then present a novel method for capturing the directionality of the information flow by applying Granger Causality to the patterns of phase shifting, called Phase Shifting Granger Causality (PSGC). Such directional relations reflect “effective connectivity.” The patterns of near and distant effective connectivity from this study show construct validity across some simple tasks, with two vigilance tasks showing increased overall connectivity, more long-range connectivity, and increased unidirectional connectivity compared with a resting condition. In addition, other results using PSGC relate to known patterns of connectivity in studies of white matter in the cortex. We will also present a comparison of PSGC with traditional coherence in an autism dataset presented in the symposium.

RELATIONS BETWEEN BEHAVIOURAL SYMPTOMATOLOGY AND REGIONAL EEG ALPHA POWER AND COHERENCE IN ADULTS WITH AUTISM SPECTRUM DISORDER

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Although individuals with autism spectrum disorders (ASD) show distinct patterns of resting brain electrical activity (EEG) and functional connectivity, only recently have researchers begun to link these activity patterns to behaviors typically associated with ASD. We examined regional eyes-closed and eyes-open EEG alpha power and coherence in relation to self-reports of behavior in 15 adults diagnosed with ASD and a matched comparison group of 16 unimpaired adults. Controls showed more alpha suppression during eyes-open rest than did adults with ASD, suggesting they were somehow better able to modulate alpha activity. Within the ASD group, preferential attention to detail (perceptual domain) was associated with relatively lower levels of eyes-open resting alpha activity and reduced coherence in posterior regions, with no relations between alpha measures and social interaction difficulties (social domain) in either group. Results suggest that relatively less coordinated alpha activity may be conducive to the processing of perceptual details in adults with ASD. Findings are discussed in relation to reduced functional connectivity and recent models of narrow minicolumnar brain structure in ASD.

IMAGINARY COHERENCE AS A BIOMARKER OF AUTISM

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Cognition arises from the transient integration and segregation of activity across functionally distinct brain areas. Autism Spectrum Disorders (ASD), a wide range of developmental disabilities, has been presumed to arise from the deviant dynamics of coordinated activity, frequently characterized as enhanced local but decreased long range functional connectivity over areas of integration. In this study we challenge this idea by presenting results from the use of the imaginary part of coherence (ICOH) in a large sample of ASD children (72) and age-matched controls (31) during a face-processing task. Since the ICOH measures connectivity at nonzero time delays it is not susceptible to volume conduction artifacts as is the case with the classical coherence analysis, it presents a more reliable picture of coordinated brain activity. The analysis shows that a net enhanced synchronization is rather the case in the ASD group in particular for local connectivity (less than 4 cm) and connectivity between most major cortical areas although some exceptions apply in relation to connections to parietal areas. An ANOVA shows a strong interaction between groups (ASD and Control) and areas of connectivity as well as with frequency suggesting perhaps a different style of information processing. We also present evidence that ICOH is a good candidate to provide features in building a classifier to be used as a potential biomarker for autism with a 78% of accuracy in distinguishing ASD subjects from Control subjects.
Shallow Structure Hypothesis (Clahsen, 2006). Chinese native speakers memorize English irregular verbs, which helps them decompose during processing, but fail to decompose regular verbs as there is no memory component to learning those inflected forms.

An ongoing issue in developmental and adult language acquisition is the nature of individual reading style differences. One proposal (Baron & Strawson, 1976) is that adult readers can be divided into those relying more on orthography ("Phoenicians") or on orthography ("Chinese"). A more recent proