increased sweat on the palms is a marker of sympathetic nervous system (SNS) activity. The aim of this study was to identify networks of brain activity that make our palms sweat. We compiled a list of neuroimaging studies that report brain activity associated with palm sweat. Our search resulted in sixteen studies, comprised of 251 participants. We used activation likelihood estimation analysis to determine nonrandom clustering of activation and deactivation of brain regions associated with palm sweat. Using a functional connectivity analysis performed on 1,000 human subjects, we identified the neural networks that encompass these brain regions. We found that palm sweating was associated with activation of brain regions (i.e., insula) in the salience network and deactivation of brain regions (i.e., precuneus) in the default mode network. This pattern of findings is consistent with previous research showing that detection of salient stimuli leads to activation of brain networks associated with focused attention and deactivation of brain networks associated with rest and introspection.

**THURSDAY, SEPTEMBER 26, 2019
POSTER SESSION II**

Poster 2-001

**COMPLEMENTARY ELECTROENCEPHALOGRAPHIC
MEASURES: WHAT ALPHA OSCILLATIONS AND 1/F
SLOPE REVEAL ABOUT COGNITIVE AGING**

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University of Illinois, Urbana-Champaign

Descriptors: Aging, Electrophysiology, Cognitive Control

Healthy aging is often associated with reduced cognitive control. We recently proposed a role for alpha oscillations in cognitive control. Power in the alpha band tends to be reduced in older compared to younger adults. Another major EEG phenomenon is the inverse relationship between power and frequency (1/f slope). According to our theory, this may also be related to cognitive control but through a different mechanism than alpha. A few recent papers suggest that 1/f slope may also be reduced with age. To investigate the relationship between age, alpha, 1/f slope and cognition, we recorded resting state EEG and obtained neuropsychological data on 29 older and 28 younger adults. As expected, older adults had less alpha power than younger adults. Older adults also showed flatter 1/f slopes compared to younger adults, suggesting less synchronous background activity. Alpha power was strongly related to tasks requiring proactive/maintenance control mechanisms even after partialing out age. In contrast, 1/f predicted performance in tasks requiring reactive/change control mechanisms. Cardiorespiratory fitness (CRF) was related to 1/f and alpha power, even after partialing out age, indicating that more fit subjects had greater alpha power and steeper 1/f slopes, both of which are related to higher cognitive performance. These results are consistent with the idea that alpha is related to maintaining existing attention sets whereas lower frequency activity is related to changing these sets – both essential cognitive control mechanisms that are reduced in aging and preserved by CRF.

Funding: NIA grant R01AG059878 (M. Fabiani & G. Gratton, PIs) Title: Optical measures of cerebral arterial function as predictors of brain and cognitive aging.

Poster 2-002

**AGE-RELATED AND INDIVIDUAL DIFFERENCES IN
ENTROPY-BASED COMPLEXITY OF HEALTHY AGING
BRAIN**

Chih-Mao Huang^{1,2}; Ya-Wen Fang¹; Guan-Yen Chen³;
Ovid J. L. Tzeng^{1,4,5,6}; Hsu-Wen Huang⁴; Shun-Chi Wu³
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Hua University, ⁴City University of Hong Kong, ⁵National Taiwan
Normal University, ⁶Taipei Medical University

Descriptors: aging, multiscale entropy, resting-state functional magnetic resonance imaging

Entropy-based complexity of neural signal characterizes intrinsic function of the human brain. In this resting-state functional magnetic resonance imaging (rs-fMRI) study, we employed multiscale entropy (MSE) analysis to examine age-related and individual differences in the complexity of intrinsic network, brain function and cognition. Specifically, the MSE of blood oxygen level-dependent (BOLD) signals of rs-fMRI data from 90 prior-selected regions-of-interest (ROIs) were calculated in 28 young and 65 healthy older adults. The results showed that healthy older adults exhibited significant reduction in MSE of BOLD signals in fronto-parietal network but increase in MSE of BOLD signals thalamus, indicating a higher degree of complexity in the aging brain with reduced information transfer between cortical and subcortical regions. Moreover, the MSE of BOLD signals in high-functioning older adults appear to be similar with the MSE of BOLD signals in the default mode and salience networks found in young adults, suggesting a preserved intrinsic network for individuals who age better than others. Our findings provide supportive evidence that complexity of brain activity is declined across the lifespan and associated with the individual variations in neurocognitive performance in the healthy elderly.

Poster 2-003**AUDITORY P3 INDICES OF ATTENTION IN ADOLESCENTS WITH ACUTE SUICIDAL BEHAVIOUR: AN EVENT-RELATED POTENTIAL STUDY**

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¹Children's Hospital of Eastern Ontario, ²Carleton University,
³University of Ottawa

Descriptors: Selective attention, Auditory, Event-related potentials

Introduction: In adolescence, suicidal behaviour is associated with cognitive impairments which have debilitating impacts on psycho-social functioning. Attention is one of the most impaired functions in suicidality. Very little research has focused on the neurophysiological correlates of suicidality in adolescents. The present study uses event-related potentials (ERPs) to investigate attentional dysfunctions associated with suicidality. **Methods:** Eighteen adolescents with suicidal behaviour and 18 healthy controls performed an auditory novelty oddball task. The task consisted of standard (80%), target (10%), and novel (10%) auditory stimuli. The participants were instructed to press a button upon presentation of the target. ERPs indexing the different stages of attention processes were collected (N2 and P3). **Results:** Adolescents with suicidal behaviour showed enhanced N2 amplitudes to target and novel stimuli. They also showed reduced target P3 amplitudes compared to healthy controls. There were no differences in the amplitude of the novel P3 across groups. **Conclusions:** These findings suggest that more resources may be required for stimulus detection and classification processes in adolescents with suicidal behaviour, indexed by an enhanced N2. Processes associated with attentional resource allocation or working memory may, however, be impaired as indexed by a reduced P3. The N2 and P3 may be useful objective markers to aid in developing a clinical risk profile of suicide in adolescence.

Funding: Children's Hospital of Eastern Ontario Psychiatrists Association.

Poster 2-004**INTERMODAL INTERACTIONS IN THE AUDITORY AND VISUAL CORTICES DURING CONCURRENT EMOTION AND ATTENTION TASKS**

Kierstin Riels; Harold Rocha; Andreas Keil
University of Florida

Descriptors: Intermodal, steady state

An extensive body of research has shown that unimodal sensory processing changes depending on where attention is purposefully directed or where attention is drawn by motivationally salient competing stimuli. In some paradigms these changes result in trade-off effects in which sensory cortical responses to attended stimuli are heightened while responses to competing distractors are attenuated. Other paradigms show no trade-off effects. Instead, facilitation is observed for simultaneous relevant stimuli. It is unclear if trade-off or facilitation effects will be observed for multimodal stimuli. The present study uses EEG frequency-tagging to investigate whether viewing emotionally salient visual stimuli interact with the processing of salient auditory stimuli, compared to neutral stimuli. The emotional content of a 6.66 Hz rapid serial visual presentation (RSVP) was manipulated to elicit well-established emotional attention effects, while a constant 63 dB tone with a 41 Hz modulation served as a concurrent auditory stimulus in two experiments. Participants detected transient sound level events in the auditory stream in Experiment 1 and expected an aversive noise burst after a higher tone in Experiment 2. Each stimulus evoked reliable steady-state sensory cortical responses in all participants (N = 30). While there was an interference effect during target auditory conditions on the amplitude of the visual steady state in Experiment 1 across visual contents later in trials, there was no significant effect of visual content on auditory cortical responses in either experiment.

Poster 2-005**SPATIAL FREQUENCY ADAPTATION IN THE VISUAL SYSTEM: EFFECTS OF EXPERIENCE ON ATTENTION AND CONTRAST SENSITIVITY**

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University of Florida

Descriptors: Attention, Spatial frequency, Vision

Using electrophysiology and a classical fear conditioning paradigm, this work examines adaptive visuocortical changes in spatial frequency tuning in a sample of 55 undergraduate students. High-density EEG was recorded while participants viewed 400 total trials of individually presented Gabor patches of 10 different spatial frequencies. Patches were flickered to produce sweep steady-state visual evoked potentials (ssVEPs) at a temporal frequency of 13.33 Hz, with stimulus contrast ramping up from 0 to 100% Michelson over the course of each 2800 ms trial. During the final 200 trials a selected range of Gabor stimuli (either the lowest or highest spatial frequencies, manipulated between-participants) were paired with an aversive 90 dB white noise auditory stimulus. Amplitude differences in both alpha band and ssVEP frequency ranges between paired and unpaired gratings before and after conditioning were evaluated for quadratic and linear trends across spatial frequencies at all timepoints using mass univariate tests. ssVEP amplitude tracked Gabor contrast, whereas alpha amplitude reduction (blocking) was independent of contrast. Blocking in the alpha band was more pronounced when viewing fear-conditioned spatial frequencies, with a frequency by group interaction. Amplitude envelopes of the sweep ssVEP were not sensitive to spatial frequency conditioning, suggesting that attention network responses (indexed by alpha blocking) to fear-conditioned stimuli operate independently of low-level stimulus feature processing (indexed by ssVEPs) in primary visual cortex.

Poster 2-006**ELECTROPHYSIOLOGICAL DIFFERENCES DURING AN ATTENTION TASK BETWEEN CHILDREN WITH TYPE-1 DIABETES AND HEALTHY CONTROLS**

Geisa Gallardo-Moreno; Andrés González-Garrido;
Vanessa Ruiz-Stovel; Fabiola Gómez-Velázquez;
Nayeli Contreras-Piña; Miriam Jiménez-Maldonado;
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Universidad de Guadalajara

Descriptors: Attention, Type-1 diabetes, ERP's

Recent evidence indicates that young adults with Type-1 diabetes (T1D) develop different neuronal activation patterns, which can be studied during the performance of different cognitive tasks. These patterns have been explained as an expression of neural compensatory strategies devoted to maintain cognitive efficiency despite the deleterious effects of this autoimmune illness. In the present study, we aim to compare the ERP components in children with T1D versus healthy matched controls, while performing a sustained attention task. We evaluated 17 right-handed patients, aged 8 to 15 with average IQ, without clinical antecedents of diabetic complications, and without developmental or neuropsychiatric disorders. The control group consisted of 15 healthy individuals matched by age, sex and educational level. The classic CPT task consisted of neutral, happy and angry facial expressions that were pseudorandomly presented. Participants were instructed to respond only to target stimuli (happy facial expressions). The ERPs reflect between-group differences mainly in fronto-central regions at early processing stages in the P2-N2 complex. The P3 component is more robust and widely distributed in the T1D group. Our results suggest that patients allocate their resources differently while solving a simple sustained attention task. These findings could be a neurophysiological manifestation of compensatory strategies devoted to maintain cognitive efficiency while meeting attentional task demands.

Poster 2-007**DISSECTING COGNITIVE OPERATIONS IN DIFFICULT VISUAL SEARCH USING STIMULUS- AND RESPONSE-LOCKED POSTERIOR CONTRALATERAL NEGATIVITY**

Brandi Lee Drisdelle; Pierre Jolicœur
Université de Montréal

Descriptors: Difficult visual search, Response-locked

We combined mental chronometry with electrophysiological measures to track the temporal sequence of events during difficult visual search. Two event-related potentials were examined, the SLpcN (stimulus-locked posterior contralateral negativity) and the RLpcN (response-locked posterior contralateral negativity), both characterised by a sustained negativity at posterior electrodes over the contralateral (compared with ipsilateral) hemisphere after the deployment of attention to the first selected stimulus. We examined the duration of visual search (modulated by varying set size) and of response selection (modulated by varying the number of response alternatives). Subjects searched for a box with one gap among boxes with two gaps. All stimuli were the same size and colour, making search difficult (compared with pop-out search). The first selected items could thus be the target or a distractor. Both experimental manipulations modulated the RLpcN, but not the SLpcN, suggesting that processing following attentional deployment to the first selected stimulus was affected. The onset of the RLpcN was earlier with an increase in set size and the number of response alternatives, suggesting a longer processing duration in both cases. However, whereas the peak amplitude of the RLpcN was earlier when there were more response alternatives, no difference was observed between set sizes. Our results therefore suggest the RLpcN can dissociate activity associated with the duration of visual search from that associated with response selection during difficult visual search.

Poster 2-008**ERP AND TIME-FREQUENCY MARKERS OF STIMULUS SELECTION AND RESPONSE CONFLICT IN THE FLANKER TASK**

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Jagiellonian University

Descriptors: Visuospatial attention, Executive functions, EEG

The aim of this flanker task study ($N = 30$) was to identify ERP and time-frequency signatures of visuospatial selection and conflict resolution. The lateralized target (up or down arrow) was flanked either by congruent flankers (arrows same as the target) or incongruent flankers (arrows opposite to the target). In the ipsilateral hemifields, no-arrow lines were displayed. Posterior contralateral negativity (PCN) and the lateralized (contra-ipsilateral) power spectra (LPS) were calculated as the ERP and time-frequency markers of attentional selection. Conflict-related mid-frontal theta power was calculated as the marker of conflict processing. The ERPs showed typical N2pc and SPCN components of PCN, reflecting target selection and identification. Importantly, while the flanker did not affect the N2pc, the SPCN amplitudes were significantly larger in the incongruent flanker condition. The LPS index showed that the occipitoparietal contralateral alpha activity (~ 8 -12Hz) was decreased, reflecting attentional modulations at the relevant hemifield. This alpha effect was significantly prolonged in the incongruent trials, presumably reflecting the involvement of visuospatial attention in the suppression of incongruent flankers. Further, the theta (~ 4 -8Hz) results showed the enhancement of mid-frontal power in the incongruent trials, presumably reflecting detection and resolution of response conflict. In conclusion, target-flanker incongruency entails interference in visual processing and conflict in response processing, thereby involving both visuospatial and executive attention.

Funding: This work was supported by Grant 2016/22/E/HS6/00139 awarded from the National Science Centre of Poland to D.A.

Poster 2-009**THE EFFECT OF ATTENTION ON AUDITORY N100 IN FIRST EPISODE PSYCHOSIS**

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School of Medicine

Descriptors: N100, Schizophrenia, Attention

Reductions of the auditory N100 have been reported in first episode psychosis (FE). However, it is unclear if this abnormality results from sensory deficits or impaired enhancement of N100 by selective attention. N100 was recorded from 21 FE and 22 matched healthy controls (HC) on a single-tone and a two-tone oddball task. N100 was smaller in FE across tasks and attentional conditions (attend/unattended; $p < .05$). Attention enhanced N100 amplitude ($p < .001$), but this differed between groups: FE was impaired in such modulation ($p = .018$). The oddball task showed greater modulation than the single-tone task ($p = .002$), but this effect also differed between groups ($p = .035$). HC, but not FE, modulated N100 with attention more on the oddball than the single-tone task ($p = .001$), and group differences in N100 enhancement in the oddball task were quite large (Cohen's $d = .98$). Tests on unattended conditions in both tasks showed no difference between groups. In terms of clinical and functional measurements, the FE N100 enhancement on the oddball task was correlated with higher premorbid IQ, better MATRICS Overall Composite scores, lower PANNS Negative factor scores, and lower SANS score. N100 was smaller in FE overall, but this likely reflects a failure in sensory modulation by attention. This suggests a long-range functional disconnection between cognitive control cortical areas and sensory cortex early in disease rather than abnormalities at the late sensory level. The modulation of N100 by attention may be a useful biomarker as it was associated with negative symptom severity and cognition.

Funding: NARSAD and NIH R01 MH108568 to DFS, a Conte Center for Translational Mental Health Research Undergraduate Fellowship to SNF.

Poster 2-010**RE-EXAMINING ANTICIPATORY CARDIAC DECELERATION AS AN INDICATOR OF ATTENTION USING RESPONSE TIME MODELING AND A REAL-WORLD SHOOTING TASK**

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Descriptors: Attention, Heart Rate, Longitudinal

Anticipatory heart rate (HR) deceleration is believed to index preparatory processes that enhance attention. However, concerns remain about HR deceleration as a robust index of attention and its utility in adaptive technologies that prevent attentional lapses. To address these concerns, the present study investigated: (i) associations between time-on-task, anticipatory HR deceleration, and response time (RT) metrics that isolate attentional processes, and (ii) whether these associations were stable week to week. For six weekly sessions, seventeen college-aged participants completed eight 3-s preparatory periods composed of a visually presented countdown. ECG was measured throughout, from which HR decelerations were computed with a regression approach. After each preparatory period, participants completed a shooting simulator task in a virtual reality headset. RTs to shoot targets were fit to an ex-Gaussian model, which estimated tau (indicator of attentional lapses). Multilevel modeling tested hypothesized associations. HR deceleration magnitude increased and tau decreased across the experiment, although this HR deceleration effect weakened across sessions. Direct inverse relations between HR deceleration and tau were only detected for some sessions. Findings suggest that anticipatory cardiac decelerations are influenced by time-varying processes that improve attention. The correspondence between cardiac decelerations and attention might vary across weeks. Cognitive processes underlying results are explored with mathematical decision models.

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Poster 2-011
TRAIT INATTENTION MODERATES THE EFFECTS OF A BRIEF MINDFUL BREATHING EXERCISE ON ATTENTION

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University of South Florida

Descriptors: mindfulness, ADHD, ERP

The current study was to investigate the potential neural mechanisms underlying the effects of mindfulness on attention and whether these effects would be moderated by trait inattention. 64 meditation-naïve participants took part in the study. First, all participants completed measures of inattention symptoms with the Adult ADHD Self-Report Scale (ASRS-v1.1), followed by completing an oddball task and a modified flanker task with their EEG recorded. Next, participants were randomly assigned to either a mindfulness group—practicing a mindful breathing exercise by listening to a ten-minute tape, or a control group—listening to a ten-minute talk about green living. After the intervention, both groups completed the oddball task and the flanker task again. Compared to the control group ($n = 30$), mindfulness group ($n = 34$) displayed a larger increase in the P3b to the rare stimuli in the post-intervention oddball task and a larger increase in the ERN accompanied by better performance in the post-intervention flanker task. Moreover, trait inattention moderated both effects. Individuals lower in inattention who meditated had a larger increase in the P3b than individuals higher in inattention. While all individuals who meditated showed a larger ERN—early error monitoring, only individuals low in inattention showed an enlarged Pe—late error awareness. Together, these findings suggest that individuals low in inattention benefit more from the brief mindful breathing exercise by improving more in attentional resources and enhancing both early and late stages of error processing.

Poster 2-012
ALPHA BAND-WAVE ACTIVITY IN RELATION TO MOOD AND EXECUTIVE FUNCTION

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University of South Carolina, Aiken

Descriptors: response inhibition, alpha power, anxiety

Anxiety disorders are among the highest mental disorders experienced around the world, and are appearing in even higher rates in college-age students. Previous findings indicate that people with high anxiety have impaired alpha synchrony, and are possibly impaired in their ability to switch engagement between an attention task and rest. Anxiety and depression are highly comorbid, so it is likely that depressive symptoms also affect attention and alpha activity. Therefore, our current study aimed to examine how depressive symptoms add to the influence of changes in alpha frequency during executive functioning. We incorporated a fast Fourier transform analysis of alpha band frequency between rest and an executive function attention task in a within-subjects design. Results from our study identified a significantly higher rate of trait anxiety in our sample of college students compared to the collegiate normative values from the Mind Garden manual for the State-Trait Anxiety Inventory. This finding is consistent with the suggestion that anxiety symptoms are continuing to increase among young adults. Our EEG data show that brain activity related to attentional focus is able to attenuate when needed to perform a task in those with low clinical symptoms. Contrary to this pattern, high clinical symptoms appear to interfere with this ability and alpha suppression. These results warrant emphasis on early interventions for those presenting with symptoms of anxiety and depression, such as establishing positive coping strategies and possibly incorporation of neurofeedback therapy.

Funding: This work was supported by the Connections Grant, awarded by the University of South Carolina Aiken.

Poster 2-013
PSYCHOPHYSIOLOGICAL CORRELATES OF NEUROFEEDBACK TRAINING IN CHILDREN WITH AUTISM SPECTRUM DISORDER

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Descriptors: Neurofeedback, Autism, Psychophysiology

Neurofeedback is a promising method for training EEG self-regulation in children with autism spectrum disorder (ASD). Most of studies of neurofeedback in ASD focus on behavioral and EEG outcomes and do not analyze psychophysiological processes during successful training. In a pilot study on 6 children with ASD (13.6 years) in a 24 session-long course aimed at the prefrontal 40 Hz-centered gamma upregulation and theta-to-beta ratio downregulation we recorded ECG, pneumogram and electodermal activity. Psychophysiological measures were analyzed during each neurofeedback session and across the course. Regression analysis revealed linear increase of skin conductance level (SCL) along with decrease of respiration rate (RSR) during each neurofeedback session without any statistical changes of SCL of RSR across the course of training. Heart rate variability measures of respiratory sinus arrhythmia (RSA) showed a trend to increase towards end of each session. According to parental behavioral reports hyperactivity and attention-related problems decreased by the end of neurofeedback course. Psychophysiological measures represent useful markers of attention and emotional engagement of children with ASD during neurofeedback and can be used as predictors of successful performance during training and clinical outcome of the intervention. In particular, increase of SCL along with RSR deceleration and increased RSA indices may reflect more active attention to neurofeedback training targets and/or experience of emotion states reflected in a pattern of recorded psychophysiological indices.

Funding: The study was supported by GHS Transformative Research Grant.

Poster 2-014
NEUROPHYSIOLOGICAL CORRELATES OF COGNITIVE CONTROL DURING A MODIFIED STROOP TASK IN ADOLESCENTS WITH ACUTE SUICIDAL BEHAVIOUR

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Descriptors: Cognitive control, Event-related potentials, Suicide

Introduction: There is increasing evidence that, in adolescence, deficits in cognitive control play a critical role in the vulnerability for suicidal behaviour. Very few studies have investigated the neurophysiological correlates of cognitive deficits in adolescent suicidality. The present study uses event-related potentials (ERPs) to investigate cognitive control in inpatient adolescents admitted for an acute suicidal crisis using an emotional Stroop task. Subjects are asked to name the ink-color of words varying in emotion (positive, negative, neutral, suicide-related). Suicidal individuals are hypothesized to be more preoccupied by the context of the suicide-related stimuli, which may interfere with their ability to perform the colour naming task. **Methods:** Seventeen adolescents with suicidal behaviour and 17 healthy controls performed an emotional Stroop task while ERPs associated with cognitive control and attention (N2 and P3) were recorded. **Results:** Adolescents with suicidal behaviour showed reduced P3 amplitudes, irrespective of the stimulus' emotional value compared to healthy controls. There were no differences in the amplitude of the N2 across emotions or groups. Suicidal adolescents also showed increased reaction times to suicide-related stimuli compared to neutral stimuli. **Conclusion:** These findings suggest that adolescents with suicidal behaviour may have deficits in overall attentional control and resource allocation compared to healthy controls. Reduced P3 amplitudes may also suggest an inability to sustain attention in order to successfully complete the task.

Funding: Children's Hospital of Easter Ontario Psychiatrist's Association.

Poster 2-015**SIGNALING REWARDS INCREASES THE REWARD POSITIVITY**

Carson Jordan; Julia Klawohn; Kreshnik Burani; Molly Kegley; Greg Hajcak
Florida State University

Descriptors: Event-related Potentials, Reward Positivity, Depression
The reward positivity (RewP) is a relative positive deflection in the ERP following favorable compared to unfavorable outcomes. Previous research has demonstrated that the RewP is potentiated when outcomes are associated with actual monetary rewards and losses. In the present study, we sought to examine if the RewP would be sensitive to manipulations that render one outcome more task-relevant. We tested this possibility by examining the impact of signaling gain or loss outcomes on the RewP. College students ($N = 27$) participated in a modified gambling task in which they either signaled gains or losses in counter-balanced experimental blocks. All participants performed a doors task in which gains and losses were equiprobable on each trial. However, in one block participants were instructed to signal reward by pressing a button following gain outcomes, whereas they pressed this button following loss outcomes in the alternate block. Results confirmed that the RewP was potentiated when participants signaled rewards compared to losses; moreover, subjective ratings also indicated that participants were more reactive to both wins and losses during the block in which rewards were signaled. The current study suggests that signaling rewards can increase reactivity to outcomes and potentiate the RewP—results we further discuss in light of previous work linking a reduced RewP to depression.

Poster 2-016**MODULATING THE REWARD POSITIVITY IN OPIOID USE DISORDER USING ROBOT-ASSISTED TMS**

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Rutgers University, Newark

Descriptors: Opioid use disorder, TMS, Reward positivity
Cognitive control is severely affected in opioid use disorders (OUD), placing opioid users at higher risk of treatment dropout and relapse. Our general objective is to improve cognitive control functioning in OUD by modulating the anterior cingulate cortex (ACC) with robot-assisted TMS (R-TMS). Indeed, the ACC plays a critical role in assigning value to goal-directed behaviors and is relatively hypoactive in substance-dependent individuals. Further, the reward function of the ACC can be measured using the reward positivity and applying R-TMS to the prefrontal cortex can modulate its amplitude in nicotine-deprived smokers. We propose that because the reward positivity tracks the assignment of reward value to goal-directed behaviors by the ACC, it can be used as a biomarker for the abnormal cognitive control processes underlying OUD. Further, we hypothesize that applying 10Hz TMS to the prefrontal cortex will enhance ACC activity during the valuation of monetary rewards. These hypotheses were tested as follows. Because the reward positivity has not yet been investigated in an OUD population, we first measured the reward positivity from opiate users and age/sex-matched controls while they navigated a virtual T-maze to find rewards. As in our prior studies in smokers, we tested whether applying 10Hz R-TMS enhanced (i.e. normalize) the reward positivity in OUD individuals. We will present our preliminary results ($n = 16$ OUD). We believe that targeting the ACC reward function in OUD constitute a promising avenue for treatment to treat cognitive control dysfunction in OUD.

Funding: This project is supported by the co-PI's faculty startup package granted by Rutgers University and the Center for Molecular and Behavioral Neuroscience.

Poster 2-017**EFFECTIVE CONNECTIVITY BETWEEN BROCA'S AREA AND AMYGDALA AS A MECHANISM OF TOP-DOWN CONTROL IN WORRY**

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Descriptors: Worry, Inhibition, Connectivity
Individuals higher in trait worry exhibit increased activation in Broca's area during inhibitory processing tasks. To identify whether such activity represents an adaptive mechanism supporting top-down control, functional and effective connectivity of Broca's area were investigated during a task of inhibitory control. fMRI data obtained from 106 participants performing an emotion-word Stroop task were examined using psychophysiological interaction and Granger Causality (GC) analyses. Findings revealed greater directed connectivity from Broca's to amygdala in the presence of emotional distraction. Furthermore, a predictive relationship was observed between worry and the asymmetry in effective connectivity, with worriers exhibiting greater directed connectivity from Broca's to amygdala. When performing the task, worriers with greater GC directional asymmetry were more accurate than worriers with less asymmetry. Present findings indicate that individuals with elevated trait worry employ a mechanism of top-down control in which communication from Broca's to amygdala fosters successful compensation for interference effects.

Poster 2-018**SPEECH AS AN INDICATOR OF COGNITIVE WORKLOAD DURING AN UPPER LIMB TASK**

Christopher Gaskins^{1,2}; Rodolphe Gentili²; Kimberly Kontson¹
¹Food and Drug Administration, ²University of Maryland

Descriptors: Cognitive workload, Speech, Upper limb
The identification of physiological measures that index cognitive workload during upper limb prosthetic performance can inform the neural underpinnings of cognitive-motor performance and facilitate the assessment of human-device interaction. Speech analysis is objective, is less expensive and obtrusive than other physiological measures used in cognitive workload assessment such as electroencephalography and pupillometry and can be used in ecologically valid scenarios. In this study, our goal was to identify speech correlates of cognitive workload during a concurrent cognitive and upper limb task in able-bodied individuals. This work will lay the foundation to later examine speech as an index of cognitive workload during upper limb prosthetic performance. In a within subject design, 8 able-bodied participants completed a cognitive demand task (story recall task) which required them to listen to a short story (13-15 seconds in length) and recall key details of the story. Participants also completed a low (block transport) and high (shape transport) motor demand task for 2 minutes each. Lastly, participants completed the story recall and motor tasks concurrently. Two measures of speech perturbation (jitter and shimmer) decreased while the voice quality measure (harmonics to noise ratio) increased as cognitive and motor demand increased. Although not statistically significant, fundamental frequency and voice intensity was higher during the concurrent story recall and motor demand tasks when compared to the story recall task alone.

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Poster 2-019**FITNESS MODULATES BEHAVIORAL NOT PUPILLOMETRIC INDICES OF ARITHMETIC PROCESSING IN COLLEGE-AGED ADULTS**

Amanda McGowan; Madison Chandler; Matthew Pontifex
Michigan State University

Descriptors: Pupillometry, Cognitive Effort

As a growing body of evidence supports a positive association between mathematics achievement and aerobic fitness, individuals higher in aerobic fitness may find assessments of mathematical reasoning to be less cognitively demanding. One means of indexing cognitive load is through the assessment of pupillary reactivity, such that lower cognitive load is associated with reduced pupillary reactivity. Accordingly, the present investigation examined pupillometric indices of cognitive load during arithmetic processing. A sample of 120 undergraduate students were separated into higher- and lower- aerobically fit groups determined by maximal oxygen consumption (VO_{2max}). Participants performed a complex arithmetic verification task presenting operands $a + b$ consecutively and were instructed to indicate whether the sums were greater than or less than 100. Problems were equally distributed across conditions that varied the numerical distance between operands: small-split (i.e., ± 2 or 5%; $67 + 38$), large-split (i.e., ± 10 or 15%; $42 + 73$), and massive-split (i.e., ± 50 or 55%; $17 + 28$). Consistent with the cognitive load account of pupil size, behavioral and pupillometric indices modulated proportionally to problem difficulty. Novel to the present investigation, higher aerobic fitness improved response accuracy yet did not modulate pupil size—as an index of cognitive load—during arithmetic processing. These findings suggest that the cognitive mechanics underlying arithmetic may be optimized in college-aged adults, remaining robust to individual variations in processing demands.

Poster 2-020**THE EFFECT OF INTRANASAL INSULIN ON NEUROELECTRIC AND BEHAVIORAL INDICES OF INHIBITION: A DOSE-RESPONSE EXAMINATION**

Kathryn Gwizdala; David Ferguson; Matthew Pontifex
Michigan State University

Descriptors: Inhibition, Intranasal Insulin, Dose-Response

A growing body of evidence has supported the assertion that the atomization of insulin into the nasal passageway as a means of increasing cerebral glucose uptake is effective for enhancing cognition. The dosage of intranasal insulin necessary to induce such changes in cognition and the extent to which the effects of intranasal insulin manifest within ERPs is as of yet unknown. Utilizing a double-blind randomized control design, the aim of this investigation was to examine the extent to which attention and inhibition differentially modulated as a function of the dose of intranasal insulin. A sample of college-aged young adults underwent administration of 6 doses of 0.2 mL of solution atomized into the intranasal passageway providing an overall dose ranging from 0 to 120 IU of insulin aspart. Prior to and 20 minutes following administration, participants completed an inhibition task while neuroelectric measures were collected. Findings revealed that the effects of intranasal insulin were specific to behavioral indices of performance with no alterations in P3 amplitude observed in response to any dose of intranasal insulin. However, a dose-response relationship for intranasal insulin was observed for the speed of responding such that faster reaction time was only observed in response to the 20 to 80 IU dose of intranasal insulin, with no modulations observed in response to the placebo or doses exceeding 100 IU. Accordingly, these findings indicate a possible curvilinear relationship between increases in cerebral glucose uptake and enhancements in the speed of responding.

Poster 2-021**BRAIN SIGNATURE OF SUBJECTIVE PERFORMANCE DURING NUMERICAL STROOP TASKS**

Hsu-Wen Huang¹; Mauro Nascimben²; Dong-Yang Fong³;
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Medical University, ⁶National Taiwan Normal University

Descriptors: numerical stroop, conflict resolution

In this study, we investigated the resolution of conflict by using the modified version of size-congruity comparison, a Stroop-like task in which numerical value and physical size were varied independently under task-relevant and -irrelevant conditions. In the physical size judgment task, congruent condition elicited a smaller anterior N2 than neutral (facilitation effect) and incongruent conditions; it also showed a greater parietal-distributed LPC than incongruent condition. In the numerical magnitude judgment task, the congruency effect was only significant on the parietal-distributed LPC. We further examined the within-subject relationship between intraindividual variability in behavioral and ERP responses of conflict monitoring. ERPs were back sorted into three bins according to the reaction time of each participant, the upper quantile, the median, and the lower quantile. Among all the trials, congruency effects were observed on parietal-distributed LPC. However, facilitation effects at anterior N2 were only evident for trials with fast RTs but not trials with median and slow RTs across two tasks. The results indicate that task irrelevant features have facilitation and interference effects during multiple processing stages in numerical stroop tasks. The intraindividual variability offers a window to understand the dynamic ranges of strategies that may be continuously employed during the conflict resolution.

Poster 2-022**MULTIVARIATE EEG ANALYSES REVEAL EVOLVING SPATIOTEMPORAL THETA NETWORKS DURING SELF-REGULATION**

Kyo Jin Kwon; Hause Lin; Michael Inzlicht
University of Toronto

Descriptors: cognitive control, EEG, multivariate analysis

Making good decisions requires us to exert cognitive control, which helps coordinate brain networks and redirect attention to relevant sensory inputs and task goals. Although frontal theta (4-7 Hz) oscillations have been implicated in cognitive control during inhibition tasks (e.g., Simon task), whether and how they implement control during value-based decisions (e.g., do you prefer apple or cake?) remains unclear. Here, we recorded EEG activity while subjects performed a self-regulatory dietary choice task. Subjects chose naturally or focused on health when indicating their preference for different foods. In the health (vs. natural) condition, the tastiness and healthiness attributes of foods influenced choices less and more respectively, suggesting subjects successfully regulated their attention. We applied multivariate pattern analysis (MVPA) to single-trial theta activity: The classifier decoded whether subjects were choosing naturally or focusing on health soon after (0.05s) stimulus onset (peaked at 0.8s). Multivariate spatial patterns revealed theta signals that propagated from occipital to parietal to frontal networks over time. When we applied the same analysis to broadband (0.1-30 Hz) data, decoding accuracies were also above chance, but the spatial patterns were dominated by parietal activity. Our results suggest theta oscillations coordinate brain networks and help redirect attention when regulating dietary decisions. Further, combining multivariate and time-frequency analyses can shed light on how the brain implements control during value-based decisions.

Poster 2-023**DISSOCIATING BETWEEN TMS-INDUCED NEURAL AND NOISE EFFECTS IN EVENT-RELATED POTENTIALS (ERPS)**

Mei-Heng Lin¹; Seema Parikh²; Neeta Bauer¹; Carrisa Cocuzza¹;
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¹Rutgers University, ²New Jersey Institute of Technology

Descriptors: transcranial magnetic stimulation (TMS), latency jitter, N200
An attractive feature of transcranial magnetic stimulation (TMS) is its ability to directly modulate neural activity as the source of behavior and thus establish causal links. A TMS protocol known as theta-burst stimulation (TBS) have recently emerged as having a fast and robust facilitatory (intermittent TBS: iTBS) and inhibitory (continuous TBS: cTBS). While TMS effects on neurocognitive functions have been commonly assessed by measuring ERPs, it is unclear whether a change in ERP morphology results from a modulation of cortical excitability, or trial-to-trial variation in ERP latency (i.e. latency jitter), a confounding factor that attenuates averaged ERP amplitude. To resolve this issue, we recorded the EEG from 20 subjects navigating a “virtual” T-maze to find rewards. A robotic arm positioned the coil over F3, and subjects received 600 pulses of either iTBS or cTBS after 1 block of trials. Subjects then completed 3 post-TBS blocks. Feedback-related ERPs (N200) were processed using an adaptive Woody filter (Woody, 1967), enabling a precise measure of jitter across trials and the ability to adjust for the trial-to-trial variability in the N200. Our preliminary analysis on the after-effects of TBS revealed a significant increase in latency jitter following TBS, and by correcting this jitter, the TBS-effects on the ERPs changed dynamically. These results suggest that latency-jitter effects on ERPs are independent of the effects on cortical excitability, and thus should be taken into account when trying to establish causal links.

Poster 2-024**BASELINE HEART RATE VARIABILITY (HRV), AFFECT, AND BEHAVIORAL FLEXIBILITY DURING THE VIRTUAL MORRIS WATER TASK (VMWT)**

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Descriptors: set-shifting, HRV, affect
Emotions have been shown to have a profound effect on cognitive control processes. The neurovisceral integration model theorizes a connection between the prefrontal cortex and the heart through the vagus nerve, suggesting that higher vagal tone will lead to better cognitive performance and emotional regulation (Thayer et al., 2009). The current study investigates the relationship between HRV, affectivity, and the higher cognitive processes of behavioural flexibility in a virtual spatial learning environment. In this set-shifting task, participants must learn and adapt to new rule sets in the VMWT. Becks Depression Inventory (BDI), Becks Anxiety Inventory (BAI), and the Positive and Negative Affectivity Scale (PANAS) were administered prior to the task followed by a 5-minute resting ECG. Participants were grouped as incomplete (INC: n = 12) or complete (COM: n = 26). T-tests were run to investigate differences in RMSSD, high-frequency HRV, and affectivity in INC and COM groups. HRV was significantly different between groups, with those who were able to complete the task showing higher HRV at baseline ($t(36) = -3.32$, $p = .001$). Pearson correlations were then run on the entire sample ($n = 38$) to investigate the overall relationship between HRV, affect, and cognitive performance in the VMWT. Significance was found between positivity and HRV ($r = .34$, $p = .03$), as well as set-shifting trials-to-criteria, HRV ($r = -.41$, $p = .01$) and BDI scores ($r = .33$, $p = .05$). These findings corroborate with theories signifying the role of vagal tone in control of emotion and cognition.

Poster 2-025**ACTIVATION BUT NOT INHIBITION: PSYCHOPHYSIOLOGICAL EVIDENCE IN SUPPORT OF THE COMMON EXECUTIVE FACTOR OF COGNITIVE CONTROL**

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Descriptors: common executive factor, Stroop task, fMRI
Introduction. The early cognitive control model included inhibition, shifting and updating (Miyake, Friedman, 2000). Later a common executive factor (CEF) was proposed instead inhibition (Friedman, Miyake, 2016). The aim of this study is to reveal brain contribution to CEF that is considered to be related to activated relevant information but not inhibited irrelevant information. **Methods.** 34 right-handed participants performed classical Stroop (CS) and modified Stroop (MS) tasks. They recognized a font color of the Russian words “red” and “green” written in red or green font. In MS participants inhibited the response to the word “red” and responded only to the word “green”. The fMRI data were obtained using a 3T scanner SIEMENS Magnetom Verio (T2*-weighted, 65 slices, TR/TE=2200/25 ms, slice thickness=2 mm, FA = 90°, MB 5, CMRR, block design) and processed using SPM12 ($p_{FWE} < 0.05$). **Results.** Activated areas were observed in left supplementary motor cortex, thalamus bilaterally, right supramarginal gyrus, left posterior orbital gyrus, right precentral gyrus (CS); right angular gyrus, left supplementary motor cortex, right middle frontal gyrus, left superior parietal lobule, left putamen, right anterior insula, left opercular part of inferior frontal gyrus (MS). Right precuneus, right angular gyrus were more activated in MS. **Conclusions.** Both tasks involved CEF (frontal areas), but inhibition of responses in MS-task increased activation in areas related to relevant stimuli processing but not the frontal regions that may be associated with irrelevant information suppression.

Funding: The research was financially supported by the Russian Science Foundation, project No 16-18-00066, and the Supercomputing Center of Lomonosov Moscow State University (non-financially).

Poster 2-026**NEURAL ACTIVATION UNDERLYING PROACTIVE CONTROL IS ASSOCIATED WITH AGGRESSIVE BEHAVIOR: AN ERP STUDY**

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Descriptors: aggression, proactive control, N2
The Pew Research Center found that there were 382.9 violent crimes per 100,000 people in the United States, making aggression a pervasive problem despite a general downward trend in violent behavior. Previous research has explored how proactive (active maintenance of information to guide subsequent behavior) and reactive (incorporating last minute environmental information to alter action) control contribute to aggressive behavior. However, these studies did not examine the underlying neural activation. The current study examines this question in a sample of undergraduate students using the Taylor Aggression Paradigm (TAP) and event-related potentials (ERPs). Specifically, we measured N2 activation—an ERP associated with various aspects of cognitive control—while participants played the AX-CPT task. Results revealed that more aggressive, compared with less aggressive, participants show less negative N2 activation underlying proactive control, suggesting inadequate ability to recruit required neural resources. No effects were found for reactive control. Braver and colleagues (2009) have shown that it is possible to improve proactive control through training. Thus, it might be possible to alter aggressive behavior by strengthening proactive control capabilities.

Poster 2-027

INTRINSIC FUNCTIONAL CONNECTIVITY BETWEEN THE DORSAL ANTERIOR CINGULATE AND MOTOR CORTEX LINKED TO ELECTROCORTICAL MEASURES OF ERROR-MONITORING

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Descriptors: Error Monitoring, Anxiety, Functional Connectivity

The error-related negativity (ERN) is a response-locked ERP, occurring approximately 50 ms following an erroneous response at fronto-central electrode sites. Elevated sensitivity to errors, as reflected by elevated ERN amplitude, is associated with increased levels of anxiety. Functional magnetic resonance imaging (fMRI) research indicates that the dorsal anterior cingulate cortex (dACC) underlies error monitoring and is likely the neural generator of the ERN. However, little is known about how dACC intrinsic connectivity relates to ERN amplitude. The aim of this study was to assess the association between dACC seeded functional connectivity and the ERN in high trait-anxious individuals. Participants included adults scoring 40 or above on the State-Trait Anxiety Inventory-Trait Scale. Participants completed one EEG and one 10-minute resting-state fMRI session. During the EEG session, the flanker task was used to measure error monitoring; participants were asked to identify the center stimulus in a series of incongruent (e.g., <<><<) and congruent arrows (e.g., <<<<<<). We found increased ERN amplitudes for error trials relative to correct trials. In addition, we identified that dACC functional connectivity measures positively correlated with the difference ERN such that greater ERN amplitude was linked to greater functional coupling between the dACC and the motor cortex. In sum, ERN amplitude appears to be related to the strength of functional connectivity between error-monitoring and motor control brain regions in anxious individuals.

Funding: National Mental Health Institute (NIMH) Grant #R15MH110951.

Poster 2-028

MODULATION OF INHIBITORY CONTROL ACROSS HIGH AND LOW ENERGY FOOD IN HEALTHY ADULTS

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Descriptors: Inhibition, Go No-Go, Food

Maintaining healthy weight requires balancing food consumption and energy expenditure. Unfortunately, increased availability of food, especially high energy (calorie dense) foods, increases appetitive drive and challenges inhibitory control in dietary decision making. Understanding the neural basis of inhibitory control for food cues could inform mechanisms underlying obesity and other food-related disorders. Inhibitory control has been assessed by a variety of Go/No-go tasks, which reveal an individual's ability to suppress prepotent responses. Inhibition is reflected in behavioral outcomes as response accuracy, and can be seen neurophysiologically in the N2 component in the ERPs, with amplitude reflecting magnitude of control processes, and latency associated with increased task difficulty. In this study, we recorded ERPs while healthy young adults were instructed to respond to frequently presented animal pictures (Go stimuli), and not to respond to infrequently and randomly presented pictures of food (No-go stimuli). The No-go stimuli consisted of 32 high and 32 low calorie foods. Subjects had more false alarms to high than to low caloric food stimuli, suggesting increased cognitive demand when presented with palatable food. The responses were associated with increased latency and reduced amplitude of the N2 to high calorie food compared with low calorie food. Thus, controlling responses toward high caloric food is more demanding, and may contribute to the difficulties in controlling food intake in environment with readily available high calorie foods.

Poster 2-029

RSA REACTIVITY RELATES TO PERFORMANCE ON A GO/NO-GO BEHAVIOR INHIBITION TASK

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Descriptors: respiratory sinus arrhythmia, behavior inhibition, neurovisceral integration model

The neurovisceral integration model (NVM) proposes that high tonic levels of respiratory sinus arrhythmia (RSA) indicate greater parasympathetic nervous system (PNS) input to neural circuits involved in behavioral flexibility. Higher PNS input is thought to afford greater behavioral flexibility (e.g., increased behavior inhibition). While studies have examined tonic RSA in relation to this, few have examined RSA reactivity (RSA-R) while performing the behavior. The ability of the PNS to respond to situational demands as measured through RSA-R should also be crucial in executing these behaviors. We hypothesize that RSA-R to a behavior inhibition task is more strongly associated with task performance than tonic RSA. Typically developing adults ($N = 33$; age $M = 36.56$, $SD = 14.60$) completed a paradigm consisting of a rest epoch, a Simple Go/No-Go (GNG), & an Emotional GNG while electrocardiogram (ECG) was measured. High frequency heart rate variability (HFHRV), a metric of RSA, was derived from the ECG for each epoch. RSA-R was then calculated by subtracting baseline HFHRV from task HFHRV. One-tailed nonparametric correlations revealed no relationship between tonic RSA and scores on the GNG tasks, or RSA-R & Simple GNG task scores. However, there was a positive relationship between RSA-R and scores on the Emotional GNG ($r_s = 0.32$, $p = 0.035$). These analyses indicate greater RSA-R is associated with better behavior inhibition. These findings have implications for the expansion of the NVM to include RSA-R in addition to tonic RSA when examining behavioral flexibility.

Funding: Research reported in this poster was funded by the Intramural Research Program (IRP) of the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) of the National Institutes of Health.

Poster 2-030

EXTENDING THE CAPACITY THEORY TO APPLY TO TYPE II DIABETES: EXAMINING CHANGES IN SYSTOLIC BLOOD PRESSURE AND VERBAL FLUENCY TASK PERFORMANCE IN OVERWEIGHT DIABETIC AND NON-DIABETIC INDIVIDUALS

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Descriptors: Psychophysiology, Left hemisphere, Obesity

The purpose of the current research is to apply the capacity theory to provide an explanatory framework for left hemisphere processing of 2 stressors concurrently in individuals with Type II diabetes. It is proposed that diabetic individuals will evidence reduced left frontal regulatory control with the requirements to manage 2 left hemisphere stressors concurrently (food digestion and performance on a verbal fluency task). Individuals with ($n = 12$) and without ($n = 12$) Type II diabetes with an average body mass index of 31.19 ($SD = 6.21$) completed the Controlled Oral Word Association Task (COWAT) while fasting and during food digestion. Blood pressure measures were taken before and after each experimental condition. A main effect for Condition was found ($F(1, 22) = 9.39$, $p = .005$), indicating increased SBP after eating and after the second administration of the COWAT. A Diabetes x Condition interaction was found ($F(1, 22) = 4.21$, $p = .05$), indicating that diabetic participants evidenced a significant increase in SBP in the digestive stress condition. Nondiabetic participants maintained stable levels of SBP across conditions. A Diabetes x Trial interaction for the number of rule violations made was found ($F(2, 44) = 3.02$, $p = .05$), indicating that diabetic individuals made more rule violations across the later trials of the COWAT compared to nondiabetics. Conversely, nondiabetics made less rule violations in later trials. The results provide support for this extension of the capacity theory in that neurophysiological and behavioral indices of reduced left hemisphere function were evident.

Poster 2-031
EXAMINING PARENTS' EMPATHIC REWARD PROCESSING AND ITS RELATIONSHIP TO CHILD PSYCHOPATHOLOGY IN A RCT OF A PARENTING INTERVENTION

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Descriptors: Reward Positivity, Parenting, Child Psychopathology
Parenting style plays a critical role in children's mental health, yet the neural processes underlying parenting styles are not well understood. One ERP linked to parenting style is the observational Reward Positivity (oRewP). The oRewP is a relative positivity elicited by observing someone receive a reward. It is sensitive to empathy, such that greater empathy for the observed yields a larger oRewP. In a prior study, we found that authoritarian (harsh) parenting was associated with blunted parental oRewP to their children. Thus, harsh parenting may be related to reduced empathic neural sensitivity to children's positive outcomes. In the current study, N = 80 mother-child dyads entered a randomized trial in which they were assigned to receive Parent Child Interaction Therapy (PCIT) or to a waitlist. To measure the oRewP, mothers completed a modified version of the doors task. In this task, mothers viewed feedback both about their own monetary wins and losses and the wins and losses of their child. The oRewP was calculated as the average ERP at FCz from 250-350ms to child wins minus to child losses. At baseline, blunting of the oRewP was associated with increased problematic parenting on the Parenting Styles and Dimensions Questionnaire (PSDQ) and increased child psychopathology on the Child Behavior Checklist (CBCL). Pre- to post-PCIT, there were significant reductions in CBCL psychopathology and PSDQ problematic parenting scales. There were no significant changes in the oRewP, suggesting that it may index a process not directly targeted by PCIT.

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Poster 2-032
BELIEF UPDATING IN DECISION MAKING: EEG, ECG AND EYETRACKING CORRELATES

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Descriptors: belief updating, uncertainty, integrated psychophysiological measures

The evidence accumulation part of a decision making process is a vital endeavor. Information may change individual preferences as to the scenario at hand. A replication of the study conducted by Stern et al. (2010) was proposed. The experiment aimed to assess the neural correlates of belief updating using functional magnetic resonance imaging. This study aims at replicating the first using the same experimental paradigm adapted to integrated psychophysiological measures (EEG, ECG, and Eyetracker). The task is made of 72 sequences of card draws aimed to assess belief updating given by sequential evidence accumulation and a posterior decision. Each new piece of information served to update uncertainty as to which deck may have supplied the card draws. 47 healthy college students participated in the task. Results show that greater uncertainty presented higher response time and inaccuracy in the final decision. The results were associated with P400 in central right electrode for the pick in uncertainty, P300 in frontal left electrode for the last draw in a less uncertain sequence, and a N100 and posterior slow cortical potential (SCP) for the last draw in a more uncertain sequence. Eyetracker data shows more fixation time on the decks and heart rate did not present any differences regarding sequence types. Results point to higher usage of cognitive effort and task engagement in order to resolve conflicts and process the sequential information presentation. That is especially for uncertain sequences. Integration of psychophysiological measures was of great support to the findings.

Poster 2-033
NEURAL OSCILLATORY DYNAMICS OF SELF-REGULATION STRATEGIES IN DIETARY DECISION MAKING

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Descriptors: self regulation, decision making, alpha oscillations

Self-regulation of dietary choice may involve strategies that are food-dependent (e.g., focusing on a specific food's healthiness), or more global (e.g., generally avoiding eating). We used EEG and Drift Diffusion Models (DDM) to study the neural and computational dynamics differentiating these strategies. On each trial, participants decided whether to eat different foods while responding naturally (Natural) or regulating their choices by focusing either on healthy eating (Health), or on decreasing their desire for all foods (Distance). Time-domain EEG analysis revealed a fronto-polar negativity ~250ms post-stimulus specific to the Health condition that represented the healthiness of specific foods and correlated with behavioural changes in the DDM-estimated influence of healthiness across subjects. In contrast, time-frequency analysis revealed a general increase in the power of alpha (9-12 Hz) and low-beta (13-20 Hz) oscillations during the Distance compared to Health condition that emerged in occipital areas ~100 ms before the food stimulus and gradually spread over the scalp. This difference correlated around response-time with a generalized "suppression of evidence" in the DDM across individuals. These results suggest that global avoidance strategies may be driven by oscillatory mechanisms for inhibition of sensory input and motor output while stimulus-dependent strategies result from changes in the translation of sensory information into decisions.

Funding: NSERC Discovery Grant, University of Toronto Connaught New Researcher Award.

Poster 2-034
REWP OR NOT REWP? STIMULUS MODALITY ALTERS THE MORPHOLOGY OF THE REWARD POSITIVITY

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Descriptors: Reward Processing, Reward Positivity, ERP Morphology

The reward positivity (RewP) is a feedback-related ERP component elicited in response to reward. Although many studies have described how the amplitude of the RewP is modulated by features of reward (e.g. expectation and magnitude), little is known about what contributes to its morphology. The current study manipulated the modality of rewards to examine if these altered the time course of the RewP. Since previous studies have observed a shorter P3 latency for auditory stimuli as compared to visual stimuli (Romero & Polich, 1996), we hypothesized that this too would be true of the RewP. Participants played a simple three door task to either accrue points (indicated by either a green dollar sign or a cash-register sound) or nothing (indicated by either a random shape or a random sound). These points were eventually traded in for real money. Auditory wins showed an enhanced P2 (Sound > Image: $p < 0.001$), whereas visual wins showed an enhanced positivity in the classic RewP time window (Image > Sound: $p = 0.002$). These findings conform to a simple model of a 3 Hz reward-related burst occurring behind an obligatory sensory-evoked 5 Hz sinusoid, with reward modality altering the timing of the 3 Hz burst to coincide with peaks or troughs in the 5 Hz rhythm.

Poster 2-035

AFFECTIVE PROCESSING AND SELF/OTHER IN FUTURE THINKING: AN HEP STUDY

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Descriptors: future thinking, HEP, EEG

Human thoughts have various orientation, including temporal orientation (past/future, and near/far), affective orientation (positive/negative), and thinking about self or others. Although some previous studies have found that affective processing is functionally coupled with a processing of afferent signals, it remains unclear that such association is also observed in thoughts about others or limited in thoughts about self. In this study, to investigate the relationships between affective processing and afferent signal on thought orientations of self/other, participants were required to think about the past or the future along with the presentations of sentences. Each sentence was separated into four parts; 1) agent (i.e., "I" and "he/she"), 2) temporal information (i.e., "near future" and "far future"), 3) object or theme, and 4) affirmative/negative conclusion. We measured and analyzed the HEP (heartbeat-evoked potentials), reflecting functional coupling of processing stimulus and afferent signals, at the presentations of agent and temporal information. The HEP amplitudes toward agent presentations were found to be different between "I" and "he/she". The differences between negative and positive thoughts about self were also founded on the HEP amplitudes toward temporal information presentation. These results suggest that the thoughts about self/other were affected by afferent signals from body, and it is also involved in affective processing at the temporal information presentation especially in thoughts about self.

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Poster 2-036

AMYGDALA AND HIPPOCAMPAL ACTIVATION TO CONDITIONED STIMULI DURING EXTINCTION FOLLOWING THREAT AVOIDANCE

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Descriptors: conditioning, neuroimaging, threat

Models of anxiety suggest that avoidance of a conditioned fear stimulus prevents new safety learning, thereby serving to maintain fear. However, there is little empirical data in humans on the impact of avoidance of conditioned fear stimuli on subsequent fear extinction. Functional magnetic resonance imaging (fMRI) studies in humans have implicated the amygdala and hippocampus in the extinction of fear through classical conditioning paradigms. In the present study we investigated the effect of avoidance of threat on amygdala and hippocampus activity during a subsequent extinction phase using ultra high-resolution (7T) fMRI. Twenty-nine undergraduate participants completed a classical conditioning task, followed by either avoidance of threat (N = 15) or a non-avoidance control (N = 14). To investigate the impact of avoidance on subsequent fear extinction, we compared BOLD activation evoked by the conditioned stimulus (CS+) during extinction in the avoidance vs. non-avoidance groups. There was a significant effect of avoidance of threat, such that participants who were previously able to avoid the shock associated with the CS+ showed reduced activation in the central amygdala (CeA) and hippocampus in response to the CS+ during extinction compared to those who did not receive the instruction to avoid the CS+. These findings suggest that avoidance of threat may be associated with attenuation of activity in CeA and hippocampus during extinction. This may represent preliminary evidence of a mechanism through which avoidance of threat interferes with subsequent extinction learning.

Poster 2-037

CHRONIC NON-MEDICAL PRESCRIPTION OPIOID USE AND EMPATHY FOR PAIN: DOES PAIN MAKE THE DIFFERENCE?

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Descriptors: empathy, heart rate variability, opioid

Non-medical use of prescription opioid (e.g., oxycodone, fentanyl, codeine) recently spread epidemically in the U.S. However, only a few studies have investigated the impact of non-medical prescription opioid use (NMPOU) on socially relevant functions such as empathy yet. We recently found impairments in understanding others' emotions (cognitive empathy) and dysfunctional responses to social stress, indexed by altered heart rate variability (HRV) and endocrinological stress parameters, in individuals with NMPOU. Based on these findings, we were additionally interested in investigating empathic responses towards others displaying physical pain in relation to NMPOU. We compared 23 individuals with NMPOU with 29 matched, opioid-naïve, healthy controls. Empathy in response to painful facial expressions was assessed by self-ratings; emotion regulation was measured by HRV. Opioid users rated to feel others' pain subjectively as less unpleasant (affective empathy) than controls ($p < .05$), which was negatively associated with RMSSD-HRV ($r = -.59$) only in the NMPOU group. This differs from our previous findings showing no differences in affective empathy for non-painful stimuli between the same groups. In line with our recent findings, high opioid cravers showed significantly lower HRV during the task compared to low cravers and controls ($p < .05$). Our results indicate that the reduced ability of feeling others' emotions in opioid users might be specifically pronounced in response to painful stimuli, which is further associated with difficulties in emotion regulation as indexed by HRV.

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Poster 2-038

ANXIETY AND INITIAL VALUE DEPENDENCY IN STARTLE HABITUATION

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Descriptors: Habituation, initial value, anxiety

Studies suggest that deficits in physiological habituation are a feature in trait and clinical anxiety. Measures of habituation, like other response changes, are affected by the magnitude of initial response, with larger initial responses predicting steeper habituation slope. The relationship between initial value and change, commonly called the Law of Initial Value or initial value dependency (IVD), has been partialled out as a covariate in habituation research, but variation in the IVD statistic may be useful in itself, reflecting differences in physiological reactivity. The present study explored how trait anxiety (TA) and contextual anxiety (CA) relate to habituation kinetics of the startle eyeblink response—initial value, linear habituation slope, and the relationship between them (IVD). Participants ($n = 31$; 15 control, 16 CA) were exposed to two blocks of acoustic startle stimuli, and CA participants were warned that they might receive an electrical shock during block 2. Trait-anxious participants did not differ in habituation slope, but displayed a weaker dependency relationship, meaning that high initial startle magnitude was less predictive of a steep decline in response over repeated trials ($\beta = .050$, $t(366) = 2.54$, $p < .05$). These effects depended on the level of analysis, with more reliable results when IVD was analyzed within-subject than at the sample level. Despite this caveat, the results provide support that individual differences in reactivity (and particularly anxiety) can meaningfully impact the initial value dependency statistic.

Poster 2-039**SEX MATTERS?! AN EXPLORATION OF SEX-SPECIFIC EFFECTS OF TRANSCRANIAL ULTRASOUND ON SELF-REPORTED MOOD**

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Descriptors: Transcranial Ultrasound Neuromodulation, Mood Effects, Sex Differences

Transcranial Ultrasound (TUS) is a non-invasive neuromodulation technique that causes significant positive effects in global self-reported mood via targeting the right prefrontal cortex. This has been shown in healthy students, depressed students and pain patients (Forster, Ziebell, Rodrigues, Allen, & Hewig, 2018; Hameroff et al., 2013; Reznik, Sanguinetti, & Allen, 2016; Sanguinetti et al., 2014). TUS offers several advantages in comparison to other neuromodulation approaches (e.g. more focused application, no side effects like headache or skin irritation) and thus has promising research potential (Tyler, Sanguinetti, Fini, Müller, Mühlberger, & Hewig, 2018), with subjects completing three different TUS-conditions on three different days: TUS, TUS-Sham, TUS-None. Sex-specific TUS effects were found in self-report items related to global vigor. Sex differences should be explored in future studies and considered in application of TUS as a possible mental health intervention.

Poster 2-040**INTERNAL RELIABILITY OF RT, P100 AMPLITUDE, AND P300 AMPLITUDE WITHIN A DOT-PROBE TASK**

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Descriptors: ERP, anxiety, emotion

Attentional bias (AB) refers to preferential processing of emotional or threatening stimuli, with a common finding in the literature that anxious individuals show evidence of AB toward threat. A task often employed to measure AB is the dot-probe task (DPT). Previous research suggests that reaction time (RT) bias scores may be less reliable than ERP measures of AB, but most previous studies have used low anxious samples and do not include an early and later ERP measure of AB, addressed in the present study. Forty-one college students reporting high levels of anxiety and low levels of depression completed a DPT before and after an attention-training task. Split-half reliability estimates were calculated for RT and ERP measures. RT reliability was low for bias scores, high for raw RT, and moderate for P100 and P300 amplitude. Present results extend previous work and support the use of ERP measures and raw RT as a more reliable measure of AB than RT bias scores.

Funding: Internal funding provided by the University of Texas at Tyler.

Poster 2-041**ROMANTIC LOVE AND ATTENTION: EARLY AND LATE EVENT-RELATED POTENTIALS**

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Descriptors: early posterior negativity (EPN), late positive potential (LPP), love

The beloved is a highly emotional stimulus, so it likely attracts attention. We tested whether the beloved captures early automatic attention, as indicated by an early posterior negativity (EPN) elicited in a typical rapid serial visual presentation (RSVP) task, while replicating previous findings that the beloved receives sustained motivated attention, as indicated by an enhanced

late positive potential (LPP) elicited in a standard passive viewing task. Participants viewed pictures of their beloved, friend, and a stranger in RSVP and standard passive viewing tasks while their electroencephalogram was recorded. Participants also rated valence and arousal elicited by the pictures. Participants felt most pleasant and aroused while viewing beloved pictures. In the RSVP task, there was a left lateral parietal EPN for the beloved (vs. friend and stranger) between 225 and 300 ms. In the standard passive viewing task, the midline centroparietal LPP between 400 and 1000 ms was larger in response to the beloved than friend and stranger. So, the beloved captures early automatic attention as well as sustained motivated attention, which is likely due to the beloved being evolutionarily significant and emotionally salient.

Poster 2-042**EVENT RELATED POTENTIALS OF EMOTIONALLY VALENCE STIMULI DURING A WORKING MEMORY TASK**

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Descriptors: Emotion, Working Memory, Distractors

The present study examined the neural correlates of the relationship between emotionally valenced images and working memory. Here, participants (N = 41, 21 males) performed a working memory task with negative and neutral valenced images as distractors, while event-related potentials (ERP) were recorded via EEG. The task presented a colored square, followed by either a negative or neutral distractor image, and then another colored square. Participants indicated whether the second square differed in color from the first. We compared the effects of the negative and neutral distractors on the amplitudes of the P1, N1, P2, N2, and P3 components in the frontal and parietal regions of the brain as well as on working memory accuracy. Our preliminary analysis found greater amplitudes of the early orienting, sensory ERP components (P1, N1, P2) in the frontal region compared to the parietal region, but the later perceptual component, P3 amplitude was greater in the parietal region. Furthermore, we found greater N1 amplitude in the frontal region associated with neutral distractors compared to negative distractors. Lastly, we found that decreased working memory accuracy was associated with negative distractors compared to neutral distractors. These results suggest that as accuracy decreases with the negative stimuli, an early orienting response to the stimuli may occur in the frontal region of the brain while later perceptual processing of the stimuli may occur in the parietal region of the brain.

Poster 2-044**SPONTANEOUS EMOTION REGULATION IN CHILDREN: ASSOCIATIONS WITH SUBJECTIVE AND PHYSIOLOGICAL RESPONSES**

Maria Panteli; Georgia Panayiotou; Andry Vrachimi-Souroulla; Thekla Constantinou; Androula Kepola
University of Cyprus

Descriptors: Emotion regulation, Heart Rate Variability, Skin conductance
Implicit emotion regulation refers to processes that happen without awareness and conscious intention, and shape humans' emotional experiences. The current study examined the associations between spontaneous reappraisal, suppression, and acceptance strategies with emotional subjective and physiological responses toward unpleasant stimuli in children. Eighty-eight children completed a picture-viewing task with concurrent monitoring of skin conductance (SC) and heart rate responses, while resting heart rate variability was also measured. Participants assessed the degree to which they used spontaneously reappraisal, suppression, and acceptance strategies to regulate their emotions during the presentation of fearful and sad stimuli. Greater suppression use was marginally significantly associated with greater subjective arousal in response to negative stimuli and lower resting SDNN levels. Greater reappraisal use predicted positively SC responses toward unpleasant stimuli, whereas greater acceptance use during the presentation of sad images was marginally negatively associated with SC responses toward sad stimuli. Findings indicate that children with greater acceptance use toward sad stimuli show a more adaptive pattern of affective reactivity, whereas those using more reappraisal strategy in response to unpleasant stimuli tend to exhibit hyperreactivity. Children who use more suppression strategy tend to exhibit more resting autonomic rigidity. Findings are discussed within the context of the existing empirical literature on emotion regulation and the appropriate interventions.

Poster 2-045

ESTIMATING STATISTICAL POWER FOR EVENT-RELATED POTENTIAL STUDIES USING THE LATE POSITIVE POTENTIAL

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Descriptors: late positive potential, statistical methods, affect

The late positive potential (LPP) is an ERP component used to study affective processing. Despite its frequent use, there is no gold standard for how to design sufficiently powered experiments. We used Monte Carlo simulations to create 1488 virtual ERP experiments with varying numbers of subjects (10 to 100), trials (5 to 40), and effect sizes (LPP differences from 0 to 3 μ V) using both within- and between-subjects designs. We repeated each simulated experiment 1,000 times and, at each iteration, we tested statistical significance ($p < 0.05$) using one-way ANOVAs. To estimate statistical power, we computed the percentage of significant results yielded by each experiment. We found that statistical power exceeded 80% only at greater numbers of subjects (≥ 30), trials (≥ 20), and effect sizes ($\geq 1.5 \mu$ V). We also found that the slope of the relationship between statistical power and effect size increased as subjects were added to the experiment, until power asymptotes to nearly 100% at the higher effect sizes. This suggests that adding subjects greatly increases statistical power at lower effect sizes ($\leq 1 \mu$ V) compared with more robust ($\geq 1.5 \mu$ V) effect sizes. Our results indicate that when making decisions regarding the trade-off between adding subjects vs. trials to an experiment, adding subjects may be preferable: doubling the number of subjects in one experiment (10 to 20) increased the statistical power nearly twofold, whereas the same experiment with twice as many trials (from 5 to 10 trials per condition) achieved a more modest (from 25% to 40%) power increase.

Funding: Supported by the NIH/NCI under award number P30CA016672 and by the National Institute on Drug Abuse award R01DA032581 and R21DA038001.

Poster 2-046

ENHANCED CORTICO-CARDIAC COUPLING UNDER THREAT OF ELECTRIC SHOCK

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University of Marburg

Descriptors: Threat of Shock, Oddball, N100/P300

Unpredictable threats lead to a basic defensive response characterized by anxious arousal and sustained vigilance. Previous work has shown that stimuli presented in the context of unpredictable threat evoke enhanced N100 and suppressed amplitudes in the EEG compared to safe contexts. In addition, significant intraindividual relationships have previously been found between N100/ P300 amplitudes and cardiac responses to phasic aversive stimuli. Meanwhile, it has not yet been tested whether this functional brain-heart coupling is potentially modulated by sustained anxiety. Participants ($N = 17$) performed a passive auditory oddball count task in which safe intervals and threat of shock intervals varied while EEG and ECG were recorded. As the primary measure we assessed intraindividual correlations of centro-medial single-trial EEG and subsequent heart period in reaction to deviant/non-deviant stimuli and under conditions of threat and safety. We found a significant positive within-subject correlation of EEG amplitude in the N100 time window and subsequent heart period, such that more negative EEG amplitudes predicted shorter heart period 2 to 5s later. Importantly, this correlation was significantly enhanced during threat vs. safe conditions. Findings suggest that cardiac deceleration in threat contexts can be intraindividually predicted by EEG activity in early (N100) time windows. Those preliminary results underpin the role of cortical processes in the modulation of early cardiac responses in the context of sustained anxiety.

Poster 2-047

ACETAMINOPHEN DOES NOT REDUCE PSYCHOPHYSIOLOGICAL RESPONSES TO CONFLICT, ERROR PROCESSING, AND NEGATIVE FEEDBACK

Katie Garrison; Anna Finley; Cassandra Baldwin;
Brandon Schmeichel
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Descriptors: acetaminophen, cognitive control, emotion

Acetaminophen, the active ingredient in Tylenol, may have psychological effects such as reducing social and emotional pain or dampening neural responses to errors. The current study aimed to extend past research on the effects of acetaminophen in a large sample of participants ($n = 173$) using psychophysiological measures. Participants ingested 1000 mg of acetaminophen or placebo and then completed a flanker task and a probabilistic learning task while we recorded EEG. We observed robust N2 magnitudes to incongruent flanker stimuli as well as ERN and Pe components following errors. And we observed the FRN to incorrect feedback on the probabilistic learning task. Acetaminophen did not alter any of these ERPs. This was in contrast to our predictions and prior research. We also discovered a significant relationship between the Pe and error rates only in the placebo condition ($r = -0.50$, $p = .004$); acetaminophen reduced the relationship between Pe and error rates ($r = -0.17$, $p = .304$), but the difference between the two pill conditions was not statistically significant. A pill condition by trait BAS interaction to predict Pe magnitudes, $B = -4.44$, $SE = 2.24$, $p = .052$, hinted that BAS predicted the Pe in the placebo condition but not the acetaminophen condition. These results suggest that the effects of acetaminophen may be less widespread than past research has suggested. The effects of acetaminophen may be more nuanced than a general "blunting" effect and might interact with physiological responses to predict behavior.

Poster 2-048

AMBIGUOUS THREAT AND STRESS-RELATED HEART RATE VARIABILITY IN SOCIAL ANXIETY

Laura Egan
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Descriptors: ambiguity, social anxiety, heart rate variability

Socially anxious individuals tend to endorse threatening interpretations of ambiguous information (Ouimet, Gawronski, & Dozois, 2009). Such cognitive biases may facilitate avoidant behavioral patterns, where individuals are unable to act and "freeze up" during social interactions. The present study explored the impact of threat arising from the interpretation of ambiguous emotional facial expressions on behavioral inhibition using a go/no-go task and stress reactivity via heart rate variability and self-report in a group of individuals ($N = 16$) recruited based on self-reported presence of social anxiety. Heart rate variability decreased from baseline to the preparation period prior to giving an unexpected speech and then returned back to baseline during the speech [$F(2, 30) = 9.55$, $p = .001$]. Additionally, self-reported somatic, but not cognitive, state anxiety increased from before to after the stressor [$t(15) = 4.22$, $p = .001$]. This stress response was related to a greater tendency to identify ambiguous emotional faces as angry when the task was to withhold responses to angry faces ($r = .73$, $p = .001$). Findings suggest that anticipation of social evaluation is particularly salient for individuals with symptoms of social anxiety and that these individuals also show disrupted behavioral inhibition to ambiguously threatening emotional faces. Future studies should explore the effects of training individuals with social anxiety to more accurately identify emotional expressions as a means of testing the causal relationship between interpretation biases and stress reactivity.

Poster 2-049**A COMPARISON OF EYEBLINK AND PUPILLARY RESPONSES TO ACOUSTIC STARTLE REFLEX ELICITATION DURING VIEWING OF EMOTIONAL PICTURES: EVIDENCE FOR CONVERGENT AND DIVERGENT PROCESSES**

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University of Trier

Descriptors: startle eyeblink, pupil dilation, emotional pictures
Phasic dilation of the pupil (PD; e.g., as part of the orienting response) is considered a reliable marker of stimulus-evoked changes in autonomic arousal, relying on both parasympathetically and sympathetically mediated processes. Likewise, rapid PD can be observed during elicitation of the acoustic startle reflex. However, little is known about potential effects of affective context on startle-induced PD responses (as recently shown in fear conditioning). To assess the trial-by-trial concordance between startle eyeblink responsivity, as measured at the m. orbicularis oculi by EMG, and PD during emotional stimulation, participants ($N = 40$) were presented with greyscale pictures (matched for valence/arousal and brightness/contrast) of erotica, neutral couples, violence, sport scenes and nature scenes (12 per category; 5000ms duration). In half of the trials, startle was elicited 3-4s after onset by noise bursts (50ms, 105dB). Overall, only limited correspondence across measures emerged. While initial picture-evoked PD was modulated mainly by stimulus arousal (with highest responses for erotica), EMG startle magnitude was linearly related to valence. By contrast, startle-induced pupillary responses varied mostly as a function of baseline pupil diameter (i.e., preceding picture-induced PD), yet may exhibit some extent of valence-specificity (after controlling for confounding factors). Our results highlight the complexity of the pupil response, presumably reflecting different underlying neurophysiological processes. Methodological implications for future research are discussed.

Poster 2-050**THE EMOTIONAL OBJECTS DATABASE: REGIONS OF INTEREST IN 1000 EMOTIONAL IMAGES**

Joanna Pilarczyk; Michał Kuniecki; Krzysztof Waniak;
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Descriptors: emotional images, visual attention, eye-tracking
Our goal was to create a database of emotional regions of interest for positive, negative, and neutral images from databases commonly used in the research on emotion, attention, and perception. To this end, we selected 1000 images from existing databases of emotional images and asked participants to mark regions which are the most meaningful and which convey the emotional valence of an image. On average 27 participants marked each image. Then, we averaged selections, obtaining an "emotional map" for each image. Secondly, we aimed to evaluate the predictive power of the obtained emotional maps. We presented a subset of 600 images in an eye-tracking study ($N = 50$), in a free-viewing task. Each image was presented for 6 seconds. Using MATLAB, we correlated fixation heat maps with the emotional maps, and with saliency maps, based both on features (GBVS) and objecthood (proto-objects). To standardize correlation coefficients between models, the histograms of emotional and saliency maps were matched to those of the fixation maps. The results show that the correlation between fixation maps and emotional maps was higher ($r = .45$) than between fixations maps and saliency maps, both for GBVS ($r = .31$) and proto-objects ($r = .20$) models. Additionally, the correlation coefficients differed between emotional valences, but only in case of emotional maps ($p = .04$), with lowest coefficients for neutral images, and highest for positive ones.

Funding: This research was supported by the National Science Center in Poland (grant numbers 2017/25/B/HS6/00758 and 2012/07/E/HS6/01046).

Poster 2-052**THE INFLUENCE OF EMOTIONAL CARDIAC DEFENSE RESPONSE IN COGNITIVE REAPPRAISAL: STARTLE REFLEX AND SKIN CONDUCTANCE IN ACCELERATORS AND DECELERATORS**

Nieves Fuentes-Sánchez; Miguel A. Escrig; Carolina Cuadrado;
M. Carmen Pastor
Universitat Jaume I

Descriptors: Cognitive Reappraisal, Cardiac Defense Response, Peripheral measures

This study aimed to explore whether Cardiac Defense Response (CDR) could be a potential biomarker of abilities in voluntary emotion regulation, measured by Startle Reflex (STR) and Skin Conductance (SCR) –as reliable indexes of hedonic valence and arousal, respectively. A total of 170 participants (62.94% female) performed a cognitive reappraisal task in which a cue (2s) signaled whether to look, increase or decrease their feelings during unpleasant, pleasant or neutral pictures (8s). Acoustic probes were delivered at 4s or 7s after picture onset to prompt startle responses. Affective ratings (SAM) were collected after picture offset. CDR pattern was obtained in an independent physiological test prior to the emotion regulation task by recording heart rate changes (80s) after an unpredictable aversive noise (500 ms). Participants were classified as accelerators ($N = 78$) or decelerators ($N = 92$) based on the CDR second accelerative component. Results showed that STR was similarly influenced by instructions in both groups, with significant blink potentiation during up-compared to nonregulation. Regarding SCR, however, only accelerators showed enhanced reactivity during up-compared to nonregulation trials. Our findings suggest that CDR second accelerative component might be a predictor of voluntary regulation, specifically for the modulation of emotional intensity. Further studies should explore in more detail the role of this cardiac defensive reflex in cognitive reappraisal due to the potential implications in clinical interventions.

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Poster 2-053**DOES INCIDENTAL COGNITIVE PROCESSING INFLUENCE SUBSEQUENT EMOTIONAL RESPONDING AND THE LPP?**

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Brandon Schmeichel
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Descriptors: Emotion, Executive Functioning, Late Positive Potential (LPP)
Research on cognitive reappraisal reveals that cognitions integrated with or integral to emotional events influence emotional responses. Additionally, much research has shown that incidental emotional events influence subsequent, unrelated cognitive processes. However, a paucity of research has examined the effects of incidental or ostensibly unrelated cognitive events on emotions. In Study 1 ($n = 214$) participants who completed a cognitive task (i.e., modified Eriksen flanker task) before viewing emotional images reported less negative valence while viewing negative images compared to participants who viewed the emotional images before the cognitive task, $t(212) = 2.28, p = .023, d = 0.31$. In Study 2 ($n = 167$) we found no effect of incidental cognitive processing on self-reported valence while viewing negative emotional images, $t(165) = 0.79, p = .430, d = 0.12$. However, participants who completed the flanker task first exhibited an enhanced late positive potential (LPP) during negative picture viewing, $ps < .020$. The LPP findings suggest that incidental cognitive task performance may increase subsequent engagement with negative images. The mixed results regarding the effects of incidental cognitive task performance on negative emotional experience hints at a deeper or more rational processing of emotional images after completing an incidental cognitive task. Implications for emotion regulation are discussed.

Poster 2-054
TIME COURSE OF AUTONOMIC CORRELATES DURING VOLUNTARY REGULATION OF POSITIVE EMOTIONS: THE HEART AND SKIN WHEN FACING EROTICA AND ADVENTURE SCENES

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Descriptors: Cognitive Reappraisal, Pleasant Pictures, Autonomic reactivity
Cognitive reappraisal is one of the most investigated emotion regulation strategies in laboratory settings. Although a number of studies have explored both neural and physiological underlying mechanisms, most of prior research has focused on negative emotions. However, individuals do also regulate their positive emotions when feelings are not adaptive to the context. This study (N = 48) aimed to explore the time course of heart rate (HR) and electrodermal changes (EDA) during instructed reappraisal of emotions prompted by pleasant (Erotica, Adventure) and neutral (Household objects) pictures. Each trial began with a cue (2s) indicating the strategy (Look, Increase, Decrease) to follow during the upcoming picture (presented for 8s). Results showed greater autonomic reactivity for adventure scenes compared to erotica and neutral stimuli across the whole picture viewing interval. Regarding instructions, enhanced HR and EDA changes were found from 2s till 7s for up-regulation, followed by down- and non-regulation trials. This sustained enhancement in autonomic reactivity when participants had to increase their positive emotions was more evident for adventure scenes. Our findings suggest differential effects of instructed emotion regulation for both pleasant contents, which might indicate divergencies in cognitive effort during reappraisal or somehow dual activation of appetitive and aversive motivational systems for this picture category. Future studies should explore how specific regulatory strategies may affect physiological correlates of ongoing positive emotions.

Funding: This study was partially funded with a Research Project (PI•1A2014-06) by the Universitat Jaume I.

Poster 2-056
EMOTIONAL ANTICIPATION IN CHILDREN AND ADOLESCENTS: AFFECTIVE AND ATTENTIONAL PROCESSING

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Descriptors: Anticipation, Children/Adolescents, Startle
Startle research in adults suggests that distinct affective and attentional processes occur when anticipating emotional or neutral events – thus, whereas startle is increasingly inhibited as anticipated neutral stimuli approach, it is augmented and sustained when anticipating aversive stimuli. This study examined emotional anticipation in children and adolescents, since the transition from childhood to adolescence is a critical emotional and cognitive development period. In the study, different 5-s cues signalled if an upcoming picture would depict aversive or mundane content, with a third cue indicating that content was uncertain. Acoustic startle probes were presented 2.5 or 1 s prior to picture onset; blink startle reactivity was indexed with electromyography, and electroencephalography was also measured to examine the neural response to probes. In 46 3rd, 6th, and 9th grade participants, patterns of blink reflex modulation were consistent with those in adults – blink magnitude decreased from early to late probes during neutral, $t(45) = -2.0$, $p = .05$, but not aversive anticipation, such that blinks were augmented late in aversive, compared to neutral, cues, $t(45) = 2.7$, $p = .009$. Similarly, neural response to probes (probe P300) was modulated for late, but not early, probes such that the P300 was reduced for during aversive, $t(45) = -2.3$, $p = .02$, compared to neutral cues. Results suggest similar affective and attentional patterns during anticipation for children/ adolescents and adults; implications for the understanding of emotion processing development are discussed.

Funding: Research conducted with support from NIMH R01 MH112209 (Carla Kmett Danielson).

Poster 2-057
INTER-TRIAL ALPHA POWER: A CORRELATE OF MIND WANDERING

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Descriptors: alpha oscillations, mind wandering, EEG
Human cognitive performance substantially depends on the proportion of processing capacity that is allocated to a given task. This proportion of processing-time and processing-bandwidth is determined by the cognitive state of an individual, the subjective importance of the task and particularly by the subjective relevance of alternative tasks to engage in. An alternative task that may be engaged in at any time in any situation is mind wandering. Engaging in mind wandering gets increasingly compelling, the more monotonous the primary task gets. It is thus no surprise that mind wandering is responsible for a substantial amount of accidents in traffic and industry, especially when cognitive activity tends to be rather unchallenging and repetitive. In order to identify electrophysiological correlates of mind wandering, we investigated the performance of healthy participants in a task-switching paradigm, in which mind wandering was assessed at random time points via self-report. The participants showed significantly slower response-times for trials in which they reported mind wandering as compared to when not. Furthermore, a regression analysis of time-frequency decomposed, single-trial EEG data revealed that the alpha power during the inter-trial interval is predictive for reports of mind wandering. These results are in line with recent findings of alpha-oscillations as a correlate of an internal orientation of attention. A reliable correlate of mind wandering could possibly be suited to detect task-disengagement in real-word scenarios like workplaces or automated driving.

Poster 2-058
UNDERSTANDING THE UNIQUE CONTRIBUTIONS OF STATE- AND TRAIT-BASED VARIANCE IN ERP MEASUREMENTS

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Descriptors: Event-related potentials (ERP), structural equation modeling (SEM)

Classical Test Theory and revised Latent State-Trait Theory stress the importance of understanding unique sources of variance which contribute to measurements of human cognition and behavior, including stable traits (e.g., sex), contextually-fluid states (e.g., fatigue), and measurement error. Recent work in the field of psychophysiology and ERPs has begun to account for some of these potential sources of variance, though the majority of statistical analyses (and study designs) used are unable to appropriately model the possible influence of state-based variance. In the present study, we apply structural equation modeling to compare two models of systematic neural processing; one which treats state-based variance as random (i.e., measurement error), and one which cohesively incorporates state-based variance into the model. ERP data were collected from 154 neurotypical children ages 7-13 years ($M = 10.22$, $SD = 1.48$) performing a visual contingent negative variation task during two separate visits. The first model, which treated state variance as random, showed overall poor model fit (e.g., RMSEA = .10, CFI = .85). The second model, which incorporated state variance into the model structure, yielded significantly better fit (e.g., RMSEA = .03, CFI = .99). This model also showed a significant, systematic relationship between states across visits. The results demonstrate the importance of appropriately accounting for multiple sources of variance in psychophysiological data, and properly modeling the dynamic, interrelated influences of trait and state variance on ERP measures.

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Poster 2-059**STABILITY AND INTERNAL CONSISTENCY OF ERPS ACROSS FOUR ASSESSMENTS I: THE REWARD POSITIVITY**

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Descriptors: Reward Processing, Reliability

With increasing interest in using ERPs to study individual differences over time, studies employing multiple within-subject assessments of the Reward Positivity (RewP) are increasingly common. However, the stability of the RewP and its internal consistency over several repeated assessments has not been examined. The present study measured ERPs across four identical assessments within one month in 27 undergraduate women. ERPs to win and loss were analyzed as the average activity between 250-350 ms at the FCz electrode site. Overall, gains elicited a more positive response than losses; there was also a main effect of assessment such that the amplitudes for both gains and losses were reduced (i.e., less positive) at later compared to earlier assessments. However, there was no interaction between trial type and assessment: the relative difference between gains and losses was similar across all four assessments. Finally, internal consistency of the win and loss response was excellent across all four assessments. The present study suggests that it is reasonable to examine the RewP multiple times within the same subjects. Future research might focus on examining sources of within-subject variability in the RewP over time.

Poster 2-060**TRAUMA SEVERITY: BRAIN FUNCTIONAL AND STRUCTURAL CORRELATES IN PATIENTS WITH ANXIETY AND MOOD DISORDER**

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Descriptors: trauma, fMRI, structural MRI

Exposure to traumatic events is not unique to post-traumatic stress disorder (PTSD) but represent a significant factor in the development of physical and mental health disorders across the diagnostic spectrum. Using functional magnetic resonance imaging (fMRI) in a large sample of 162 anxiety and mood disorder patients during visual perception, we recently found that functional activity in a cortico-limbic circuit during emotional processing predicted questionnaire reports of experienced trauma and PTSD-like symptoms. Specifically, patients showing the smallest blood oxygen level dependent (BOLD) changes when viewing emotional, compared to neutral, scenes in the amygdala reported the highest trauma scores, whereas those patients with the largest amygdala emotional reactivity differences reported the lowest trauma scores. To further characterize the brain pattern that differentiates low, compared to high, emotionally reactive patients, the current analysis focused on structural brain changes such as grey matter volume, grey matter thickness, and multiple measures of cortical complexity (gyrification, sulcus depth). Low, compared to high, emotionally reactive patients was characterized by a reduction in cortical volume and brain complexity in dorso-visual, ventro-visual, and parietal cortex. The findings suggest that trauma severity may be a transdiagnostic vulnerability factor contributing significantly to the psychopathology of internalizing disorders.

Poster 2-061**FEAR OF NEGATIVE EVALUATION LINKS SOCIAL EXCLUSION AND SOCIAL ANXIETY: EVIDENCE FROM SUBJECTIVE AND NEUROPHYSIOLOGICAL RESPONSE**

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Descriptors: Social exclusion, Mentalizing, ERP

Despite the vast literature suggesting an association between social exclusion (SE) and social anxiety, the underlying mechanisms remain largely

unexplored. Fear of negative evaluation (FNE), a core feature of social anxiety, may be a potential mechanism. We construed FNE as not only a mentalizing trait influenced by one's SE history but also a mentalizing state triggered by situational SE stress—largely overlooked in previous work. In the current study, in a sample of 109 adolescents (12-17 yrs.), we found that individuals who experienced SE more frequently in real life were more susceptible to SE simulated by the Cyberball paradigm. They reported having greater state FNE during exclusion, which correlated positively with felt ostracism distress ($r = .62, p < .01$) and negatively with a slow wave event-related potential (ERP) for rejection events in Cyberball ($r = -.22, p < .05$). Moreover, a series of mediation analyses showed that self-reported trait FNE fully mediated the effect of SE history on subjective and neurophysiological response to SE. Our results underscore the role of FNE in linking SE and social anxiety: individuals who report experiencing SE more frequently also report greater trait FNE, in turn rendering them more sensitive and vulnerable to SE. We propose this process may create a vicious cycle, contributing to the development and maintenance of social anxiety. Our findings highlight FNE as a maladaptive form of mentalizing, important for understanding the link between SE and mental health outcomes.

Poster 2-062**FEEDBACK-RELATED NEGATIVITY MODERATES THE RELATIONSHIP BETWEEN NEGATIVE URGENCY AND HAZARDOUS ALCOHOL USE**

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Descriptors: negative urgency, alcohol, FRN

Negative urgency strongly predicts alcohol misuse, as do neurophysiological individual differences. Alcohol misuse is associated with decreased dopamine (DA+) response to non-alcohol reinforcement (Goldstein & Volkow, 2011). Reduced baseline DA+ levels contribute to impulsive behaviors, perhaps to elevate DA+ levels to a satisfactory baseline. We examined negative urgency's connection to alcohol misuse, as moderated by a putative neural indicator of reinforcement: feedback-related negativity (FRN). We recorded EEG while 23 participants completed a reinforcement-cued flanker-task. We presented a negative reinforcement cue, following which, participants responded to an arrow flanker stimulus. Outcome information, which could be lower than, greater than, or as expected, was presented at the end of each trial. Negative urgency and hazardous alcohol use levels were assessed via the UPPS-P and AUDIT respectively. Multiple regressions used standardized scores for negative urgency and FRN-activation, loaded as predictors in the first step, and the interaction term loaded in the second. We observed a significant moderating effect of FRN activation on the relationship between negative urgency and alcohol misuse in negative reinforcement conditions. Greater negative urgency in combination with more negative FRN amplitude predicted increased alcohol misuse. Based on theory suggesting the FRN represents a DA+ prediction error signal, this suggests negatively-urgent individuals with decreased DA+ response are more likely to hazardously use alcohol.

Funding: This work was supported by the Arkansas Biosciences Institute 0402-27504-21-0216 to CL.

Poster 2-063
**THE INTERPLAY BETWEEN DISINHIBITION
AND REWARD SENSITIVITY IN RELATION TO
EXTERNALIZING BEHAVIORS**

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Descriptors: Externalizing, Reward Positivity

Both disinhibitory tendencies and aberrant neural reward sensitivity have been implicated in a range of externalizing behaviors. Recent work suggests that the association between neural reward sensitivity and one externalizing outcome, substance abuse, is moderated by trait disinhibition (Joyner et al., *Clinical Psychological Science*, in press). The current study sought to extend these findings by testing for synergistic associations of dysfunctional reward sensitivity and trait disinhibition in relationship to other externalizing outcomes involving law- and rule-breaking behavior. Community and college adults ($N = 139$) completed a scale measure of trait disinhibition along with the Behavior History of Rule Breaking questionnaire, a criterion measure of antisocial behavior, and performed a pseudo-gambling feedback task that yielded a well-validated index of neural reward sensitivity, the Reward Positivity (RewP; Hajcak Proudfit, *Psychophysiology*, 2015). Both trait disinhibition and RewP independently predicted rule-breaking behavior; additionally, these two predictors evidenced an interactive effect, whereby participants high in disinhibition who showed blunted RewP response were especially likely to engage in rule-breaking behavior. Though limited by its cross-sectional design, this work highlights the importance of the interplay of disinhibition and reward processing for externalizing behaviors of different types.

Poster 2-064
**DISPOSITIONAL THREAT SENSITIVITY & AVERSIVE
STARTLE POTENTIATION MODERATE EFFECTS OF
PHASIC THREAT CUEING IN A TASK SWITCHING
PARADIGM**

James Yancey; Kara Hultstrand; Colin Bowyer; Jens Foell;
Walter Boot; Christopher Patrick
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Descriptors: Threat, Startle, Task Switching

The capacity to effectively deploy cognitive resources in dangerous or stressful situations is vital for emergency service professionals (e.g. first responders, combat personnel, trauma surgeons). One laboratory task that shows promise for assessing this critical capacity is task switching under threat of shock. A recent study using this procedure (Yancey et al, *JEP: Human Performance*, 2019) found that performance during blocked (tonic) threat cueing was generally reduced relative to safe. Moreover, these effects were moderated by individual differences in threat sensitivity (THT) as indexed by trait-scale and physiological (blink-startle) measures. The current study tested for moderating effects of THT, assessed in these two ways – through trait-scale scores and startle-blink potentiation – on switching performance under conditions of phasic (trial-by-trial) shock cueing. For participants overall, switching performance (i.e., efficiency for switch versus repeat trials), as indexed by both accuracy and reaction time, was generally improved under conditions of shock-cueing. However, the impact of shock cueing on performance was moderated by variations in THT as assessed by scale scores. A Scale Score x Startle Potentiation interaction was also observed, whereby individuals showing low startle potentiation on shock-threat trials along with low THT-scale scores showed the most improved performance under threat. Implications for understanding the role of individual differences in defensive (fear) reactivity on cognitive performance during threat will be discussed.

Poster 2-065
**THE IMPACT OF PUNISHMENT ON THE
ERROR-RELATED NEGATIVITY IN CHILDREN**

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Descriptors: ERN, punishment, children

The error-related negativity (ERN) is a negative deflection in the event-related potential waveform occurring after commission of an error. The ERN amplitude has been associated with anxiety in adults and children; furthermore, punishing errors has been shown to increase the ERN amplitude in adults. However, no previous study has investigated the impact of punishment on the ERN amongst children. In a sample of 46 children ($M_{age} = 9.11$, $SD = 1.34$; range = 7 – 11), participants completed a flanker arrow task to elicit the ERN. In one condition, children did not receive punishment for errors. In another condition, children were punished with an aversive “peep” tone after half of all errors committed. Repeated measures ANOVA revealed that the 3-way interaction between response (correct vs. incorrect), condition (punishment vs. no punishment), and child age approached significance, $p = .058$. Residual-based differences scores of ERN in the punishment condition minus no punishment condition significantly correlated with child age, such that older children were characterized by a larger ERN after punishment, $r(46) = -.36$, $p = .014$.

Poster 2-066
**EVALUATING THE RELATIONSHIP BETWEEN
DEHYDROEPIANDROSTERONE (DHEA), WORRY, AND
ERROR-RELATED BRAIN ACTIVITY**

Julia Gorday; Alexandria Meyer
Florida State University

Descriptors: error-related negativity, pubertal hormones, worry

The error-related negativity (ERN) is a negative deflection in the event-related-potential, occurring when individuals commit errors and has been related to increases in anxiety and to adolescence. However, no previous study has investigated the potential relationships between pubertal hormones and the ERN. In the current study, we examine the relationship between four different pubertal hormones; estradiol, progesterone, dehydroepiandrosterone (DHEA), and testosterone, and the Δ ERN in participants between 8 and 14 years old ($N = 99$). Each participant and the accompanying parent completed the Pubertal Developmental Scale (PDS). Participants completed a Go/NoGo Task while EEG was being recorded. Participants' clinical symptoms were also assessed using the KSADS clinical interview (administered to parent and child). Participants further provided saliva samples for hormone assays. Results indicated a heightened ERN significantly related to increased DHEA levels, PDS, and dimensional worry. Additionally, DHEA also related to increased worry. A simultaneous multivariate regression suggested that DHEA levels predicted the Δ ERN, even when controlling for age, behavioral variables, and PDS. When DHEA and ERN were entered simultaneously into a regression predicting worry, neither held significance. Findings suggest that the ERN amplitude is positively related to DHEA levels, providing evidence to link the developmental increase in the ERN to the onset of puberty. Moreover, these findings indicate that worry relates to both DHEA and ERN, although they are not independent predictors.

Poster 2-067
RISK STATUS INTERACTS WITH ANXIETY SYMPTOMS IN PREDICTING CORTICAL THICKNESS IN MIDDLE CHILDHOOD: A CROSS-SECTIONAL STUDY OF CPS-INVOLVED CHILDREN AND LOW RISK COMPARISONS

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Descriptors: cortical thickness, anxiety, risk status

Early caregiving adversities are associated with increased risk for anxiety disorders during middle childhood. Although prior research suggests that anxiety symptoms alter neurostructural development of emotion regulation systems, it is unknown how caregiving adversities might shape cortical thickness outcomes. To investigate this, high-resolution 3-Tesla T1-weighted MRI scans were acquired in a cross-sectional sample of 45 CPS-involved and 25 low risk children (age range = 8.08 - 12.14; mean age = 10.05). Anxiety symptoms were assessed using the anxious/depressed scale of the Child Behavioral Checklist (CBCL). No main effect of group on CBCL anxiety scores or cortical thickness outcomes were found. However, risk status interacted with CBCL anxiety scores in predicting cortical thickness outcomes in bilateral fronto-parietal cortical areas, such that CPS-history was associated with decreasing cortical thickness as anxiety scores increased. In the low risk sample, increased anxiety scores predicted statistically significant increase in the precentral and pericalcarine gyri thickness in the left hemisphere. The findings suggest that anxiety is associated with exaggerated cortical thinning in the fronto-parietal control network in children with a history of adversity, but not in children without. Given the important role these regions play in regulating emotional responses, thinner cortices could reflect greater engagement of these regions in the service of regulating emotion (i.e., a compensatory mechanism) or a potential vulnerability marker for emotion regulation problems.

Funding: National Institute of Mental Health R01 MH074374 Award Supplement - "Intervening Early with Neglected Children: Adding Imaging to Assess Developmental Trajectories." Period of support: August 18, 2015 - August 17, 2019. Total amount: \$158,000. (Dr. Mary Dozier: Principal investigator).

Poster 2-068
COHORT STUDY OF GAZE FOLLOWING FROM 5 TO 14 MONTHS IN PRETERM AND FULL-TERM INFANTS

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Descriptors: gaze following, preterm, infants

The data on the development of gaze following ability in preterm and full-term infants is contradictory. The aim of the study was to investigate this ability in preterm (pT) and full-term (fT) infants within the first years of their development (from 5 to 14 months). Three cohorts comprised study sample: (1) 5 months cohort included 6 pT, corrected age (CA) = 5.56 (SD=0.42) months, gestational age (GA) = 33.5 weeks (SD = 2.07), and 19 fT infants, age = 5.87 (0.59); (2) 10 month: 18 pT, CA = 10.06 (1.01) months, GA = 32.28 (2.42), and 43 fT, age = 10.55 (0.73); (3) 14 months: 22 pT, CA = 14.34 (1.07), GA = 32.68 (2.71), and 39 fT babies, age = 14.84 (0.92). Within each cohort infants were matched for gender and age. Procedure and task were similar to those used by Senju group (Senju et al., 2008). Standard different scores (DS = (c-i)/(c+i), where c – congruent and i – incongruent gaze) and latency of gaze shift to the congruent (LC) and incongruent (LI) objects at the last stage of the task was calculated. There were neither significant differences between pT and fT groups in DS nor in the latency of gaze shift found at any presented cohort. Differences between 10 and 14 months cohorts appeared to be statistically significant in DS for fT (U = 543.0, p = 0.004) and pT infants (U = 111.5, p = 0.017) as well as in LC (U = 500.0, p = 0.006 and U = 96.6, p = 0.009 for fT and pT groups consequently). Preterm infants demonstrated no difference in gaze following ability compared to full-term infants at each age, moreover, their developmental trajectory was similar to the full-term infants.

Funding: The research was supported by the grant of the Russian Science Foundation No 6-18-10371.

Poster 2-069
LONGITUDINAL ASSOCIATIONS BETWEEN INTERNALIZING SYMPTOMS AND THE ERN IN MIDDLE CHILDHOOD

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Lindsay Zajac; Robert Simons; Mary Dozier
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Descriptors: internalizing, ERN, children

The error-related negativity (ERN) is an event related potential (ERP) observed about 50ms after an error. Although anxiety is often associated with larger ERNs, anxiety may be associated with smaller ERNs in young children (Meyer, 2017; Moser, 2017). The present study examines the ERN and internalizing symptoms across middle childhood among a diverse sample of children. At ages 8 and 10, 156 children (53% male) completed a flanker task while EEG was recorded. Δ ERN (ERN-CRN, or correct response negativity) was calculated at Cz, such that more negative Δ ERN values indicate a greater difference. Parents reported on children's internalizing symptoms at ages 8 and 10 using the Child Behavior Checklist. Cross-lag analyses were conducted in Mplus 8.1 to examine cross-sectional and longitudinal paths between the Δ ERN and internalizing symptoms at ages 8 and 10. Cross-sectional paths were not significant (age 8: $\beta = .23$, $p = .07$; age 10: $\beta = .18$, $p = .13$). Longitudinally, higher internalizing symptoms at age 8 were associated with larger Δ ERNs at age 10 ($\beta = -.28$, $p = .02$). Examining depressive and anxiety symptoms separately produced similar results, but effects were significant for depressive symptoms (cross-sectional at age 8: $\beta = .26$, $p = .04$; symptoms at 8 predicting Δ ERN at 10: $\beta = -.31$, $p = .03$) and only marginal for symptoms of anxiety. Results align with previous work indicating that associations between the ERN and psychopathology may change across development, and suggest that it may be important for ERN researchers to examine symptoms of both anxiety and depression.

Funding: R01MH074374.

Poster 2-070
RISK-TAKING AND NEURAL RESPONSE TO REWARD ACROSS ADOLESCENCE

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Descriptors: Reward Sensitivity, Risk-taking, Adolescence

Risk-taking peaks in adolescence and is thought to reflect, in part, hyperactivity of the brain's reward system. However, it has not been established whether reward-related brain activity is differentially associated with risk-taking across adolescence. The present study investigated how neural sensitivity to reward is associated with laboratory risk-taking throughout adolescence as a function of age. Adolescents (n = 72) ages 10-19 (M = 13.82) completed the Balloon Analogue Risk Task (BART), which indexes risk-taking behavior. Participants also completed a forced choice monetary gambling task while the electroencephalogram (EEG) was recorded. This task elicits the reward positivity (RewP), a frontocentral event-related potential component that is more positive to gains than losses and indexes reward sensitivity. Consistent with previous research, we observed a negative quadratic association between age and risk-taking, such that those in early and late adolescence had lower relative risk-taking compared to mid-adolescence, with risk-taking peaking around 15 years. In predicting risk-taking, we also observed an interaction between age and the RewP. The RewP was not associated with risk-taking in early adolescence, but a larger RewP was associated with a greater propensity for risk in later adolescence. These findings suggest that neural reward sensitivity is an important factor in predicting risk-taking only later in adolescent brain development.

Funding: This research was funded by the Canada Research Chair program given to Dr. Anna Weinberg.

Poster 2-071**EFFECTS OF UNILATERAL DYNAMIC HANDGRIP ON RESTING CORTICAL ACTIVITY**

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Technische Universität München

Descriptors: Embodiment intervention, Body and mind intervention
We have previously shown that a generalized enhancement of EEG alpha (8-12 Hz) amplitude occurs after 45 sec of unilateral dynamic handgrip contractions, reflecting cortical down-regulation. Further evidence has shown dynamic handgrip can prevent skill failure under pressure, possibly due to the induced cortical deactivation. Considering such field application, in this study we explored the effect of shorter durations of unilateral dynamic handgrip on subsequent alpha amplitude. Whole scalp EEG activity was recorded in N = 15 participants (right-handed, eight female, mean age of 23 years) during a pre- and a post-intervention 2 min rest condition (eyes open). As an intervention participants had to contract the hand at an approximate pace of two times a second (dynamic handgrip), for 5 and 10 seconds, for each hand, with the initial hand counterbalanced. Subtraction of post- from pre-test of alpha amplitude did not show significant differences. Thus, in contrast to earlier findings, no effect of unilateral dynamic handgrip on subsequent alpha amplitude was detected. This result may be explained that 5 and 10 seconds of dynamic handgrip are too short to significantly alter subsequent cortical activity. In a similar vein, but related to strength not the duration of dynamic handgrip, other researchers have found stronger hand contractions lead to greater changes in cortical activity. Future studies for the field application of dynamic handgrip need to consider both the strength and length of the contractions.

Poster 2-072**ULTRASOUND STIMULATION ON THE SKIN STIMULATES EEG THETA ACTIVITY IN SPEECH-RELATED BRAIN AREAS**

Diana Henz
University of Mainz

Descriptors: ultrasound, language, EEG
Several studies have shown distinct effects of ultrasound stimulation on brain activity and cognitive functions. In the present study, we tested whether short-term application of a language course applied by ultrasound on the skin stimulates specifically brain areas that are related to auditory and speech processing. A language course (German for beginners) was transmitted soundlessly by an ultrasound device with two electrodes placed on the right wrist of the participants. High-density EEG was recorded from 128 electrodes before, during, and after the ultrasound application. Each experimental condition (ultrasound stimulation, no stimulation) was tested for 30 minutes. Data of source localization show increased overall theta activity in the superior temporal gyrus and Wernicke's area, as well as the temporo-parietal junction after 15 minutes of ultrasound application. Results indicate that language information can be stimulated in the brain by ultrasound application on the skin. Further, activation of the temporoparietal junction indicates that sensory information of the ultrasound stimulation applied on the skin enhances multisensory integration of language information. We discuss the underlying neurophysiological processes and potential application fields of ultrasound stimulation on the skin on language processing and language learning.

Poster 2-073**MODULATION OF THREAT LEARNING AND EXTINCTION BY EMERGENCY CONTRACEPTION: AN ERP AND SCR INVESTIGATION**

Elizabeth Bauer; Nancy Downing; Mary Meagher;
Annmarie MacNamara
Texas A&M University

Descriptors: PTSD, progesterone, LPP
Post-traumatic stress disorder (PTSD) is a debilitating and costly disorder that can develop following exposure to a traumatic event and disproportionately affects women. Recent work suggests that gonadal hormones such as progesterone and estrogen can affect retention of threat memories. For

example, administration of emergency contraception (EC) following sexual assault might be helpful in reducing PTSD symptoms, while other studies suggest that progesterone may increase memory for threat. The mechanism(s) behind these effects are unclear and could include reduced concern about pregnancy and/or hormonal modulation of threat memory or extinction processes. In this pilot study, female participants ($n = 17$) completed a two-day threat acquisition, extinction and extinction retention paradigm while EEG and SCR were recorded. Following random, double-blind group assignment, participants consumed a progesterone-only EC (levonorgestrel 1.5 mg, Plan B) or placebo pill 30 minutes prior to extinction training. There were no baseline group differences. However, during early extinction, the levonorgestrel group showed reduced discrimination between threat and safety cues (as measured by the late positive potential, LPP). The levonorgestrel group also showed superior late threat extinction (SCR results). Therefore, acute administration of levonorgestrel might increase threat generalization (LPP results) and/or may facilitate threat extinction (SCR results). Levonorgestrel's effects on threat memory appear to be complex; however, this EC may hold promise as an adjunctive treatment in PTSD.

Funding: This work was supported by Texas A&M University. AM is supported by National Institute of Mental Health grant, K23 MH105553.

Poster 2-074**INSTRUCTIONAL MANIPULATIONS INFLUENCE BACKWARD EVALUATIVE CONDITIONING ON EXPLICIT VALENCE RATINGS, BUT NOT STARTLE MODULATION**

Luke Green; Camilla Luck; Ottmar Lipp
Curtin University

Descriptors: Backward Conditioning, Evaluative Conditioning, Startle Modulation

Backward conditioning results in a conditional stimulus (CS) either acquiring the valence of the unconditional stimulus (US; assimilation effect) or valence opposite to that of the US (contrast effect). The aim of this experiment was to determine whether the instructions provided would affect the nature of backward conditioning on explicit valence ratings and startle modulation (startle is larger during negative than positive stimuli). Concurrent forward and backward conditioning was performed with positive, neutral, and negative sound USs. One group was asked to learn which CSs started and stopped the respective USs (start-stop group), while a second was asked to pay attention to the stimuli (observe group). Assimilation effects were observed for forward conditioned CSs in explicit valence ratings and startle modulation. For backward conditioned CSs, explicit valence ratings indicated a contrast effect in the start-stop group, whereas no backward conditioning was evident in the observe group. Startle modulation revealed contrast effects for backward conditioning in both groups. These findings suggest that explicit valence ratings and startle modulation during backward conditioned CSs are differentially sensitive to instructional manipulations. This may be explained from a dual process perspective as startle modulation appears to reflect the association between US offset and the emotional response this causes, while explicit valence ratings appear to reflect the proposition about stimulus relationships provided by the instructional manipulation.

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Poster 2-075

WORKING MEMORY LOAD, THREAT EXTINCTION AND TRAIT ANXIETY

T. Bryan Jackson; Annmarie MacNamara
Texas A&M University

Descriptors: late positive potential, working memory load, anxiety
Working memory load reduces the processing of task-irrelevant emotional and neutral stimuli, and this effect is attenuated in participants with increased anxiety, suggesting less flexible modulation of attention/increased distractibility. It is unclear whether working memory load can also modulate the electrocortical processing of threat-conditioned stimuli; whether working memory load might facilitate or interfere with threat extinction; and whether effects might vary for participants with increased anxiety. Here, we recorded EEG for 35 participants (age: $M = 20.0$ $SD = 5.6$; 22 females) who viewed two letters (low-load) or six letters (high-load) prior to seeing one of four task-irrelevant shapes, two of which had been previously paired with shock (CS+) and two of which had never been paired with shock (CS-). Results showed that the P2 and the late positive potential (LPP) were larger for CS+ compared to CS- during early extinction ($ps < .03$). During late extinction, the P2 was larger for CS+ compared to CS- presented on low-load trials only ($p = .03$). In addition, working memory load reduced the LPP elicited by CS+ and CS- during both early and late extinction ($ps < .02$) and in early extinction, this effect was attenuated for participants with increased trait anxiety ($r = -.34$, $p = .046$). Results indicate that working memory load can reduce the processing of threat cues (i.e., conditioned stimuli), though this is impeded in anxiety; moreover, working memory load might facilitate extinction learning, at least as reflected in early, automatic stimulus processing.

Funding: AM is supported by National Institute of Mental Health grant, K23 MH105553.

Poster 2-076

COMPLEX PTSD SYMPTOM EFFECTS AND CARDIAC RESPONSE TO STARTLE STIMULI DURING FEAR CONDITIONING

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Descriptors: Complex PTSD, Cardiac response, gender
Research has shown that patterns of associative learning influence stress responses, and that responses to safety stimuli may be higher in individuals endorsing PTSD symptomatology than in the general population. Specifically, findings support greater heart rate change in response to trauma-related stimuli among PTSD survivors compared to control groups. In the current study, electrocardiography (ECG) data were collected while undergraduates (female = 36; male = 12) engaged in a fear learning paradigm with CS+ trials consisting of the image of a face paired with aversive screaming noise, and CS- trials consisting of a different face with no scream. Prior to the session, subjects completed the Self-Report Inventory for Disorders of Extreme Stress (Pelcovitz et al., 1997), designed to capture typical symptoms of complex trauma. Multilevel modeling tested whether fear conditioning context (CS+ or CS-), gender, or complex trauma symptom (CTS) severity impacted cardiac responses to 100-dB white noise stimuli across 72 trials. Contrary to hypotheses, cardiac responses did not differ between CS+ and CS- trials ($\beta = 0.023$, $p > .05$). Neither gender ($\beta = -0.382$, $p > .05$) nor CTS severity ($\beta = 0.002$, $p > .05$) contributed to change in heart rate. Because of the chronic nature of CTS compared to single-incident trauma, non-significance may indicate disengagement or blunted responses as a form of adaptive coping in individuals with complex trauma symptoms. Thus, these findings may inform future data collection in survivors of complex trauma, and help to identify at-risk individuals.

Poster 2-079

THE EFFECTS OF THETA TRANSCRANIAL ALTERNATING CURRENT STIMULATION ON VERBAL WORKING MEMORY

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Descriptors: tACS, working memory, frontal midline theta
Numerous studies have shown strong relationship between frontal midline theta (4-8 Hz) (FMT) activity and working memory (WM) performance. Activation of the cortical generators of FMT plays a key role in manipulation of information in WM. Such studies, however, cannot by definition demonstrate any causal relationship. Therefore, ethically correct intervention studies are necessary, such as non-invasive brain stimulation experiments. Transcranial alternating current stimulation (tACS) is a non-invasive technique capable of inducing long-term changes in oscillatory activity of the brain. The current study had an initial goal to check the effect of tACS on accuracy in a set of match-to-sample WM tasks. Two types of tasks were used: with mental manipulations and just retention tasks. 23 (6 females, mean age = 25) healthy adults participated in two testing sessions (after sham and tACS). The locations of stimulation electrodes were based on the results of a simulation of field distribution performed in SimNIBS. tACS was applied for 20 min over Fpz and CPz at 6 Hz, 1 mA. No after-effects of tACS were observed in the stimulation sessions as compared to sham. The data suggest that tACS delivered before the WM task is not able to produce any observable changes in WM performance. Future studies could apply simultaneous stimulation and EEG recording during maintenance of information in WM for better understanding of the theta tACS effects.

Funding: Study was supported by Russian Foundation for Basic Research #19-013-00027.

Poster 2-080

FILTERING OF SAD AND FEARFUL FACES FROM WORKING MEMORY IN DYSPHORIC AND CONTROL PARTICIPANTS

Chaoxiong Ye¹; Xueqiao Li¹; Elisa Ruohonen¹; Qianru Xu¹;
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Descriptors: Dysphoria, Distractor filtering, Emotional face
By using an event-related potential called contralateral delay activity (CDA) to measure the filtering efficiency of face distractors, previous studies have found that that fearful face distractors are more difficult to filter than neutral ones from the visual working memory (VWM). It is not known, however, if filtering of other emotional faces is equally difficult. In order to study this issue, and investigate if depressive symptoms have an effect on filtering, we recruited 20 healthy and 20 dysphoric (Beck's Depression Index-II scores > 12) participants with matched VWM capacity to conduct a colour memory task with sad or fearful face distractors. By measuring the CDA indicative of filtering, we found that the healthy group failed in filtering both the sad and fearful face distractors. In contrast, the dysphoric group successfully filtered the distractors. The results indicate that for healthy individuals not only fearful faces, but also sad faces are difficult to filter during the VWM task. However, dysphoric individuals can avoid consolidating negative emotional faces into their VWM when they are task-irrelevant. The efficient filtering of faces with negative emotions in dysphoric individuals can be related to the automatic emotion regulation strategy that is beneficial in dysphoria.

Funding: This research was supported by grants from the National Natural Science Foundation of China (NSFC 31700948) to C.Y.

Poster 2-081
**VISUO-CORTICAL ENGAGEMENT
AND SUBSEQUENT VISUAL WORKING
MEMORY PERFORMANCE: EFFECTS OF SET
SIZE AND RECALL SEQUENCE**

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Descriptors: working memory, attention, EEG

How is visual encoding of a stimulus related to its subsequent activation in visual working memory? To answer this question, we used steady-state visual evoked potentials (ssVEP), which allow simultaneous measurement of the visuo-cortical responses to multiple concurrent stimuli (frequency tagging). Twenty-four participants were asked to remember the orientations of two, four, or six differently oriented gratings, each tagged at a different frequency. The orientations of the items were either -15°, 45°, or 105°, relative to a vertical axis, each randomly presented at one of six possible locations, evenly spread around a fixation circle. After 3 seconds of presentation, the stimuli were masked, followed by the appearance of response gratings prompting participants to rotate them in the same orientations as the original gratings. As expected, performance worsened with increasing set size, while ssVEP amplitude decreased. This suggests a continuous resource shared among all items held in visual working memory for orientation. Furthermore, accuracy decreased linearly with the order of recall, later recall being associated with poorer performance. Analyses relating accuracy to ssVEP amplitude demonstrated that higher visuo-cortical engagement predicted better performance, across set sizes, specifically for lower tagging frequencies.

Poster 2-082
**OPPORTUNITIES TO SIT AND
STAND ELICIT EQUIVALENT REWARD-RELATED
BRAIN ACTIVITY**

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 Mariane Bacelar¹; Robyn Feiss¹; Victoria Zona¹
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 Columbia

Descriptors: Behaviors minimizing energetic cost, Reward, Event-related potential

A recent theory posits that behaviors minimizing energetic cost are rewarding (Cheval et al., 2018). Yet, direct experimental evidence supporting this theory is lacking. To address this shortcoming, we investigated the effect of energy expenditure on reward-related brain activity. Thirty-one participants performed a monetary incentive delay task while having their electroencephalographic (EEG) signal recorded. After attempting to quickly respond to a target stimulus, participants received feedback instructing them to retrieve a token (reward condition) or to wait (no reward condition). In half of the rewarding trials, participants stood up to retrieve a token, thus increasing energy expenditure. In the other half, participants just had to extend their arm to retrieve a token, thus minimizing energy expenditure. The contingent negative variation (CNV) event-related potential (ERP) component preceding the motor response to the target stimulus was used as an indicator of reward pursuit. The reward positivity (RewP) ERP component time-locked to feedback onset was used to assess reward valuation. Results showed that neither response time, CNV, nor RewP were influenced by energy expenditure (remaining seated vs. standing up). This null effect of condition was confirmed using equivalence tests. These results do not support the theory of energetic cost minimization, but the equivalent effect of sitting and standing on reward-related brain activity is new knowledge that could contribute to shed light on the neural processes underlying the pandemic of physical inactivity.

Poster 2-083
**RIGHT ALPHA ACTIVATION
MODERATES THE STABILITY OF
PUNISHMENT SENSITIVITY OVER TIME**

Taylor Heffer; Teena Willoughby
 Brock University

Descriptors: EEG, Punishment Sensitivity, Alpha

Stable punishment sensitivity (i.e., consistent across time) has been found to predict anxiety (Frenkel et al., 2015). Importantly, lower levels of right alpha activation (a measure of electrical activity in the brain during rest) is thought to be associated with punishment sensitivity (e.g., avoidance tendencies). This study examined whether lower right alpha activation was more strongly associated with stability of punishment sensitivity than higher right alpha activation. Adolescents ($N = 112$, $M_{age} = 11.54$) filled out a self-report measure of sensitivity to punishment at two time points, one year apart. EEG was recorded in the second year while participants were at rest. Using multiple regression, we found a significant interaction between punishment sensitivity and right alpha activation ($b = -.212$, $p = .009$). Adolescents with lower right alpha activation had larger stability in their punishment sensitivity scores across time ($r = .771$, $p < .001$) compared to those with higher right alpha activation ($r = .331$, $p = .022$). These findings have important implications for the understanding of punishment sensitivity. Individuals with more avoidance tendencies (i.e., low levels of right alpha activation) appear to have consistently high punishment sensitivity.

Funding: The second author acknowledges funding received from Canadian Institute of Health Research.

Poster 2-084
**GENDER, SEXUAL ORIENTATION, AND MODERN
PREJUDICE PREDICT MFN AND LPP RESPONSES TO
SEXUAL IMAGERY**

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 Jennifer Bosson
 University of South Florida

Descriptors: Prejudice, Gender, ERP

The ventral striatum (VS) plays a key role in the processing of rewarding stimuli, and patterns of VS activation to sexual images vary across individuals' gender and sexual orientation. To demonstrate that ERPs can be used to index homonegative attitudes and determine whether this effect is moderated by gender and sexual orientation, we utilized a passive S1-S2-outcome reward prediction task, where S1 predicted S2 80% of the time, and S2 fully predicted the outcome. We placed same-sex and other-sex pornographic images in the outcome position, and measured medial-frontal negativity (MFN) and late positive potential (LPP) amplitude after S2 and outcome stimuli, respectively. We predicted that the MFN and LPP amplitudes would be largest to unpredicted gay/lesbian stimuli, with moderation by participants' gender, sexual orientation, and sexual prejudice scores. Results from a sample of 50 participants indicated that the MFN was most negative on unpredicted gay trials and most positive to unpredicted straight images among heterosexual people. In addition, the LPP was more positive to heterosexual images than homosexual images. A 3-way interaction showed that the MFN was most negative and the LPP most positive to unpredicted gay images among highly-prejudiced gay men, whereas neither component was influenced by sexual orientation or prejudice among women. In conclusion, MFN and LPP responses to sexual stimuli are similar among women and men, but these components index sexual prejudice among men only and effectively detect internalized homophobia among gay men.

Poster 2-085**STABILITY OF FRONTAL EEG
ALPHA ASYMMETRY IN A HOSTILE MRI
ENVIRONMENT**

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University of Arizona, Psychophysiology Laboratory

Descriptors: EEG, MRI, Frontal Alpha Asymmetry

Previous investigations have examined the stability of EEG alpha asymmetry over multiple recording sessions and found that about 60% of the variance is stable trait variance. The present study examined whether frontal EEG alpha asymmetry showed similar stability when recorded in the MRI environment. The MRI environment poses novel psychological and signal-processing challenges, each of which might reduce the stability of frontal EEG asymmetry. This study was conducted on a depressed group ($n = 31$) and a control group ($n = 30$). EEG data obtained in the scanner was cleaned using BrainVision's MR Correction and CB Correction successively, then performing manual rejection and ICA removal. After transforming with the current-source density transform alpha power was extracted via FFT and asymmetry scores were calculated at four frontal regions. Test-retest correlations for asymmetry scores across a 30 minute interval for frontal EEG alpha asymmetry recorded inside the MRI scanner were comparable (range = 0.44 to 0.71) to those for data recorded outside the scanner reported in other investigations.

Funding: NIMH R21 MH101398.

Poster 2-086**SURVIVORS OF SEXUAL TRAUMA:
DO THEIR VOICES TELL THE STORY?**

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Descriptors: Voice, Sexual Victimization, Trauma

Literature suggests certain cues in body language are "tells" of previous victimization history. Psychopathic traits and previous perpetration history tend to be predictors of accuracy in using such "tells" to target a potential victim. However, work has not yet examined whether other communication cues, such as those detected by voice, may also confer data about vulnerability. Vocal measures reflect physiological aspects of laryngeal perturbation such as muscle tension and breath passage over the larynx. The purpose of the two studies presented here is to investigate whether voice measures can be indicative of previous sexual victimization. A sample of women (S1) was recruited for voice recordings. Listeners (S2) were instructed to assess the degree of vulnerability to future victimization of the voices they heard (9 survivors and 9 controls). Several relationships emerged between vocal perturbation and trauma exposure (S1). Listeners' accuracy in distinguishing survivors of sexual trauma from controls was predicted by listeners' previous endorsement of sexual perpetration, assessed using self-report validated measures. Results suggest that a relationship between sexual trauma and physiological activity associated with the voice may exist. The ability to perceive trauma in voice may highlight the role of voice in prevention and intervention.

Poster 2-087**FOCAL TRANSCRANIAL ELECTRICAL STIMULATION
ON A REALISTIC HEAD MODEL VIA TEMPORAL
INTERFERENCE**

Kyle Curham; John Allen
University of Arizona

Descriptors: temporal, interference, stimulation

Transcranial electrical stimulation (TES) is a safe and non-invasive method to modulate ongoing brain electrical activity. However, TES is limited because of its low spatial resolution due to volume conduction; the vast majority of the applied current is conducted through the skin rather

than through the skull and into the brain. Moreover, TES induces a large stimulation artifact that obscures EEG data collected during stimulation. Temporal interference stimulation (TIS) is a new approach to overcome these limitations. TIS has a simple premise: the summation of two or more sinusoids at different frequencies results in an amplitude-modulated signal that undulates at the difference between the applied frequencies. High frequency (>1 kHz) stimulation has little effect on neurons due to the intrinsic low-pass characteristics of brain tissue. However, TIS combines two or more high-frequency waveforms to induce a focal interference pattern. Grossman et al. (2017) were able to modulate hippocampal activity in mice without exciting the overlying cortex, using TIS (2+2.01 kHz) to generate a 10 Hz temporal interference pattern. Extending this work to humans requires an initial testing phase to examine the safety and validity of the approach. TIS (1+1.005 kHz) was compared to 5 Hz TES on a three-layer Phantom head model comprising a 3-d printed (ABS-CB) conductive skull, a saline-dosed agarose gel brain mold, and saline to mimic CSF. As expected, there was a prominent 5 Hz peak in the power spectrum for both TIS and TES, but TIS exhibited a much more focal scalp topography.

Poster 2-088**DO PERSONALITY FACTORS PREDICT MODULATION
OF THE NOCICEPTIVE FLEXION REFLEX AFTER
BIOFEEDBACK TRAINING?**

Mara Demuth; Natalie Hellman; Cassandra Sturycz; Tyler Toledo; Jamie Rhudy
University of Tulsa

Descriptors: Nociceptive Flexion Reflex, Personality Factors, Biofeedback Training

The nociceptive flexion reflex (NFR) is a withdrawal response measured from biceps femoris (hamstring muscle) EMG in response to painful ankle stimulations. NFR is used to assess spinal nociception, and studies have shown that the NFR threshold is reduced (sensitized) in chronic pain patients. This study was designed to train individuals to engage descending inhibitory processes to increase NFR thresholds. There were 3 groups: 1) biofeedback (BF) to reduce arousal (assessed by SCL; $N = 25$), 2) BF to reduce arousal during painful stims ($N = 24$), and 3) BF + painful stims but painfulness was reduced as arousal reduced ($N = 33$). 3 biofeedback sessions were scheduled ~1 week apart, and NFR threshold was assessed before and after each session. All groups showed similar increases in NFR threshold within and across sessions; thus, this study focused on assessing whether the 5 domains of the Personality Inventory for the DSM-5 (negative affect, detachment, antagonism, disinhibition, and psychoticism) predicted NFR change across sessions. Results found that higher scores on psychoticism ($B = 2.30, p = .025$) and lower scores on detachment ($B = -2.28, p = .003$) were associated with larger increases in NFR threshold. This suggests participants who were better able to dissociate from the pain (i.e., higher psychoticism) and who had higher positive emotionality (i.e., lower detachment) were more successful in learning to engage descending inhibitory processes to dampen incoming pain signals. These personality traits might serve as resiliency factors for persons undergoing interventions targeting pain.

Funding: This study was funded by the Oklahoma Center for the Advancement of Science and Technology Health Research Award, grant number HR15-079.

Poster 2-089**PERSONALITY TRAITS AND ERROR-RELATED BRAIN ACTIVITY IN ADOLESCENT GIRLS**

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Stony Brook University

Descriptors: Personality, Psychopathology, Error-related brain activity
Personality traits have been associated with both internalizing and externalizing psychopathology. The error-related negativity (ERN) is an ERP component that is elicited after an error of commission and has been shown to index increased cognitive control, response monitoring, and threat sensitivity. The ERN has also been linked to internalizing and externalizing psychopathology and might provide a neural mechanism that links personality traits and psychopathology. The present study examined the relationship between personality traits (and facets) and error-related brain activity in a sample of 550 adolescent girls from the community. The girls and a biological parent completed questionnaires to assess the Big 5 personality traits and their facets. The girls also completed a flanker task while EEG was recorded to measure the ERN and correct response negativity (CRN). Across both child- and informant-report measures, greater conscientiousness and the facets achievement-striving and dutifulness were associated with increased response accuracy while greater neuroticism and the facet melancholia were associated with decreased response accuracy. Greater conscientiousness was associated with an increased Δ ERN (i.e., ERN - CRN), while lower agreeableness and greater neuroticism and the facet anxiety were associated with a decreased Δ ERN. The present study provides novel evidence supporting error-related brain activity as a potential transdiagnostic neural mechanism that might link the gap between personality and psychopathology.

Poster 2-090**PERFECTIONISM AND ERROR-RELATED BRAIN ACTIVITY**

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University of Mary Washington

Descriptors: Error Related Negativity, Perfectionism
The Error Related Negativity (ERN) has been found to have an increased amplitude in people with high levels of worry and obsessive-compulsive symptoms. However, even when people with anxiety disorders are successfully treated, their ERN amplitudes continue to be large compared to non-anxious groups. Studies like these have supported the idea that an ERN may not be characteristic of the symptoms of anxiety disorders, but rather better be described as a biologically based trait. The present study examines the relationship between the ERN and several facets of perfectionistic personality traits. Since personality traits are fairly stable in adults, they may provide a more stable correlate of the trait ERN than anxiety symptoms which can fluctuate over time. The results reveal that of the various facets of perfectionism examined, only Doubt about Actions and Planfulness significantly predict ERN amplitude when controlling for the other facets of perfectionism and worry. These facets of perfectionism seem particularly related to error-monitoring.

Poster 2-091**SUPPRESS OR ACCEPT? THE EFFECT OF COPING STRATEGIES ON ERN AMPLITUDE AMONG INDIVIDUALS WITH OBSESSIVE-COMPULSIVE TRAITS**

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Descriptors: ERN, Suppression, Acceptance
Intrusive thoughts are characteristic of many disorders; attempts to cope can become maladaptive perpetuating the problem (e.g., thought suppression), while others can provide long-term symptoms relief (e.g., acceptance). Although emerging research explores the neural correlates of these strategies

in healthy population, it is important to explore these strategies in populations with clinical symptoms, who are more likely to naturally attempt to use such strategies. Therefore, this study explored whether using an acceptance or suppression strategy to manage intrusive cognitions following an emotion-eliciting film would be differentially reflected in the error-related negativity (ERN) amplitude of individuals characterized by obsessive-compulsive symptoms -a group commonly associated with suppression efforts relative to a low OC control. Results were consistent with well-established and emerging literature. The ERN was enhanced in individuals with high OC symptoms. Additionally, a marginal effect of thought-control strategy was observed, such that the ERN amplitude was reduced in the suppression condition and greater for the acceptance condition. Uniquely, the study expanded on emerging literature by exploring whether the relationship between ERN and thought control strategies was moderated by level of OC. Although results were not conclusive, these preliminary findings represent an important first step to study the effects of suppression and acceptance on the ERN in a sample characterized by clinically relevant symptoms and overall encourage further exploration.

Poster 2-092**NEUROSTRUCTURAL HETEROGENEITY IN YOUTH WITH INTERNALIZING SYMPTOMS**

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Descriptors: internalizing, youth, heterogeneity
It is increasingly recognized that symptom-based classification approaches to internalizing disorders do not align with underlying neurobiology. An alternative to classifying psychopathology based on clinical symptoms is to identify neurobiological subtypes based on brain data. Here, we used a recently developed semi-supervised machine learning method (HYDRA) to delineate patterns of neurobiological heterogeneity within youth with internalizing symptoms using structural brain data from a large community-based sample of 1,141 youth. Using volume and cortical thickness data, cross-validation methods indicated a highly stable solution (Adjusted Rand Index of .66; permutation-based $p_{thr} < .001$) and identified two subtypes of internalizing youth. Subtype 1, defined by smaller brain volumes and reduced cortical thickness, was marked by impaired cognitive performance and higher levels of psychopathology than Subtype 2 and typically developing youth. Using two independent imaging modalities not used in clustering, Subtype 1 showed reduced amplitudes of low frequency fluctuations in fronto-limbic regions at rest and reduced fractional anisotropy in white matter tracts such as the uncinate fasciculus. In contrast, Subtype 2 showed greater volume, cortical thickness, and amplitudes during rest as well as intact cognitive performance relative to typically developing youth, despite still showing clinically significant levels of psychopathology. Identification of neurobiological subtypes of internalizing disorders is the first step towards a biologically-grounded classification system.

Funding: This work was supported by grants from the National Institute of Mental Health (NIMH; grant numbers: K99MH117274 to ANK, R01MH107703 and R01MH113550 to TDS, R01NS085211 to RTS, R01MH112847 to RTS and TDS, R01MH107235 to RCG, and R01MH112070 to CD); the Dowshen Program for Neuroscience, and the Lifespan Brain Institute at the Children's Hospital of Philadelphia and Penn Medicine. The PNC was funded by RC2 grants MH089983 and MH089924 to REG from the NIMH. Support for developing statistical analyses (RTS & TDS) was provided by a seed grant by the Center for Biomedical Computing and Image Analysis (CBICA) at Penn. Support for developing multivariate pattern analysis software (AS & TDS) was provided by a seed grant by the Center for Biomedical Computing and Image Analysis (CBICA) at Penn. Support was also provided by a NARSAD Young Investigator Award (ANK) as well as a Penn PROMOTES Research on Sex and Gender in Health grant (ANK) awarded as part of the Building Interdisciplinary Research Careers in Women's Health (BIRCWH) grant (K12 HD085848) at the University of Pennsylvania.

Poster 2-093**COLD OFF THE PRESS: NEURAL RESPONSE TO REWARDS IS BLUNTED DURING AN ACUTE STRESSOR**

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Thomas Joiner; Greg Hajcak
Florida State University

Descriptors: Reward, Acute Stress, RewP

Acute stress has been related to increases in depressive symptoms and predicts major depressive disorder. One potential mechanism for how stress contributes to the etiopathogenesis of depression may involve the impact of stress on reducing reward processing (i.e., stress-induced anhedonia). Previous work utilizing self-report, behavioral, and fMRI measures of reward processing indicate that acute stress may increase anhedonia; however, electroencephalogram (EEG) measures of reward processing have not been examined. The present study examined the effects of acute stress on the reward positivity (RewP), an event-related potential (ERP) elicited following the receipts of rewards versus non-rewards. Participants ($n = 20$) completed a monetary reward (i.e. Doors) task twice, once during a stress-condition (i.e., cold pressor set at 13°C) and once during a control condition (i.e., room temperature water), approximately one-week apart in counter-balanced order. ERPs to rewards and non-rewards as well as the gain minus loss difference waveform (RewP) was scored 230-330 ms following feedback at FCz. Results indicated that the RewP was blunted during the stress condition compared to the control condition--and this effect was driven by reduction in the ERP to gains but not losses. The current study suggests that an acute stressor can reduce the RewP, providing further evidence for models of stress-induced anhedonia and depression.

Poster 2-094**DEPRESSIVE SYMPTOMS AND PHYSIOLOGICAL RESPONSE TO SOCIAL FEEDBACK**

Samantha Birk; Rebekah Mennies; Thomas Olino
Temple University

Descriptors: Depressive Symptoms, Repetitive Negative Thinking, Heart Rate Variability

Repetitive negative thinking (RNT) is a transdiagnostic factor implicated in the development and maintenance of depression and anxiety (McLaughlin & Nolen-Hoeksema, 2011). Moreover, lower heart rate variability (HRV) has been linked to depression (Schiweck et al., 2019) and RNT (Ottaviani et al., 2016), but research examining these constructs and physiological response to social feedback is limited. This study explored the impact of RNT and depressive symptoms on physiological response to social feedback. Participants were 48 undergraduates ($Age = 20.66$, $SD = 2.91$) who completed questionnaires assessing trait RNT (RTQ-10) and depressive symptoms (CES-D), as well as the Chatroom task while physiological data were acquired. Participants' HRV significantly decreased from neutral motor match ($M = 8.46$, $SD = 1.01$) to acceptance ($M = 8.23$, $SD = .96$), $t(47) = 2.61$, $p < .05$, and rejection ($M = 8.24$, $SD = 1.14$) phases, $t(47) = 2.54$, $p < .05$. A series of repeated-measures general linear models were used with condition (Motor Match, Acceptance, and Rejection) as the within-subjects variables and RNT and depressive symptoms as the between-subjects variables. Results for the model examining depressive symptoms indicated that depressive symptoms were positively associated with HRV during Acceptance ($b = .029$, $SE = .013$, $p < .05$). The main effect of condition and interaction between depressive symptoms and condition were nonsignificant ($ps > .05$). This study suggests that the Chatroom task may be used to examine physiological response to social feedback and that psychological symptoms may be related to this response.

Poster 2-095**RESPONSE MONITORING ERPS IN CLINICAL DEPRESSION: THE IMPORTANCE OF THE STIMULUS-LOCKED P300**

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Florida State University

Descriptors: Depression, Response Monitoring, P300

Although the P300 is most often studied in the context of oddball tasks, imperative stimuli in response monitoring tasks also elicit a P300, which

overlaps with the response-locked correct response negativity and error related negativity (CRN/ERN). It is well-known that the P300 is blunted among individuals with major depressive disorder (MDD)—though this effect has not been examined in a response monitoring task. The current study examined the response-locked ERN and CRN, and the stimulus-locked P300 on correct trials elicited during an arrowhead version of the flanker task. The sample consisted of 72 currently depressed individuals and 42 healthy controls with no history of depression. Consistent with previous work using oddball tasks, the P300 was reduced among depressed compared to healthy participants. A repeated measures ANOVA further indicated that depressed participants had an increased ERN and CRN compared to the healthy control group. P300 amplitudes were highly correlated with the ERN and CRN. Indeed, when the P300 was entered as a covariate, group differences in CRN/ERN were no longer evident. These results suggest that the apparent increase in the CRN/ERN in depression was due to overlap with a significantly blunted P300. Depression-related differences in the P300, and task-dependent variation in this overlap might explain inconsistencies in previous research on the ERN in depression.

Poster 2-096**IMPAIRED RESPONSE INHIBITION IN PATIENTS WITH INTERNET GAMING DISORDER**

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Bomi Kim; Jung-Seok Choi
SMG-SNU Boramae Medical Center

Descriptors: Inhibition, Event related Potentials, Internet gaming disorder
Inhibitory processing has been thought to be a core feature in addictive disorders. Internet gaming disorder (IGD) is characterized by impaired control over persistent gaming behavior. The aim of this study was to investigate inhibitory control in IGD using event related potentials (ERPs). Thirty-eight patients with IGD and 41 healthy controls performed Go/Nogo task with EEG recording. Participants were instructed to respond to Go trials and not to Nogo trials. In the behavioral performance, no significant difference was found between the patients with IGD and healthy controls. ERP results revealed decreased Nogo P3 amplitudes in patients with IGD compare to healthy controls. However, Nogo N2 values did not differ between the two groups. These findings suggest patients with IGD have deficits in the later stage of the inhibitory processing.

Funding: This work was supported by a grant from the National Research Foundation of Korea (2014M3C7A1062894).

Poster 2-097**AEROBIC FITNESS DOES NOT MODERATE THE REWARD POSITIVITY ACROSS MAJOR DEPRESSIVE DISORDER AND FIRST-EPISODE PSYCHOSIS**

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¹Rutgers, The State University of New Jersey, ²Florida State University

Descriptors: Reward Processing, Aerobic Fitness, Psychiatric Disorders
In recent years, efforts have focused on understanding reward processing deficits across psychiatric disorders. Previous research indicates that both major depressive disorder (MDD) and first episode psychosis (FEP) may be characterized by aberrant reward-related brain activity; however, little research has examined these deficits in the same sample. Given the established reliability of the reward positivity (RewP) in clinical research, a better understanding of potential deficits in RewP may help to elucidate the pathophysiology of each disorder. Additionally, the extent to which individual difference variables (e.g., aerobic fitness) influence RewP in clinical populations is unclear. We assessed the RewP difference score from a simple gambling task among 45 age- and sex-matched individuals (15 MDD/15 FEP/15 controls). Results indicated group differences in RewP, $F(2,42) = 3.4$, $p < .05$, suggesting a blunted RewP in individuals with MDD relative to controls. No significant differences in RewP were observed between FEP and MDD or controls. Lower fitness levels were observed in FEP relative to MDD and controls. The effects of group remained significant after controlling for fitness, $F(2,40) = 3.7$, $p < .05$, indicating that fitness did not moderate RewP across diagnostic groups. These results suggest that RewP may capture reward dysfunction in MDD, yet may remain intact in FEP. Although fitness did not moderate reward processing, future studies should investigate additional individual difference factors that may impact reward processing deficits in psychopathology.

Poster 2-098

THETA AND DELTA POWER IN RELATION TO ERROR MONITORING: EVIDENCE FROM GENERALIZED ANXIETY DISORDER, MAJOR DEPRESSIVE DISORDER, AND COMORBID DISORDERS

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Descriptors: Time-frequency Power, Generalized Anxiety Disorder, Major Depressive Disorder
Error monitoring, or the ability to detect mistakes and subsequently improve future behaviors, is suggested to be altered in people with psychopathology; however, studies typically compare psychopathology with psychiatrically-healthy individuals. Few studies have directly compared multiple psychopathology groups to each other to clarify if error processing alterations are common or unique psychopathology processes. We computed delta and theta power from EEG data collected during an Eriksen flanker task in 169 total participants in four groups: psychiatrically-healthy controls ($n = 109$), individuals diagnosed with generalized anxiety disorder (GAD; $n = 24$), major depressive disorder (MDD; $n = 38$), or comorbid depressive or anxious psychopathology ($n = 28$). A 2-Accuracy (correct, error) $\times$ 4-Group (control, GAD, MDD, comorbid) repeated measures ANOVA for delta power revealed a main effect of trial ($F(1,165) = 11.67, p < .001$) but no main effect of group ($F(3,165) = 2.28, p = .08$) or interaction ($F(3,165) = 1.13, p = .34$). An ANOVA for theta power revealed a similar profile, with a main effect of trial ($F(1,165) = 44.87, p < .001$) but no main effect of group ($F(3,165) = 1.89, p = .13$) and no interaction ($F(1,165) = 1.13, p = .37$). Results suggest that, although greater theta and delta power is observed for error trials versus correct trials, increased power is generally similar across healthy controls and individuals diagnosed with psychopathology in depression, anxiety, and comorbid participants.

Funding: The funding for this poster was provided for through a grant from the School of Family, Home, and Social Sciences.

Poster 2-099

SEMANTIC PROCESSING DEFICITS IN SCHIZOPHRENIA: LINKS WITH SYMPTOM SEVERITY AND NEUROPSYCHOLOGICAL PERFORMANCE

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Descriptors: N400, Schizophrenia, neuropsychological performance
Reduced N400 amplitude provides evidence of deficits in semantic priming in schizophrenia (SZ) and other psychotic disorders. Links between neuropsychological performance of verbal reproduction (VerbR) and visual reproduction (VisR), symptom severity, and N400 remain unknown. The current sample consists of individuals with SZ, other psychotic disorders (OP; affective psychosis, substance-induced, not otherwise specified), and controls (Ctl). 569 participants (SZ: $n = 158$; OP: $n = 150$; Ctl: $n = 261$) were recruited as part of a longitudinal study of first-admission psychosis. A matching task elicited the N400 at the 20-year follow-up. Across all groups, N400 (related and unrelated pairs) negatively correlated with performance on VerbR and VisR, and positively with symptoms. A regression model revealed a mediating effect of VisR ($\beta = -.21, p = .000$) and delayed VisR ($\beta = -.18, p = .000$) between N400 (related) and disorganized symptoms. Controlling for demographics, differences emerged between diagnostic groups and symptom severity (SZ > OP > Ctl), performance on VerbR, VisR, and delayed VisR (Ctl > OP > SZ). OP and Ctl displayed significantly higher performance than SZ on delayed VerbR. Within patients, regressions showed negative symptoms significantly predicted all VerbR and VisR performance. Avolition ($\beta = -.22, p = .000$), Inexpressivity ($\beta = -.22, p = .000$) and disorganized symptoms ($\beta = -.17, p = .02$) predicted VisR, but no others. These data suggest variability of semantic processing deficits in late-phase psychosis, as well as links with neuropsychological performance and symptoms.

Funding: This work was supported by the National Institutes of Health (MH094398 to R.K.).

Poster 2-101

AUDITORY PARABELT GRAY MATTER DEFICITS ARE RELATED TO IMPAIRED SELECTIVE ATTENTION IN FIRST-EPISODE PSYCHOSIS

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Descriptors: Gray matter, Selective attention, First-episode psychosis
Selective attention is impaired at the first episode of psychosis (FEP). Using EEG or MEG, selective attention can be measured with N1 modulation during an auditory oddball task, as N1 amplitude increases with attention. The difference between N1 amplitudes on attend vs ignore trials produces a negative difference (Nd). Our data show FEP have a reduced Nd, suggesting impaired modulation of N1 with selective attention. In this study, we source-resolved the Nd during an auditory oddball task and examined gray matter (GM) deficits in FEP within regions implicated by the source-resolved activity. While EEG and MEG were recorded, individuals either ignored tones while watching a silent movie (Ignore) or selectively attended the tones by pressing a button to every oddball tone (Attend). To estimate Nd source activity, differential source MEG activity between "ignore" vs "attend" conditions was estimated with MNE 100ms post-stimulus in 10 healthy controls (HC). The HCP Glasser parcellation was used to identify the region with maximum Nd source activity, which was the parabelt region. GM thickness within parabelt was estimated from T1w MRI data for 11 HC and 15 FEP. FEP had thinner GM in auditory parabelt (Cohen's $d = 0.7$). In FEP, a more impaired Nd was associated with less GM in the parabelt region in AC ($p = -.075, p = 0.001$). No such correlation was found in HC ($p > .05$). This suggests impaired N1 modulation with selective attention in FEP is related to GM deficits in the auditory parabelt region.

Funding: Supported by NARSAD and NIH R01 MH108568, P50 MH103204.

Poster 2-102

STRESS EFFECTS ON WORKING MEMORY IN SCHIZOPHRENIA

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Michael Green¹; Kenneth Subotnik¹; Joseph Ventura¹;
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Descriptors: Schizophrenia, Stress, Working Memory
The impact of stress on working memory (WM) and associated psychophysiological mechanisms in schizophrenia (SZ) has yet to be clarified. Specifically, it is unknown whether social evaluative stress may affect WM differentially in SZ than in healthy comparison subjects (HC) due to an aberrant HPA axis stress response or compromised cognitive functioning. Before and after induction of social evaluative stress, 78 SZ patients and 60 HC provided salivary cortisol samples and completed an N-back task to assess WM. In subsamples of 42 SZ and 24 HC, EEG was recorded during each WM task. Cortisol and P300 amplitude were examined in relation to group differences in pre- and post-stress WM. Overall, SZ performed more poorly than HC on the pre-stress and post-stress WM tasks. As predicted, stress effects on WM differed in SZ: whereas HC performance was unchanged following stress induction, SZ performance declined significantly. The groups did not differ on pre-stress salivary cortisol, but SZ showed attenuated cortisol reactivity following stress. However, cortisol did not mediate group differences in WM at either time point. The groups also did not differ on mean P300 amplitude at either time point, nor did P300 amplitude mediate group differences in WM. These findings suggest that moderate stress has more disruptive cognitive effects in SZ than in HC and that this difference is not explained by availability of processing resources, as indexed by P300. Cortisol reactivity appears blunted in SZ but does not appear to account for group differences in stress effects on WM.

Funding: This research was supported by NIH Grant P50-MH066286, as well as a UCLA Graduate Research Mentorship Award.

Poster 2-103**BETTER WITH AGE: AGE PREDICTS PARASYMPATHETIC NERVOUS SYSTEM PATTERNS REGARDING MOOD INDUCTION AND REPAIR**

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Cleveland State University

Descriptors: Respiratory Sinus Arrhythmia, Emotion Regulation, Age
The literature identifies parasympathetic nervous system (PNS) activity as a marker of emotion regulation (ER) capacity in depression and may further elucidate ER deficiencies associated with the disorder. Rumination is commonly associated with depression and utility of positive memories (PM) has mixed efficacy for dysphorics. Given the confluence of processes involved with the two ER responses, we sought to examine the role of the PNS in rumination sabotaging use of PM. Fifty-four community-dwelling adults completed a self-report depression rating, an interview regarding negative, positive, and neutral memories within the past three months, and a laboratory protocol. Protocol involved participant's recalling and verbally recounting a neutral memory (NM) and a stressful memory (SM). Participants were randomly assigned into two conditions: one where participants dwelled on SM prior to recalling PM ($N = 28$) and one where they recalled PAM after SM ($N = 26$). PNS activity in the form of respiratory sinus arrhythmia (RSA) was derived from electrocardiogram. Repeated-measures MANOVA revealed a significant association between age and changes in RSA between protocol tasks ($F(2,48) = 5.3, p < .01$). Specifically, age predicted RSA augmentation from NM in response to the SM ($b = .02, p = .02$), and withdrawal from recalling PM in response to SM ($b = -.02, p < .01$). Depressive symptoms and condition type were found to be unrelated. Our results demonstrate the PNS's protective role in response to negative mood induction in the pattern of increased activity during mood induction with regards to aging.

Poster 2-104**WHAT ELECTRODE SITES MAXIMIZE STATISTICAL POWER FOR THE ERN, LRP, MMN, N2PC, N170, N400, AND P300?**

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Descriptors: ERP, Electrode Site
The analysis of event-related potential (ERP) data requires researchers to make a number of decisions that can greatly influence the ability to detect a statistically significant effect. One of these is the choice of which electrode site(s) to use in measuring the ERP waveform. In some studies, researchers measure from a single electrode site, often chosen either on the basis of the previous literature or on where the component was most prominent. An alternative approach is to measure from a composite electrode site created by averaging across multiple electrodes within a spatial region. This approach is thought to decrease noise to allow more accurate measurement of the ERP component. Despite the widespread use of both of these approaches, there has been no systematic evaluation of the impact of these methods on statistical power (i.e., the ability to detect differences in ERPs between conditions or groups). In the current study, we directly compared these two approaches of quantifying ERPs based on single sites versus composite sites for seven ERP components: the ERN, LRP, MMN, N2pc, N170, N400, and P300. We also examined the consistency of these results across conditions of varying effect magnitudes, sample sizes, and numbers of trials, which we simulated with real data using a Monte Carlo approach. Results will be provided on the role of each of these factors in determining which analysis method is optimal. We also provide practical guidelines researchers can use to determine which electrode site selection method may maximize their statistical power.

Funding: SDSU/UCSD JDP Travel Funds.

Poster 2-105**BINAURAL INTERACTION IN HUMAN AUDITORY BRAINSTEM RESPONSE DETERMINED WITH TASK MODALITY, LATERAL STIMULATION VARIABILITY, AND SOUND FREQUENCY**

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Tokyo Gakugei University

Descriptors: binaural interaction, auditory brainstem response, attention
The waveform discrepancy between a binaural response and the sum of monaural responses in the ERPs is termed binaural interaction. The DN1 is the primary binaural interaction component in the human auditory brainstem response that expresses binaural amplitude being smaller than the summed monaural amplitude occurring at and after wave-V latency. The present study observed the effects of task modality and lateral stimulation variability on the DN1 in reference to sound frequency of stimuli. Sixteen right-handed participants received either low-passed (< 1000 Hz) or high-passed (2000 Hz $<$) clicks by monaural left, right, and binaural stimulation at 30 dB SL. Two experimental conditions were set for each stimulus category (i.e., low-passed or high-passed clicks). In a variable lateral condition, the binaural and monaural clicks were presented randomly with an equal probability. In a stationary lateral condition, a train of clicks was delivered only to one lateral position among the three. The stimulus onset asynchrony was at 180 ms. Participants conducted two attention tasks (auditory and visual tasks) during each experimental condition for each stimulus category. For the two kinds of clicks, the detection of DN1 amplitudes as compared to zero voltages was easier in the auditory task than in the visual task. Restricted to low-passed clicks, the variable lateral condition made the DN1 amplitudes difficult to be found. The present outcomes suggest the modulation of the human DN1 by the task modality and lateral stimulation variability dependent on sound frequency of stimuli.

Poster 2-106**EVENT-RELATED POTENTIALS TO SPEECH SOUND CHANGES DURING NOCTURNAL SLEEP**

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University of Jyväskylä

Descriptors: event-related potentials, auditory change detection, sleep
The sleeping human brain has the ability to react to behaviorally relevant stimuli such as a person's own name. It is not known, however, if behaviorally irrelevant speech sounds, such as foreign speech sounds, are processed during sleep. Here we investigated whether adult humans can detect changes in foreign speech sounds during nocturnal sleep. 20 Finnish-speaking participants slept in the laboratory for four consecutive nights. When the participants were in light non-REM sleep (S2), Chinese lexical tones were presented to them via a loudspeaker, and event-related potentials (ERPs) to the sounds were recorded (Fpz, C3 and C4 electrodes). The sound series consisted of a frequently occurring 'standard' speech sound (/a/) and two rare 'deviant' sounds of either small or large tonal change compared to the frequently occurring standard. MMN (120-200 ms post stimulus), P2 (200-280 ms post stimulus), P400 (340-420 ms post stimulus) and late negative wave (620-700 ms post stimulus) were analyzed from the second night's recording. The ERPs showed that the foreign speech sound features were discriminated by the brain during S2 sleep. MMN was elicited to both small and large changes. The P2 and late negative wave differed between the standard and deviant responses for the large change. The results suggest that change detection in unfamiliar speech sounds is not restricted to awake state but occurs also in nocturnal sleep.

Funding: The research was supported by the Academy of Finland (grant number 273134 to PA).

Poster 2-107
ELECTROPHYSIOLOGICAL CORRELATES OF SEMANTIC ASPECTS OF CORTICAL OBJECT REPRESENTATIONS: A STEADY STATE VISUALLY EVOKED POTENTIALS STUDY

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Descriptors: SSVEP, EEG, Object Representations

This high-density EEG study ($N = 18$) examined neuronal correlates of semantic versus perceptual aspects of cortical object representations. We used an adaptation design combined with steady state visually evoked potentials (SSVEPs). SSVEPs are evoked oscillatory cortical responses at the same frequency as visual stimuli flickered at this frequency. Adaptation is the result of sequentially presenting two equal or similar stimuli activating the same or overlapping neuronal subpopulations, indexed by decreased SSVEP amplitudes in response to the second stimulus. We presented realistic drawings of familiar objects or words describing the objects twice with a randomized number of intervening stimuli – all flickered at 15 Hz to elicit SSVEPs. Contrasting SSVEPs after first presentation of pictures versus second presentation of pictures after pictures, we investigated adaptation to perceptual repetition (PR). Contrasting SSVEPs after first presentation of pictures versus second presentation of pictures after words, we investigated adaptation to semantic repetition (SR). PR was associated with adaptation only at left occipital electrodes. SR was associated with adaptation at left occipital and centro-parietal electrodes. Therefore, processing perceptual versus semantic aspect of objects share neuronal correlates but processing semantic aspects involves additional networks. Source analysis revealed right inferior and middle temporal gyrus, left and right lingual gyrus and cuneus, and right postcentral gyrus activation as additional networks recruited during semantic processing.

Poster 2-109
CHARACTERISTICS OF BRAIN WAVES AND HEART RATE VARIABILITY WHEN HAVING SLEEP DIFFICULTIES: USING THE FIRST NIGHT EFFECT IN SLEEP EXPERIMENTS

Toshiro Mizuta; Ibuki Takahashi; Fumihito Morimoto;
 Yasuko Omori
 Jin-ai University

Descriptors: sleep difficulties, the first night effect, ERP

When sleeping in a laboratory, the first night effect is observed. This effect includes the extension of sleep onset latency and light sleep. In this experiment, stimulus reactivity during sleep difficulties was examined by using ERP and heart rate variability. Participants were 7 university students. They participated in an overnight sleep experiment conducted twice within three days. On both nights, a 500Hz pure tone (the presentation percentage = 90%) and a 2500Hz pure tone (10%) were randomly presented using a bedside speaker. The subjective feelings of sleep were assessed just after waking up, by using the OSA Sleep Inventory. Moreover, EEG (C3/4, O1/2), and ECG were recorded. Polysomnogram measurement was conducted for 180 minutes after going to bed, and ERP, as well as the heart rate during sleep, were calculated. Participants got into bed at 24:00. The results indicated that the scores of "sleep onset and sleep maintenance" on the second night were significantly higher. In the sleep Stage 1, the negative potential was observed around 300ms in ERP, indicating no difference between the two nights. In the sleep Stage 2, although a negative potential was observed around 550ms on both nights, a relatively higher potential was shown on the first night, suggesting the possibility that attention mechanisms to external stimuli might be activated in sleepless conditions. Results indicated that the heart rate on each sleep stage tended to decrease as sleep become deeper. However, no difference was shown between the two nights.

Poster 2-110
RELATIONSHIP BETWEEN ALPHA (8-12 HZ) POWER (μ V2) AND COMPONENT SCORES ON THE PSQI

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Descriptors: Sleep, Alpha, PSQI

This study examined the relationship between a commonly used sleep scale and EEG to further understand the neurophysiological correlates of sleep deficiency. The Pittsburgh Sleep Quality Index (PSQI) is a 9-item self-report measure of global sleep disturbance. The scores are converted into seven component scores that assess different aspects of sleep quality, both positive and negative. Baseline EEG was recorded from 58 college-aged participants (39 women). Significant correlations between PSQI component scores and various scalp sites were observed. Daytime dysfunction was correlated with alpha at FZ ($r^2 = .304, p = .020$), F4 ($r^2 = .293, p = .027$), F8 ($r^2 = .265, p = .045$), FC3 ($r^2 = .339, p = .011$), FCZ ($r^2 = .325, p = .013$), FC4 ($r^2 = .292, p = .026$), C3 ($r^2 = .318, p = .015$), CZ ($r^2 = .332, p = .012$), C4 ($r^2 = .304, p = .022$), CP3 ($r^2 = .218, p = .036$), CPZ ($r^2 = .330, p = .014$), CP4 ($r^2 = .330, p = .023$), P3 ($r^2 = .317, p = .016$), PZ ($r^2 = .331, p = .015$), P4 ($r^2 = .310, p = .021$), T6 ($r^2 = .288, p = .033$). Alpha power was also correlated with total PSQI score at PZ ($r^2 = .302, p = .027$), P4 ($r^2 = .285, p = .035$). Left frontal alpha asymmetry (F4/F3) was related to Sleep Latency ($r^2 = .348, p = .008$), and greater sleep dysfunction, as indicated by higher PSQI total scores ($r^2 = .412, p = .001$). These results indicate that alpha power is associated with daytime dysfunction at several scalp sites. Implications for daytime dysfunction related to sleep disturbance and neurophysiology are discussed.

Poster 2-111
SOCIAL BONDING WITH AN ARTIFICIALLY INTELLIGENT SOCIAL ROBOT INFLUENCES OUTCOME VALUATION AS INDEXED BY A NEURAL MEASURE OF REWARD

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Descriptors: Human-Robot interaction, Social bonding, Social cognition

Humans rely on the ability to modulate reward-monitoring in different social contexts to adjust actions to reach desired outcomes. For example, when gambling in contexts where a stranger, as opposed to oneself, is awarded positive outcomes, reward-monitoring is attenuated as less value is assigned to the outcome. This difference in reward monitoring is indexed by an event-related potential (ERP) - the reward positivity (RewP) - generated over brain areas related to action monitoring based on reward valuation, and whose amplitude increases when receiving positive feedback. While RewP is influenced by the degree of familiarity between players and recipients of reward in human-human dyads, little is known about how RewP is influenced in social contexts where humans bond with social robots. Here, subjects performed a gambling task where they either gambled for themselves (*self-outcome*) or for a robotic agent (*other-outcome*), with whom they either did (*social bonding*) or did not familiarize with (*no social bonding*) before the task. We expected RewP to be greater for self- versus other-outcome in the no social bonding condition, but that this difference would not be present in the bonding condition. Contrary to expectations, there was no difference in RewP amplitude between self- or other-outcome in either condition, although the RewP was larger in the bonding condition, overall. The findings suggest that interactions with social robots can influence reward valuation, although possibly not in a manner that affects prioritization of self over other.

Poster 2-112

OUTCOME EVALUATION ON THREE-PERSON TIME-ESTIMATION TASK WITH SIMULTANEOUS EEG RECORDING

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Descriptors: outcome evaluation, group, emotion

Evaluative processing of action outcome is flexibly modulated by various social contexts. However, the characteristics of outcome evaluation in group situations remain unclear. The present study investigated the outcome evaluation in a three-person time-estimation task with simultaneous EEG recording. We compared groups of three participants with individual participants. The task was to accurately estimate one second intervals and participants were rewarded per trial with 10 JPY, if the majority (at least two out of three) responded correctly (otherwise they lost 10 JPY). (For individual participants two additional responses were generated by a computer.) A visual indicator displayed who responded correctly, and (simultaneous) EEG was recorded from outcome onset for all participants. Epochs were averaged over outcome (correct, error) and trial type (uniform, majority, minority) within subjects, and between context (group, individual). In both contexts, error feedbacks elicited larger feedback-related negativity (FRN) than correct feedbacks. Moreover, we created difference FRN by subtracting correct- from error-ERP. Difference FRN, which reflect emotional significance of the outcome, for uniform-trials (i.e., all collect or error) was larger than those for majority- and minority-trials in the group context, but not in the individual context. These results suggest that the sameness of action outcome in group situation enhances emotional significance of the outcome.

Poster 2-113

NEURAL SENSITIVITY TO PEER PRESENCE AMONG CHILDREN AND ADOLESCENTS WHO DIFFER ON WHETHER THEY HAVE AN AFFINITY FOR SOLITUDE: AN ERP STUDY

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Descriptors: ERP, peer presence, adolescents

Early adolescents who have an affinity for solitude (AFS; i.e., a non-anxious enjoyment of solitude) are thought to be at risk for negative adjustment (e.g., peer victimization) given the strong social norms of that age group. The purpose of this ERP study was to examine whether peer presence during a computer task would differentially impact AFS (N = 40, Mage = 11.30; high enjoyment of solitude, low social anxiety) versus control (N = 65, Mage = 11.16; low enjoyment of solitude, low social anxiety) early adolescent groups. Participants were randomly assigned to complete a Balloon Analogue Risk Task (BART) either alone or when they thought they were being observed by a peer. The BART is a computer task that elicits neural responses to wins vs losses. An ANOVA revealed a significant 2 feedback type (wins, losses) x 2 condition (alone, peer) x 2 group (AFS, control) interaction for the P3 amplitude, $p < .05$. Amplitudes were larger for losses than wins (consistent with other ERP studies), but this effect was significantly stronger in the peer condition versus alone condition for the AFS group only. The largest amplitudes in the AFS group were exhibited by the adolescents who reported low scores on a sociability measure (e.g., "It is easy for me to make new friends"). In contrast, adolescents in the AFS group who reported high sociability scores had amplitudes that were not significantly different from the control group. These results suggest that examining adolescents' underlying motivations for spending time alone is important when examining the association between AFS and adjustment.

Funding: The first author acknowledges funding received from Canadian Institutes of Health Research.

Poster 2-114

LEFT-EYEDNESS AS A POSSIBLE CORRELATE OF READING DISORDER: BRAIN MECHANISMS OF LANGUAGE PROCESSING

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Descriptors: left-eyedness, inferior temporal gyrus, language processing

Introduction. Role of eye dominance in language processing is usually not considered. This research is devoted to the brain mechanisms of language processing in left-eyed humans. **Methods.** 34 right-handed (20 right-eyed, R; 14 left-eyed, L) healthy participants were recruited to perform classical Stroop (CS), modified Stroop (MS) and Stop-signal tasks (StS). Both Stroop tasks consisted of the Russian words "red" and "green" written in red or green font and required to recognize a font color. In MS-task participants inhibited the response to the word "red" and responded only to the word "green". In StS participants distinguished between green consonants and vowels and ignored red letters. The fMRI data were obtained using a 3T scanner SIEMENS Magnetom Verio (T2*-weighted, 65 slices, TR/TE = 2200 / 25 ms, slice thickness = 2 mm, FA = 90°, MB 5, CMRR, block design) and processed using SPM12 ($p_{FWE} < 0.01$, cluster level). **Results.** The activated clusters were shown in the contrasts: MS > CS – right precuneus (L), right precuneus & right angular gyrus (R), MS > StS – left precuneus (L), StS > MS – left occipital pole (L), left inferior occipital gyrus & right occipital pole (R), StS > CS – left and right occipital poles (L), left and right inferior occipital gyri & right inferior temporal gyrus (R). **Conclusions.** Activation of right inferior temporal gyrus as a part of ventral stream seems to be related to letters recognition and might be insufficient in left-eyed humans. This fact may be a possible correlate of reading disorder such as dyslexia.

Funding: The research was financially supported by the Russian Science Foundation, project No 16-18-00066, and the Supercomputing Center of Lomonosov Moscow State University (non-financially). The research was partially financially supported by the Russian Science Foundation, project No 16-18-00066, and the Supercomputing Center of Lomonosov Moscow State University (non-financially).

Poster 2-115

HOW MOOD AFFECTS PROCESSING OF EMOTIONAL ADJECTIVES IN L1 AND L2: AN ERP STUDY

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Descriptors: Mood, Bilingualism

We investigate how positive or negative moods affect categorization of and ERPs elicited by positive, negative, or neutral adjectives presented either in one's native language (L1: German) or one's non-native language (L2: English). Participants viewed short, emotionally evocative movie-excerpts and were then visually presented with series of adjectives. EEG was recorded while participants performed a valence decision task on the words. Most words were categorized as positive and fewer as negative or neutral in L2, whereas in L1, words were categorized more often as positive or negative than as neutral, positive and negative not differing. The N400 ERP was larger in L1 than L2 and larger in negative than in positive mood. On the late positive potential (LPP) an interaction was found: In L1, particularly in positive mood, larger responses occurred for both positive and negative adjectives compared to neutral ones. In L2, by contrast, across moods largest LPPs were found for positive adjectives. This research specifies the effects of mood on the processing of emotion words in the native versus non-native language, extending previous sentence-level work. Results corroborate the idea of reduced processing of negative content in L2, laying the groundwork for future cross-linguistic research into mood-content interactions.

Poster 2-116**EFFECTS OF CONSCIOUSNESS AND TASK RELEVANCE IN FACE PROCESSING AS REVEALED BY ERPS AND fMRI**Torge Dellert^{1,2}; Miriam Müller-Bardorff¹; Michael Pitts³; Maximilian Bruchmann^{1,2}; Thomas Straube^{1,2}¹University of Muenster, ²Otto Creutzfeldt Center for Cognitive and Behavioral Neuroscience, ³Reed College*Descriptors:* consciousness, awareness, face processing

The search for the neural correlates of consciousness (NCC), i.e., the minimum neural mechanisms sufficient for one specific conscious percept (e.g., a face), has made remarkable progress in recent years. However, an ongoing challenge is disentangling conscious perception from task-related processes that precede or follow the experience (e.g., report). The present study employed simultaneous EEG and fMRI in order to dissociate the effects of consciousness and task relevance in face processing. In a no-report inattentional-blindness paradigm, participants went through three experimental phases. They began with a difficult distractor task during which line drawings of faces and control stimuli were presented centrally. While many participants spontaneously noticed the faces in phase 1, about forty percent of them reported inattentional blindness. In the second phase, all participants were made aware of the task-irrelevant faces, but continued with the same distractor task. In phase 3, the faces became task-relevant. ERP results showed that the N170 and visual awareness negativity (VAN) covaried with conscious perception, while the P3b component was primarily modulated by task relevance. In fMRI, conscious versus unconscious face processing increased fusiform gyrus and precuneus activity, whereas task demands recruited different brain regions including fronto-parietal networks. These findings inform contemporary theories of the role of the frontal cortex in conscious perception.

**FRIDAY, SEPTEMBER 27, 2019
POSTER SESSION III****Poster 3-001****EVENT-RELATED POTENTIALS TO SOUND INTENSITY CHANGES AS MARKERS OF OLD AGE DEPRESSION**Elisa Ruohonen; Saara Kattainen; Xueqiao Li;
Anna-Elisa Taskila; Chaoxiong Ye; Piia Astikainen
University of Jyväskylä*Descriptors:* ERP, depression, aging

Better diagnostic tools are needed to detect depression in older adults. Intensity dependence of auditory event-related potentials (ERPs) has potential as a diagnostic tool, because it has been suggested to reflect monoaminergic neurotransmission that is implicated in the pathophysiology of depression. Auditory ERPs can also be used to study sensory gating deficits related to aging. The aim of the present study was to disentangle aging and depression related changes in auditory ERPs. Depressed and non-depressed female participants were recruited from younger (18-40 years) and older (62-80 years) adult groups. ERPs to auditory intensity changes were measured in an oddball condition where a repeated standard tone was replaced by a rare deviant tone of different intensity. Two types of analyses were conducted: one investigating N1 amplitudes to rare and repeated tones (sensory gating) and the other investigating N1 differential responses to standard tones (high-intensity minus low-intensity; i.e. intensity dependence). Larger N1 responses to both repeated and rare tones were found in older depressed adults in comparison to younger control adults. In addition, the older depressed adults had larger N1 differential response compared to both younger groups. The findings indicate deficits of sensory gating and possible alteration in monoaminergic neurotransmission in older depressed adults.

Funding: Personal grant for PhD-work from Finnish Cultural Foundation.**Poster 3-002****ERP CORRELATES OF REDUCED SPATIAL WORKING MEMORY ENCODING CAPACITY IN HIGH-FUNCTIONING OLDER ADULTS**Makenna McGill; Rachel Scrivano; Paul Kieffaber
College of William & Mary*Descriptors:* Spatial Memory, ERP, Aging

Fluid cognitive abilities like spatial working memory are thought to be particularly vulnerable to age-related decline, and have been shown to decline throughout the adult lifespan. Research even suggests that spatial working memory should be considered when screening patients for suspected MCI and monitoring its progression. Despite being used for decades in either analog or computerized form, little is known about the electrophysiological correlates of spatial working memory encoding during the "span task". The current study measured ERPs time-locked to each stimulus in a simplified version of the spatial span task in both younger and high-functioning older adults. Behavioral results show that older adults exhibited a small, but significant reduction in working memory capacity. ERP results show that an ERP positivity recorded over frontal electrode sites, and peaking around 600 ms, increased linearly with the temporal position of the stimulus in the sequence. The amplitude of this ERP component was reduced in older adults and correlated with measures working memory capacity. These findings are discussed in the context of growing interest in the development of ERP-based neuromarkers of cognitive aging.

Poster 3-003**CONSONANCE CAPTURES ATTENTION MORE STRONGLY THAN DISSONANCE WHEN ATTENTIONAL RESOURCE IS INSUFFICIENT: ERP AND THREE-TONE ODDBALL PARADIGM STUDY**Motoyuki Sanada^{1,2}; Takayuki Kuwamoto¹; Jun'ichi Katayama^{1,2}
¹Kwansei Gakuin University, ²Center for Applied Psychological Science CAPS*Descriptors:* attention, ERP, odd-ball task

Consonance and dissonance are defined by mutual relationships among multiple notes, and they give us different impression. Previous researches have submitted some findings about their perceptual processing; for example, their discrimination starts at very early stage in auditory perception (Bidelman, 2013), and this process depends on innate mechanism (Izumi, 2000), but it can be affected by postnatal experience (Itoh et al., 2010). To this date, however, it is unclear how they differ in influence on higher cognitive function, like attention. Current study focused on their effect on attentional capture, thus used them as task-irrelevant stimuli in three-tone oddball paradigm and recorded ERP during the task. In addition, main task difficulty was manipulated (easy and difficult conditions), and participants were divided into two groups by experience of musical training (over three years or not). The results showed that amplitude of P3a, an ERP component reflected attentional capture by task irrelevant stimulus, was larger in consonance than in dissonance condition, but only when main task was difficult. Furthermore, we did not find any effect of musical training. The former result means that consonance captures our attention more strongly than dissonance, but it occurs when most of attentional resource is used for main task. The latter result indicates that the difference of attentional capture between consonance and dissonance is irrespective of musical training.

Funding: This study was conducted as part of the project supported by the MEXT, JAPAN, for the Strategic Research Foundation at Private Universities (2015-2019; Project number S1511032) to the Center for Applied Psychological Science (CAPS), Kwansei Gakuin University. Part of this study was also supported by JSPS KAKENHI (No.17K13968) awarded to MS.

Poster 3-004**USING MATHEMATICAL MODELS FOR QUANTIFYING EVENT-RELATED ELECTROPHYSIOLOGICAL RESPONSES**Anna-Lena Tebbe^{1,2}; Nathaly Czernin¹; Andreas Keil¹¹University of Florida, ²Max Planck Institute for Human Cognitive and Brain Sciences*Descriptors:* EEG, Naturalistic scenes, Statistical modeling

Emotional modulation of visual perception measured with EEG has been reliably observed in a variety of psychological and neuroscientific paradigms in both frequency and time domain. Processing of sensory signals is known to be sensitive to semantic content, predictive value, and basic physical scene statistics. Here, we present two techniques to characterize and estimate neural responses of the visual system to affective stimulus content. The first method quantified the neural contrast-response function (CRF) evoked by complex naturalistic stimuli of varying luminance contrast, as a metric of lower-level visual processing. CRFs were modeled by fitting Naka-Rushton functions to sweep steady-state visual evoked potentials. Results ($n = 18$) show picture type specific amplification of the CRF for faces compared to naturalistic scenes. The second method used simple inverse solutions (deconvolution, ridge regression) to map EEG data ($n = 25$) evoked by a rapid picture stream with variable inter-trial intervals onto predictor models based on stimulus features, i.e., physical characteristics (complexity), semantic categories, and subjective ratings (valence, arousal). For each technique, we report internal consistency and sensitivity to known experimental effects.

Poster 3-005**PROACTIVE VERSUS REACTIVE DISTRACTION FILTERING UNDER THREATENING CONDITIONS: EVIDENCE FROM A COMBINED EEG AND EYE-TRACKING STUDY**Salahadin Lotfi; Madeline Rech; Richard Ward; Maryam Ayazi;
Christine Larson; Han-Joo Lee
University of Wisconsin, Milwaukee

Descriptors: proactive Cognitive Control, event-related potentials, anxiety
Proactive distraction filtering (PDF) preemptively modulates selective target processing, whereas reactive distraction filtering (RDF) relies on late adjustments of attentional control in response to distractors. While it is well documented that anxiety disturbs attentional processing, it is unclear whether it would distinctively impact these two modes. This two-phase study aimed to examine behavioral, eye-gaze and neural correlates of PDF and RDF under safe and threatening conditions. The study utilizes flanker task with three blocks that vary in the level of incongruent/distracting information: no distraction (only central target arrow); low distraction (mostly congruent trials); high distraction (mostly incongruent trials). The results showed PDF is beneficial when distraction presents, however, its recruitment isn't without costs when expected distraction is absent. Particularly, compared to RDF, PDF showed a slower RT to no distraction and prolonged eye fixations on the central target with reduced attention deployed toward the peripheral area. However, N2 amplitude was lowest in RDF compared with PDF, attesting that PDF preemptive mode of distraction control was in operation in anticipation of forthcoming distractors with lower conflict. With threat of shock, the second study revealed opposite results with significant lower magnitudes under threat of shock relative to safe. There was a significant enhancing effect of shock on RDF, but not PDF, such that shock disturbs preemptive distraction processing while facilitating readjustment to unexpected distraction stimuli.

Funding: This study was supported through a faculty fund to Dr. Hanjoo Lee.

Poster 3-006**RETROACTIVE ATTENTIONAL ORIENTING AND CONCURRENT MOTOR SELECTION: HOW COMPLEX STIMULUS-RESPONSE MAPPINGS PROMOTE WORKING MEMORY GUIDED ACTIONS**Daniel Schneider; Marlene Rösner; Laura-Isabelle Klatt;
Edmund Wascher

Leibniz Research Centre for Working Environment and Human Factors

Descriptors: working memory, selective attention, motor selection

Working memory enables us to actively store mental representations of past information to guide future cognitive operations and actions. Here, we investigated the sequence of attentional and motor selection processes in visual working memory by means of oscillatory EEG parameters. Participants stored either two, three or four objects in working memory and subsequent retroactive cues (retro-cues) indicated either one or two items as task-relevant. Afterwards, participants judged if a memory probe matched (one of) the cued item(s). Both accuracy and response times to the memory probes benefitted from retro-cuing only one item. On EEG level, a posterior hemispheric asymmetry in alpha oscillatory power (8-13 Hz) relative to cued vs. non-cued positions reflected the retroactive orienting of attention. Furthermore, neural oscillations were clustered on the level of independent components (ICs) in the EEG signal. An IC cluster featured the oscillatory response in mu (10-14 Hz) and beta (15-25 Hz) frequencies with an estimated source in sensorimotor cortex contralateral to response side. Simultaneous to the alpha power asymmetry following the retro-cues, this cluster showed a stronger suppression of mu/beta power when only one item was cued. Importantly, this correlate of motor selection appeared although the required response could not be anticipated at this point in time. These results indicate that attentional selection in working memory can include the concurrent generation of multiple, alternative stimulus-response mappings, thereby facilitating future goal-directed actions.

Poster 3-007**MODULATION OF NEUROELECTRIC MARKERS DEPENDENT ON TIME SPENT IN NATURAL ENVIRONMENTS**Rachel Hopman^{1,2}; Sara LoTemplio¹; Emily Scott¹; David Strayer¹
¹University of Utah, ²Northeastern University

Descriptors: Oscillatory EEG, Environmental Exposure, Posterior Alpha
According to the attention restoration theory, spending time in natural environments can restore cognitive functioning, decrease stress, and improve cognitive performance. Previous research shows prolonged exposure to natural environments changes cognitive processing and neural activity. Specifically, electroencephalography (EEG) research shows those who have spent prolonged time in natural environments have increased power in neural regions associated with attentional engagement and lower physiological arousal compared to urban environments, thus reflecting physiological differences from environmental exposure. However, research has yet to determine the time course of the restorative experience, and has yet to explore other neural correlates, such as alpha power (8-12 Hz) in the occipital region. Changes in posterior alpha power reflect changes in attentional processing – decreased alpha power suggests engagement of visual attention towards the environment. In these studies, EEG was collected during a resting baseline period from participants ($N = 36$) before, during, and after a four-day nature trip to determine changes in neuroelectric activity across a prolonged period in natural and urban environments. Posterior alpha power, extracted using a fast Fourier transform, significantly decreased ($p < 0.01$) from pretrip testing each day of the nature exposure compared to before and after the trip, whereas midfrontal theta power did not significantly change across days. These findings show that exposure to natural environments influences orientation of visual attention at rest.

Poster 3-008
RETINOTOPIC MAPPING OF ATTENTION FIELD IN THE HUMAN BRAIN

Martine Desjardins¹; Jean-Marc Lina²; Jean-Francois Gagnon¹; Pierre Jolicoeur³

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³Université de Montréal

Descriptors: cortical source, visual field, spatial attention

Stimuli located in the lower visual field are processed more accurately than stimuli in the upper VF. N2pc, a lateralized visual event-related potential reflecting visual spatial attention, is larger for attended stimuli in the lower VF compared with upper VF. The causes of this upper/lower VF effect on N2pc amplitude remain poorly understood. Our goal was to clarify the upper/lower VF effects in attentional tasks by mapping their cortical sources using MEG for 16 subjects performing a visual search task. Ten stimuli, including 1 colour singleton (target) were placed on an imaginary circle centered at fixation. There were 8 possible target locations, 4 in left VF and 4 in right VF, 2 above and 2 below the horizontal midline in each L-R hemifield. Cortically-constrained source reconstruction suggested attention-related activity was stronger in the posterior fusiform when the target was closer to the horizontal meridian. Activation was stronger when the target was in the lower VF compared with the upper VF in the superior parietal lobule. Activity found in a more restricted selection on the occipital superior gyrus also showed a polarity reversal for targets in the upper VF versus the lower VF. Our results highlight the importance of considering specific target positions in attention experiments and can provide a partial answer regarding the effects observed in EEG and MEG between the upper VF and lower VF, which appear, in part, to reflect different retinotopic mappings of stimuli in upper versus lower VFs.

Funding: CMER RNQ 13-14-021.

Poster 3-009
THE EFFECTS OF EXPERTISE ON THE RELATIONSHIP BETWEEN MENTAL WORKLOAD AND ATTENTIONAL RESERVE

Kyle Jaquess^{1,2}; Li-Chuan Lo^{2,3}; Hyuk Oh²; Clayton Domingues⁴; Jing Zhang²; Bradley Hatfield²

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Descriptors: EEG, ERP, canonical correlation

The limited cognitive resources of humans can be broadly divided into two categories: those which are used to perform task functions ("mental workload"), and those which remain unused ("attentional reserve"). These two concepts are considered to have an inverse relationship which only recently has been empirically observed. However, whether between-subject factors, such as expertise, impact this relationship remains unclear. To address this gap, 19 skilled pilots and 27 novice pilots completed three simulated flight scenarios of varying difficulty (easy, medium, and hard) while cortical activity via electroencephalography and task performance were monitored. As in prior work, mental workload was assessed via spectral measures of cortical activation, and attentional reserve was assessed via amplitudes of event-related potentials evoked by task-irrelevant sounds. The data revealed that, as task difficulty increased, mental workload tended to increase while attentional reserve tended to decrease for both groups. Furthermore, while both groups displayed a strong negative relationship between measures of mental workload and attentional reserve, illustrating its broad generalizability, the strength of the relationship was slightly, but significantly, stronger for the novices than for experts. This result supports the notion that between-subject factors, such as expertise, can impact the strength of the relationship between mental workload and attentional reserve. However, due to the small size of the effect, the practical significance of this difference is limited.

Funding: Lockheed Martin Corporation, U12001B, Hatfield, B.D. (PI) Dates: 3/1/2014 to 2/28/2015 Title: Objective assessment of cognitive workload in flight tasks as a result of flight simulation demand and expertise (phases 3 and 4). Total award: \$150,000.00 Project location: United States Naval Academy, Annapolis, MD and University of Maryland, College Park Role: Researcher The aim of the project is to provide a valid biomarker of cognitive workload, derived from electroencephalography (EEG), eye tracking, and cardiovascular activity under conditions of varying mental challenge, which is robust for employment in operational environments.

Poster 3-010
NOVELTY P3 AMPLITUDE DIFFERENTIATION FOR FOOD AND NON-FOOD STIMULI

Yael Cycowicz; Ida Jamshidy; Weiru Xu;
Diana Rodriguez Moreno

Columbia University/New York State Psychiatric Institute

Descriptors: orienting, novelty P3, food

In recent years there has been a dramatic increase in the prevalence of overweight and obese individuals around the world. In our obesogenic environment the abundance of food cues may result in unhealthy food-related decision making. While the etiology of obesity is multifactorial, we postulate that increased attention to food cues may contribute to over-eating. The present study examined novelty P3 responses to biologically significant stimuli (food) and compared them other neutral stimuli. Modulation of novelty P3 responses to infrequently occurring stimuli has been suggested to reflect variation in orienting and attention-capture of those rare events. Specifically, novelty P3 amplitude reflects stimulus saliency and the degree in which there will be further processing. In this study, young adults performed a visual novelty oddball task. They were asked to press a button for rare (16%) red square target stimuli presented among frequent (68%) blue circle stimuli. They were not informed about the occurrence of infrequent (16%) novel stimuli (food and neutral objects). Both food and neutral object stimuli elicited a typical Novelty P3, with a more frontal scalp distribution than the P3 elicited by targets. However, food stimuli elicited novelty P3 with larger amplitude than neutral object stimuli, thus providing a neurophysiological basis for the saliency of food stimuli. Therefore, this simple paradigm could potentially be used to assess attentional basis of unhealthy food choices leading to obesity and various eating disorders.

Poster 3-011
USING ECOLOGICAL MOMENTARY ASSESSMENT AND WEARABLE PSYCHOPHYSIOLOGICAL MEASUREMENT TO EXAMINE THE EFFICACY OF COGNITIVE BEHAVIORAL THERAPY FOR PANIC DISORDER

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Descriptors: Anxiety, Panic disorder, symptoms

Studies of the efficacy of cognitive-behavioral therapy (CBT) for anxiety rely on retrospective recall of symptoms and the use of aggregate sum scores, which are prone to bias and may mask potential differences in individual symptoms. These methods limit our understanding of how CBT has its effect. The present study addressed these limitations by using ecological momentary assessments (EMA) and psychophysiological measurements to examine the effects of treatment on individual symptoms of panic disorder (PD) in daily life. Patients ($n = 20$) completed EMA on their smartphones five times per day for two weeks pre- and post CBT while wearing a device collecting blood volume pulse, electrodermal activity and temperature. Patients rated core panic symptoms in five categories. All symptom scores exhibited significant reductions in both within-person mean (mean differences 0.55-0.90, all $ps < 0.04$) and within-person standard deviation (mean differences 0.46-0.71, all $ps < 0.01$), suggesting that symptoms reduced in both severity and variability after CBT. The largest reductions in both mean severity and variability were seen for emotion-related symptoms (i.e., feeling anxious or panicky) ($d = 0.80$ and $d = 1.01$, respectively). Corresponding psychophysiological responses will also be presented. Our findings suggest that CBT reduces PD symptoms, and that experience sampling methods provide unique opportunities for gaining insight into anxiety symptomatology. Future directions for using EMA and wearable psychophysiological devices to enhance the delivery of CBT will be discussed.

Funding: KL2/Catalyst Medical Research Investigator Training (CMerIT) Award from Harvard Catalyst/The Harvard Clinical and Translational Science Center (National Center for Research Resources and the National Center for Advancing Translational Sciences, National Institutes of Health Award.

Poster 3-012
EFFECTS OF INCREASED HEART RATE VARIABILITY ON BAROREFLEX SENSITIVITY AND CONTINGENT NEGATIVE VARIATION

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Descriptors: Heart rate variability, Baroreflex sensitivity, Contingent negative variation

This study investigated the hypothesis that an increase in heart rate variability (HRV) enhances baroreflex sensitivity (BRS), and is associated with cortical excitability evaluated by contingent negative variation (CNV). Healthy college students and young adults ($N = 28$) participated in this study. EEG, ECG, respiration, and continuous blood pressure data were collected during a 5-min baseline period followed by four successive 5-min sessions of paced breathing at a rate of 0.1 Hz (HRV condition) or four successive 5-min sessions of observing video clips of natural scenery (control condition). After conducting each condition, as the measures of EEG corresponding to attention and expectation, CNV was obtained using a constant foreperiod reaction time paradigm. The standard deviation of the normal sinus initiated R-R interval of ECG (SDNN) increased significantly only during the HRV condition, which indicated that the paced breathing technique effectively induced an increase in HRV. Moreover, the CNVs at Fz and Cz in the HRV condition were significantly higher than in the control condition, whereas BRS was significantly enhanced only during HRV condition. These results suggest that the increased HRV elicited by paced breathing stimulates autonomic baroreflex function and is associated with cortical excitability.

Funding: This work was supported by JSPS KAKENHI Grant Number 16K04395.

Poster 3-013
COMPARING THE SALIENCE OF MONETARY VERSUS CANDY REWARDS: A REWARD POSITIVITY (REWP) STUDY

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Descriptors: Event-Related Potentials, Reward Processing, Food

A poor diet is associated with negative physical and mental health consequences; therefore, it is important to understand what factors guide diet decisions, like the rewarding properties of food. Little is known about what happens at the neural level when individuals are rewarded with or lose a desirable food and how it compares to other rewards, such as monetary reward. We tested possible differences in Reward Positivity (RewP; an event-related potential reflecting reward processing) when individuals were rewarded with or lost money or food. Participants ($N = 62$, $M(SD)_{age} = 20.45(1.96)$, 55% female) completed neutral, monetary, and food-based tasks in counterbalanced order. Feedback was randomized so participants were correct on 50% of trials. Participants were told if they were correct or not on the neutral task, rewarded with one dollar for every 5 correct choices and lost a dollar for every 10 incorrect choices on the money task, and rewarded with a candy rated highly on a personal-preference scale for every 5 correct choices and lost a candy for every 10 incorrect choices on the candy task. A 3-Task (neutral, money, candy) by 2-Trial (reward, loss) ANOVA showed a main effect of Trial, with a more positive RewP amplitude for reward than loss trials ($p < .001$). No other effects or interactions were significant ($ps > .26$). While receiving positive feedback, money, or a desirable candy is rewarding, the salience of those rewards may not differ from each other at a neural level. Future studies comparing types of food to each other (high- vs. low-calorie) are warranted.

Funding: Brigham Young University Graduate Student Mentoring Award.

Poster 3-014
EVENT-RELATED POTENTIAL INDICES OF TARGET DISCRIMINATION AND DISTRACTION DURING COGNITIVE CONTROL

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Descriptors: Go/NoGo task, Flanker task, ERPs

Cognitive control includes the ability to selectively monitor conflicting stimulus information, the selection of appropriate context-dependent responses, and the inhibition of inappropriate response options. We examined Event-Related Potential (ERP) indices of cognitive control obtained for a combined Go/NoGo-Flanker task. Participants were instructed to respond (button press) based on the direction (up/down) of a central target arrow stimulus (Go trials), and withhold their response if the target was a two-sided arrow (NoGo trials). Non-target flankers were presented alongside the target stimuli (arrows or rectangles). ERPs were compared among the following task trial types: Go trials with congruent, incongruent, or neutral flankers; and NoGo trials with arrow flankers. Larger frontal N2 amplitude (250 msec post-target) was observed for Go trials with incongruent flankers in comparison with other trial types, in line with an interpretation that N2 is associated with conflict monitoring. In comparison with other trial types, NoGo trials with arrow flankers elicited larger amplitudes for frontal-central P3 and a late central-parietal negativity (680 msec post-target). These effects may reflect motor inhibition and post-decision monitoring, respectively. Finally, Go and NoGo trial types that included arrow flankers all had a larger anterior positivity and posterior negativity beginning at about 70 msec post-target, in comparison to Go trials with neutral flankers. This effect may reflect initial sensory gain control that discriminates directional vs. neutral flankers.

Funding: This work was supported in part by grants from the National Multiple Sclerosis Society and the Mark Diamond Graduate Research Fund.

Poster 3-015
NEITHER WRONG NOR RIGHT: ENHANCED PERFORMANCE MONITORING UNDER CONDITIONS OF UNCERTAINTY

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Descriptors: Performance Monitoring, Uncertainty, Electroencephalogram (EEG)

The brain's performance monitoring system monitors ongoing actions and signals the need for cognitive control in the face of uncertainty. Performance monitoring has typically been studied using the flanker task wherein a single optimal behaviour exists. However, real-world performance monitoring occurs in contexts where there is not a single best option. The present study examined performance monitoring in the context of certain and uncertain responses in 62 adults. We modified the flanker task such that, in addition to arrows pointing left or right, we instructed participants to respond to some stimuli for which there would be no right or wrong responses (i.e., ambiguous trials). Neural indices of performance monitoring were examined in both the temporal (error-related negativity [ERN] and correct-related negativity [CRN]) and spectral domains (theta and delta power) on error, correct, and ambiguous trials. Individual differences in performance monitoring were assessed by examining associations between intolerance of uncertainty (IU) and neural responses. Ambiguous responses elicited a relative negativity in the event-related potential waveform that was smaller than the ERN and CRN. These ambiguous trials—on which there was no right or wrong answer—also elicited increases in theta and delta power relative to correct trials. Greater IU was associated with increased performance monitoring on correct and ambiguous trials. These findings indicate ongoing performance monitoring and execution of cognitive control under conditions where the accuracy of our actions is unknown.

Funding: This work was supported by the Canada Research Chairs Program awarded to A. Weinberg. This work was also supported by a Healthy Brains for Healthy Lives Graduate Student Fellowship awarded to A. Sandre.

Poster 3-016
MULTILEVEL PROCESSES OF ERROR MONITORING IN DUAL-TASKING

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Descriptors: Dual-tasking, Error-related negativity, Error positivity
Dual-tasking scenarios feature a number of characteristics that set them apart from conventional choice-response paradigms with only one task per trial. Recent evidence suggests that the close temporal succession causes the two tasks to be processed, at least partly, in a conjoint way. This raises questions on the independence of subtask-specific error monitoring as well as on how error monitoring is implemented on the level of the superordinate dual-task set. We investigated two correlates of error monitoring, the error-related negativity (Ne/ERN) and the error positivity (Pe), by utilizing variations of the PRP paradigm in two EEG experiments. In Experiment 1, we examined whether the error monitoring system elicits independent error signals when participants respond to the task at exactly the same time and errors occur in both tasks concurrently. We found the Ne/ERN and the Pe to be integrated into one combined error signal. In Experiment 2, we investigated how the error monitoring system handles errors that emerge on the level of the dual-task set. To this end, we measured the Ne/ERN and Pe in order reversals, in which the individual subtasks are executed correctly but in the wrong order, and found a sustained negativity with similar topography as the Ne/ERN on such trials. In contrast, the Pe on order reversals followed a similar time course as in conventional errors. Together, these results point towards a hierarchical structure of error monitoring in dual-tasking.

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Poster 3-017
VALENCE AND TASK DIFFICULTY EFFECTS ACROSS FLANKER AND STROOP TASKS

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Descriptors: Cognitive Control, Emotion-Cognition Interactions, Event-Related Potentials (ERPs)
When investigating effects of task-irrelevant negative emotion on cognitive control, rarely are multiple cognitive control tasks compared within the same sample of participants. Nonetheless, interference effects across these tasks are often assumed to be caused by similar mechanisms. In this study, participants (n = 41) completed two versions of emotional flanker tasks (color word flanker task (CWF) and traditional flanker task with word primes (FLK)) and the emotional Stroop task with two, three, or four response options while high-density, 64-channel EEG was recorded. Reaction times were slower on incongruent trials compared to congruent trials on both flanker tasks, and RTs got significantly slower as response options increased across Stroop tasks, all p's < .05. No main effects or interactions were found for valence on RT in any task. Incongruent trials on the CWF evoked larger N100 responses than congruent trials, p < .05, and neutral trials evokes larger P200 responses than negative trials, p < .05. On the FLK task, incongruent trials evoked larger N200 and smaller P300 responses than congruent trials, p's < .05. On the Stroop tasks, negative trials evoked larger P200 responses than neutral trials, trending toward significance, p = .07. How emotion interacts with stimulus processing across these tasks may not be as similar as is assumed in the literature. As such, it is important to consider when task-irrelevant negative emotion appears relative to the response stimulus and the difficulty of the task.

Poster 3-018
CARBOHYDRATE MOUTH RINSE DOES NOT AFFECT NEUROELECTRIC AND BEHAVIORAL INDICES OF COGNITION

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Michigan State University

Descriptors: Carbohydrate Mouth Rinse, Action Monitoring, Inhibitory Control

There is a growing market for carbohydrate mouth rinse solutions, which have been purported to enhance not only physiological performance but also to induce increases in cognitive performance. In particular, the supposition is that the use of these rinses results in an increase in attention and greater activation of the anterior cingulate cortex. However, much of the research in this area has been conducted in small samples, without appropriate controls, and using weak assessments of cognitive function. Using a double-blind, within-subjects randomized cross-over design, the aim of the present study was to examine the extent to which use of a carbohydrate mouth rinse solution incurred changes in neuroelectric & behavioral indices of cognition, relative to a taste-matched placebo control. Fifty college-aged adults were brought in on separate days and asked to swish a 20 mL solution of either the carbohydrate mouth rinse or a placebo control in their mouth for 10 seconds. Prior to the mouth rinse and within one minute following, participants completed assessments of motor speed and inhibitory control while neuroelectric measures were collected. Findings revealed no differences between solutions for motor speed and faster reaction time on the inhibitory control task following rinsing the mouth with the placebo control. No differences were observed for amplitude or latency of the P3 or ERN ERP components. Despite the claims for cognitive enhancement, these findings suggest that carbohydrate mouth rinses do not alter aspects of cognition as compared to a placebo control.

Funding: The authors wish to thank Unit Nutrition, LLC for provision of the mouth rinse solutions.

Poster 3-019
DIFFERENCES IN THE DEFAULT MODE NETWORK AND COGNITION BETWEEN OBESE AND NORMAL WEIGHT PREADOLESCENT CHILDREN

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Descriptors: Resting state functional connectivity, Executive function, Obesity

Childhood obesity has become one of the most serious public health concerns in the United States and around the world. While obesity has been related to poorer brain health and cognition, no studies have investigated associations between obesity, resting-state functional connectivity (RsFc), and cognition. We investigated group differences in default mode network (DMN) between normal weight (NW) and children with obesity (OB). Follow-up analyses examined if group differences in DMN were associated with cognition. We performed whole-brain RsFc analyses (CONN Toolbox) from the DMN as the seed region of interest to investigate between-group differences of NW and OB in 131 children (7-9 years; 81 NW and 50 overweight or OB) after accounting for age and sex differences. Prior to RsFc analyses, pre-processing (SPM12), scrubbing for head motion artifacts and denoising was carried out. A whole-brain height-threshold of p < 0.001 (non-parametric statistics) and False Discovery Rate corrected cluster-threshold of p < 0.05 was applied. The Woodcock Johnson provided cognitive measures of thinking ability, cognitive efficiency, and executive processing. Results from RsFc analyses revealed that OB children had reduced DMN RsFc compared to NW in BA11 and right parahippocampus. Follow-up cognitive analyses found that poorer executive processing in the OB group was associated with significantly reduced RsFc in BA11. As childhood obesity is a public health concern, these results have implications for the physical and mental health of children.

Funding: Supported by NIH R01 HD069381.

Poster 3-020**EVALUATION OF ERROR TYPES AND ERROR SOURCES IN THE MEDIAL FRONTAL CORTEX**

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Descriptors: error monitoring, error-related negativity, error types
The medial frontal cortex is believed to play an important role in action control by representing and rapidly updating expectations about action outcomes. Recent studies on the error-related negativity (Ne/ERN), an electrophysiological correlate of errors in choice tasks, indicates that this process involves an evaluation of the type of an error already at the time of the erroneous response. This can be shown in a four-choice flanker task, where errors occur either by pressing a button associated with the distractors (flanker errors), or by pressing a button not associated with the stimulus at all (nonflanker errors). When these error types entail different monetary losses, the Ne/ERN is increased for the more expensive error type. Here, we investigate whether this error type evaluation is effective only if error types (flanker vs. nonflanker errors) are linked to different error sources (selective attention errors vs. other errors). To this end, we compared conditions with different distractor-target orders, utilizing the fact that flanker and nonflanker errors cannot be due to different error sources if distractors are presented after the target and thus cannot influence the error response. The results indicate that Ne/ERN amplitudes mirrored the costs associated with each error type if distractors preceded the target but not if distractors succeeded the target. This demonstrates that error type evaluation in our paradigm involves an evaluation of error source.

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Poster 3-021**CONCURRENT ASSESSMENT OF PERFORMANCE, ATTENTIONAL RESERVE AND COGNITIVE-MOTOR EFFORT DYNAMICS THROUGHOUT PRACTICE OF REACHING MOVEMENTS**

Isabelle Shuggi; Hyuk Oh; Emma Shaw; William Galway; Christopher Gaskins; Rodolphe Gentili
University of Maryland

Descriptors: Mental workload, Cognitive-motor practice, Human-machine interface

While prior work has assessed mental workload during cognitive-motor performance under various levels of challenge through an evaluation of attentional reserve and cognitive-motor effort, to date a combined assessment in a cognitive-motor practice context has not been examined. Hence, the objective of this study was to determine if a joint assessment of attentional reserve and cognitive-motor effort could index mental workload dynamics throughout practice of a novel arm reaching task. Participants practiced a reaching task through a human-machine interface, which required control of a virtual robotic arm through limited head motion within a planar workspace. Throughout task completion, EEG and kinematic data of the arm were collected. Head motion artifact was removed from the EEG data prior to computing the novelty-P3 component amplitude of the ERP as well as spectral power in the theta, low-alpha, high-alpha, low-beta and high-beta bandwidths. The findings showed that throughout practice while the kinematic performance was enhanced, both the novelty-P3 component amplitude as well as low and high-alpha increased. Such increases indicate elevated attentional reserve and reduced cognitive-motor effort. Low-beta also increased possibly suggesting a refinement of attentional processes during practice. Overall, these findings suggest that attentional reserve and cognitive-motor effort can be jointly used to assess changes in mental workload throughout practice. This work can inform the design and use of assistive technology meant to assist individuals with motor disabilities.

Poster 3-022**MODELING NEURAL PROCESSES OF EVENT-RELATED POTENTIAL (ERP) COMPONENTS FROM STIMULUS TO RESPONSE ON A FLANKER TASK IN TYPICALLY-DEVELOPING CHILDREN**

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Descriptors: structural equation modeling (SEM), event-related potentials (ERPs), flanker task

Univariate analysis is often used to examine brain-and-behavior relationships. Yet, by doing so, researchers may overlook the interdependent nature of neural processes underlying cognitive functions. This study investigates the neural mechanisms of information processing indicated by ERP components to predict response times (RTs) using structural equation modeling (SEM). We also examine the effect of state and trait variables on the sequence of neural processes. We analyzed EEG data from 143 neurotypical 8-12 year-old children (Mean: 10.24 years, 65 Males) who performed a speeded Flanker task on 2 separate visits. For each visit we first conducted manifest path models (N1->P2->N2->P3->RTs) separately for correct and incorrect trials controlling for trait variables (e.g. sex, age). The model fit indices showed acceptable to excellent fit, yet the 4 models yielded diverse results. To better control for measurement error, two latent path models, correct vs incorrect trials, were tested with each latent variable defined by their respective ERP component amplitudes from each visit. The results showed that latent models with both trait and state variables yielded excellent model fit (correct trials: RMSEA = 0, CFI = 1; incorrect trials: RMSEA = 0.028, CFI = 0.994) while models controlling for trait variables alone did not. This study shows the feasibility of utilizing SEM analysis techniques to better understand the interrelationships among ERP components and suggests the importance of trait and state variables when examining brain-and-behavior relationships.

Funding: NIH-NIHCD and the Department of Occupational Therapy at Colorado State University.

Poster 3-023**CONFLICT MONITORING MODERATES THE RELATIONSHIP BETWEEN ATTENTIONAL FOCUS AND CONFLICT RESOLUTION IN THE FLANKER TASK**

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Descriptors: ERN, Attentional Control, Conflict Monitoring

In flanker tasks, incongruent trials are associated with increased reaction times (RT) compared to congruent trials. Increased RT on incongruent trials may be due to a difficulty discriminating between target stimuli and distractors. Two mechanisms that may contribute to performance on incongruent flanker task trials are attentional focus and conflict monitoring. To address this possibility, we examined the interactive effects of attentional and conflict monitoring on incongruent RT in 97 women from an ongoing study of EEG activity and hormones across the menstrual cycle. The error-related negativity (ERN) is an event-related brain potential that is observed after an error is made and is considered a neurophysiological index of conflict monitoring. Attentional focus was measured using the Attentional Control Scale (ACS-Focus). It was hypothesized that attentional focus and the ERN would be related to RT on incongruent flanker trials, such that increased attentional focus and ERN would be related to decreased reaction time. Results indicated that on both congruent and incongruent trials, attentional focus was related to RT, but only on incongruent trials was there an interaction between attentional focus and the ERN on RT. Specifically, attentional focus was related to faster reaction time on incongruent flanker task trials more so when ERN was large compared to when the ERN was small. Findings indicate that higher attentional focus and greater conflict monitoring (ERN) is related to a greater ability to discriminate between target stimuli and distractor information.

Funding: This research is supported by the National Institute of Health (Project # 1R01MH108511-01; "Cognitive Control in Anxiety: The Role of Ovarian Hormones").

Poster 3-024**THE INFLUENCE OF ACTION HISTORY AND ATTRACTIVENESS OF STIMULUS UPON RESPONSE INHIBITION: AN ERP STUDY OF GO/NOGO TASK**

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Descriptors: Inhibitory control, Go/Nogo task, Event-related potentials
 Inhibitory control has been suggested to be modulated by various factors. Previous studies focusing on the action history showed that prior responses on particular cues will influence on the subsequent response control. Some clinical studies found that disrupted inhibitory control invokes abnormal attentional bias to attractive features of stimuli. The present study aimed to provide electrophysiological evidence for the impact of action history and attractiveness of cue on inhibitory control using Go/Nogo task. To carry out the study in non-clinical context, we treated purchase frequency and likeability of products as action history and attractiveness of cue, respectively. In Experiment 1 (Exp 1), participants were asked to evaluate purchase frequency for popular products, and the items with highest or lowest frequency were used as the Nogo stimuli. Experiment 2 (Exp 2) was almost same as Exp 1 except that participants were asked to evaluate likeability of fictitious products in order to avoid the effect of action history. The result of Exp 1 showed that withholding response to stimuli with high purchase frequency elicited greater Nogo-N2 amplitude that reflects conflict, while no significant difference was found in Exp 2. These results suggest that response inhibition to frequently acted-on cues could provoke greater conflict, whereas response inhibition to likeable cues could not. The study may imply that action history and attractiveness of cue have some influence on different aspects of inhibitory control.

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Poster 3-025**BLOCK VERSUS RANDOM DESIGN: THE BEHAVIORAL AND ELECTROPHYSIOLOGICAL EFFECTS OF EMOTIONAL STIMULI ORDER**

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 University of Arkansas

Descriptors: emotion, cognitive control, presentation order
 Emotion cognition theories suggest that emotional valence impacts cognitive performance, however, results have been mixed. One cause for the discrepancy may be the order in which emotional stimuli are presented. To address this discrepancy, EEG data were recorded as 130 undergraduate students (M age = 22.15, SD = 5.38; 79 female) completed a modified version of the AX-CPT task in which the cue was followed by an IAPS image (positive, negative, and neutral), designed in either a block or random order, prior to probe presentation. We examined two ERPs, the N2, reflects aspects of cognitive control, and the LPP, reflects facilitated attention to emotional stimuli. We were able to assess the impact of emotional arousal on cognitive control and how this relationship might differ for a random vs. blocked task design. We found a main effect of valence (picture), $F(2, 258) = 63.16, p < .001$, with the negative trials showing larger LPPs than the positive and neutral trials; however, we found no effects of task design (random vs. blocked). For N2s (probe), we found a task design-by-valence-by-probe (AX vs. AY) interaction, $F(2,264) = 4.06, p = .02$. N2s for the negative valenced condition showed less negative activation than both for the positive and neutral conditions. These results, in conjunction with the LPP results, suggest an emotion-related depletion of neural resources, and that this depletion was slightly more for the random task design. When examining neural processes underlying emotion-cognition interactions, future research should pay attention to trial order when designing tasks.

Poster 3-026**GREATER BLOOD PRESSURE REACTIVITY DURING AN EFFORTFUL TASK IS ASSOCIATED WITH ENHANCED PERFORMANCE MONITORING**

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 Brandon Schmeichel¹
¹Texas A&M University, ²Fors Marsh Group

Descriptors: effort, blood pressure, ERN
 Much research on mental effort has found that effortful tasks impact blood pressure and the magnitude of the error-related negativity. As part of a larger study investigating the effects of glucose on self-control, the current research explored relationships among blood pressure reactivity to a mentally effortful task and subsequent neural reactions to errors and emotional images. Participants rested for baseline physiological measurements including blood pressure, heart rate, and EEG before completing a writing task that required high effort. Then participants completed a modified Eriksen flanker task. Some participants completed the flanker task right after the effortful writing task and others completed a picture viewing task first. Change in participants' SBP during the controlled writing task was associated with the magnitude of the ERN at FCz in response to correct ($r = .18$) and incorrect flanker trials ($r = .21$), $ps < .03$ and at Fz in response to correct trials ($r = .19$), $p = .020$. Thus, greater blood pressure reactivity was linked to greater performance monitoring as revealed by the ERN. Individuals with high responsiveness to mental effort as measured by blood pressure appear to be high performance monitors.

Poster 3-027**PERCEPTUAL DEMAND MODULATES EVENT RELATED POTENTIALS DURING A DEGRADED STIMULI AX-CONTINUOUS PERFORMANCE TASK**

Xuedi Wang; Janet Shucard; Thomas Covey; Melissa Meynadasy; John Violanti; David Shucard
 University at Buffalo

Descriptors: Perceptual demand, ERPs, Conflict monitoring
 The aim of this study was to examine the influence of perceptual demands on neural mechanisms involved in inhibitory control using event-related potentials (ERPs) and source localization modeling with ERP data obtained during an AX-CPT (Go/NoGo) task. During the task, participants responded to the letter "X" (Go), only when it followed the letter "A" (Cue), and withheld their response to any other letter that followed the "A" (NoGo). The Cue served as a warning that "X" might occur. In the current study, participants performed the visual AX-CPT under two conditions: a normal stimulus condition in which all letters were clearly identifiable and a degraded stimulus condition in which all Go and NoGo stimuli were degraded and difficult to discriminate. Preliminary analyses revealed the expected greater fronto-central NoGo conflict and inhibitory control effects for N2 and P3 amplitude, respectively. Increased perceptual demand (due to degraded stimuli) produced increased response conflict and was associated with greater frontal N2 amplitude for both Go and NoGo stimuli. Cortical source estimation indicated that this N2 effect was associated with the enhanced limbic and anterior cingulate activity for degraded compared to normal stimuli. In contrast, P3 was not modulated by perceptual demand. Further, the NoGo > Go frontal-central P3 effect was associated with enhanced medial frontal cortex activity. The results are consistent with the view that the N2 effect indexes conflict monitoring that is modulated by perceptual demands, whereas P3 indexes response inhibition.

Funding: This study was supported in part by the National Institute for Occupational Safety and Health (NIOSH) and National Institute of Justice.

Poster 3-028**ELECTROPHYSIOLOGICAL INDICES OF REWARD VALUATION AND COGNITIVE CONTROL INVOLVED IN DECISION MAKING FOR PHYSICAL EFFORT**Akina Umemoto^{1,2}; Hause Lin¹; Clay Holroyd²
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Descriptors: Reward positivity, frontal midline theta, physical effort
Trading off between rewards and effort-related costs is critical to performing goal-directed behaviors. Several recent theories have proposed a role for anterior cingulate cortex (ACC) in regulating effortful control over behaviors. To elucidate how ACC serves this role, 74 participants engaged in a decision-making task involving physical effort while their brainwaves were recorded. On each trial they freely selected between an effortful or effortless choice (i.e., squeeze a hand-dynamometer strongly or less strongly) for reward, and executed their choice immediately after. Replicating previous studies, participants selected the effortful choices more frequently with increasing reward probability and magnitude. This pattern persisted even though participants' overall effortful choices decreased over time. We then examined the amplitude of reward positivity (RewP) component of the event-related potential, which is believed to reflect the reward function of ACC. RewP amplitude was larger and more focally distributed over the frontal-central scalp area when participants chose the effortful than effortless choice, but this effect was not statistically reliable. An exploratory analysis of frontal midline theta (FMT) power, consisting of 4-8 Hz neural oscillations associated with effortful control, showed that FMT power during the decision phase positively correlated with the likelihood of participants' effortful choices. Our results illuminate the ACC's role in incorporating information related to reward and effort costs to effect decision-making and task performance.

Funding: Natural Sciences and Engineering Research Council of Canada Discovery Grant 312409-05 to Clay B. Holroyd.

Poster 3-029**LIKE MOTHER, LIKE DAUGHTER? ASSOCIATIONS BETWEEN MOTHERS' AND DAUGHTERS' NEURAL RESPONSES TO REWARDS ARE MODERATED BY DAUGHTERS' DEVELOPMENTAL STATUS**Paige Ethridge; Anna Weinberg
McGill University

Descriptors: RewP, intergenerational concordance, reward
Extensive evidence suggests that risk for emotional disorders (e.g., depression) is familial. It is unclear, however, how risk for these disorders is transmitted across generations. A promising line of research suggests that vulnerability for psychopathology may be transmitted, at least in part, by inherited abnormalities in neural responses to reward. However, we know that neural regions responsible for processing rewards undergo substantial maturation during adolescence; moreover, the contribution of genetic influences is not stable across development. In the present work, therefore, we aimed to examine the familial nature of neural responses to positive feedback, and whether correspondence in neural responses between parents and children varies based on the developmental stage of the child. A sample of 74 mothers (ages 33-56) and their adolescent daughters (ages 10-19) completed a simple guessing task in which they won or lost money while an electroencephalogram was recorded. We then isolated the reward positivity (RewP), an event-related potential elicited by positive feedback. Results indicated that the negative association between mothers' and daughters' RewP was significantly moderated by daughters' pubertal status, such that the RewPs of less pubertally-advanced girls were significantly negatively associated with their mothers' RewPs. These findings have important implications for identifying biological risk markers in early life for emotional dysfunction.

Funding: CIHR Canada Research Chair in Clinical Neuroscience CIHR Canada Graduate Scholarship – Doctoral.

Poster 3-030**EXAMINING SYMPATHETIC NERVOUS SYSTEM SYNCHRONY AND OUTCOMES IN COUPLES PSYCHOTHERAPY**Julia Bernards; Angela Bradford; Lee Johnson
Brigham Young University

Descriptors: physiological synchrony, couples therapy, SNS
Researchers have examined physiological synchrony as an interpersonal relational measure in clinical and non-clinical settings, with dyads as the primary unit of investigation, for many decades. In this study we expand synchrony research into the multi-actor setting of couples therapy. In a multi-case comparative study of two couples who significantly improved and two who declined across four sessions of couples therapy, we examined skin conductance (SC) data collected in-session to examine how sympathetic nervous system (SNS) synchrony between husband, wife and therapist related to couple outcomes. Using skin conductance responses (SCR) of at least one standard deviation from participants' session means, we analyzed each of the 16 sessions for concurrent and lagged synchrony between participants in the therapeutic system. Sessions were also coded for content coinciding with SCRs. Findings from these case studies showed the session content which triggered synchronized SCRs to be more indicative of therapeutic outcomes than the quantity or magnitude of, or participants involved in synchronized SNS activation events. Positive outcomes were associated with acknowledgement and validation of triggers and physiological responses while negative outcomes were associated with concealed reactions or a lack of acknowledgement of the physiological experience. Implications for clinical practice are given.

Funding: The CHAMPS project, which supplied the data for this poster, was funded by research grants from Brigham Young University.

Poster 3-031**A VIRTUAL REALITY SETUP FOR THE COMBINED ASSESSMENT OF SUBJECTIVE, BEHAVIORAL AND PSYCHOPHYSIOLOGICAL CUE-REACTIVITY IN GAMBLING DISORDER**Luca Bruder; Jan Peters
University of Cologne

Descriptors: Virtual Reality, Electrodermal Activity, Heart Rate
Incentive sensitization theory suggests that addiction-related cues and environments play a central role in the maintenance of addiction (cue-reactivity). The classical cue-reactivity design involves presentation of visual addiction-related cues with arguably limited ecological validity. Here we present a novel experimental setup that utilizes Unity-based virtual reality to allow immersion in highly controlled and ecologically valid addiction-related environments. Our setup is targeted at gambling addiction and has three core features. First, it allows participants to physically explore two spacious virtual environments. These environments are a gambling related casino environment and a neutral restaurant environment. Second, it enables researchers to measure physiological reactivity during immersion via remote sensors, which do not impede free exploration of the environments (electrodermal activity and heart rate, however it can easily be expanded to include additional measures). Finally, behavioral tasks are implemented directly in the Unity-environments to assess behavioral effects of exposure to addiction-related environments as well as subjective craving and arousal. The task mechanisms are designed in C#. Presently, we implemented two decision-making tasks thought to tap into core processes of addiction (temporal discounting and a 2-step reinforcement learning task assessing the degree of model-based and model-free behavioral control). We show that concurrent acquisition of behavioral and psychophysiological data in virtual reality is feasible, accurate and reliable.

Funding: This work was supported by Deutsche Forschungsgemeinschaft PE162715-1.

Poster 3-032**SIMULTANEOUS EEG-PUPILLOMETRY REVEALS COUPLING BETWEEN ELECTROPHYSIOLOGICAL AND PUPILLARY RESPONSES IN A VISUAL ODDBALL TASK**

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¹University of Utah, ²University of Illinois, Urbana Champaign

Descriptors: Electroencephalography, Pupillometry, LC-NE
 Adaptive gain theory suggests that the locus-coeruleus norepinephrine (LC-NE) system plays an important role in optimizing the performance of goal-directed behavior. Previous research suggests two candidate psychophysiological measures that are correlated with phasic changes in LC-NE activity: task-evoked pupillary responses (TEPRs) and the P3b component of the event-related brain potential. Findings from both animal models and human neuroimaging research have found evidence for a strong relationship between variation in LC activity and pupil size. Moreover, there is also growing evidence that the P3b component reflects phasic LC activity. This suggests that there should be strong coupling between TEPRs and the P3b during continuous task performance. At the same time, evidence for correlations between TEPRs and ERPs has been mixed. In the current study, we simultaneously measured ERPs and pupil dilation in a standard two-stimulus visual oddball task and examined coupling between TEPRs, ERPs, and response times (RTs). Infrequent stimuli elicited a robust and posteriorly distributed P3b component, as well as a substantial phasic increase in pupil dilation and slowed response times. We present analyses focusing on between-subject and within-subject (single-trial) relationships between TEPRs, ERPs, and response times (RTs), revealing evidence that task-evoked pupillary, electrophysiological, and behavioral responses are coupled during task performance. Findings are discussed with respect to the adaptive gain theory of optimal performance and decision making.

Poster 3-033**DELAY EFFECTS ON NEURAL EVALUATION OF MONETARY GAINS AND LOSSES: AN EVENT-RELATED BRAIN POTENTIAL (ERP) STUDY**

Toyoki Yamagata¹; Takuji Kinjo¹; Jun'ichi Katayama²;
 Asuka Murata¹

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Descriptors: Outcome evaluation, Delay effect, Feedback-related negativity (FRN)

The aim of this study was to examine the neural processing of delay effects on monetary gains and losses in the inter-temporal gambling task. According to many time discounting studies, people are found to devalue both delayed gain and delayed loss but the degree of discounting is smaller in the case of loss. This asymmetry is called a "sign effect." In this study, in order to investigate a neural sign effect, we measured feedback-related negativity (FRN), an indicator of neural evaluation of feedback. Thirty-four participants performed the gambling task. On each trial, they selected one out of two options and the feedback was presented. There were four types of monetary feedback: Outcome (Gain vs. Loss) x Delay (Today vs. One month later). Participants were told to receive monetary reward or loss immediately or one month after the experiment based on their performance. After the gambling task, participants performed a subjective time discounting task. FRN amplitudes elicited by the feedback at Fz electrode were analyzed. Results showed a significant main effect of Outcome and a significant interaction between Outcome and Delay. Post-hoc tests revealed that FRN for Loss was larger (i.e., more negative) when the loss was given one month later as opposed to today. These results showed a sign effect in neural outcome evaluation. Interestingly, the neural sign effect shows a possibility of "time extra-wage" to losses, i.e., losses are highly evaluated when they are delayed. We discuss the possibility with subjective results of time discounting.

Funding: JSPS KAKENHI Grant Number JP 16K20873.

Poster 3-034**RELAXATION EFFECTS OF A CANDLE FLAME: DIFFERENCES BETWEEN A REAL FLAME AND A LED LIGHT**

Yasuko Omori; Saori Ito; Toshiro Mizuta
 Jin-ai University

Descriptors: relaxation, candle flame, LED light

This study examined the relaxation effects of candle flames by comparing a real flame and a LED light, by assessing physiological responses and subjective feelings. Participants were nineteen university students (eight men and eleven women, mean age = 18.42 years). The participants conducted a calculation task of adding two digits for 5 minutes. Then, the lights in the shielded room were slightly dimmed and participants were required to watch a candle flame for 3 minutes. Two types of experimental conditions were established; the real condition using a real candle flame, and the LED condition using a LED light. The same procedure was repeated twice with a one-minute interval. Eyeblinks (vertical-EOG), and heart rate (ECG) when watching the candle were recorded through a polygraph system, and salivary amylase activity was also measured. Moreover, participants' feelings were assessed before and after watching the candlelight. Results indicated that the blink rate decreased significantly 60 seconds after watching the candle flame, and subjective tension and anxiety decreased compared to before watching the flame. Also, the heart rate significantly decreased 60 seconds after starting to watch only the real candlelight. The amylase activity significantly increased after watching the candlelight only in the LED condition. The mood assessment was more positive when watching the real flame, compared to the LED light. These findings demonstrated the relaxing effects of watching a candle flame.

Poster 3-035**THE DEVELOPMENTAL TRAJECTORY OF THE LATE POSITIVE POTENTIAL: TEMPOROSPATIAL PCA AS A TOOL FOR EXAMINING WITHIN-SUBJECT DEVELOPMENTAL CHANGES IN ERPS**

Elizabeth Mulligan¹; Zachary Infantolino²; Daniel Klein²;
 Greg Hajcak¹

¹Florida State University, ²Stony Brook University

Descriptors: Late Positive Potential, temporospatial PCA, development
 Previous studies have reported developmental differences in spatial and temporal characteristics of the Late Positive Potential (LPP). However, this work has primarily relied on visual or statistical comparison of event-related potentials (ERPs) at relatively few electrode sites. The current study aimed to test a novel, empirically-based approach to characterizing temporal and spatial changes in ERPs over time. Data were utilized from a large longitudinal study (n = 380) in which the LPP was recorded to pleasant, neutral, and unpleasant pictures around age 9 and again around age 12. Age 9 ERPs were subtracted from age 12 ERPs for all three image types; the resulting ERPs for each subject at each electrode site were then submitted to a temporospatial PCA. We found a PCA factor that was greater in amplitude for emotional pictures compared to neutral pictures between ages 9 and 12, evident as an occipital negativity and frontocentral positivity which peaked approximately 850 ms following picture presentation. Moderate internal consistency was found for the PCA-derived LPP difference scores. Furthermore, the factor scores to emotional pictures for this component were increased as a function of age 12 pubertal development, consistent with the notion that the LPP shifts from occipital to more frontocentral sites in relation to developmental changes from childhood to adolescence. We propose that temporospatial PCA on within-subject subtraction-based ERPs may be an efficient way of visualizing and quantifying developmental changes in both the timing and scalp distribution of ERPs.

Funding: This work was supported by National Institute of Mental Health grants R01 MH069942 to Daniel Klein and T32 MH093311 to Elizabeth Mulligan.

Poster 3-036**WE FOUND THIS HUMERUS: FMRI META-ANALYSIS OF PICTORIAL AND LANGUAGE EVOKED MIRTH**

Andrew Farkas; Elizabeth Edge; Ling-Yu Huang; Aviva Kasowski; Olivia Thomas; Rebekah Trotti; Tucker Bond; Eli Chlan; Maria Granros; Justin Guld; Benjamin Park; Kajor Park; Dean Sabatinelli
University of Georgia

Descriptors: Humor, fMRI, Meta-Analysis

Humor is associated with stress reduction, and is implicated in successful emotion regulation and therapeutic outcome. While recent qualitative reviews have linked multiple cortical and subcortical regions of the brain to the processing of various sorts of humor, no quantitative analysis of functional MRI (fMRI) studies has identified brain regions reliably associated with the experience of humor, and the means by which humor is induced. Here we employed coordinate-based activation likelihood estimate (ALE) meta-analysis of fMRI studies that report brain activation increases associated with humor compared to control conditions. In addition, we assessed the potential distinctions between the experience of humor in general and the medium through which humor is evoked. We identified 55 fMRI studies that met our inclusion criteria ($n = 1191$), including 27 that employed pictorial stimuli, 23 that employed language stimuli, and 5 that employed audio of laughter. Across all studies, humor-related clusters were found across much of the brain, including bilateral amygdala, medial prefrontal cortex, auditory cortex, left inferior frontal, as well as middle and superior temporal cortex. The network of clusters associated specifically with pictorial, language-based and laughter stimuli was consistent with the cortical regions associated with processing the media modality. A clearer understanding of the processes by which humor modulates brain networks associated with emotion could enhance its use in translational research and therapy.

Poster 3-037**EARLY FACE-SPECIFIC EMOTION EFFECTS ARE DETECTED FOR THE N170 COMPONENT BUT NOT FOR THE P1 COMPONENT: ERP STUDIES ON FACE PERCEPTION UNDER LINEARLY INCREASING PERCEPTUAL LOAD**

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Institute of Medical Psychology and Systems Neuroscience, University of Münster

Descriptors: face perception, EEG/ERP, emotional expressions

Emotional facial expressions are prioritized processed in the human brain, leading to distinct modulations of early event-related potentials (ERPs). However, there is an ongoing debate which ERP components is the earliest marker of decoding emotional expressions. To answer this question, we conducted two preregistered EEG studies, each exhibiting 40 participants. The paradigm used linearly increasing perceptual load, either applying a block-wise or trial-wise load manipulation, while task irrelevant angry, happy and neutral faces, as well as their phase-scrambled versions were presented. Behaviourally, increasing perceptual load resulted in increasing reaction times and decreasing accuracy. Crucially, emotional expressions affected the P1 and N170 components. For the P1, emotion effects were unspecific, showing similar amplitude enlargements for real as well as for scrambled emotional faces. In contrast, emotional modulations of the N170 were restricted to real faces. Faces, compared to scrambles, increased both P1 and N170 amplitudes. Finally, increasing perceptual load led to increasing P1 amplitudes, while not modulating the N170. There were no interactions between perceptual load and emotional expression or face modality (face-scramble) effects regarding these early ERP components. These results show, that the N170 emotion effects only occur for real faces, but seem to be unaffected by perceptual load. In contrast, P1 emotion-modulations were found for faces as well as phase-scrambled versions, suggesting that low-level features contribute to this early emotion effect.

Poster 3-038**MESSAGE VALENCE AND AROUSAL INFLUENCE SKIN CONDUCTANCE SYNCHRONY IN DYADS OF FRIENDS AND STRANGERS: A COMPARISON OF LINEAR AND NONLINEAR ANALYSES**

Jingjing Han¹; Yang Shi²; Yaojun Yan¹; George Roberson¹; Liang Zou³; Seung Woo Chae¹; Annie Lang¹
¹Indiana University, ²Zhejiang University, ³New York University

Descriptors: Synchrony, Emotion, Nonlinear methods

This study asks how message valence, message arousal, and social relationship influence skin conductance level synchrony when the individuals view television alone. The study employs a 2 (message valence: positive, negative) $\times$ 2 (arousing level: calm, arousing content) $\times$ 2 (message repetition) $\times$ 2 (stimuli presentation order) mixed factorial design. 23 pairs of friends simultaneously watched NCAA basketball games that varied in valence and arousal in separate rooms in one of two orders. To create dyads of strangers, we randomly paired individuals from different pairs. We used cross correlation coefficients (linear) and recurrence percentage (%REC) from cross recurrence analysis (non-linear) to quantify synchrony. Repeated ANOVA on the fisher z transformed correlation coefficients produced a main effect of arousing content but no significant effect of message valence on synchrony for strangers while correlation coefficients for friends did not differ as a function of arousing content or message valence. Arousing compared to calm content produced more synchrony. In the non-linear analysis, repeated ANOVA on the logit transformed %REC shows significant main effects of arousing content and message valence for both friends and strangers. Synchrony was higher for negative and calm messages. In addition, friends had significantly higher %REC than strangers but they did not differ in correlation coefficients. Our study suggests that cross recurrence analysis might more accurately capture the dynamics of physiological synchrony.

Funding: Dissertation Completion Fellowship Indiana University College of Arts and Sciences.

Poster 3-039**THE THRILL OF VICTORY: SAVORING POSITIVE AFFECT, THE REWARD POSITIVITY, AND SYMPTOMS OF DEPRESSION**

Kelsey Irvin; Bruce Bartholow; Debora Bell
University of Missouri, Columbia

Descriptors: Reward Positivity, Emotion Regulation, Depression

Previous research indicates that dysfunctional reward processing may be an important behavioral, psychophysiological, and neural indicator of depression. Depression is also characterized by a pattern of maladaptive affect regulation, yet little is known about how affect regulation and reward processing relate to and potentially influence one another. The current study examined the psychophysiological underpinnings of depression and their association with dysfunctional reward processing by exploring the relationship between the use of positive affect regulation strategies and the Reward Positivity (RewP) elicited by gain vs. loss feedback. $N = 100$ participants completed two computerized gambling tasks while ERPs were recorded, as well as a battery of questionnaires assessing affect, affect regulation, and depressive symptoms. Results showed that (a) the relationship between RewP amplitude and depressive symptoms is moderated by positive affect regulation strategies, (b) RewP elicited by gains appears sensitive to a simple savoring intervention, and (c) savoring and the RewP elicited by gains interact to predict general distress. Findings will be discussed alongside data from an ongoing study ($N = 90$) attempting to replicate these findings and extend them to other facets of reward processing. Such findings may provide insight into the underpinnings of depression and have important implications for clinical prevention and intervention efforts for Major Depressive Disorder.

Funding: This research was supported in part by the University of Missouri, Columbia Life Sciences Fellowship, and by grant R01AA025451 from the National Institute on Alcohol Abuse and Alcoholism.

Poster 3-040**STARTLE REFLEX AND EVENT-RELATED POTENTIALS
IN ANTICIPATION OF DIFFERENT TYPES OF
UNPREDICTABLE THREAT**

Rachel Ferry; Brady Nelson
Stony Brook University

Descriptors: unpredictability, startle reflex, event-related potentials
Unpredictability enhances defensive motivation and attentional engagement. Few studies have compared the impact of different types of threat on attention and motivation in anticipation of unpredictable threat. Across two studies, this investigation utilized a within-subject design to examine defense motivation (startle reflex) and attention (probe N100 and P300) in anticipation of shocks and aversive noises during a no, predictable, and unpredictable threat task. In Study 1, the startle reflex was enhanced during the unpredictable threat condition for both types of aversive stimuli, but enhancement was greater for shocks compared to aversive noises. The startle reflex was enhanced during the predictable shock condition, but attenuated during the predictable aversive noise condition. The atypical predictable aversive noise results prompted a follow-up study in which the aversive noise was paired with a visual stimulus (scared face). In Study 2, the startle reflex was enhanced during the predictable and unpredictable threat conditions for both shock and aversive noise plus scared face stimuli. Across both shock and aversive noise plus scared face trials, the probe N100 was uniquely enhanced during the unpredictable threat condition and the probe P300 was suppressed during both threat conditions. The present study suggests that unpredictability enhances defensive motivation and early attentional engagement across both tactile and auditory aversive stimuli, but predictable auditory aversive stimuli need to be paired with a visual stimulus to enhance defensive motivation.

Funding: This project was funded by National Institute for Mental Health grant K01MH107808 awarded to B.D.N.

Poster 3-041**THE EFFECT OF SAD MOOD ON CHANGE DETECTION
OF FACIAL EXPRESSIONS**

Xueqiao Li; Piia Astikainen
University of Jyväskylä

Descriptors: change detection, ERP, mood induction
The deviance detection of emotional facial expressions plays an essential role in social interactions. It is not known if sad mood can affect automatic change detection of facial expressions in healthy participants. Here we investigated how induced sad mood, comparing to neutral mood, affects the event-related potentials to faces. Velten's mood statements and music, in neutral and sad conditions, were utilized to induce the target mood. Sad and happy 'deviant' faces were interspersed with neutral 'standard' faces in a passive oddball paradigm while participants ($n = 15$) concentrated on a calculation task. In order to explore the change detection of emotional faces, differential responses (deviant minus standard) for N170 and P2 responses were extracted separately for sad and happy faces. P2 differential response was smaller in amplitude after the sad mood induction than after neutral mood induction regardless of the facial emotion. No such effect was found for the N170. The results indicate that pre-attentive orienting to facial expressions, but not structural encoding of faces, is affected by sad mood in healthy participants.

Poster 3-042**EFFECTS OF BITTER TASTE ON COGNITIVE
REAPPRAISAL OF FOOD PROCESSING: AN ERP STUDY**

Matteo Giraldo¹; Marta Ghisi¹; Nicola Cellini¹; Gioia Bottesi¹; Anne Schienle²; Michela Sarlo¹
¹University of Padova, ²University of Graz

Descriptors: Cognitive reappraisal, Food processing, ERP
Cognitive reappraisal is an emotion regulation strategy that might help to control food intake. The present study investigated whether neural processing of food cues during emotion regulation is influenced by the presence of a bitter taste in the mouth, as bitterness is associated with food rejection. Forty-five participants were divided into two groups: the bitter group (BG; $n = 21$) tasted a bitter tea and the control group (CG; $n = 24$) tasted water after an overnight fast. Both groups were then presented with pictures of high- and low-calorie foods. ERPs were recorded while participants were instructed to either passively look at the pictures (Watch) or to change the appetitive value of food (Increase, Decrease). Results showed that the N200 was larger during passive viewing than during the reappraisal conditions in both groups. Moreover, it was larger during passive viewing for high- than low-calorie foods in the CG but not in the BG. Overall, the amplitude of the Late Positive Potential was larger during cognitive reappraisal than during passive viewing in the 500-700ms time window, whereas it was reliably lower during the Decrease than during the Watch and Increase conditions in the 1300-1600ms time window. Our data suggest that during passive viewing the bitter aftertaste inhibits early attentional selection of high-calorie food but does not modulate allocation of attentional resources at later processing stages nor it affects cognitive reappraisal. Overall, more time seems to be needed to effectively decrease the appetitive value of food, at least under fast condition.

Poster 3-043**EMOTION REGULATION AND EMOTIONAL
MODULATION OF SPINAL NOCICEPTION AND PAIN**

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University of Tulsa

Descriptors: emotion regulation, emotion modulation, NFR
Research suggests that emotions modulate pain and nociceptive flexion reflexes (NFR, a correlate of spinal nociception measured from EMG), such that positive emotions inhibit pain/NFR and negative emotions enhance pain/NFR. To date no study has examined whether emotion regulation (ER) strategies can influence emotional modulation of pain/NFR. This study examined whether suppress vs. enhance ER strategies influenced affective picture modulation of pain/NFR in 45 healthy, pain-free participants. Painful electric stimulations were delivered during and in between affective pictures (mutilation, neutral, erotica) and pain/NFR were assessed in response to electric stimuli. Emotional modulation of pain/NFR was defined as the difference in pain/NFR evoked during erotic vs. mutilation pictures. Participants completed 1 block of affective picture viewing before being randomized to training for an enhance or suppress ER strategy. Next, participants were instructed to use the strategy while viewing a second affective picture block. Valence and arousal ratings confirmed participants were successful in their ER strategies. During block 1, both groups demonstrated similar emotional modulation of pain/NFR. During block 2, both groups demonstrated similar emotional modulation of NFR, but only the enhance group demonstrated emotional modulation of pain. These findings suggest that suppression of emotions may disrupt a supraspinal circuit associated with emotional modulation of pain, but has no influence on the brain-to-spinal cord circuit that emotionally modulates NFR.

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Poster 3-044**COMPARING EMOTIONAL MODULATION OF PICTURE-, FACE-, AND WORD-ELICITED HEMODYNAMIC ACTIVITY**

Lea Stieghorst^{1,2}; Martin Wegrzyn^{2,3}; Friedrich Woermann¹; Johanna Kissler^{2,3}; Christian Bien¹

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Descriptors: visual emotion processing, fMRI

Emotional visual stimuli trigger higher BOLD-response in visual processing areas than do neutral stimuli. Such emotion effects have been shown for pictures, faces, and words, suggesting a common underlying mechanism. However, there is also evidence for stimulus-specific differences in emotion effects. To our knowledge, so far no fMRI study has directly compared emotion effects between these three stimulus types within one group of participants. Therefore, we investigated similarities and differences in visual processing of negative and neutral pictures, faces, and words in 34 healthy participants (age: $M = 31.44$ ($SD = 11.67$) years, 17 female, 2 left-handed) using a passive viewing fMRI paradigm. Whole-brain ANOVA showed an interaction of stimulus type and emotion condition, which was most pronounced in bilateral extrastriate visual cortices. Here, emotion effects were most pronounced for pictures, followed by faces and not significant for words. Conversely, words showed emotion effects in the left angular gyrus, whereas faces and pictures did not. This evidence for stimulus-specific emotion effects was further supported by results of the analysis of emotion effects within each stimulus type, which suggest that emotion effects occur specifically in brain areas that are involved in the processing of the respective stimulus in general. In sum, our study delineates stimulus-specific emotion effects in visual processing within a reasonably large sample from the general population and can inform stimulus selection in future emotion processing studies.

Funding: Deutsche Forschungsgemeinschaft (DFG).

Poster 3-045**DOES MY HEART ALWAYS FEEL GOOD WHEN I OFFER CONTACT COMFORT TO MY PARTNER WITH CHRONIC PAIN?**

Leah Clement; Marie-France Lafontaine; Michelle Lonergan; Stephanie Azzi; Marie-Pierre Daigle; Stephanie Jolin
University of Ottawa

Descriptors: Romantic Attachment, Caregiving, Couples

While romantic partners can be a primary source of comfort for patients with chronic pain, little is known about the psychophysiological experience of providing comfort. Results from a previous pilot study indicated that high attachment anxiety, high attachment avoidance, and high levels of relationship satisfaction were associated with decreased electrodermal activity in partners of patients when offering contact comfort while viewing a stressful chronic pain video (Clement, Daigle, Jolin, Azzi, & Lafontaine, 2018). The goal of the present study was to expand these findings with a different psychophysiological measure, heart rate variability (HRV), using the same participants in addition to two new romantic partners of patients with chronic pain. We predicted that the same dimensions of romantic attachment and relationship satisfaction would be associated with increased HRV, indicating greater ease in providing comfort. The ECR-12 was used to measure romantic attachment, and relationship satisfaction was measured with the DAS-4. Using a single-case repeated measures design, 6 couples watched a chronic pain video and a neutral video, while the partner alternated every 2.5 minutes between holding and not holding the patient's hand. HRV was recorded throughout the experiment. Results were successfully replicated for high attachment anxiety, high attachment avoidance, and relationship satisfaction, but not for low attachment anxiety. Findings from this study are discussed considering previous research on psychophysiological reactivity to providing contact comfort.

Poster 3-046**EVALUATIVE CONDITIONING AFFECTS SUBSEQUENT FEAR LEARNING**

Ottmar Lipp; Camilla Alana; Alana Muir
Curtin University

Descriptors: Fear learning, conditioning, electrodermal activity

It is not clear whether the acquisition of negative valence in evaluative and fear conditioning paradigms reflects on the same or distinct learning mechanisms. The current study used a transfer paradigm to address this question. Three groups of participants ($N = 85$) were trained in differential fear conditioning comprising acquisition, extinction, and reinstatement test, after completing a picture-picture evaluative conditioning paradigm. In group Congruent, the to-be-CS+ was paired with negative pictures whereas the to-be-CS- was paired with positive pictures; in group Incongruent the to-be-CS+ was paired with positive pictures whereas the to-be-CS- was paired with negative pictures, and different CSs were used in evaluative and fear conditioning in group Different. Extinction and reinstatement of negative valence were not affected differentially. Differential electrodermal responses emerged within fewer training trials in groups Congruent and Different than in group Incongruent and there was a trend towards faster extinction in group Incongruent. Reinstatement of electrodermal responses was not affected differentially. The current research indicates that CS valence acquired during evaluative conditioning transfers across conditioning paradigms and will differentially affect the acquisition of fear learning as indexed by subjective evaluations and electrodermal responses. This supports the notion that a single learning mechanism mediates affective learning in evaluative and fear conditioning paradigms.

Funding: This work was supported by grants DP180111869 and SR120300015 from the Australian Research Council.

Poster 3-047**SYSTEMATIC TESTING OF MACHINE LEARNING ALGORITHMS PREDICTING SUBJECTIVE AROUSAL AND VALENCE RATINGS FROM PSYCHOPHYSIOLOGICAL ACTIVITY**

Hedwig Eisenbarth; Caitlin Heesterman; Tim Gastrell; Bing Xue
Victoria University of Wellington

Descriptors: machine learning, EEG frequency bands, arousal

Prediction models of emotional states based on psychophysiological activity have been showing poor predictive validity so far. We aimed at comparing different prediction algorithms, data and feature selection characteristics in order to compare prediction of subjective valence and arousal ratings by EEG, GSR, HR and Respiration. Using the DEAP dataset, containing psychophysiological data from 32 participants watching a range of music videos, we systematically varied data processing, feature selection, regressors and sample train / test methods and compared root mean square errors (RMSE). We consistently found lower RMSEs when predicting valence compared to arousal. More importantly, training the model across the sample as a group compared to within each participant decreased the RMSE for arousal prediction but increased the RMSE for valence prediction. This suggests that the (neuro-) physiological correlates of subjective arousal seem to be more consistent across a sample but that the psychophysiological correlates of subjective valence are more consistent within an individual. Thus, subjective experience of emotional states could be better explained by neurophysiological activity with some accuracy but that individual differences in the relationship between experience and this activity decrease accuracy. Limitations of these analyses are due to limitations of the datasets regarding variance of arousal ratings, limited number of participants and stimuli and will be addressed by creating larger databases.

Poster 3-048**PHYSIOLOGY, EMOTIONS AND SENSITIVITY TO PUNISHMENT AND REWARD TRAITS IN CHILDREN: EVALUATING RISK FACTORS FOR EXTERNALIZING BEHAVIORS**

Thekla Constantinou; Andry Vrachimi-Souroula; Maria Panteli;
Androula Kepola; Georgia Panayiotou
University of Cyprus

Descriptors: Motivation, Sensitivity to Punishment, Sensitivity to Reward
The current research examines the emotional responses of children with high/low Sensitivity to Punishment and Reward traits in an affective picture viewing task. Consensus regarding the physiological and behavioural profiles are lacking, especially for children with high sensitivity to reward. The research incorporates multiple levels of analyses including, subjective traits, behaviours (internalizing and externalizing), and physiological indexes (Heart Rate Variability; HRV- HF, LF, LF-HF, resting and task Skin Conductance; SCR). Eighty-seven children participated in the experiment. Two questionnaires were completed 'Sensitivity to Punishment and Sensitivity to Reward Questionnaire Child Revised' and the 'Child Behavior Checklist. Moderation models with the SP as the moderator, the SR as the predictor, tonic HF-HRV, LF, LF-HF and resting/task SCR as dependent variables. It was indicated that SR levels negatively predicted the HF-HRV, LF, LF-HF and resting SCR only when moderated by low SP levels. It can be assumed that Low SP and High SR sensitivities may be linked with increased psychological rigidity and autonomic hyporeactivity at resting state. Also, SR positively predicted on task SCR levels during sad images, only when SP levels are high. Indicating that higher anxiety traits may function as a moderating factor in the expression of sensitivity to reward traits. The results support the interaction between SP and SR in the prediction of externalizing behaviours. Empirical and clinical implications are discussed.

Poster 3-049**PUPIL DIAMETER AND THE LATE POSITIVE POTENTIAL DURING PICTURE VIEWING**

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Descriptors: pictures, pupil, ERP
Data relating the amplitude of pupil diameter and the amplitude of the P3, based on presumed activation of the locus coeruleus, have been mixed. In Experiment 1, 48 participants viewed pleasant, neutral, and unpleasant scenes while pupil diameter and dense sensor EEG were simultaneously and continuously recorded. Pupil diameter during picture viewing and the amplitude of the late positive potential measured over centro-parietal sensors were assessed as a function of emotional content, and as these measures co-varied within and between participant. Overall, replicating many previous studies, the amplitude of the late positive potential was significantly enhanced when viewing emotional (pleasant or unpleasant), compared to neutral, scenes, and pupil diameter showed the same pattern of affective modulation. Correlation analyses on the amplitude of pupil change and late positive potential, either within or between participant, however, showed no relationship between the measures. A larger proportion of individuals (93%) showed enhanced pupil diameter when viewing emotional, compared to neutral, scenes, compared to those showing emotional modulation in the amplitude of the late positive potential (72%). Follow-up studies increased the N (> 100) to re-assess these effects, and to determine whether temperament or gender contribute to individual differences in the pattern of pupillary and electrocortical modulation during affective picture viewing.

Poster 3-050**HRV DURING AN EMOTION REGULATION TASK PROVIDES UNIQUE MEASURES OF ANS ACTIVITY, RELATIVE TO RESTING HRV**

Aniruddh Ajith; Shruti Patel; Melanie Arenson; Spencer Fix; Edward Bernat
University of Maryland

Descriptors: Heart Rate Variability, Emotion Regulation
Current research demonstrates that greater PNS activity is linked to improved self-reported emotion regulation (ER), e.g. the Difficulties in Emotion Regulation Scale (DERS). To assess practiced ER in the current study, we recorded HRV both during rest and during a conventional ER task, which involves enhancing and suppressing emotional reactions to salient pictures from the IAPS dataset, as well as just viewing the pictures. We measured high frequency HRV (HF-HRV) to index parasympathetic nervous system (PNS) activation, and mean heart rate (HR) to index sympathetic (SNS) activity. Results indicated that HF-HRV was greatest for enhance and suppress conditions relative to view, and view greater than resting, suggesting PNS engagement was increased during regulation conditions relative to view and resting. For HR, we found no significant difference between view and suppress conditions, but greater HR in the enhance condition relative to view, suggesting SNS engagement was increased during the enhance condition relative to suppress and view. Using regressions to predict DERS with HR and HF-HRV in the ER task, only HR uniquely predicted the DERS in the view condition, while both HF-HRV and HR predicted DERS in the enhance and suppress conditions. Results suggest that HR (SNS) and HF-HRV (PNS) measures taken during practiced efforts to regulate (enhancing and suppressing) offer new information in predicting the DERS, relative to the commonly used resting task.

Poster 3-051**AMYGDALA AND ANTERIOR INSULA FUNCTIONAL CONNECTIVITY ARE ASSOCIATED WITH ANXIETY-RELATED ATTENTIONAL BIAS TO THREAT**

Taylor Susa; Lin Fang; Joshua Carlson
Northern Michigan University

Descriptors: Attention Bias, Anxiety, Functional connectivity
Attentional bias to threat is elevated in individuals with anxiety. The brain circuitry underlying attentional bias to threat is thought to mainly include the amygdala, anterior insula, anterior cingulate cortex. Previous research has found that greater functional connectivity between the amygdala and anterior cingulate cortex is linked to attentional bias to threat. However, the relationship between functional connectivity networks and attentional bias in individuals with heightened levels of anxiety remains unclear. This study aimed to bridge this gap by measuring attentional bias with the dot-probe task and functional connectivity with resting-state fMRI in a sample of high trait anxious individuals. We hypothesized that higher attentional bias scores would be linked to less connectivity between prefrontal cognitive control regions and emotion reactive regions in the brain. Differences in functional connectivity networks were assessed using amygdala and anterior insula seed regions. We found that the connectivity between the bilateral anterior insula and the prefrontal cortex was negatively correlated with attentional bias scores, as was the connectivity between the amygdala and the anterior cingulate cortex. The results suggest that weaker connectivity between cognitive control and emotion reactive regions is associated with increased attentional bias in high anxiety individuals.

Funding: Yes, a R15MH110951 grant awarded to JMC.

Poster 3-052**ESTIMATING PATTERNS OF PHYSIOLOGICAL LINKAGE UTILIZING THE NEW R PACKAGE, RTIES**Savannah Boyd¹; Claire Yee²; Ashley Kuelz¹; Michelle Shiota³; Emily Butler¹¹University of Arizona, ²Northwestern University, ³Arizona State University

Descriptors: Physiological linkage, Pre-ejection period, Heart rate

In order to understand connections between close relationships and health we need to examine social, emotional, and biological variables as they interact dynamically across time both within and between people. Physiological linkage (i.e., the degree of covariation between partners' autonomic physiology) patterns are diverse; however, most methods do not distinguish between the qualitatively and quantitatively different forms (e.g., in-phase and anti-phase). The exploratory results presented here utilized the new R package, *rties*, to model different forms of physiological linkage among same sex friends ($n = 43$ dyads) engaging in a conversation. One partner was assigned to be the speaker and to describe a situation that was upsetting them, while the listener tried to be supportive. Preejection period (PEP) and heart rate (HR) were measured continuously throughout the conversation. A coupled linear oscillator model was utilized to estimate the parameters representing frequency, amplification, and coupling of oscillations over time. These parameters were then used as the input for a latent profile analysis to represent the complex dynamic patterns of physiological linkage over the conversation period. For the HR models, results showed two profiles that were distinguished by levels of amplification and damping. The results from PEP showed 3 profiles that were distinguished by a combination of phase pattern, amplification, and damping. Future work should focus on determining whether these profiles are associated with relational processes and overall wellbeing.

Poster 3-053**THE DUALITY OF VIOLENCE: OCCIPITAL N1 ACTIVITY MAY DIFFERENTIATE AGGRESSION AND INJURY DURING PICTURE PROCESSING**Rosemarie Miller; Frances Martin
University of Newcastle

Descriptors: N1, Handguns, injury

Violence is alleged to be a fundamental part of human nature, although quantifying the unconscious response to this form of threat is difficult due to its emotionally charged nature. The aim of the present study was to examine whether N1 activity indexes perceptual differentiation between an overtly aggressive stimulus (i.e., aimed hand gun) and the aftermath of violence (i.e., severely injury). Forty participants (20 male) completed an image matching task, based on the Eriksen Flanker paradigm, while electroencephalography (EEG) was recorded. All target and flanking images featured humans. Event-related potential (ERP) amplitudes for an anterior N1 (90-150ms) and an occipital N1 (120-170ms), two components implicated in early perceptual processing, were identified and derived for analysis. Modulation via the action disposition and arousal level of targets was evident for the occipital, but not the anterior, N1. Neutral targets showing awake humans evoked more negative occipital N1 than aimed handgun targets, while the opposite pattern of N1 activity for aversive and neutral targets was observed for contrasts between severe injury and sleeping human images. Early identification of a potential threat is presumed vital to one's continued survival. The current findings suggest some visual aspects of violence may be differentiated early in picture processing, as indexed by occipital N1 modulation, and highlight a need to continue investigating the ways in which early perception informs later motivationally-based picture processing.

Poster 3-054**THE NEUROBIOLOGY OF ANTICIPATING UNCERTAIN AND CERTAIN THREAT**Juyoan Hur¹; Jason Smith¹; Kathryn DeYoung¹; Jinyi Kuang²; Allegra Anderson³; Rachael Tillman¹; Hyung Cho Kim¹; Alexander Shackman¹¹University of Maryland, College Park, ²University of Pennsylvania, ³Vanderbilt University

Descriptors: Anxiety, Uncertainty, fMRI

Anxiety—a sustained state of heightened arousal in response to uncertain threat—can become debilitating when extreme or prolonged. Although there is clear evidence that exaggerated responses to *uncertain threat* significantly contribute to the development and maintenance of both anxiety and depression, the underlying neurobiology remains poorly understood. A total of 99 subjects were selectively recruited from a pool of >2,000 individuals to capture a wide range of risk for the development of internalizing disorders. A novel MultiThreat countdown task was used to rigorously dissect regions sensitive to the anticipation of uncertain and certain threat. Neuroimaging results revealed that threat anticipation recruited the cortical regions involved in attention control (e.g., MCC, AI) as well as subcortical regions involved in organizing threat responses (e.g., amygdala, BST) ($qs < .05$, corrected). In terms of specificity, anticipation of uncertain threat more strongly engaged cortical control regions whereas anticipation of certain threat more strongly engaged the central extended amygdala (EAc) ($qs < .05$, corrected). FIR analyses revealed more fine-grained, subtle distinctions among the major sub-divisions of the EAc (e.g., amygdala vs. BST) in their time-course dynamics of the BOLD response during the anticipation period. These findings provide new insights into the neural systems most responsive to different types of threat in humans, setting the stage for refining animal models and ultimately developing improved interventions for pathological anxiety.

Funding: National Institutes of Health (DA040717, MH107444) and University of Maryland.

Poster 3-055**HOW DO OTHERS SEE ME? NEURAL OSCILLATIONS IN SOCIAL ANXIETY AND SELF-REFERENTIAL PERSPECTIVE-TAKING**Erin Maresh¹; Andrea Coppola¹; Finn Roberts²; James Coan²¹University of Arizona, ²University of Virginia

Descriptors: social anxiety, social cognition, self-concept

Social anxiety involves excessive self-focus and fear of evaluation by others. Yet, it is unclear how social anxiety influences responses to self-relevant words considered from one's own vs. others' perspectives. We recorded EEG while participants ($n = 67$, all women), high and low in social anxiety, viewed positive and negative trait words and decided whether each word described them from their own perspective or from the general perspective of people they know. Frontal theta (5-7 Hz at Fz) and frontal alpha asymmetry (8-13 Hz, $\ln(F4) - \ln(F3)$) were examined as EEG correlates of cognitive control and behavioral approach, respectively. Overall, positive traits were endorsed as self-relevant considerably more often than negative traits. However, participants were more likely to endorse negative traits from their *own* perspective than from the perspective of others, especially if they were higher in social anxiety. Neurally, participants displayed greater relative left frontal activity when assessing positive traits from other people's perspectives compared to positive traits from their own perspective or negative traits from either perspective. Participants higher in social anxiety showed decreased frontal theta when assessing the self-relevance of negative trait words. In sum, subclinical social anxiety may influence responses to self-relevant traits that are *negative* and *self-generated* more so than to self-relevant traits that are positive and/or from others' perspectives.

Poster 3-056**NETWORK TOPOLOGY DYNAMICS OF CIRCULATING BIOMARKERS AND COGNITIVE PERFORMANCE IN OLDER CYTOMEGALOVIRUS (CMV) SEROPOSITIVE AND -NEGATIVE MEN AND WOMEN**

Svetlana Di Benedetto^{1,2}; Ludmila Müller¹; Sandra Düzel¹; Graham Pawelec²; Viktor Müller¹

¹Max Planck Institute for Human Development, ²University of Tübingen

Descriptors: Network topology dynamics, Inflammatory biomarkers, Cognition

Cytokines are signaling molecules operating within complex networks and modulating many physiological processes. In our previous study, we found in 161 older participants that sex and CMV modulated inflammatory markers and cognitive performance. Here, we used a graph-theoretical approach to investigate the network topology dynamics of 22 circulating biomarkers and 11 measures of cognitive performance in these same people. For network construction, we used coefficient of determination (R^2) that was calculated for all possible pairs of variables in four groups: CMV⁻ men (m) and women (f); CMV⁺ m and f. To obtain sparse and stable network topology, the cost level was set to 25%. We determined clustering coefficient (CC) and characteristic path length (CPL) as well as local and global efficiency. For statistical analysis, the rewiring procedure was used. Mean CC was highest and CPL shortest in CMV⁻ m and in total higher (shorter) in m than in f. Correspondingly, both local and global efficiency were highest in CMV⁻ m and in total higher in m than in f. CMV⁻ and CMV⁺ women did not show any significant differences. This indicates that the segregation and integration properties of the network were notably stronger in m (particularly, in CMV⁻) than in f and these network topology differences were in particular stronger for cytokines and cognitive variables. In addition, modularity analyses showed that the networks exhibited highly differentiated modular organization. We conclude that network topology dynamics provide crucial information about physiological system interactions.

Poster 3-057**PHYSIOLOGICAL RESPONSES TO AUDIOVISUAL MEDIA MESSAGES BY PEOPLE WITH DIFFERENT POLITICAL ATTITUDES AND MORAL MOTIVES**

Xia Zheng; Jingjing Han

The Media School, Indiana University, Bloomington

Descriptors: political attitude and moral motive, skin conductance level, heart rate

This study tests two competing hypotheses regarding the relationship between trait negative bias and political & moral attitudes. The essentialism hypothesis contends that people with more conservative political attitude and with higher social order moral motive will have a higher trait negative bias. The dynamical coordination hypothesis argues that trait negative bias should modulate an individual's political attitudes and moral motives so as to be congruent with the attitudes held by the majority of people in the proximal social context. The study uses subjects' physiological reactions to audiovisual messages, specifically heart rate and skin conductance level, to index trait negative bias based on previous research. The study design is a 2 (valence) * 2 (arousal) * 6 (message repetition) * 3 (political attitude) * 2 (moral motive) mixed design. Valence (negative and positive), arousal (calm and arousing), and message repetition are within-subject factors. Political attitude and moral motive are between-subject factors. Neither between-group effects on political attitude nor on moral motive were found for skin conductance level to audiovisual stimuli. Additionally, conservatives show more heart rate deceleration when viewing negative arousing stimuli compared to other groups ($F(46, 2622) = 1.7, p = 0.003$, partial Eta square = .065), which is indicative of lower negative bias for the conservatives. These results cast doubt on the essentialism hypothesis and offer preliminary support for the dynamical coordination hypothesis of morality.

Poster 3-058**STABILITY AND INTERNAL CONSISTENCY OF ERPS ACROSS FOUR ASSESSMENTS II: THE ERROR-RELATED NEGATIVITY**

Magen Lowe; Jessica Day; Elizabeth Mulligan; Greg Hajcak
Florida State University

Descriptors: Error Sensitivity, Reliability, Repeated Measures

The error-related negativity (ERN) is increasingly used as an individual difference measure and in relation to psychopathology. Several studies have employed repeated within-subject assessments of the ERN. However, the stability of the amplitude and internal consistency of the ERN across many repeated assessments has not been examined. The present study examined the ERN and its psychometric properties across four identical assessments within one month. EEG was recorded during a flanker task in 23 undergraduate women at each assessment, which took place approximately once per week for four weeks. The correct-response negativity (CRN) and error-related negativity (ERN) were quantified as the average activity between 0-100 ms at the FCz electrode site. Although the ERN was more negative than the CRN, there was not an effect of assessment order on the CRN or ERN—and no interaction between assessment and trial type. Additionally, internal consistency of the CRN and ERN was excellent across all four assessments. Our findings suggest that the amplitudes of the CRN and ERN do not habituate over repeated assessments – and that the Δ ERN (i.e., the difference between the ERN and CRN) also remains stable. The present study suggests that it is feasible to utilize the Δ ERN as a repeatable index of error sensitivity.

Poster 3-059**THE PSYCHOPHYSIOLOGY OF ANXIETY AND MOOD DISORDERS: TRANSDIAGNOSTIC PATTERNS**

Sherry Zhou; Margaret Bradley; Vanessa Dominguez; Peter Lang
Center for the Study of Emotion and Attention, University of Florida

Descriptors: Negative Affectivity, Trauma, Telomere

Currently, diagnoses of mental disorder are based on patient reports of symptoms at interview. Motivated by the NIMH RDoC initiative, "To explore potential dimensional, biological measures of psychopathology, unconstrained by current diagnostic categories", the current study assesses a range of psychophysiological measures as they relate to biological differences among patients with principal anxiety and mood disorders. The research focuses on measures that could be easily implemented at the time of clinical interview, exploring their relationship to questionnaire assessment, incidence of co-morbidity, life dysfunction and ratings of clinical severity. Participants were 343 patients and 40 healthy controls who responded seventeen questionnaires, and were clinically evaluated in an intensive, structured interview (ADIS, DSM-4). Physiological measures included blood pressure, resting heart rate, BMI, and telomeres (from saliva samples). Three questionnaire factor scores were calculated—*negative affectivity*, *anxious arousal*, and *trauma*. Preliminary results: 1) Pulse pressure (systolic minus diastolic) is negatively related to factor scores of *anxious arousal* and *trauma*. 2) Reduced telomere length is significantly associated with higher scores for *negative affectivity* and *trauma* history, and marginally associated with clinicians' severity ratings. The relationship between telomere length and negative affectivity remains after controlling for patients' age, gender and BMI, suggesting a possible relationship between severity of internalizing disorders and early aging.

Poster 3-060**A COMPARISON OF NOMOTHETIC AND INDIVIDUALIZED ALPHA FREQUENCY APPROACHES TO MEASURING FRONTAL EEG ALPHA ASYMMETRY**

Diheng Zhang; John Allen
University of Arizona

Descriptors: EEG, Frontal Asymmetry, Individualized Alpha Frequency
Frontal asymmetry (FA) is considered to be a reliable marker of affective processing and psychopathology. Traditionally, the magnitude of alpha is calculated by taking the average over a nomothetic fixed frequency window (e.g. 7.5 to 13.5 Hz). Methods have been proposed to extract individualized alpha frequency (IAF) peaks and windows in hopes of improving the reliability and validity of signal detection. However, no study has compared the nomothetic to IAF approaches in a large well-characterized data set. In this study, we assessed the psychometric performance of the standard fixed window approach, a PZ-alpha based IAF and a global-alpha based IAF windows detection approaches on a previously collected EEG data set (8 recordings per subject collected on four occasions across two weeks). Our results revealed that FA calculated with these three different methods are highly correlated at all frontal channels ($r_{\text{mean}} = 0.98$). The stability across the 8 recordings over the two weeks also showed no substantial difference between approaches as indicated by Intra-class correlations (ICCs: Standard F4_F3: 0.53; PZ-based IAF F4_F3: 0.54; Global-alpha based IAF F4_F3: 0.51). Our results supported the overall trait-like reliability of two different IAF approaches, and is a starting point for more sophisticated comparison including within day internal-consistency reliability, and validity with respect to measures of emotion and emotion-related psychopathology. Guidelines for evaluating previous literature and conducting future EEG research will be provided.

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Poster 3-061**PERSONALITY AND CHRONOTYPE TRAITS ARE ASSOCIATED WITH TASK-SPECIFIC BRAIN NETWORK DYNAMICS**

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Nick Wasylyshyn¹; Steven Tompson¹; Scott Grafton²;
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Descriptors: fMRI, network neuroscience, traits
Traits encapsulate habits and attitudes that are robust markers of individual differences across time. Personality traits, for example, have been shown to account for individual variability in performance across a variety of tasks. Brain imaging studies have further identified that aggregate brain activity can capture these relationships between traits and behavioral performance. Recently, network neuroscience has provided new analytic tools to capture the temporal dynamics of system interactions among brain regions, revealing neural dynamics that extend beyond static snapshots of traditional analyses. Here, we employ community detection methods on fMRI data while participants performed five different tasks (attention shifting, vigilance, visual working memory, emotional valence, and mental arithmetic). Our analysis examined whether five trait measures (including MEQ, Big Five Inventory, BIS/BAS) were differentially related to brain network dynamics during task execution. Fifty-seven participants (24 males and 33 females; $M = 22.58$ $SD = 3.34$) were included in the analysis. Results indicate different traits account for network dynamics in different tasks: trait differences in MEQ components capture network dynamics in an attention task, while personality traits (BFI-Extroversion) relate to emotional task performance. Overall, our findings extend previous research by linking the literature on trait-performance relationships with recent literature on network dynamics.

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Poster 3-062**THE STUDY OF PUBLIC SPEAKING ANXIETY IN VIRTUAL REALITY USING PSYCHOPHYSIOLOGICAL PARAMETERS**

Stepan Strelnikov; Artem Kovalev
Lomonosov Moscow State University

Descriptors: Virtual reality, stress test, public speaking anxiety
The present paper is devoted to study the effect of application the virtual reality public speaking environment on the level of anxiety using psychophysiological indices. For this aim we investigated such factor as the virtual audience size, which may affect the level of speaker anxiety. State-Trait Anxiety Inventory (STAI) (Spielberger, 1976) and biofeedback stress-test were used to anxiety level estimation. For creating the public speaking situation in virtual reality was applied the HTC Vive system and application «Presentation Simulator». Subjects were invited to prepare a short presentation for public speaking in the virtual environment. They executed this procedure three times in different virtual classrooms (small, medium and large) which were displayed in pseudorandom order. Six subjects took part in this experiment: four with a moderate level of anxiety and two with a high level of anxiety. The results showed that there subjects experienced the greatest anxiety in a small audience. The heart rate and photo-plethysmogram amplitude between pre-exposure and post-exposure tests were also significantly different for this size in comparison to medium and large audience size. These results may be related to the fact that in a small audience the listeners are closer to the speaker and their avatars stand out in more detail, which can affect the presence effect.

Funding: This work supported by grant RFBR No 17-29-02169.

Poster 3-064**FRONTO-THALAMIC EEG PATTERNS IN ADOLESCENTS WITH PROBLEM AND RISK-TAKING BEHAVIOR**

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Descriptors: risk-taking, problem behavior, EEG
Maladaptive and risk-taking behavior in adolescence is associated with impaired executive control and poor decision making. Our previous developmental EEG study showed the correlation between deficient executive functions and native EEG changes, i.e. bilaterally synchronous groups of theta-waves in the frontal cortices. These changes were regarded as a sign of suboptimal functioning of fronto-thalamic regulatory system (FTS). In this study, we analyzed associations between deviant behavior, risk-taking propensity, and FTS functional state. In a large group of adolescents ($N = 177$, aged 14.37 ± 1.12 years), risk-taking propensity was measured using Balloon Analog Risk Task (BART), problem behavior was scored with the Youth Self Report (YSR) adapted for Russian speakers, and resting state EEG was recorded and qualitatively analyzed for the presence of FTS specific patterns. After YSR, two contrasting subgroups, control (C) and deviant (D) were arranged. The D group showed the most pronounced difference, as compared with C in Delinquency and Aggression scales ($p < 0.001$). Two strategies in BART were found among D subjects: risky and impulsive strategy, i.e. high stakes in the beginning of the session followed by lower stakes in the middle and return to high stakes by the end of the session; risk-aversion strategy, i.e. low stakes during the whole session. In risky subjects of the D group, FTS specific EEG patterns were found significantly more often, as compared with the C subjects ($\chi^2 = 12.167$, $p = 0.002$).

Funding: Russian Foundation for Basic Research, project # 17-06-00837-OGN.

Poster 3-065
DYNAMICS OF EEG ALPHA-ACTIVITY IN MODERATELY PRETERM CHILDREN

Nadezhda Pavlova¹; Polina Pavlova¹; Dmitrii Chegodaev¹;
Olga Lvova^{1,2}

¹Ural Federal University, ²Ural State Medical University

Descriptors: prematurity, high-density EEG, infants

The dynamical changes in electrophysiology of the brain in moderately preterm (pT) children are considerable for understanding the features of development and therapy strategies. The study aimed to assess electroencephalographic (EEG) spectral power in alpha-band (6.04-9.03 Hz) in full-term (fT) and pT children within their early development. EEG (128-channels) were registered in pT (32-36 gestational weeks (gw)) and fT (>38 gw, matching pTs' corrected age) children, which comprised groups based on the age of assessment: 5 (pT: N = 9/ 5 male/ mean corrected age (mca) = 4.9 months/SD = 0.7; fT: N = 10/ 5 male/ mean chronological age (mcha) = 5.7 months/SD = 0.26), 10 (pT: N = 9/5/mca = 10.3/SD = 0.53; fT: N = 10/5/mcha = 10.79/SD = 0.38), 14 (pT: N = 7/4/mca = 14.9/SD = 0.97; fT: N = 7/5/mcha = 14.7/SD = 0.4) and 24 (pT: N = 7/2/ mca = 25.21/SD = 1.19; fT: N = 7/2/mcha = 25.29/SD = 1.16) months. We analyzed data from the following groups of electrodes: prefrontal (pref), parietal (P), occipital (O), temporal (T), premotor (preM), sensorimotor (SM). Fast Fourier transform algorithm (Hanning window) was applied in 20 seconds segments of background EEG. The Mann-Whitney U test revealed significant differences in alpha-band power for 5 months groups in preM (p = 0.001), P (p = 0.022), T (p = 0.028), O (p = 0.046), and for 24 months groups in preM (p = 0.017), SM (p = 0.017). Differences in alpha activity in central regions plausibly represents formation of mu-rhythm, which spectral power reaches in moderately pT children values compatible to the ones of fT group by the end of first year, but decrease within second years of life.

Funding: This work was supported by the funding of the Russian Science Foundation 16-18-10371.

Poster 3-066
INFANT FRONTAL EEG ASYMMETRY PREDICTS TODDLER PHYSIOLOGICAL AND BEHAVIORAL SYNCHRONY WITH MOTHER DURING PUZZLE INTERACTION TASK

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Descriptors: frontal asymmetry, physiological linkage, self-regulation

Mothers continuously respond to children's actions and physiology in guiding children's developing self-regulatory behaviors (Feldman, 2012). We focused on infant self-regulation (frontal EEG asymmetry or FA; Fox, 1994) in the examination of 36 mo regulatory physiology and behavior during dyadic interactions with mother. Fifty infants had FA calculated from baseline EEG at 5 and 10 mo (Coan & Allen, 2007). At 36 mo, children and mothers had 5 min to complete puzzles during EEG hyperscanning. FA was calculated and parsed into 1-sec epochs. Using dynamic linear time series regression over pooled dyadic data, we modeled how mother and child sec-by-sec FA scores were predicted by own past FA and partner's past FA at lags of 1-3 sec. Product of the regression was a physiological linkage score for child and for mother during the puzzle task. We also produced a behavioral linkage score for child and for mother during puzzle task with continuous coding of maternal scaffolding-type behaviors and child engagement-type behaviors (Qu, Leerkes, & King, 2016). Results show that 5 mo infant FA predicts 36 mo child sec-by-sec compliance behaviors in context of maternal encouragement with 1 sec lag in compliance; Rsqr = .11; beta = -.33. Results show that 10 mo infant FA predicts 36 mo child sec-by-sec FA responding to mother's FA during puzzle task with 2 sec lag; Rsqr = .14, beta = .38. Our work suggests it is critical to consider infant biological contributions to children's developing self-regulation and that it is best to do so in the context of social interactions with the caregiver.

Funding: R01 HD049878 (PI Bell); R03 HD057318 (PI Bell); Virginia Tech – ISCE Scholars Award (PI Bell).

Poster 3-067
THE EVIL OR THE GOOD? EEG DELTA POWER IN RECOVERY PERIOD OF PERINATAL ISCHEMIC STROKE

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Descriptors: electroencephalography, delta power, perinatal ischemic stroke
Quantitative electroencephalography (EEG) data can substantially contribute into clarifying structural and functional changes of impaired brain. Besides, it reflects, to some extent, the sanogenetic processes during stroke recovery phase. The aim of the study was to assess absolute EEG spectral power in typically developing infants and infants with perinatal ischemic stroke. EEG (128-channel) were registered in 6 full-term infants (mean chronological age (ma) = 5.64±0.94 months, 3 male) with perinatal ischemic stroke in the basin of the middle cerebral artery (stroke was confirmed by MRI scans in acute period of a disease) and 6 full-term control infants (ma = 5.77±0.17 months, 3 male). The absolute spectral power of delta (0.49-3.91Hz), theta (4.15-7.81Hz), alpha (8.06-12.94Hz) and beta (13.18-30.03Hz) frequency ranges were calculated for each subject by Fast Fourier Transform algorithm (Hanning window) in 10-second segment of background EEG activity. The ANOVA analysis showed significant differences only in delta range (p = 0.006), whilst other comparisons appeared to be insignificant^ theta (p = 0.436), alpha (p = 0.984) and beta (p = 0.196). Elevated EEG delta activity in stroke is typically interpreted as a sign of neuronal alterations. But some studies report that delta activity can serve as a correlate of neuronal rearrangement accompanying brain recovery from stroke. Nevertheless, greater power values in delta frequency band observed in post-stroke participants apparently reflect of extensive brain changes, but not necessarily a structural.

Funding: The research was supported by the grant of the Russian Science Foundation No 16-18-10371.

Poster 3-068
EXAMINING THE WITHIN-FAMILY CONCORDANCE OF FRONTAL ALPHA ASYMMETRY AS A NEURAL MEASURE OF TRAIT MOTIVATION

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Bridgette Tonnsen; Dan Foti
Purdue University

Descriptors: alpha asymmetry, affect, infant-mother

Brain activity captured via electroencephalography (EEG) has been used to investigate both state and trait affective experiences. Asymmetry in the alpha frequency band (8-13 Hz) has been consistently linked to depression in adults such that those with depression demonstrate a relative increase in right frontal brain activity, indicative of motivational withdrawal. A similar electrocortical pattern has also been observed in newborns of depressed mothers, indicating a possible transmission of risk. However, research assessing how the relationship between alpha asymmetry in mother-infant dyads is best captured is currently lacking. For example, while 8-13 Hz is commonly used as the alpha frequency band for adults, research with pediatric samples varies, at times using the adult alpha band and other times using 6-9 Hz (conceptualized as the infant alpha band). The aim of the current study was to assess and optimize the coherence of asymmetry across mothers and infants. Resting state EEG was collected from mothers and their 12-month old infants (N = 24). Exploratory analyses across frequencies revealed that mother-infant concordance is optimized in the 6-9 Hz frequency range (i.e. infant alpha) for infants and the 11-13 Hz frequency range (i.e. adult high alpha) for mothers. At these frequencies, asymmetry in mothers and infants shares a significant, medium-sized correlation, $r = .46, p = .023$. Planned analyses will also examine the internal consistency of alpha asymmetry for both mothers and infants across various recording durations.

Poster 3-069**COMPARING THE OSCILLATORY DYNAMIC IN THE TRIER SOCIAL STRESS TEST AND CONTROL IN YOUTH**

Jia Wu; Linda Mayes; Michael Crowley
Yale University

Descriptors: stress, oscillation, gamma

Background: While physiological markers have been identified for stress reaction (eg. cortisol, HR), EEG markers for stress has been rarely studied. The few previous literatures found that during stress frontal alpha asymmetry increased (Zhang et al, 2018), frontal alpha power decreased while frontal beta power increased (Al-Shargie, et al, 2016, 2018). **Method:** Eighty-eight adolescents (10-17 years old, female 44) did a 7-min resting phase and then a 10-min task phase while high-density EEG was collected. During the task phase, the stress group (randomly assigned $n = 44$) experienced the Trier Social Stress Test, while the control group ($n = 44$) watched a neutral nature themed video clip (Wu, et al 2018). Frontal asymmetry and powers were examined in delta, theta, alpha, beta and gamma. **Results:** Asymmetry scores across all bands decreased (closer to zero), ($F_s > 5.18$, $p_s < .018$). The right hemisphere had a higher activation than the left hemisphere, but less increase from the resting to the task phase. While power in all frequency bands increased ($F_s > 19.66$, $p_s < .001$) (except alpha), greater increase of gamma power was found in the stress than the control group ($F(1, 79) = 11.63$, $p = .001$). **Discussion:** A greater frontal gamma power increase was observed in the stress group compared to the control. Frontal gamma was associated with greater depressive and other psychopathology symptoms (Fitzgerald and Watson 2018). It is speculated that a general concept of psychopathology symptoms could be driven from chronic stress reflected by elevated frontal gamma power.

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Poster 3-070**THE EFFECTS OF TRANSCUTANEOUS VAGUS NERVE STIMULATION ON NORADRENERGIC ACTIVITY**

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Descriptors: vagus nerve stimulation, pupil diameter, noradrenalin

Transcutaneous stimulation of the auricular branch of the vagus nerve (tVNS) has been proposed as a potential treatment for a large variety of psychological and neurological disorders. The main working mechanism hypothesized to underlie the effects of tVNS is the increased activity of the locus coeruleus – noradrenaline (LC-NA) system. In a series of experimental studies (total $N = 204$), we tested whether tVNS presented at a set intensity (0.5mA) increases resting pupil diameter as an index of LC-NA network activity. Additionally, we tested whether tVNS affects task performance and task-related phasic pupil dilation during an Attentional Blink task. We found no evidence that tVNS increases resting pupil diameter or task-related pupil dilation in any of the tasks, compared to sham stimulation. No effects of tVNS on the attentional blink task were found. Overall, these studies indicate that tVNS at a fixed intensity of 0.5mA does not affect these behavioral and physiological indices of noradrenergic activity. In an ongoing study, we will extend these findings by testing whether tVNS at an individually calibrated intensity does increase noradrenergic activity, as indexed by salivary alpha-amylase and P300b amplitude. The results of both fixed as well as individually calibrated intensities will be presented on the poster. These studies will help researchers gain more insight into the working mechanisms underlying the effects of tVNS.

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Poster 3-071**VALIDATION OF A NEW SEQUENTIAL-SET FEAR ACQUISITION PARADIGM: CONDITIONED FEAR MODULATES EARLY AND LATE EVENT-RELATED POTENTIAL COMPONENTS**

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Descriptors: fear conditioning, microstate segmentation, N170/LPP

The temporal dynamics of threat processing has often been neglected in neuroscientific investigations, as specific paradigms and methods are necessary to reveal valid results. Typical fear conditioning paradigms use two conditioned stimuli: A CS+ is paired with an aversive US, while a CS- remains unpaired. Several neurophysiological methods that are promising for studying temporal dynamics of threat processing (e.g., EEG, MEG) require many trials to achieve an adequate signal-to-noise ratio. However, fear responses may attenuate over trials. Here, our goal was to address this issue by developing and validating a new sequential-set fear acquisition paradigm that consists of three subsequent 30-trial acquisition phases, each with a novel CS+/CS- set (different faces on different background colors). During each phase, 7 CS+ were paired with an electric shock US. We tested $N = 21$ participants and found successful fear conditioning on the subjective (arousal/valence), psychophysiological (SCR/ECG), and electrophysiological (EEG) level. Specifically, CS+ (vs. CS-) were rated as more arousing/aversive, evoked higher SCRs, and evoked a stronger heart rate deceleration. Data-driven randomization statistics were applied to identify changes in EEG topographies. Importantly, early (< 100 ms) EEG activity, the face-sensitive N170 component, and the late positive potential (LPP) were potentiated for CS+ as compared with CS-. In conclusion, our findings support the validity of our new fear conditioning design, and its sensitivity to capture early and late electrophysiological processes.

Funding: MFJS was supported by the RTG 2271 “Breaking Expectations” (University of Marburg, Department of Psychology).

Poster 3-072**DEFINING THE LOCUS OF ASSOCIATIVE LEARNING EFFECTS IN VISUAL CORTEX**

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University of Florida

Descriptors: aversive conditioning, visual cortex, ssVEP

Work in human and animal models has shown effects of adaptive change in the primary visual cortex. For example, associative learning with exemplars taken from a specific stimulus dimension systematically alters visuocortical response. Models of attention have shown the role of selective attention is demonstrated not in V1, but in processing areas further along the visual stream. Thus, alternative hypotheses exist stating that associative learning (i) always involves changes in V1, irrespective of the feature dimension manipulated, or (ii) selectively involves the tissue most sensitive to the feature dimension relevant for learning. In the present study, we used the steady-state potential technique and a classical conditioning paradigm in which one exemplar of three stimulus sets was selectively paired with an aversive outcome: Gabor patches, dot motion kinematograms, and faces. Luminance changes across the trial were minimized by adding the stimuli to visual Brownian noise which was regenerated before each trial. We used source estimation by means of an L2 (minimum norm) inverse projection ($N = 21$) and examined the differences between conditioned stimuli paired (CS+) or not paired (CS-) with an aversive loud noise via mass-univariate permutation-controlled F-tests. Results indicate that associative learning effects involve distinct brain regions: calcarine cortex for Gabor patches, mid-occipital gyrus for visual motion, and temporal cortex for faces. Thus, adaptive changes in visual cortex selectively occur in areas most sensitive to the critical stimulus dimension.

Poster 3-073**DISTAL STRESS INDUCTION FACILITATES FEAR MEMORY CONSOLIDATION**

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Descriptors: Fear conditioning, Distal stress

The experience of stressful events is a risk factor for anxiety or trauma- and stressor related disorders. Experimental investigations of the effect of predating stress on fear memory trace in humans is scarce. Therefore, the present study aims to investigate distal stress effects on fear conditioning in humans. The experiment comprised three days. On Day 1, seventy-four participants underwent a stress (socially evaluated cold pressor test; SECPT) or sham protocol. During the subsequent two days, a differential fear-conditioning paradigm was conducted. During acquisition (Day 2), one geometrical shape (conditioned stimulus, CS+), but not the other one (CS-), was paired with an electric stimulus (unconditioned stimulus, US). The extinction learning protocol (Day 3) was identical, but without presentation of the US. Preliminary results showed successful fear acquisition, evident in larger skin conductance responses (SCR) and aversive ratings for the CS+ vs. CS-, but not for the startle response. Successful extinction was indicated by decreasing discriminative ratings; while for SCR CS+/CS- differentiation marginally persisted for the stress (vs. sham) group. Taken together, the results suggest that distal stress seems to stabilize fear memory consolidation and thereby impairing extinction in humans.

Funding: Study is funded by SFB-TRR 58, project B08.

Poster 3-074**THE HEART CAN BE UNPREDICTABLE: EXAMINING EMG AND CARDIAC STARTLE RESPONSES DURING FEAR CONDITIONING**

Heather Kissel; Alex Faunce; Michael Lewis; Bruce Friedman
Virginia Tech

Descriptors: Fear conditioning, Startle response, Cardiac responses

Past studies have demonstrated that humans display stronger fear conditioning responses when an aversive stimulus is paired with the image of a face whose race differs from their own (Olsson et al., 2005). The current study of 32 undergraduates investigated whether the skin tone of faces used as fear conditioning stimuli impacted the extent of fear conditioning as measured by eyeblink electromyography (EMG) and cardiac (HR) changes in response to auditory startle. Face stimuli consisted of two different female faces, one with light skin and one with dark skin. Fear conditioning presentation templates differed according to which face served as the conditioned stimulus (CS); half of participants were exposed to the lighter-skinned face as the CS, and half were exposed to the darker-skinned face as the CS. During acquisition, the CS started with a neutral expression and then changed to a fearful expression accompanied by a loud scream. Fear conditioning was operationalized as the difference in response between trials with and without screams. This conditioning effect was significant for EMG ($B = -.11$, $SE = .01$, $p < .001$), but not for HR responses. Neither HR nor EMG changes were moderated by skin tone of the CS. These results do not replicate prior findings on fear learning and race of faces. Rather, they suggest that cardiac responses to repeated loud stimulation during fear paradigms are more complex than eyeblink reflexes, and do not appear to be predicted by threat versus safety contexts or individual differences related to the perception of fearful social cues.

Poster 3-075**CHANGES IN FUNCTIONAL BRAIN CONNECTIVITY AFTER A VIBROTACTILE WORD-DISCRIMINATION TRAINING PROGRAM IN PROFOUNDLY DEAF INDIVIDUALS**

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Adolfo Flores-Saiffe; Fabiola Gómez-Velázquez;
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Descriptors: vibrotactile discrimination, linguistic stimuli, functional connectivity

Cognitive development of children with profound bilateral deafness is significantly influenced by delayed and impoverished language acquisition, which has motivated the exploration of vibrotactile stimulation as an alternative sensory substitution method that might allow the discrimination of oral language. In a previous study, a short vibrotactile sound-discrimination training modified electrophysiological processing and connectivity. Therefore, we hypothesize that learning to discriminate linguistic stimuli will also induce neural changes. In this study, we aim to compare functional brain connectivity in 12 profoundly deaf participants and their 12 matched normal hearing controls, before and after a training program that focused on the vibrotactile discrimination of words, specifically color names. Participants were scanned at baseline and after a 10 to 12-week training period (15 sessions; 45-min each). The fMRI paradigm consisted of two vibrotactile discrimination Go/noGo tasks. One task involved the discrimination between two pure tones with different duration (T: 500 ms; NT: 250 ms) and the other involved semantic word discrimination (T: Mexican flag colors; NT: other colors). Our results confirm that a training program in vibrotactile linguistic-discrimination modifies brain functional connectivity in terms of modularity and mean node strength in the left hemisphere. This lateralized significant decrease in modularity after the training and increased connectivity strength could be associated with the development of a more global linguistic decodification strategy.

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Poster 3-076**SINGLE-TRIAL P300 DEFLECTIONS ARE LINKED TO COMPUTATIONALLY DERIVED PREDICTION ERRORS AND SUBSEQUENT BEHAVIORAL ADJUSTMENT IN PUNISHMENT-RELATED AND REWARD-RELATED REINFORCEMENT LEARNING**

Christopher Stolz; Erik M. Mueller
University of Marburg

Descriptors: Single-trial EEG, Reinforcement Learning, Prediction Error
While neural prediction errors largely have been studied in reward-related reinforcement learning, the neural basis of prediction errors in punishment-related reinforcement learning is widely unknown. Here, $n = 21$ participants underwent one reward-related and one punishment-related 360-trial three-armed bandit task. Feedback in the reward task signaled monetary reward (+10 Cent) vs. nonreward (+0 Cent) and feedback in the punishment task signaled nonpunishment (no noise burst) vs. punishment (noise burst titrated to match aversiveness of monetary nonreward). In the tasks, participants had to choose between three colored circles, which differed in the probabilities to lead to reward/nonpunishment vs. nonreward/punishment (sine waves, $M = 60\%$, ranging from 20% to 100%). Single-trial regression analyses demonstrated that event-related potential amplitudes from 410 to 750 ms significantly scale with a prediction error that was computed based on the cumulative learning history, suggesting that unexpected nonreward and punishment evoked more positive single-trial P300 deflections than unexpected reward and nonpunishment, respectively. Moreover, preliminary analyses revealed that increased electrocortical responses to feedback in the P300 time-window successfully predicted switch vs. stay behavior in the subsequent trial. Overall, indicating that the P300 is related to prediction errors and behavioral adjustment, our study provides important hints for intersections in neurobehavioral dynamics of prediction errors in reward-related and punishment-related reinforcement learning.

Funding: RTG 2271 "Maintenance vs. change of expectations in the context of expectation violations."

Poster 3-078**THE SELF-REFERENCE EFFECT: NEURAL CORRELATES OF ENCODING AND RETRIEVAL**

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Nencki Institute of Experimental Biology of Polish Academy of Sciences

Descriptors: the self, memory, ERP

Prioritized processing of the self-related information is well-documented. One example of such preference is the self-reference effect (SRE): self-relevant stimuli are better remembered than other-relevant stimuli. The aim of our ERP study was to elucidate the role of encoding and retrieval stages in the SRE. At encoding, participants were asked to judge whether a number of trait words could describe the self, a close-other, and a famous person. At retrieval, they were asked to judge whether words were old (previously presented) or new. Participants demonstrated the greatest recollection of words encoded within the self-referent condition. At encoding, self-descriptive words were associated with significantly increased amplitudes of the late positive component, with a fronto-central distribution and latency over 500 ms. At retrieval, amplitudes of three analyzed ERP components were significantly increased for correctly classified old words in comparison to new words: FN400 (a frontally distributed negative component), LPC (a parietally distributed late positive component; parietal old/new effect), and RFE (right-frontal old/new effect). Splitting the old words according to the encoding conditions revealed enhanced FN400 for words encoded in all conditions, indicating similar 'sense of oldness' (i.e. familiarity). In contrast, enhanced LPC and RFE were found for words encoded in reference to the self, suggesting efficient recollection and source-monitoring processes. Thus, ERP findings of our study suggest that both encoding and retrieval stages contribute to the SRE.

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Poster 3-079**INTERFERENCE AND WORKING MEMORY FOR ACTION: INTERRUPTIONS DISRUPT THE REACTIVATION OF ACTION PLANS**

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Descriptors: working memory, interruptions, P3b

Interruptions and distractions have been shown to disrupt the storage of visual and auditory representations in working memory (WM) leading to reduced task performance. However, WM can also maintain higher-level representations, such as action plans, which have not been examined in the context of these two types of interference. Therefore, we investigated the impact of interruptions and distractions on WM for action in an EEG study. Using a continuous number task (CNT), a random sequence of digits ("1" to "4" and "6" to "9") was presented and participants had to indicate whether the preceding digit was odd or even. Accordingly, participants had to store a response until the next stimulus appeared that served as a start signal. In 25% of all trials, participants had to further respond to interlaced single colored digits (interruptions) or ignore them (distractions) while maintaining the previously formed action plan. Our behavioral results revealed that accuracy was significantly decreased after interruptions compared to distractions or the absence of an interference. This performance deficit was reflected by a reduced stimulus- and response-locked P3 suggesting a disrupted stimulus-response (S-R) mapping following interruptions. More precisely, a diminished response-locked P3 100 ms prior to the response indicates that interruptions hamper the reactivation of the S-R mapping of the preceding trial. Thus, we demonstrate that particularly interference in form of secondary tasks that require a distinct S-R mapping hamper the retrieval of action plans and disrupt WM for action.

Poster 3-080**DISCONNECTION BETWEEN PRE-STIMULUS ALPHA POWER AND CONTRALATERAL DELAY ACTIVITY IN FIRST EPISODE SCHIZOPHRENIA**

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Descriptors: Working Memory, Attention, Parietal Cortex

Working memory (WM) is a core deficit in schizophrenia, which may be related to attention problems. We measured neurophysiological indices of vigilance and working memory in first-episode psychosis participants (FEP) and healthy controls (HC) using concurrent EEG/MEG. Twenty-seven FEP and 27 matched HC performed a visual WM task where they were cued to covertly attend one visual hemifield, viewed a sample array of 1 (low-load) or 3 (high-load) colored circles in each hemifield for 200ms, then, one second later, a probe array was presented, and participants indicated whether any attended circles changed color. For vigilance, alpha power at EEG electrode Pz was measured immediately before the sample stimulus. For WM, Contralateral Delay Activity (CDA) was measured from parieto-occipital EEG sensors and from MEG angular gyrus sources from 300-1000ms after sample stimulus onset. CDA was compared between groups and memory load conditions, and bivariate correlations between alpha power and load-related CDA differences (Δ CDA) were compared between groups. Δ CDA was larger for HC than FEP at parieto-occipital EEG sensors and MEG angular gyrus sources (p 's < .05); however, pre-stimulus alpha power was not different between groups (p > 0.1). Further, pre-stimulus alpha power was correlated with Δ CDA in HC (r = .38), but not FEP (r = -.02; group difference p < .05). FEP were unable to modulate parietal cortex activity by WM load to the same degree as HC, despite similar vigilance between groups. This cortical pathophysiology early in the disease course may relate to emerging visual WM deficits.

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Poster 3-082**FEEDBACK-RELATED NEGATIVITY REFLECTS UNEXPECTED PRESENCE OR ABSENCE OF EMOTIONAL IMAGES**

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Descriptors: feedback-related negativity, reward, punishment

The feedback-related negativity (FRN) is thought to track the valence of an outcome, with more positive amplitudes to rewarding outcomes. Recent evidence indicating the FRN tracked with the salience (i.e., the presence or absence of both rewarding and punishing outcomes) has challenged this view (Soder & Potts, 2018). However, the previous study employed rewarding and punishing outcomes within different domains (i.e., monetary reward versus aversive noise burst). Here, we aimed to replicate the presence/absence effect within the same domain by using emotional images as rewarding and punishing outcomes. We collected EEG data from 45 healthy undergraduate students while they completed a passive, slot machine-like task. There were three conditions (positive, negative, and neutral) corresponding to image valence, presented in a blocked format. Participants viewed cues: S1 that indicated the upcoming predictability (unexpected or expected) and S2 that predicted perfectly the upcoming delivery (presence or absence) of an emotional International Affective Picture System image. Following the cues, the participants could view an image (presence) or an empty box (absence). The valence of the image was determined by the block (e.g., in the positive block, participants either viewed a pleasant image or nothing). Results indicated that the S2 cue predicting the unexpected presence of an emotional image (regardless of valence) evoked more positive waves, while cues predicting the unexpected absence evoked more negative waves. These results support a salience prediction model of the FRN.

Funding: This study was funded in part by the National Science Foundation [MRI 1428999].

Poster 3-083**RIGHT FRONTAL ASYMMETRY RELATES TO BETTER PERFORMANCE IN RISK TAKING CARD GAME**Lauren Neal¹; Philip Gable²¹University of Texas of the Permian Basin, ²University of Alabama

Descriptors: Frontal Asymmetry, Motivational Control, Risk Taking
Recent work on frontal asymmetry in motivational contexts has suggested that right frontal asymmetry underlies motivational control. More controlled behavior in risk taking and inhibition paradigms have been related to right frontal asymmetry. The current study (N = 48) was the first to use a modified Columbia Card Task (CCT) in which participants win or lose money by flipping over cards to encounter gain cards or loss cards while recording electroencephalography (EEG). On half of the trials (Conflict), a conflict between approach and avoidance was manipulated through contrasting loss aversion (avoidance) with the potential for monetary reward (approach). On the other half of trials (Neutral), participants were given no possibility of reward. Participants scored more points on Conflict compared to Neutral trials. Higher points scored related to greater relative right frontal asymmetry during these Conflict trials ($r = -.29, p < .05$), but not for neutral trials. Better control to maximize outcomes on a risk taking task was predicted by greater relative right frontal asymmetry during the task.

Poster 3-084**MISMATCH NEGATIVITY (MMN)-INDEXED AUDITORY CHANGE DETECTION IN RELAPSING-REMITTING MULTIPLE SCLEROSIS**Derek Fisher^{1,2}; Laura Pimer¹; Jenna Bissonnette¹;Ashley Francis³; Krista Hull¹; Jennifer Leckey¹; Lindsay Berrigan³¹Mount Saint Vincent University, ²Nova Scotia Health Authority, ³Saint Francis Xavier University

Descriptors: Multiple Sclerosis, Mismatch Negativity
Multiple sclerosis (MS) is the most common neurodegenerative disease affecting young and middle-aged adults. Over half of those with MS experience some form of cognitive impairment, with processing speed, memory and attention being the most frequently affected domains. MMN generators overlap in anatomical location with reported hypofunction of the bilateral superior temporal gyrus in MS, and the passive nature of MMN paradigms minimizes the potentially confounding impact of fatigue. Research on the MMN in MS has reported reduced amplitudes, suggesting deficits in pre-attentive auditory change detection processes. The primary aim of this study was to examine the MMN in MS using a multi-feature paradigm. Event-related potentials elicited by duration, pitch, gap, intensity and location deviants were recorded in 10 MS patients and 10 matched healthy controls (HC). MMN amplitudes and latencies were compared between groups and were correlated with clinical/demographic measures. Contrary to our hypotheses, MS patients exhibited larger MMN amplitudes for gap deviants ($p = .044$; $d = .97$), duration deviants ($p = .047$; $d = 0.95$) at F_3 and larger MMN amplitudes for intensity deviants ($p = .32$; $d = 1.04$) and location deviants ($p = .027$; $d = 1.08$) at C_3 . Additionally, location MMN amplitudes were correlated with fatigue at frontal electrodes ($p < .005$). We report larger MMN amplitudes in MS (vs. HCs), contrary to previous findings. It is unclear if this represents some form of hypervigilance, or some form of adaptive plasticity in response to commonly occurring visual deficits in MS.

Funding: The project was funded by a New Scholars grant from Saint Francis Xavier University awarded to LB.

Poster 3-085**DELETERIOUS EFFECTS OF FAMILIAR TARGET ON P300 AND RT-CIT**Joseph Olson; Ella Perrault; Peter Rosenfeld
Northwestern University

Descriptors: P300 CIT, Reaction Time CIT, Three stimulus Protocol
Lukacs et al. (2017) explored the use of familiarity-themed stimuli (fillers) to prime probe recognition in the RT-CIT. Relatedly, the use of familiar targets in the P300-CIT has been urged by Farwell (2012), but to our knowledge has never been empirically tested. Thus, this study tested whether crime-relevant targets improve probe recognition in guilty subjects. Participants were instructed to steal one of two items from a drawer: a watch, or a ring. All saw the watch and the ring during the crime, but stole only the watch. We then formed two groups: 1) A familiar group; the target is the ring, 2) an unfamiliar (control) group; the target was a random irrelevant item. We found clear evidence of the familiar target priming the probe, as shown by a between-groups effect on latency, ($F[1, 32] = 5.69$, $p = .023$, with familiar probe latency significantly shorter than unfamiliar. However, no between-groups effect on p-p probe-irrelevant amplitude was found, ($p = .766$). The interaction between CIT effect and condition approached significance ($p = .055$). We also examined the closely related variable, BTM, the bootstrapped probe-irrelevant amplitude difference, as a measure of the CIT amplitude effect. A Mann-Whitney U test (due to non-normality) on BTM, F vs U, yielded $U = 79.5$, $p = .025$. We found strong effects on reaction time, with significant degradation in RT-CIT effect in the familiar group, ($F[1, 32] = 7.9$, $p = .008$, contrary to our hypothesis. Therefore, it seems that familiar targets have deleterious effects on P300 and RT CIT, making their use inadvisable.

Poster 3-086**ALPHA-BAND OSCILLATORY BRAIN ACTIVITY AS AN INDEX OF CHRONIC KNEE PAIN INTENSITY IN OLDER ADULTS**Harold Rocha; John Marks; Adam Woods; Roland Staud;
Roger Fillingim; Kimberly Sibille; Andreas Keil
University of Florida

Descriptors: chronic pain, alpha band, EEG
Quantifying an individual's chronic pain experience can be challenging. The Graded Chronic Pain Scale (GCPS) offers a characteristic pain intensity measure with demonstrated utility which averages current, worst, and average pain over the previous six months. Corroborating the GCPS with physiological measures is desirable for understanding possible somatosensory dysregulation associated with chronic pain. The present study reports on resting cortical alpha-band power and alpha blocking—two common measures of sensory reactivity—and their relationship to characteristic pain intensity ratings in 31 older adults (ages 51–80, 14 female) with chronic knee pain, with or at risk for knee osteoarthritis. Occipital alpha was repeatedly measured at rest across two EEG sessions one week apart, during eyes-closed and eyes-open instruction. Internal consistency and re-test reliability of alpha measures were calculated to determine parameters for stable, trait alpha measures within this population. Results show satisfactory-to-excellent re-test reliability (Pearson's $r_s > 0.6$) and high internal consistency (Cronbach's $\alpha > 0.7$). Signal-to-noise ratios of alpha power averaged across sessions for matching conditions proved to be the most reliable. The data show a positive correlation between chronic pain intensity rating and both eyes-closed alpha levels [$r(27) = .416$] and closed-minus-open alpha blocking [$r(27) = .375$] while at rest. Findings suggest the potential to index chronic pain intensity by utilizing averaged resting EEG alpha in future research.

Poster 3-087**ATTENTIONAL MODULATION OF THE NOCICEPTIVE FLEXION REFLEX AND ANXIETY SENSITIVITY**

Erin Ross¹; Felicitas Huber¹; Natalie Hellman¹; Bethany Kuhn¹; Edward Lannon¹; Cassandra Sturycz¹; Michael Payne²; Tyler Toledo¹; Yvette Guereca¹; Shreela Palit³; Mara Demuth¹; Joanna Shadlow¹; Jamie Rhudy¹

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Descriptors: Pain, Attention, Anxiety Sensitivity

Pain and nociceptive flexion reflexes (NFR, spinally-mediated, pain reflexes assessed from EMG) are modulated by attention; however, it is unknown whether psychological traits are related to attentional modulation of pain/NFR. 257 healthy, pain-free participants completed the Anxiety Sensitivity Index-Revised (ASI-R; a measure of fear of anxiety symptoms with 4 subscales: somatic symptom interpretation, fear of cognitive dyscontrol, fear of publicly displaying anxiety, and fear of cardiac symptoms of anxiety) and viewed affective pictures during which painful electric stimulations were delivered. For this study, attentional modulation was defined as the difference between pain/NFR evoked without pictures (no distractor) to those evoked during neutral pictures (distractor). 3 groups were created based on modulation during distraction (no modulation of pain/NFR, inhibited pain/NFR, facilitated pain/NFR) and compared on the ASI-R. Pain modulation was related to ASI-R total and the cardiac symptoms subscale, whereas NFR modulation was only related to cognitive dyscontrol. Specifically, the pain facilitation group exhibited greater anxiety sensitivity and greater fear of cardiac symptoms than the no pain modulation group. The no NFR modulation group exhibited greater fear of cognitive dyscontrol than the NFR facilitation and inhibition groups. Findings indicate individuals with a fear of cardiac symptoms may facilitate pain during a neutral distractor, whereas individuals with a lower fear of cognitive dyscontrol may not modulate NFR during a neutral distractor.

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Poster 3-088**AVOIDANT AND APPROACH NEGATIVE TRAITS AND RIGID CARDIOVASCULAR RESPONSES TO STRESS WITH DISTINCT DEMANDS**

Wei Lü
Shaanxi Normal University

Descriptors: Avoidant negative traits, Approach negative traits, stress cardiovascular responses

A cluster of negative personality traits characterized by passive avoidant tendency (e.g., trait anxiety, depression), or by aggressive approach tendency (e.g., trait anger, hostility), are the risk factors for cardiovascular diseases. The potential mechanism was explored by examining the relation of these traits and stress cardiovascular responses (CVR). Avoidant traits were related to blunted CVR, while approach traits were related to exaggerated CVR. However, it remains unknown whether these findings are always true across different stress demands. This study used a 2 (stress intensity: moderate vs. high) × 3 (baseline, stress, post-stress) mixed-factorial design to investigate associations between avoidant, approach negative traits and CVR to distinct intensity stress (speech task). Results showed that regardless of stress intensity, avoidant negative trait (average score of trait anxiety and depression) was related to blunted cardiovascular reactivity and poor recovery (moderate intensity: DBP reactivity, $\beta = -0.31$, $p = .005$; HR recovery, $\beta = 0.27$, $p = .014$; high intensity: DBP reactivity, $\beta = -0.30$, $p = .009$; DBP recovery, $\beta = 0.20$, $p = .078$); approach negative trait (average score of trait anger and hostility) was related to exaggerated cardiovascular reactivity and poor recovery (moderate intensity: HR reactivity, $\beta = 0.34$, $p = .002$, HR recovery, $\beta = 0.33$, $p = .004$; high intensity: HR reactivity, $\beta = 0.36$, $p = .001$, DBP recovery, $\beta = 0.23$, $p = .031$). Findings suggest that avoidant, approach negative traits are related to differential but rigid CVR to stress varied in demands.

Poster 3-089**SEX-SPECIFIC MODERATION OF ALCOHOL'S EFFECTS ON HEART RATE BY ALCOHOL USE-RELATED ENVIRONMENTAL CUES**

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Descriptors: alcohol, autonomies, cardiovascular

Alcohol-related environmental cues can affect behavior even when no alcohol is consumed, suggesting that such cues may moderate the experienced psychopharmacological effects of alcohol. Here, we examined effects of alcohol on heart rate (HR) change from baseline resting HR among young adult social drinkers in environments with and without natural alcohol use-related cues. Participants (27-31 yrs old) were administered an alcoholic beverage ($n = 88$; target peak blood alcohol concentration (BAC) of 0.08 g/dL) or a placebo beverage ($n = 57$) in groups of 3-5 people in a simulated bar. In the bar, men ($n = 58$) and women ($n = 87$) in both beverage groups exhibited a small, sustained increase in HR. Women who drank alcohol ($n = 52$) exhibited additional increases in HR over time in the bar, whereas men who drank alcohol ($n = 36$) did not. Elevated HR persisted when women who drank alcohol left the bar (i.e., when removed from alcohol-related cues). Men who drank alcohol exhibited elevated HR only once peak BAC was achieved outside of the bar. In contrast, men ($n = 22$) and women ($n = 35$) who drank placebo exhibited an initial decrease in HR upon removal from the bar and its alcohol-related cues. This pattern of findings suggests that acute effects of alcohol consumption on heart rate may be amplified by the presence of alcohol-related cues in women. These findings are important for understanding how physiological reactivity to alcohol-related cues may modify the experienced psychopharmacological effects of alcohol consumption, potentially affecting decision-making.

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Poster 3-090**A CRITICAL EXAMINATION OF THE CONVERGENT AND DISCRIMINANT VALIDITY OF RESTING EEG FRONTAL THETA AND POSTERIOR ALPHA**

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Descriptors: EEG biomarkers, depression, validity

Prior research has identified two resting EEG biomarkers with potential for predicting functional outcomes in depression: theta current density in frontal brain regions (especially rostral anterior cingulate cortex) and alpha power over posterior scalp regions. As little is known about the discriminant and convergent validity of these putative biomarkers, a thorough evaluation of these psychometric properties was conducted toward the goal of improving clinical utility of these markers. Resting 71-channel EEG recorded from 35 healthy adults at two sessions (one-week retest) were used to systematically compare different quantification techniques for theta and alpha sources at scalp (surface Laplacian) and brain (distributed inverse) level. Signal quality was evaluated with signal-to-noise ratio, participant-level spectra, and frequency PCA covariance decomposition. Convergent and discriminant validity were assessed within a multitrait-multimethod framework. Posterior alpha was reliably identified as two spectral components, each with unique spatial patterns and condition effects (eyes open/closed), high signal quality, and good convergent and discriminant validity. In contrast, frontal theta was characterized by one low-variance component, low signal quality, lack of a distinct spectral peak, and mixed validity. Correlations between candidate biomarkers suggest that posterior alpha components constitute reliable, convergent, and discriminant biometrics in healthy adults. Improved measurement and conceptualization of frontal theta is necessary to determine clinical utility.

Funding: Grant # is NIMH MH115299.

Poster 3-091

DESPERATELY SEEKING: PRECENTRAL GYRUS LINKED TO A CUNEUS/PRECEUNEUS RESTING STATE NETWORK IN COMPLICATED GRIEF

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Descriptors: grief, emotion, resting state fMRI

Introduction: Following the death of a spouse, complicated grief (CG) is an absence of typical adaptation marked by prolonged, intense yearning. Yearning is a motivation to seek proximity to the partner, anticipating the reward of reunion, and frustration of this goal results in separation distress. **Method:** 38 older adults (15 CG, 23 non-CG) underwent resting state fMRI after viewing photos of their deceased partner. The GIFT toolbox (Calhoun et al., 2001) was used to decompose the BOLD timeseries and identify functional networks via group ICA. **Results:** Five independent components of interest were identified: cuneus/precuneus (IC1); right frontoparietal network; anterior default mode network/medial prefrontal cortex; and two posterior default mode network ICs (posterior cingulate/precuneus/fusiform; precuneus/angular gyri). Voxelwise two-sample t tests over the IC spatial maps identified a cluster in the left dorsal precentral gyrus more strongly connected with IC1 in the CG vs. non-CG group, $T = 6.83$, $pFDR = .028$. Precentral gyrus intensity was predicted by yearning intensity even after controlling for overall grief severity and general approach bias. The association was specific to affective vs. cognitive yearning. **Conclusion:** The cuneus/precuneus IC enables autobiographical memory and mental imagery, and results suggest that in CG, this network is more closely linked with the precentral gyrus, implicated in motor imagery and reward. Emotional distress in CG may be related to activation of automatic, unfulfillable motor patterns of proximity-seeking during internal thought.

Funding: DANA Foundation grant to Mary-Frances O'Connor, "Neurobiological Mechanisms of Complicated Grief".

Poster 3-092

OCD CHECKING SYMPTOMS AND THE ERN ACROSS THE MENSTRUAL CYCLE: A REPLICATION & EXPLORATION OF METHODOLOGICAL CHALLENGES AND POTENTIAL SOLUTIONS

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Descriptors: OCD checking symptoms, ERN, menstrual cycle

A recent study found that the error-related negativity (ERN) measured during the flanker task was associated with greater OCD checking symptoms during the luteal phase of the menstrual cycle (Mulligan et al., 2019). The current analysis aimed to (1) highlight methodological weaknesses of cross-sectional approaches, (2) replicate Mulligan et al. (2019) findings and (3) demonstrate a more comprehensive methodology. The current study collected saliva samples for 35 days from naturally-cycling women in order to assay for estradiol and progesterone. Additionally, women completed four electroencephalogram (EEG) visits projected to occur in one of four menstrual cycle phases. For replication analyses, only women with at least one EEG visit occurring in follicular and mid-luteal were utilized. Replication revealed that current methods of projecting menstrual cycle phase have poor accuracy, resulting in misidentification of phase timing. Findings from Mulligan et al. (2019) were not replicated, with no significant relationship found between the ERN amplitude and checking symptoms during luteal phase. To provide a solution for some methodological challenges, phases coded by examining estradiol and progesterone levels and multilevel modeling were utilized. Results revealed menstrual cycle phase was not related to the ERN amplitude nor checking symptoms. Levels of estradiol, progesterone and ERN amplitude did not significantly relate to checking symptoms. Implications for future research of the menstrual cycle in psychophysiology and future directions are discussed.

Funding: The data collected for this poster is supported by the National Institute of Health (Project # 1R01MH108511-01; "Cognitive Control in Anxiety: The Role of Ovarian Hormones").

Poster 3-093

INTEROCEPTION IN BULIMIA NERVOSA: EVIDENCE AT CORTICAL AND SELF-REPORT LEVELS

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University of Luxembourg

Descriptors: interoception, bulimia nervosa, heartbeat evoked potentials

Bulimia nervosa (BN) is characterized by recurrent episodes of binge eating and compensatory behaviors, such as self-induced vomiting. Body image disturbance is also prominent in BN. Current research is trying to determine which dimensions and sensory domains of body perception are affected in BN. Regarding heartbeat perception, findings are inconclusive, with some studies reporting reduced and others reporting unaltered interoceptive accuracy in BN. The current study contributes further data on heartbeat perception by using an indicator of the cortical processing of cardio-afferent signals (heartbeat evoked potentials, HEPs). We investigated 22 women with current or partially remitted BN (BMI 23.94[3.61]; age 31.86[11.20]) and 22 healthy women (HC; BMI 24.24[3.37]; age 31.00[10.15]). Participants performed a heartbeat perception task (according to Schandry) with concurrent 64-channel-EEG and ECG recording. HEPs were calculated as mean EEG amplitudes in the interval 455-595ms after the R-peak of the ECG. Results show no significant differences between the BN and HC groups, neither for heartbeat perception, HEPs, or mean heartrate. These results confirm previous findings of intact heartbeat perception in BN. In addition, cortical processing of cardio-afferent signals is unaltered. Heartbeat perception is particularly relevant for emotion processing and regulation. The previously reported emotion-regulation deficits in BN appear not to be based on altered CNS processing of cardiac signals.

Funding: This project was supported by the Luxembourg National Research Fund (FNR; 8371546).

Poster 3-094

REDUCED NEURAL RESPONSE TO PLEASANT IMAGES IN MAJOR DEPRESSIVE DISORDER

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Descriptors: Depression, Late Positive Potential, Passive Viewing

Major depressive disorder (MDD) has previously been associated with reduced neural response to pleasant stimuli, as measured with the late positive potential (LPP). The LPP is a stimulus-locked ERP that is potentiated to emotionally salient (e.g. pleasant or threatening) stimuli. The current study examined the LPP in an adult sample consisting of 42 healthy controls and 78 participants currently fulfilling diagnostic criteria for MDD or persistent depressive disorder (PDD). Sixty images were selected from the International Affective Pictures System (IAPS), consisting of thirty pleasant (i.e. erotic and affiliative) images and thirty neutral (e.g. household items and buildings) images presented randomly. The LPP was scored as the average activity from 400 ms to 1000 ms at a centro-parietal electrode pool. Results indicated that participants in the depression group had a blunted LPP to pleasant images. Further, within the depression group, the residualized LPP to pleasant images controlling for neutral was negatively correlated with self-reported anhedonia as measured by the PID-5. Previous research has mostly linked anhedonia in depression to impaired neural reward processing (e.g. the reward positivity, RewP). This association with blunted neural reactivity to pleasant stimuli could represent a novel marker of anhedonia and a promising avenue for further research on the pathophysiology of depression. Ongoing research will examine the relation of the RewP and LPP in depression to assess whether these are independent phenomena.

Poster 3-095**POSTERIOR EEG ALPHA AND PERSONAL IMPORTANCE OF RELIGION/SPIRITUALITY AS PREDICTORS OF DEPRESSION SEVERITY IN FAMILIES AT RISK FOR DEPRESSION**

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Descriptors: Depression risk, EEG alpha, Religion/spirituality

In a longitudinal study of families at risk for depression, risk for and lifetime history of major depressive disorder (MDD) have been linked to greater posterior EEG alpha, a biomarker of clinical outcome. Separately, personal importance of religion and spirituality (RS) has been shown to provide protective benefits for persons at high risk for MDD. Given our prior findings showing stable associations between EEG alpha and RS (Tenke et al 2013, 2017), we aimed to directly explore the interaction between posterior alpha and RS on a clinical health outcome measure of depression. Introducing a novel mixed-effects model approach, we obtained individual estimates of RS importance at age 21 using data collected at 5 different timepoints spanning 25 years. Existing resting 72-channel EEG, previously quantified via Current Source Density and frequency Principal Component Analysis, was used to provide posterior alpha amplitude estimates. Depression severity was measured with the Patient Health Questionnaire (PHQ) about 5 years after EEG collection. Supporting prior findings, greater RS importance and greater EEG alpha predicted lower PHQ. An interaction between alpha and RS importance indicated that higher alpha levels amplified the difference in RS importance on depressive symptoms. Additional interactions with risk for and lifetime history of MDD revealed a complex interrelationship of these variables. Although effect sizes were small, these findings suggest a compounded association of posterior alpha and RS importance that may together afford a protective mechanism for MDD.

Funding: This work was supported by grants from the National Institute of Mental Health (MH36197) and the John F. Templeton Foundation (#54679 and #61330).

Poster 3-096**IDENTIFYING OPTIMAL TASK LENGTH TO ELICIT THE LARGEST BETWEEN GROUP EFFECTS IN REWARD PROCESSING DURING A SIMPLE GAMBLING TASK**

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Descriptors: Reward, Depression, EEG/ERPs

The reward positivity (RewP) event-related potential (ERP) has been proposed as an objective neural indicator of reward sensitivity in major depressive disorder (MDD). Although previous research has demonstrated blunted RewP in depression, additional factors, such as task length and duration, should be considered when designing experiments to elicit between groups effects in clinical studies. We examined differences in neural responses to monetary reward and losses during a simple gambling task in individuals with MDD ($n = 51$) and healthy controls ($n = 47$). 50 reward and 50 loss trials were presented randomly across the duration of the task. Results showed a blunted RewP difference wave in individuals with MDD relative to controls. Across the experimental paradigm, a significant time x group interaction for RewP difference wave indicated that between group differences were first observed after 25 trials and were sustained across the remainder of trials ($ps < .01$). Further, the largest between groups difference was observed after completing 40 trials ($d = 0.73$). To determine which parent ERP drove this effect, we examined between groups parent waveforms across time and found that the parent RewP was significantly different after completing 40 trials ($d = 0.41$), while the parent FN was similar between groups across time ($d = 0.08$). These findings have implications for improving experimental design in clinical research by optimizing task length to elicit the largest between groups effects, which may improve the clinical utility of ERPs as biomarkers of psychiatric disorders.

Poster 3-097**REDUCED BETA AND GAMMA BAND ACTIVITY TO AUDITORY STIMULI IN CHILDREN WITH AUTISM SPECTRUM DISORDERS**

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Descriptors: Autism Spectrum Disorders, Neural oscillations, Auditory processing

Auditory processing is the most commonly affected sensory domain in autism spectrum disorders (ASD). However, there is little research examining the basis of auditory processing dysfunction in ASD. This study examined brain oscillations during a paired-click EEG paradigm in 21 children with ASD (5-12 years) and 20 age-matched neurotypical children. The baseline corrected time-frequency characteristics of evoked power (signal intensity) and phase-locking factor (PLF; signal synchronization) were measured at 3 regions of interest; a) beta, 13–18 Hz from 60–90ms, b) early gamma, 30–50 Hz from 20–60ms, and c) late gamma, 30–50 Hz from 60–90ms. Caregivers of all children completed the Sensory Profile (SP) questionnaire. The ASD group had reduced beta evoked power, $F_{(1,39)} = 25.1, p < .0005$, and reduced beta PLF, $F_{(1,39)} = 27.3, p < .0005$, to both clicks compared to controls. Early gamma but not late gamma PLF was reduced in the ASD group compared to controls for both clicks, $F_{(1,39)} = 10.5, p = .002$. There were no group differences in early or late gamma evoked power. Across all participants, greater sensory processing issues on the SP was associated with lower click 1 beta evoked power, $r = .44, p = .004$, lower beta PLF, $r = .49, p = .001$, and lower gamma PLF, $r = .45, p = .003$. Results show that children with ASD have reduced evoked power and phase synchrony of beta activity and reduced early gamma phase synchrony during auditory processing compared to controls, specifically in orienting and filtering auditory stimuli, which strongly correlate with sensory processing issues in everyday activities.

Funding: NICHD R03HD049532 Graduate Student Grant from the Organization of Autism Research.

Poster 3-098**SHUT DOWN AND SHUT OUT: DISSOCIATIVE SYMPTOMATOLOGY AND UNUSABLE PSYCHOPHYSIOLOGICAL DATA**

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The New School for Social Research

Descriptors: skin conductance, dissociation, methodology

Participants in psychophysiological studies may not always conform to parameters for quality data set forth in guidelines papers. While prior work shows that race accounts for a disproportionate amount of “unusable” data, we ask whether clinical features may also yield data outside expected parameters. In particular, we examine whether symptoms of depression, anxiety, PTSD, or clinical dissociation systematically yield skin conductance levels (SCL) below expected physiological thresholds. Baseline data from six studies conducted at the same lab were compiled ($N = 337$). Symptomatology was coded dichotomously as above/below a clinical threshold score. SCL was coded dichotomously as above/below 0.67 microsiemens, an established cut-off value for quality data. A binary logistic regression was used to determine the relationship between symptoms and usable SCL. The odds of showing usable SCL were significantly lower for participants endorsing dissociation ($OR = 0.324, p < .001$). Race does not confound this finding, as it was not significantly associated with symptoms ($OR = 1.409, p = .320$). These results suggest that the SCL data of participants with dissociative symptomatology may be being systematically excluded from psychophysiological studies. Refining of methodological standards may be required in order to improve the utility of psychophysiology in clinical studies.

Poster 3-099**WHAT'S BLOOD GOT TO DO WITH IT? CARDIAC RESPONSE TO STARTLE AND FEAR CONDITIONING IN BLOOD PHOBIA**

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Virginia Polytechnic Institute and State University

Descriptors: Blood Phobia, Defense Cascade, cardiac startle response
Peak cardiac responses to startle typically emerge around 2 seconds and persist until 8 seconds after a startle probe (Bradley, Silakowski, and Lang, 2008). Response patterns can be bi- or tri-phasic, showing heart rate deceleration, then acceleration, and sometimes deceleration again. An acceleration-deceleration-acceleration pattern has also been reported. Our study examined cardiac responses within subjects and across conditions in a fear conditioning paradigm. Variability was assessed in four 32-trial CS+ blocks: early acquisition at 75% reinforcement, late acquisition at 100% reinforcement, early extinction and late extinction trials. Even within each block of each subject's cardiac response to startle, no clear response patterns emerged. However, when cardiac response variability was aggregated across trials by subject, a strong positive correlation emerged with scores on the Blood Injury subscale of the Fear Survey Schedule (Wolpe & Lang, 1964; $r = 0.42$, $p = .004$). These seemingly disparate constructs are actually linked in the *defense cascade* model. In this view, startle probes initiate orienting and subsequent defensive behavior. People with blood phobia move rapidly through the defense cascade, often culminating in a vagally-mediated shut-down, and have shown significant correlations with high-frequency heart rate variability (Thayer & Friedman, 1998; Nackley et al., 2018). This study provides new support for the defense cascade, and suggests that startle/fear conditioning paradigms may be viewed as a way to examine cardiac and behavioral response to threat.

Poster 3-100**NEUROPHYSIOLOGICAL CORRELATES OF REWARD ANTICIPATION AND ANHEDONIA IN VETERANS WITH ALCOHOL USE DISORDER**

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Descriptors: AUD, Anhedonia

Alcohol use disorder (AUD) and depression are highly prevalent and comorbid in Veterans. Anhedonia is a reduction in motivation for reward. However, the neural correlates of reward anticipation in Veterans with AUD and anhedonia are unclear. A total of 85 Veterans (17F, mean age = 47) in treatment for AUD completed self-report questionnaires, such as the Mood and Anxiety Symptoms Questionnaire (MASQ), and fMRI during the Monetary Incentive Delay task. During the task, participants were cued to anticipate and respond to a target to gain or avoid losing money. MASQ anhedonic depression was not related to demographic characteristics in this sample. Cluster threshold was 297ml and $t > 2.64$ activation intensity ($p < 0.01$). Results revealed anticipation of gain versus no gain (GvN) and anhedonia were positively associated in left inferior frontal and superior temporal regions, but negatively associated in bilateral medial frontal gyri, cuneus, prefrontal gyri and cerebellum. During anticipation of loss versus no loss (LvN), anhedonia had a positive relationship in right middle and superior frontal regions but a negative association in bilateral posterior cingulate, right caudate, and parahippocampal areas. Consistent with reward network literature, left hemisphere is involved in the perception and expression of positive emotions (GvN) and right hemisphere is involved in negative emotions (LvN). Prefrontal and limbic regions play a crucial role in reward processing and individuals with anhedonia in the context of AUD may have aberrant reward systems, which may increase risk for relapse.

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Poster 3-101**OBSESSIVE-COMPULSIVE SYMPTOMS ASSOCIATED WITH ABNORMAL FEEDBACK PROCESSING**

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Descriptors: feedback processing, EEG, compulsivity

Electrophysiological studies of feedback processing among individuals with elevated obsessive-compulsive (OC) symptoms have demonstrated that OC symptoms are associated with less negative difference feedback-related negativity (dFRN) amplitude, suggesting that such symptoms may be related to deficits in reward processing, punishment sensitivity, or both. However, in addition to focusing on difference waves, all such studies involved tasks with binary outcomes (e.g., reward or loss), which do not inform how OC symptoms may be related to sensitivity to the magnitude of the reward or loss or to processing of neutral outcomes (e.g., breaking even). The goal of the current study was to compare two gambling tasks -- one with binary outcomes and one with 5 outcomes including large loss, small loss, neutral, small reward, and large reward in order to test whether OC symptoms are associated with reward or loss magnitude insensitivity and/or abnormal processing of neutral feedback. Thirty-seven undergraduate participants completed both versions of the gambling task and self-reported on their OC symptoms. Although there were no associations between OC symptoms and FRN amplitude in any of the reward or loss conditions across the two tasks, OC symptoms were associated with less negative FRN amplitudes following neutral feedback ($p = .006$). Results highlight the importance of examining responses to neutral outcomes and suggest that, compared to low OC individuals, high OC individuals may evaluate neutral outcomes as more favorable and therefore may be more averse to losses.

Poster 3-102**EEG THETA/BETA RATIOS AS BIOMARKERS: EVIDENCE OF VALIDITY**

Sherona Garrett-Ruffin
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Descriptors: EEG theta/beta ratios, validity

There is evidence that electroencephalography (EEG) theta (4-8 Hz)/beta (13-30 Hz) ratios can serve as biomarkers of attention, impulsivity and trait anxiety. To our knowledge, however, no researchers have systematically explored whether EEG theta/beta ratios change significantly in response to transient state conditions. To explore whether EEG theta/beta ratios change in response to different conditions, participants completed drawing and coloring tasks. Baseline and post-task measures of self-reported mood and EEG theta/beta ratios were gathered. Participants reported more positive affect and less negative affect post-task, as compared to baseline. There were, however, no statistically significant changes in EEG theta/beta ratios across conditions. These preliminary results suggest that EEG theta/beta ratios are stable across conditions and provide additional evidence for the validity of EEG theta/beta ratios as biomarkers. Further research involves exploring possible changes in EEG theta/beta ratios in response to acute stress conditions.

Poster 3-103**RESTING ALPHA FREQUENCY COMPONENTS AS INDICES OF AROUSAL**Frances De Blasio^{1,2}; Robert Barry^{1,2}; Jack Fogarty^{1,2}; Adam Clarke^{1,2}¹University of Wollongong, ²Brain & Behaviour Research Institute*Descriptors:* Alpha, f-PCA, Arousal

Alpha is traditionally defined as ~8-13 Hz, yet range variations are often used. Frequency principal components analysis (f-PCA) offers an alternative approach, quantifying natural EEG frequency components in a *data driven* manner. We assessed whether such alpha components, derived during eyes-open (EO) and eyes-closed (EC) resting, demonstrate the traditional association with arousal, as indexed by SCL. Continuous EEG and SCL were recorded from 27 young adults ($M_{age} = 20.8$) while they completed three 2 min resting blocks: EO, EC, and EO. Sequential 4 s epochs were extracted, DC corrected, and artifacted. Spectral data were obtained for accepted epochs using Fourier Transforms, and mean (within-subjects) spectral amplitudes (DC-30 Hz) were submitted to f-PCAs for each condition/block. Mean SCL reduced significantly (within-subjects) from EC to EO, and inversely correlated with global amplitude in (traditional) alpha (8-13 Hz), confirming the typical arousal associations. Congruent alpha components were identified in EO; a low alpha component peaked at 9.25 Hz in each EO block, while a high alpha component peaked at 11.50 Hz in EO1 and 11.75 Hz in EO2. Correlations identified inverse relationships between SCL and global amplitudes in each alpha component (across EO1/EO2). In EC, four alpha components were identified, yet only one of these (peaking at 8.50 Hz) was inversely associated with SCL. Overall, results suggest that multiple components with different functionality underlie the traditional alpha band; f-PCA in future studies may help clarify these beyond arousal.

Poster 3-104**PERCEPTUAL AND NEUROPHYSIOLOGICAL COMMONALITIES OF DIFFERENT AVERSIVE BODILY SENSATIONS**Valentina Jelencic; Diana Torta; Ilse Van Diest; Andreas von Leupoldt
KU Leuven*Descriptors:* event-related potentials, perception of aversive bodily sensations, perceptual sensitivity

Chronic bodily diseases are characterized by a multitude of aversive bodily symptoms, with pain and dyspnea commonly co-occurring. Despite evidence of common emotional neural networks in chronic pain and dyspnea, systematic studies into their potential perceptual and neural commonalities are lacking. This study measured neural responses to brief respiratory and somatosensory sensations and explored their links to perceived intensity and unpleasantness of induced pain and dyspnea, as well as perceptual sensitivity. We hypothesized intra- and cross-modal links within and across neural and perceptual measures. Using EEG in 39 healthy adults, we defined neural responses to paired respiratory occlusions (150ms; ISI = 500ms) and paired electrocutaneous stimuli (2ms; ISI = 500ms) as peak amplitudes of the N1 component of respiratory-related and somatosensory evoked potentials. Participants reported intensity and unpleasantness of these sensations, completed magnitude estimation for inspiratory resistive loads and electrocutaneous stimuli to assess perceptual sensitivity, and reported the unpleasantness of 10 consecutive aversive stimuli. We observed significant intra- and cross-modal correlations within neural and perceptual measures, but no significant correlations between neural responses and perceived intensity and unpleasantness. However, a significant correlation of the respiratory N1 amplitude and perceptual sensitivity for inspiratory loads was found. The results suggest common mechanisms behind the perception of different aversive bodily sensations and invite further research.

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Poster 3-105**MOTOR-PARAMETER MATCHED ESTIMATION OF ACTION-RELATED AUDITORY ATTENUATION**János Horváth^{1,2}; Dávid Nevelő³; Bence Neszmeily^{1,3}¹Research Centre for Natural Sciences, Hungarian Academy of Sciences,²Károli Gáspár University of the Reformed Church in Hungary,³Budapest University of Technology and Economics*Descriptors:* Voluntary action, Auditory, N1

Numerous studies suggest that the N1 and P2 auditory event-related potential (ERP) waveforms are attenuated for sounds elicited by one's own actions. To estimate the auditory contribution to the compound motor-auditory ERP, in most studies an ERP elicited by actions without a sound (motor ERP) is subtracted. This procedure relies on the assumption that actions are identical irrespective of whether they elicit a sound or not. We recently showed that for various everyday actions (pressing a button, tapping, or pinching a card), this assumption is false: actions with an auditory effect are typically executed with lower force levels than those without. Importantly, force differences affect motor-ERPs, which lead to the overestimation of action-related auditory ERP attenuation. The goal of the present study was to assess whether auditory ERP attenuations were observable when only actions with similar forces were involved in the estimation procedure. In our previous studies the minimal overlap between force distributions for actions with and without auditory effects prevented such comparisons. In the present study we instructed participants in both motor and motor-auditory conditions to apply soft and strong pinches in alternation to increase the overlap between force distributions. This procedure made it possible to estimate auditory ERP contributions to the motor-auditory ERPs conservatively. The results showed that although force differences affected motor ERPs, an attenuation of the auditory ERPs could still be observed.

Funding: This work was supported by the National Research, Development and Innovation Fund of Hungary (K128083).

Poster 3-106**ELECTROMYOGRAPHIC ACTIVITY MEDIATES ACCESSORY STIMULUS EFFECT BUT NOT CARDIAC TIMING EFFECT**Xiao Yang¹; J. Jennings¹; Bruce Friedman²¹University of Pittsburgh, ²Virginia Polytechnic Institute and State University*Descriptors:* Cardiac timing, Accessory stimulus, EMG

Consistent with Lacey's (1974) hypothesis, reaction times (RTs) vary as a function of cardiac timing. RT is also influenced by accessory stimuli (i.e., task-irrelevant intersensory stimuli; Tona et al., 2016). These effects interact in controlling simple RTs (Yang et al., 2017). However, it is unknown whether this interaction influences response inhibition. The loci of the two effects are also unclear. Twenty-seven college students performed 540 trials of an auditory Go/No-go task with a 2:1 ratio. Neutral and fearful faces were presented as accessory stimuli. Stimulus presentation occurred at either cardiac systole or diastole. RTs and false alarm (FA) rates were recorded. Electromyography (EMG) was measured from subjects' dominant hand. Repeated measures ANOVA showed accessory stimulus effects on RTs, FA rates, and EMG, $F_s > 3.27$, $ps < .047$, but no cardiac timing effects, $ps > .35$ nor interactions, $ps > .76$ for RTs or EMG. However, FA rate was higher at systole than diastole in the fearful accessory condition. Also, mediation analyses showed an indirect effect of accessory stimuli on RTs through EMG, $a = 47.08$, $b = -0.02$, 95% CI: (-2.47, -0.01), indicating that accessory stimuli speeded RTs by increasing EMG. The results challenge the view of the general inhibition by cardiac afferent feedback, and suggest that cardiac timing effects depend on stimuli and outcome measures of tasks. Moreover, accessory stimuli influence motor execution. These findings contribute to a better understanding of the interaction between the processing of interoceptive and exteroceptive stimuli.

Poster 3-107**EFFECTS OF SPATIALLY INDICATIVE SOUND STIMULI ON THE HUMAN STARTLE RESPONSE: PERCEPTION AND REACTION TO SPATIALLY INDICATIVE "3D" SOUND BURSTS**

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¹University of Trier, ²Wake Forest University

Descriptors: acoustic startle reflex, spatially indicative sounds

Although the acoustic startle reflex (ASR) as well as sound localization have been studied extensively on their own, the influence of spatially indicative sounds on startle in humans has, to the best of our knowledge, only been investigated in our lab. This is especially interesting, as prior publications indicate laterality effects on startle elicited with monaural, unilaterally presented sounds in humans, as well as with 3D sound bursts in insects. We aimed at investigating such effects by presenting participants ($N = 20$) with four different kinds of "3D" sound bursts via headphones, each one indicating a source either on the left or right side. Monaural sounds, presented unilaterally, as well as binaural sounds with interaural time difference (ITD), with interaural level differences (ILD) and with emulated head related transfer functions (HRTF) were employed. All sounds had a maximum intensity of 105 dB(A) and a duration of 50ms. Bilateral EMG (OO and arms) and reaction times were measured. Participants were instructed to press a button corresponding to the perceived location of the sound source. ANOVA revealed a significant difference in responses between the different types of spatial stimuli, indicating that monaural tones and sounds with ITD evoked stronger laterality effects than ILD or HRTF did. These results suggest that spatially indicative "3D" sound bursts have an influence on the human ASR and should be addressed more thoroughly by future ASR research.

Poster 3-108**RESTING ANTERIOR FRONTAL ALPHA ASYMMETRY IS RELATED TO STAGE 2 SLEEP AND APNEIC EVENTS DURING OVERNIGHT POLYSOMNOGRAPHY**

Daniel Everhart¹; Alex Nicoletta¹; Andrea Winters¹; Taylor Zurlinden¹; Amy Gencarelli¹; Quinn Corbett¹; Eric Watson²; Katie Lehockey³; Jonathan Highsmith⁴; James Loveless⁵

¹East Carolina University, ²Mt. Sinai Rehabilitation Hospital, ³MedStar National Rehabilitation Hospital, ⁴South Texas Veterans Health Care System, ⁵University of Virginia

Descriptors: sleep, alpha asymmetry

Resting frontal alpha (8-12Hz) power (μV^2) asymmetry is associated with approach-withdrawal related behavior. Previous studies have found that patterns of alpha asymmetry are stable across sleep stages, that asymmetry correlates with emotional reactivity, and that differing patterns of asymmetry are observed with sleep dysfunction. Our previous study found that alpha asymmetry was associated with adherence to treatment for obstructive sleep apnea. In particular, relative left frontal activity predicted the use of continuous positive airway pressure. Within this context, it is now important to understand the relationship between frontal alpha asymmetry and sleep parameters. The current exploratory study examined the relationship between anterior alpha asymmetry and sleep study characteristics among patients with obstructive sleep apnea. Resting EEG was recorded in 88 (46 women) adults (age, $M = 54.12$, $SD = 12.12$) as part of polysomnogram (PSG). Alpha asymmetry was calculated during post processing. Resting alpha asymmetry for F3-F4 scalp sites was positively associated with stage 2 sleep ($r^2 = .23$, $p = .02$), and negatively associated with the number of arousals ($r^2 = -.21$, $p = .03$) and apneic events ($r^2 = -.379$, $p = .01$). These data suggest that relative left hemisphere activity (typically associated with approach-related behavior and in some cases positive emotion) is associated with increased stage 2 sleep and fewer arousals and apneic events. The results are discussed in terms of neurophysiological models of healthy sleep and approach-related behavior.

Poster 3-109**THE P2 AS AN INDEX OF SOCIAL CATEGORIZATION: EXAMINING WITHIN-SUBJECT VARIATION**

Hannah Volpert-Esmond; Bruce Bartholow
University of Missouri

Descriptors: Person perception, Faces, Trial-level data

The appeal of using event-related potentials (ERPs) to study social cognition derives from the potential to link distinct, rapidly unfolding cognitive responses to overt behaviors. However, the signal averaging approach typically used to quantify ERPs severely limits researchers' ability to test such brain-behavior associations. Here, we used trial-level data to investigate the influence of within-subject variation in the amplitude of the P2 ERP component elicited by faces, which consistently has been linked to differentiation of social categories, on overt categorization responses. Across two studies, 125 participants (32 black, 93 white; 30 female, 95 male) viewed white and black male and female faces and categorized them by race and gender (in separate tasks). A disaggregation approach using multilevel modeling showed no between-subjects effect of P2 amplitude on categorization RT in either task. However, significant within-subject effects emerged when categorizing by race in Study 1 ($b = -3.60$, $p < .001$), as well as categorizing by gender ($b = -2.63$, $p < .001$) and race ($b = -2.70$, $p < .001$) in Study 2, indicating that a larger P2 on a particular trial predicted a faster categorization decision on that trial. Implications of this technique for testing ERP-behavior relationships in social cognition will be discussed.

Poster 3-110**ERP CORRELATES OF IMPLICIT BIASES TOWARD PEOPLE SUFFERING FROM SCHIZOPHRENIA**

Jill Grose-Fifer^{1,2}; Denice Vidals¹; Esther Kim¹; Lorraine Singh¹; Jayden Zeng¹

¹John Jay College, CUNY, ²The Graduate Center, CUNY

Descriptors: N170, Implicit bias, Schizophrenia

Despite reports of attitudinal improvements toward people with mental illnesses, those suffering from schizophrenia experience disproportionately more stigma, abuse, and discrimination. Moreover, there may be a mismatch between peoples' self-reported attitudes and their implicit biases. To investigate this, we recorded EEGs from undergraduates while they looked at photographs of angry or happy faces. Colored borders indicated whether the individual in the picture suffered from schizophrenia, or not; border color was counterbalanced across participants. We measured both early (P1, N170) and later (N2, P3) ERP components. The participants then rated their perceptions of dangerousness of each face. We found no evidence for explicit biases toward people suffering from schizophrenia. However, the N170 was larger for angry than for happy expressions for photos of people purportedly suffering from schizophrenia. In contrast, we found no facial expression-related amplitude differences for photos of people who were labeled as "healthy". Our results suggest that the N170 may be sensitive to implicit biases, as it seems to indicate our participants increased their attention toward threatening facial expressions of people labeled as suffering from schizophrenia.

Funding: PSC CUNY Grant.

Poster 3-111**WHY TV COMMERCIALS INSIDE THE ADVERTISING UNIT ATTRACT LESS ATTENTION: DFA EXPLANATION**Sergii Tukaiev¹; Ivan Seleznev²; Anton Popov²¹National Taras Shevchenko University of Kyiv, ²National Technical University of Ukraine

Descriptors: Detrended Fluctuation Analysis, TV commercial, attention

TV viewing affects the EEG parameters of the cortical activity. The main task of advertising is to cause emotions and be memorized by the viewer. The Detrended Fluctuation Analysis (DFA) has been widely used to quantify the presence and stability of the oscillatory activity over time in each region of the brain. The aim of the study was to reveal whether DFA allows analyzing the specific emotional features of cortical activity while watching TV commercials depending on Ads placement. 91 healthy volunteers (62 women and 29 men) aged 18 to 26 years (Mage = 19.47, SD = 1.67 years) participated in this study. For the current experiment, we used the set of negative TV news reports interrupted by a pause for three 30 seconds-long TV commercials. We found that the character and degree of EEG changes during the perception of emotional stimuli significantly depend on the placement of a particular stimulus. DFA revealed an increase of oscillations stationarity in all bands above 1.00 while watching the Ads inside advertising unit. The last pointed on the nonstationarity of the process. It relates to the instability of EEG dynamical characteristic and may point on the global decrease of the informational cognitive component in the brain activity and explain why TV commercial inside TV attract less attention.

Poster 3-112**THE EFFECT OF ACETAMINOPHEN ON MU RHYTHM SUPPRESSION AND PAIN EMPATHY DURING AN ACTION-BASED PAIN-OBSERVATION TASK**Brooke Turk; Sara McCommon; Laura Jelsone-Swain
University of South Carolina, Aiken

Descriptors: pain empathy, mu rhythm oscillations, acetaminophen

Empathy is a complex ability that entails the subjective feeling and understanding of emotions someone else may be experiencing. Acetaminophen, the active ingredient found in Tylenol, is among the most common pain medications consumed. There is new evidence however that suggests this common analgesic may also dampen empathic processes and prosocial behavior. However, no previous study has investigated the basic effect this pain-reducing drug may have on pain empathy. Further, this relationship has not been examined in the context of neural oscillations, as measured by EEG. Therefore, we recruited 30 participants who were randomly assigned to either an experimental (acetaminophen) or control (placebo) group in a double-blind experimental research design. Participants in the experimental group were administered 1000mg of acetaminophen, and it was verified that participants were unable to guess which group they were assigned. We hypothesized that participants in the experimental group would have less mu suppression while observing others in action-based painful situations, which was supported. This decrease of motor resonance in the experimental group supports the suggestion that acetaminophen does interfere with the neural response associated with the processing of others in pain. Further, this supports the notion that acetaminophen may dampen our empathic responding. The implications of these findings are widespread, and may redefine how we prescribe and administer this common drug.

Funding: This research was supported by the Magellan Scholars Award internal grant from the University of South Carolina.

Poster 3-113**NEURAL CORRELATES OF GRAPHOPHONEMIC REPRESENTATION IN ADULTS WITH APHASIA: A PILOT STUDY**Amanda Nagler; Emily Salerno; Tihomara Todorova;
Melissa Randazzo
Adelphi University

Descriptors: Neural processing, Rhyme recognition, Aphasia

Previous studies have used visually-based rhyme judgment tasks as an index of preserved internal speech in adults with non-fluent aphasia. We examine the neural correlates of rhyme judgment in auditory rhyme to understand the relationship between rhyme and internal speech, as well as the influence of graphophonemic representation in adults with non-fluent aphasia. Participants performed auditory rhyme judgment for words across 4 orthographic and phonological conditions, varying in congruency. Preliminary results for controls show little difference between congruent and incongruent waveforms which suggests that controls resolve auditory rhyme without reliance on graphophonemic representations. In persons with aphasia there is an effect of orthography evidenced by negativities in the 200-300 and 400-500 ms window for incongruency in orthography. These preliminary pilot results suggest that adults with aphasia may access graphophonemic representations to judge auditory rhymes, thus recharacterizing the notion that visual rhyme judgment is an index of internal speech in aphasia.

Poster 3-114**AN ERP STUDY: INTERPLAY OF PHONOLOGICAL AND ORTHOGRAPHIC PROCESSING DURING READING IN SPANISH**Fabiola Gómez-Velázquez; Juan Quiñones-Beltrán;
Vanessa Ruiz-Stovel; Andrés González-Garrido
Universidad de Guadalajara

Descriptors: semantic incongruence, orthographic knowledge, N400

Event-related potential (ERP) studies have provided valuable information about semantic processing showing that N400 is a component sensitive to expectancy violations. However, it is not clear how different types of knowledge are integrated during language comprehension. We used ERPs to study the interplay of phonological and orthographic processing during reading in a group of 30 right-handed young adults (15 male). A total of 170 high cloze probability sentences were visually presented and participants were asked to determine if the sentence was semantically congruent or incongruent regardless of spelling errors. The sentences consisted of 6 words in which the last word was completed by a) a congruent word, b) a congruent word with a pseudohomophone error, c) a congruent word with a typo-like error, d) an incongruent word, or e) an incongruent word with a pseudohomophone error. Our results showed that N400 seems to be insensitive to orthographic information and is determined by semantic incongruency. Orthographic expectancy violations are reflected by a late positivity rather than a larger N400 amplitude. The P600 amplitude was modulated for pseudohomophones (sentence completions that are acceptable phonologically but are misspelled) and typo-like errors, but only in semantically congruent endings. It seems that orthographic information is not fully processed when there is a deeper linguistic processing in progress such as semantic incongruence. Furthermore, the orthographic knowledge of the participants positively correlated with the amplitude of N400 and P600.

Funding: Neuroscience Institute of Guadalajara.

Poster 3-115**COMPUTATIONAL MODELLING OF SINGLE-TRIAL VISUAL MISMATCH NEGATIVITY UNDER DIFFERENT TASK CONDITIONS: ADAPTATION OR PREDICTION?**

Insa Schlossmacher^{1,2}; Maximilian Bruchmann^{1,2};
Thomas Straube^{1,2}

¹University of Muenster, ²Otto Creutzfeldt Center for Cognitive and Behavioral Neuroscience

Descriptors: computational modelling, visual mismatch negativity, single-trial EEG

The mismatch negativity (MMN) is an early electrophysiological component that reliably indexes deviance processing – even if subjects are unaware of the stimuli. However, what mechanisms contribute to the MMN is still a matter of debate: candidates range from simple change detection, over adaptation, to predictive coding accounts. Under aware conditions some studies already delineated predictive coding as a main contributor to the MMN, nonetheless influences of task and awareness have not yet been focused on. In order to address this gap, we presented a standard oddball sequence made from geometrical shapes in a sustained inattention blindness paradigm. Electrophysiological responses were recorded in three physically identical phases that differed only with respect to the subject's instructions: subjects (A) were uninformed about the shapes and attended the foreground task (inattentionally blind), (B) were informed about the shapes but still attended the foreground task and (C) attended the shapes. Visual MMN was observed during all experimental phases including inattentionally blind subjects in phase A. Further, we compared single-trial models of adaptation, predictive coding and change detection against a null model. Winning models differed between experimental phases: While in unattended and unaware conditions mismatch was best explained by adaptation, prediction did play an important role when shapes were attended. In summary, contextual variables strongly influence the mechanism at play during deviance processing.

Poster 3-116**CORTICAL THICKNESS AND RESTING STATE CARDIAC FUNCTION ACROSS THE LIFESPAN: A CROSS-SECTIONAL POOLED MEGA ANALYSIS**

Julian Koenig
University of Heidelberg

Descriptors: heart rate variability, cortical thickness, aging
Understanding the association between autonomic nervous system (ANS) function and brain morphology across aging may provide important insights into neurovisceral mechanisms underlying health and disease. Resting state ANS activity, indexed by measures of heart rate (HR) and its variability (HRV), has been associated with brain morphology, particularly cortical thickness (CT). While findings have been mixed regarding the anatomical distribution and direction of the associations, these inconsistencies may be due to sex and age differences in HR/HRV and CT. Previous studies have been limited by small sample size, thereby impeding the assessment of sex differences and aging effects on the association between ANS function and CT. In an effort to overcome these limitations, 20 groups worldwide contributed data collected under similar protocols of CT assessment and HR/HRV recording to be pooled in a mega-analysis ($N = 1,598$, 51.06% female). Findings suggest that the natural decline in HRV is related to a decline in prefrontal CT, particularly in the orbitofrontal cortex. These effects were observed independent of sex and were specific to HRV, with no association between CT and HR. Maintaining greater CT across the adult lifespan appears vital for healthy cardiac regulation via the ANS. Nonetheless, in the absence of longitudinal data, alternative explanations, such as dual effects of underlying (atherosclerotic) disease processes or reverse causality of bottom-up influences of ANS activity on brain morphology, need to be considered.

Late-Breaking Undergraduate Poster Abstracts

Please note that this section includes abstracts for all of the late-breaking undergraduate posters. As withdrawn posters were replaced with late-breaking undergraduate posters to utilize all space available, please refer to this section to view these additions and note that late-breaking posters are interspersed throughout all three poster sessions.

WEDNESDAY, SEPTEMBER 25, 2019 POSTER SESSION I

Poster 1-017

FURTHER UNDERSTANDING THE RELATIONSHIP BETWEEN RESTING HEART RATE VARIABILITY AND EMOTIONAL CLARITY

Catalin Dragomirescu¹, DeWayne Williams², Julian Koenig³, Julian Thayer²

¹The Ohio State University, ²University of California, Irvine,

³Heidelberg University

Descriptors: HRV, Emotion Regulation, Clarity

Our group previously found an especially strong association between resting heart rate variability (HRV) and emotional clarity using the 36-item Difficulties in Emotion Regulation Scale (DERS). In the current study we elaborated on the association between resting HRV and emotional clarity measures by using multiple emotional clarity measures. We also split this association by sex given recent recommendations. A 5-minute baseline period was used to first calculate resting HRV from 77 participants (39 females, mean age = 19.97). HRV was calculated using the root mean square of successive differences in accordance with previously established guidelines (Task Force, 1996). Participants then completed both the DERS and the Trait Meta-Mood scale (TMMS); from these scales, emotional clarity was assessed via respective subscales. Results showed a weak and non-significant relationship between HRV and DERS-clarity ($r = .065$, $p = .574$) as well as HRV and TMMS-clarity ($r = .007$, $p = .951$). When split by sex, results showed a significant positive association HRV and DERS-clarity ($r = .328$, $p = .021$) as well as HRV and TMMS-clarity ($r = .280$, $p = .042$) for females. The relationship between HRV and DERS-clarity ($r = .228$, $p = .084$) and TMMS-clarity ($r = .113$, $p = .250$) was weaker and not significant in males. These data extend our prior work on resting HRV and emotional clarity, and further suggests that the association between resting HRV and emotional clarity is stronger in women than in men. Future directions and limitations will be discussed.

Poster 1-032

NEUROTICISM AND THE PHYSIOLOGICAL AND SELF-REPORTED RESPONSES TO STRESS

Rebekka Anderson, Annie Ginty, Danielle Young
Baylor University

Descriptors: Neuroticism, Stress, Physiology

Background: Neuroticism has been described as experiencing negative emotional states (e.g. anger, anxiety). While research findings have been inconsistent, some evidence suggests neuroticism is associated with attenuated physiological stress responses, such as heart rate (HR) and systolic blood pressure (SBP), and increased negative psychological responses, such as higher perceived stress. **Hypothesis:** Individuals with higher levels of neuroticism would report higher levels of stress and experience blunted physiological stress responses compared to those with lower levels of neuroticism. **Method:** 88 participants (Median (SD) [range] age 26.7, (10.7) [18-62], 67.9% female, 51.7% Caucasian) completed a 10-minute baseline period and a 10-minute mental arithmetic stress task (PASAT). HR was measured continuously and SBP was taken every 2 minutes during baseline and PASAT. HR and SBP reactivity were calculated as task—baseline. Participants completed the neuroticism subscale of the EPQ-R and the Perceived Stress Scale. **Results:** Participants with higher neuroticism ratings reported higher perceived stress levels ($r = .55$, $p = .01$). Neuroticism was unrelated to HR ($r = -.14$, $p = .20$), but negatively correlated with SBP reactivity ($r = -.28$, $p = .01$). **Conclusion:** As hypothesized, neuroticism was linked to higher levels of perceived stress and blunted blood

pressure responses in a stress task. However, neuroticism was unrelated to cardiac responses. Future research should examine the association between cardiovascular reactivity in real-life stress exposures with neuroticism.

Funding: Baylor University Ginty Start-Up.

Poster 1-033

WITH FRIENDS LIKE THESE, WHO NEEDS ENEMIES? DIFFERENTIAL EFFECTS OF SOCIAL INTERACTION ON THE ERROR-RELATED NEGATIVITY

Philipp Lange, Luisa Lühn, Björn Albrecht, Marcel Wilhelm,
Winfried Rief, Martin Peper, José García Alanis
University of Marburg

Descriptors: Error-Related Negativity, Social Context

Individual differences in neuronal correlates of performance monitoring, such as the Error-Related Negativity (ERN), are implicated in many psychopathologies. In addition, performance monitoring is considerably influenced by situational factors. However, it remains unclear how personal factors interact with situational incentives to influence performance monitoring. Here, we analyzed how performing a task after a positive or negative social interaction influenced the ERN. In addition, individual dispositions (e.g., social anxiety) were assessed to test for possible moderation effects. Electroencephalography was recorded from 30 individuals while they performed a Flanker Task in three different contexts: solitary, positive, and negative social interaction. In the positive and negative conditions, participants received a video call from a second participant and were instructed to explain the task to the other. Unbeknownst to them, the second participant was a confederate and reacted either positively or negatively to the participant's explanation. Results indicate a selective enhancement of the ERN after negative social interaction. In addition, this enhancement was dependent on whether and to which degree participants reported negative feelings and pessimistic performance-related expectations after negative social interaction. This suggests that performance-monitoring is not only influenced by the nature of a social interaction, but also depends on individuals' subjective experience of the same.

Poster 1-105

RESTING HEART RATE VARIABILITY PREDICTS EXECUTIVE ATTENTION IN COLLEGE STUDENTS

Gunnar Budzyn, Alisa Huskey, Catherine Van Orden,
Bruce Friedman
Virginia Tech

Descriptors: HRV, attention, executive function

Chronic stress has been observed to have effects on neuropsychiatric and cardiac health (Liston 2009). The ability to self-regulate has been linked to performance in academic and cognitive aspects (Posner 2014). Heart rate variability (HRV) has been linked with neural and cognitive measures of self-regulation, including executive functioning. The Attention network task (ANT) is a neurocognitive task used for measuring attention with three subscales: alerting, orienting, and executive function. A sample of 30 students (4 males, 26 females; mean age=20.8) were monitored with an electrocardiogram during a 3-minute resting baseline and then completed the ANT. The measure of baseline HRV can account for 13.6% of variation in performance of the executive attention subscale of the ANT ($F = 4.319$). The beta-value ($-.368$) indicates that the relationship is inversely proportional; as the HRV increases the executive attention score decreases, meaning that the participants with higher resting HRV perform better on tasks requiring executive attention. HRV is not significantly related to the other two ANT subscales; orienting ($R^2 = 0.052$, $F = 1.551$, $b = .229$) and alerting ($R^2 = 0.034$, $F = 0.980$, $b = -.184$). These findings may have implications for the physiological impact of stress on academic performance.

Poster 1-119**NEURAL RESPONSES TO REWARD MODERATE THE ASSOCIATION BETWEEN NEGATIVE EXPERIENCES AND DAILY NEGATIVE AFFECT**

Helena Renault, Paige Ethridge, Aislinn Sandre,
Iulia Banica, Anna Weinberg
McGill University

Descriptors: Reward processing, Depression, Negative affect

Not only have stress and blunted neural responses to rewards been associated with the development of depression, but increased negative affect (NA) in response to daily life stressors has also been found to be a precursor to depression. The present study used an ecological momentary assessment (EMA) phone application to investigate whether university students' neural response to reward at the start of the academic year is associated with their daily levels of NA during the stressful time of midterm examinations. At time one, sixty participants completed a monetary reward guessing task to elicit the reward positivity (RewP), an event-related potential that is sensitive to reward and loss feedback, and has been shown to be a potential biomarker of depression. Following this, participants completed the Positive and Negative Affect Schedule nine times a day, as well as questions about negative events they experienced each day, on ten consecutive days. Experiencing more negative events during a period of high stress was associated with increased NA overall; additionally, the RewP significantly moderated this association, such that individuals with a smaller RewP were more likely to report heightened NA following negative events, relative to individuals with a relatively larger RewP, who reported less of an increase in NA following such events. These findings suggest that increased neural reward sensitivity may buffer against the adverse effects of negative experiences during times of stress, furthering our understanding of risk and resilience for the development of depression.

Poster 1-120**THE MODERATING ROLE OF SELF-ESTEEM ON POST-DISCRIMINATION CARDIOVASCULAR RECOVERY AMONG AFRICAN AMERICANS**

Saurabh Divakaran, Nasha Rios-Guzman, Mona El-Hout,
Kristen Salomon
University of South Florida

Descriptors: Cardiovascular Recovery, Rumination, Discrimination

This study attempts to expand upon the existing literature on the relationship between racial discrimination and cardiovascular health outcomes by examining the impact of self-esteem on recovery after an ambiguously discriminatory interaction. The experiment measured 110 African American participants' respiratory sinus arrhythmia (RSA) during three stages: baseline, an uncivil interaction with a White, female research associate, and recovery. During the recovery period, participants were randomly assigned to either control (no prompts given), rumination, or distraction thought prompts to further evaluate how prolonged cognitive effects of a given stressor may aggravate recovery (Brosschot et al., 2006). One-way ANOVAs showed no significant differences in RSA recovery between the 3 conditions. However, moderation analyses controlling for reactivity found that RSA recovery was significantly different between the three conditions only among individuals low in self-reported self-esteem. Control participants displayed poorer recovery compared to distracted individuals, but more improved recovery than ruminating individuals, and distracted participants were shown to have significantly better recovery compared to ruminating participants.

**THURSDAY, SEPTEMBER 26, 2019
POSTER SESSION II****Poster 2-043****WORRY YOUR HEART OUT: WORRY AFFECTS CARDIAC SAFETY LEARNING**

Abigail Greenway, Alex Faunce, Alisa Huskey, Bruce Friedman
Virginia Tech

Descriptors: heart rate deceleration, safety learning, worry

The majority of previous stress research has focused on the relationship between stress responses and acutely stressful events. The Generalized Unhappiness Theory of Stress (GUTS) suggests that responses to aversively conditioned, but objectively safe environments may be a superior indicator of anxious pathology, as opposed to gauging only stress responses. Since worry is a transdiagnostic feature, a self-report measure of trait worry is expected to moderate safety conditioning in terms of cardiac deceleration. Threat conditioning is not expected to vary by trait worry. A study involving fear-potentiated startle in a discriminant conditioning paradigm was conducted to explore fear inhibition during threat and safety conditions. Thirty-four adults (mean age=20.6 years; 28 females) experienced threat learning (A) and unlearning (B) blocks of geometric shapes. Heart rate was examined as a repeated measures variable in terms of low and high trait worry in 4 periods (1-4s, 4-8s, 8-12s, & 12-16s). There was a multivariate effect of high and low trait worry as well as a main effect of period (*Wilk's* $\lambda=.669$, $F(3, 30)$, $p<.05$, *partial* $\eta^2=.331$) and trial type (*Wilk's* $\lambda=.825$, $F(3, 30)$, $p=.014$, *partial* $\eta^2=.175$). Post-hoc analyses indicated a difference between periods 2 and 3, signifying HR deceleration in response to the aversive stimulus or its omission during the safety trial ($p=.007$). However, this deceleration effect was not observed during threat trials in the high worry group ($p=.015$).

Poster 2-051**EXAMINING THE RELATIONSHIP BETWEEN THE STABILITY AND FLUCTUATION OF HORMONES AND MOOD ACROSS THE MENSTRUAL CYCLE**

Paula Guzman, Madison Marras, Courtney Louis, Jason Moser
Michigan State University

Descriptors: Estradiol, Progesterone, Mood

Currently, there is very little known about the relationship between ovarian hormones (i.e., estradiol and progesterone) and mood symptoms across the menstrual cycle in naturally cycling women. In addition, there is uncertainty regarding whether average hormone levels relate to mood stability, or whether fluctuations in hormones relate to mood fluctuations. To better understand this relationship, the aim of the current analysis was to examine mean levels and standard deviations of hormones and mood, and their relations across the menstrual cycle. A total of 66 naturally cycling women between the ages of 18-25 completed daily assays of saliva and daily measures of mood - worry, anxious arousal, and anhedonic depression - across 35 days of their cycle. Regression analyses were conducted to examine whether mean levels of estradiol and progesterone predicted mean levels of each mood measure, as well as whether, instead, fluctuations (i.e., standard deviations) of these hormones predicted fluctuations in mood. We found that mean levels of estradiol and progesterone, as well as their interaction did not significantly predict mood measures. However, a significant interaction between fluctuations in hormones was found to predict worry only, such that women with high fluctuations in both estradiol and progesterone also experienced high fluctuations in worry. These findings provide an initial understanding of the importance of considering fluctuations in both hormones and mood in the study of the role of hormones in anxiety and depression.

Poster 2-055**THE EFFECT OF ALCOHOL INTOXICATION ON NEURAL RESPONDING TO AFFECTIVE-ODDBALL STIMULI**

Chloe Johnson, Keanan Joyner, Christopher Patrick
Florida State University

Descriptors: event-related potential, alcohol intoxication, trait disinhibition
Alcohol intoxication affects several aspects of cognitive function and may alter the capacity for cognitive-affective processing. This study tested for effects of alcohol consumption on brain responses to incidental affective pictures in a visual oddball task with schematic heads as targets (70% of trials), and simple ovals and novel picture stimuli (pleasant, neutral, unpleasant) as non-targets (15% each). Undergraduates (21 years old) consumed either an alcoholic beverage ($n = 35$; M BAC = .09 g/100ml), a placebo beverage ($n = 33$), or no beverage ($n = 27$) prior to the oddball task. ANOVAs were used to test for effects on three event-related potentials (ERPs) known to be modulated by emotional content: early posterior negativity (EPN), P300, and late-positive potential (LPP). Group differences in response amplitude were evident for each of these ERPs: relative to the no-beverage group, the alcohol groups exhibited blunted P300 for all pictures and LPP modulation to affective versus neutral pictures, whereas the placebo (but not alcohol) group exhibited reduced EPN to all picture types. We also found that scale-assessed trait disinhibition (DIS) moderated the alcohol-LPP effect (i.e., high-DIS alcohol subjects showed greater affective-LPP modulation than low-DIS alcohol subjects). These results indicate an effect of alcohol intoxication on neural processing of incidental affective stimuli that is amplified in individuals at dispositional risk for alcohol problems. Findings also suggest a placebo effect on early allocation of attention to incidental novel stimuli as a whole.

Poster 2-077**THE RELATIONSHIP BETWEEN THE MOTHER-DAUGHTER BOND AND A NEW MOTHER'S PHYSIOLOGICAL RESPONSE TO HER BABY**

Allison Keil, Deirdre Katz, Sabrina Legaspi, Rachel Mehlman, Valerie Truong, Brienne Pfeifer, Sarina Saturn
University of Portland

Descriptors: Respiratory Sinus Arrhythmia, Diadic Family Relationships, Emotional Response

Our biopsychosocial research examines the relationship between physiological and psychological profiles in mother-baby-grandmother triads ($N=78$) during a laboratory visit which involves measuring socioemotional dynamics, autonomic physiology, biomarkers, breastfeeding, and behavior. This transgenerational study explores the relationships between new mothers and their babies and how they are related to the patterns that new mothers feel they may be receiving from their own mothers (maternal grandmothers) through the Parent-Child Interaction Questionnaire-Revised (PACIQ; Lange et al., 2002). Results show that new mothers ($N=26$) who reported more positive relationships with their own mothers have significantly lower change scores in heart rate (HR) and respiratory sinus arrhythmia (RSA) during key bonding events with their babies. Mothers who reported higher levels on the Acceptance subscale of PACIQ in their relationships with their mothers had significantly lower levels of RSA change during preparation for their baby's heel prick ($p=0.001$), lower percentages of RSA change during soothing after the heel prick ($p=0.001$), and lower percentages of HR change during nursing ($p=0.018$). These results suggest that women who report having stronger relationships with their mothers' experience less vagal regulation during key segments of the study involving their babies. This data is useful because understanding how one's relationship with her own mother greatly affects how she responds to her baby and therefore the potential future success and wellbeing of the next generation.

Funding: NSF CAREER Grant BCS-1151905.

Poster 2-078**VIEWING FOOD IMAGES GENERATES AROUSAL IN HIGH EATING RESTRAINT INDIVIDUALS: EVIDENCE FROM SELF-REPORTS AND SKIN CONDUCTANCE**

Maria Isabel Barros Guinle, Mikhal Yudien, Catherine Norris
Swarthmore College

Descriptors: Arousal, Dieting, Skin Conductance

Individuals high in eating restraint (i.e., chronic dieters) feel ambivalent (i.e., positive and negative at the same time) about both healthy and unhealthy food images (Norris et al., 2019). As ambivalence is considered an arousing state, the current study built on past research by investigating whether healthy and/or unhealthy food images also elicit higher self-reported and physiological arousal (using skin conductance reactivity; SCR). Replicating our earlier findings, high-restraint individuals reported ambivalence toward both healthy and unhealthy food images but not nonfood images; whereas low-restraint individuals reported low and equivalent levels of ambivalence toward all three image types. Furthermore, unhealthy food images were rated as more arousing than healthy food images, which were rated as more arousing than nonfood images; and high-restraint individuals reported higher arousal than did low-restraint individuals. Most importantly, SCR was higher for high-restraint individuals than low-restraint individuals when viewing healthy and unhealthy food images, but not when viewing nonfood images. Taken together, our results indicate that individuals in general report higher arousal to unhealthy versus healthy food images, consistent with societal pressures to maintain a healthy diet. However, high-restraint individuals (i.e., chronic dieters) also exhibited increased SCR to food images regardless of health value, suggestive of a disordered physiological response to food stimuli. Implications for treating individuals with eating disorders are discussed.

Poster 2-100**HEART ACTIVITY AND ANTISACCADE PERFORMANCE IN WOMEN WITH THE BROAD AUTISM PHENOTYPE**

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Descriptors: Autism, Antisaccade Task, Physiological Regulation

Background: Executive functioning skills are comprised of working memory, planning, flexibility, and inhibition. We zeroed in on inhibition control to study executive function in mothers of children with autism, who may show features of the broad autism phenotype. To measure inhibition control, this study used the antisaccade task. **Research Question:** (1) Do mothers with children who have autism, when compared to control women, show impairments in inhibitory? (2) Does the antisaccade performance of the women with autism relate to respiratory sinus arrhythmia (RSA)? **Methods:** Participants included 18 mothers of children with autism and 19 neurotypical control women, similarly aged 26-65 years ($p = 0.165$). First a block of 60 prosaccade tasks were performed, followed by a block of 40 antisaccade tasks. A difference score for average latency and percent correct was computed. Mean RSA and heart rate in each condition was estimated through the heart activity that was recorded. **Results:** The latency difference between the groups was significantly different [$F(1,37) = 4.51$, ($p = 0.041$)]. A significant interaction between group and heart rate change was detected in predicting the latency change score [$F(1,37) = 4.21$, ($p < 0.0420$)]. RSA change predicted the latency change score [$F(1,37) = 5.02$, ($p < 0.0329$)] across both groups. **Conclusion:** The relationship between physiological regulation and inhibition performance suggests that the broad autism phenotype may be characterized by difficulties with arousal modulation that could be linked inhibition deficits.

Funding: Explorations Scholars Research Grant - UofSC Honors College Grant.

Poster 2-108**CARDIAC VAGAL ACTIVITY AND RESPIRATORY SINUS ARRHYTHMIA (RSA) IN RELATION TO RESILIENCE AND NOTIONS OF LOVE AND AFFECTION IN MOTHER-DAUGHTER DYADS**

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Descriptors: respiratory sinus, arrhythmia, love/affection, prosocial
Our study focused on the relationship between vagal activity and prosocial behaviors and traits in mother-daughter dyads (N=52). Affectionate Exchange Theory proposes that affectionate communication for behaviors expressing and receiving love, play a large role in the mediation of personal affect and physiological responses by buffering stress susceptibility (Floyd, 2014). Participants show different respiratory sinus arrhythmia (RSA) patterns of responding to moral elevation: 30% went up, N=15; 26% went down, N=13; and 44% had no change, N=22. Following Porges' Polyvagal Theory, participants were categorized as coactivators (those whose Heart Rate and RSA both increased post-elevation induction) or coinhibitors (those whose HR & RSA both declined post induction). T-tests comparisons reveal that coactivators (N=17) had significantly higher traits of giving affection than coinhibitors (N=5) [$t(20)=-2.718$; $p=0.013$]. Coinhibitors show significantly higher levels of perceived stress than coactivators [$t(20)=2.679$; $p=0.014$]. ANOVA analyses reveal that participants' self-reported resilience was significantly different between groups with different vagal activity ($F(2,47)=3.7$, $p=.03$). Those whose RSA values increased were associated with lower resilience of social resources compared to those who did not change ($p=.01$). Results from this study help us understand the mechanisms involved in how compassion and resilience in family relationships may be associated with both psychological and physiological wellbeing.

Funding: NSF career Grant BCS-1151905.

Poster 2-117**HISTORY OF CHILDHOOD EMOTIONAL ABUSE PREDICTS BLUNTED RESPIRATORY SINUS ARRHYTHMIA AMONG YOUNG WOMEN**

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School of Medicine

Descriptors: Childhood Emotional Abuse, RSA, Psychopathology
Trauma can have a lasting impact on a person's ability to regulate emotion, increasing their risk of developing psychopathology, with effects being strongest if the trauma occurred during childhood. Physiological research has linked childhood trauma with impairments in parasympathetic tone, in particular decreased respiratory sinus arrhythmia (RSA) (Dale et al., 2009; Hamilton & Alloy, 2017) an index of self-regulation (Beauchaine, 2015). However, whether childhood emotional abuse specifically exerts effects on RSA is unclear. The current study examined whether young women's history of childhood emotional abuse predicted variance in their resting RSA. We hypothesized that women with a history of childhood emotional abuse would have lower resting RSA, and emotional abuse history would be a stronger predictor of women's RSA than current psychopathology. 105 young women (aged 18-22) completed surveys on childhood trauma history, depressive and anxiety symptoms, before watching a 5-minute nature video during which RSA was assessed. Women who reported higher childhood emotional abuse exhibited significantly lower RSA, $\beta = -0.24$, $p = .015$. This association was maintained even when covarying for current depression and anxiety symptoms $\beta = -0.23$, $p = .036$. Young women's history of emotional abuse predicted lower resting RSA over and above that of current psychopathology. These results suggest that the effect of childhood emotional abuse on parasympathetic control continues to linger into early adulthood.

Poster 2-118**A CHINESE LANGUAGE ERP/FMRI STUDY OF THE N450 RHYMING EFFECT**

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Descriptors: ERP, fMRI, Reading

There has been widespread interest in the N450 rhyming effect due to its potential as a biomarker for phonological deficits in dyslexia. There has, however, been some questions as to whether this effect could be due to orthographic or semantic confounds, given its relatively long latency. Chinese characters, which have an arbitrary link between orthographic and phonological information, were used to help resolve this concern. Furthermore, we enlisted fMRI data to identify its generator site. We recorded event-related potentials with 65 channels when twenty native Chinese speakers were making rhyming and meaning judgments on single Chinese characters. An N450 effect was observed in the phonological task compared to the semantic task. Moreover, BOLD data were collected in a 3T magnet using multi-plane EPI using the identical tasks with fifteen native Chinese speakers. The source analysis of the N450 co-registered with a Supplementary Motor Area activation. These results reinforce the notion that the N450 reflects phonological, not semantic, processing of word stimuli.

Funding: Chinese National Science Foundation.

Poster 2-119**THE EFFECT OF BRIEF MINDFULNESS TRAINING ON ERROR RECOGNITION: AN ELECTROPHYSIOLOGICAL STUDY**

Ling Peng, Yanli Lin, Jason Moser
Michigan State University

Descriptors: mindfulness, meditation, Pe

Previous research has linked mindfulness with error recognition (indexed by the Pe). However, study findings have been mixed and inconclusive due to methodological challenges related to the polythetic nature of mindfulness. The present study sought to address the construct heterogeneity by studying the effects of open monitoring (OM) mindfulness meditation on error recognition in novice non-meditators while accounting for trait mindfulness. Results revealed that the guided meditation enhanced Pe amplitude relative to the control group, but neither group exhibited differences in accuracy, reaction time, or trait mindfulness. Taken together, the findings suggest that a brief OM meditation exercise increases error recognition and highlight the value of systematic research that clearly delineate the different aspects of mindfulness.

Poster 2-120**MECHANISMS OF N2PC, N2PB, P2PC/PD, REVEALED FROM TARGET-DISTRACTOR INTERACTIONS IN UPPER VS. LOWER HEMIFIELDS**

Marie-Eve Picard, Brandi Lee Drisdelle, Pierre Jolicoeur
Université de Montréal

Descriptors: N2pc, N2pb, Visual Spatial Attention

The N2pc component, which indexes visual spatial attention, is a greater negativity at contralateral posterior electrodes (relative to ipsilateral). Much remains to be learned about the mechanisms that lead to the N2pc. We examined target-distractor interactions and differences in attention to stimuli in the upper versus lower visual hemifields, and for stimuli on the vertical midline versus in left/right lateral locations. In each trial, six visual search frames were presented sequentially, followed by a response in which subjects indicated the number of frames with a target. Each search frame contained 12 stimuli. There were either no salient items (only grey fillers), one salient item, or two salient items (salient by virtue of their colour difference with the fillers). When items were salient, there could be a single target or salient distractor, a target and a salient distractor, or two salient distractors. The N2pc was calculated for lateralised salient items, and the N2pb using items presented on the midline for which frames with no salient item were subtracted to isolate activity specifically-related to salient items. The N2pc and N2pb increased in amplitude with an increased need for focal attention (more salient items to differentiate) as well as when salient items were in the lower hemifield compared with the upper hemifield. The number of distractors had little effect when in the upper hemifield, in contrast with the lower hemifield. Implications of these and other results for underlying neural mechanisms of N2pc, N2pb, P2pc/Pd and SPCN are discussed.

Funding: This study was supported by the Natural Science and Engineering Research Council of Canada (Discovery Grant Program), by support from the Canada Foundation for Innovation, the Canada Research Chair program, and the Institute for Data Valorisation.

**FRIDAY, SEPTEMBER 27, 2019
POSTER SESSION III**

Poster 3-063**NEURAL RESPONSES TO PEER ACCEPTANCE MODERATE ASSOCIATIONS BETWEEN PEER-NOMINATED PEER VICTIMIZATION AND DEPRESSIVE SYMPTOMS IN EARLY ADOLESCENCE**

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Melanie Dirks, Anna Weinberg
McGill University

Descriptors: Depression, Reward processing, Peer victimization

First onset of depression is increasingly common in adolescence. Earlier onset of depression is linked to a more chronic and recurrent course. Peer victimization, a common form of social stress for adolescents, has been associated with increased vulnerability to depression; however, not all youth who are victimized will develop depression. Aberrant neural response to social feedback may be useful in identifying those adolescents most likely to be susceptible to the adverse effects of peer victimization. We investigated whether peer-reported peer victimization was associated with self-reported depressive symptoms, and whether laboratory-recorded neural responses to positive feedback from virtual peers moderated this association. Early adolescents in Grade 7 took part in a large school-based study in which peer nominations about participants' experience of peer victimization were collected. Thirty-seven participants (M age = 12.8, SD = .43) took part in a lab-based social interaction task, during which EEG was recorded. Results showed that two reward-sensitive ERPs, the P2 and RewP, significantly moderated associations between peer victimization and depressive symptoms. Specifically, the association between peer-nominated peer victimization and symptoms of depression was strongest for participants with a smaller P2 and a larger RewP to social acceptance. These findings suggest that neural responses to positive feedback from peers may represent vulnerability markers and may help us predict which adolescents will be most susceptible to the adverse effects of peer victimization.

Poster 3-077**IT'S NOT JUST THE AGE IT'S THE EMOTION: OWN AGE BIAS IS MEDIATED BY EMOTION**

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Descriptors: perception, expertise, Event-related potentials

The "Own Age Effect" (OAE) refers to a bias for older and younger adults to better recognize those of their own age group. Previous studies have investigated how emotion interacts with the OAE in memory, but few have investigated whether emotion interacts with the OAE during face perception. In an ERP study, young adults (ages 18-23) viewed older and younger adult male faces while performing one-back tasks for facial identity (discriminate facial identity, ignore emotion expression) and emotion identification (discriminate emotional expression- anger, fear, neutral, ignore identity). Greater N170 amplitudes at PO7/PO8 were found for young adult than for older adult faces in both face and emotion tasks, documenting the OAE. However, an interaction was found between viewed face age and emotion: greater N170 amplitudes were found for older faces with fear expressions and for young adult faces with angry expressions. Fear expressions on older adults indicate a potential nearby threat. Anger expressions on younger male adults are threats themselves. These results are consistent with the idea that attention is drawn to information relevant to threat and our subsequent actions.

Funding: NSF DUE 1625610, DUE 1625521, DUE 16226554.

Poster 3-081**CAN YOU FEEL THEIR PAIN? AN ERP INVESTIGATION OF THE INFLUENCE OF STIGMA ON PAIN EMPATHY**

Elise Cummings, Catherine Norris
Swarthmore College

Descriptors: Stigma, Pain Empathy, P300

There is great disparity in the quality of treatment patients receive based purely on their social identities. The aim of the current study was to understand how social information, specifically stigma, affects perception, evaluation, and treatment of pain. Participants imagined their job was to monitor patients in an emergency room. Using event-related potentials (ERPs) we compared P300 responses to stigmatized and non-stigmatized patients with painful expressions using an oddball paradigm. P300 responses were stronger to stigmatized (vs. non-stigmatized) patients in pain, regardless of stigma type. However, this pattern of bias was moderated by individual differences in empathic concern, such that highly empathic participants had stronger P300 responses overall and did not differentiate between stigmatized and non-stigmatized patients in pain, whereas less empathic participants had stronger P300 responses to stigmatized (vs. non-stigmatized) patients in pain. In addition, we observed stigma-related implicit and explicit biases during character trait rating, pain rating, and treatment recommendation tasks, also moderated by empathy. Overall, our results suggest that individuals low in empathy (e.g., physicians; Decety, Yang, and Chen, 2010) are more susceptible to developing neural biases in pain perception based on stigma, which may ultimately lead to discriminatory treatment based on a patient's stigmatized status.

Funding: Funding for this project was provided by the Psychology Department at Swarthmore College.

Poster 3-117**SHOOTING YOUR ACCURACY IN THE FOOT: THE EFFECT OF ACTION VIDEO GAMES ON COGNITIVE CONTROL**

Michaela Rice, Lexi Lease, MaLia Walker, Kira Bailey
Ohio Wesleyan University

Descriptors: cognitive control, video gaming, EEG/ERP

The current study examined the effects of brief video game exposure on cognitive control using event-related potentials (ERPs). Cognitive control was assessed by ERP components associated with the ability to detect (N2) and resolve (SP) conflict when the conflict was either expected or unexpected. After playing either an action or strategy video game, participants completed a counting Stroop task while ERPs were recorded. The proportion of congruent to incongruent trials was manipulated across blocks to create conditions where conflict was expected or unexpected. For the N2, the interference effect was slightly larger for the action group than strategy group, possibly indicating that the former experienced more conflict than the latter. Similarly, the interference effect in the conflict SP was larger in participants exposed to the action game compared to the strategy game, particularly in the unexpected conflict condition. The behavioral data revealed lower accuracy for participants exposed to the action game for incongruent trials in the unexpected conflict condition. These results suggest greater difficulty in resolving conflict when it was unexpected after playing an action video game. Consistent with previous work, this study demonstrates that action video game exposure impacts cognitive control; exposure to action games may specifically decrease the ability to handle unexpected conflict.

Funding: Ohio Wesleyan University, Summer Science Research Program, Neuroscience Department at Ohio Wesleyan University.

Poster 3-118**FIND THE SILVER LINING OR IGNORE THE CLOUD? DIFFERENCES BETWEEN EMOTION REGULATION STRATEGIES IN DEPRESSION**

Heather Robinson, Rachel Sliwinski, Elisa Sheen, Rebecca Compton
Haverford College

Descriptors: Visual attention, Affect, Emotion regulation

To better understand mechanisms of emotion regulation, which is relevant to depression and other clinical conditions, we compared two strategies, cognitive reappraisal (CR) and attentional control (AC), with regard to their effectiveness in altering affect and visual attention to negative information. Sixty-seven undergraduates, prescreened with the CESD depression scale, were trained to use either CR or AC in a between-subjects design. Participants viewed images (60 neutral, 60 negative) from the International Affective Picture System in three phases: baseline, training, and test. CR training involved instruction in reinterpreting the meaning of the images, while AC training used gaze-contingent feedback to guide attention away from negative content. Dependent variables were affect ratings and gaze fixation on negative areas of images measured via eye-tracking. Both strategies reduced negative affect, but CR was more effective than AC ($F(1,63) = 5.8, p < .05$). Further, both training conditions reduced time gazing at negative areas of images, but this pattern was more pronounced following AC than CR training ($F(1,63) = 23.5, p < .001$). In sum, CR was more effective in altering self-reported emotion whereas AC was more effective in altering gaze patterns. Surprisingly, individual differences in depression did not significantly moderate these results. These findings shed light on cognitive mechanisms involved in the two emotion regulation strategies, and imply that a change in visual attention may not be necessary for successful emotion regulation.

Poster 3-119**ELECTROPHYSIOLOGICAL CORRELATES OF ASSOCIATIVE AND SEMANTIC SIMILARITY RELATIONS**

D.J. Bolger, Joseph Dien, Katie Shrout
University of Maryland, College Park

Descriptors: ERP, Reading, Semantics

There has been extensive debate over the possible role of associative (e.g., dog-bone) and semantic similarity (e.g., basketball-pumpkin) relations in the structure of semantic knowledge (Collins & Loftus, 1975; Shelton & Martin, 1992; Thompson-Schill, Kurtz, & Gabrieli, 1998). Semantic priming research suggests both contribute (Hutchison, 2003; Lucas, 2000) but the nature of their respective roles has been unclear. Sixty-nine channel EEG data were collected while forty-nine participants performed lexical decision (automatic conditions) and relationship judgment (controlled conditions) with both associative and semantic similarity related word pairs. Results suggested that the N400pz relatedness effect primarily reflected associative relations and did so under both automatic and controlled conditions. In contrast, the N300fz relatedness effect was seen only under controlled conditions and the main effect was larger for semantic similarity trials, consistent with our prior research (Franklin, Dien, Neely, Waterson, & Huber, 2007). This observation further supports our hypothesis that the N300fz measure may help researchers distinguish a controlled post-lexical visualization process from genuine effects of semantic memory in semantic priming tasks. These findings also further support hemispheric asymmetry proposals (Deacon, Grose-Fifer, Yang, Stanick, Hewitt, & Dynowska, 2004; Dien, 2009).

Poster 3-120**THE DYNAMIC THREAT PROCESSING GAME: AN ERP-BASED INVESTIGATION OF ATTENTIONAL BIASES IN CHILDHOOD ANXIETY**

Diego Sialer, Michael Crowley, Jia Wu
Yale University

Descriptors: Anxiety, ERP, Threat Processing

The role of threatening stimuli on neural correlates of attentional biases in anxious children was investigated in this study. Specifically, the P2 and P300 event-related potentials (ERPs) were examined via a high-density EEG as participants ($N=36$) engaged in a novel threat processing paradigm for assessing attentional biases in anxious children, "The Dynamic Threat Processing Game," a computer-simulated hot-potato game. The paradigm was designed in order to establish scenarios where a player would be faced with ambiguous threat cues that would signal a potential threat. The paradigm also establishes a scenario where players are faced with an acute threat. Children with high trait-anxiety were found to have amplified P2 responses to ambiguous threat cues and reduced P300 responses to an acute threat relative to low trait-anxiety children. These findings suggest a dysregulation in the allocation of attentional resources for high trait-anxiety children during threat processing. The present study may provide insight into the temporal unraveling of threat processing in anxious children.

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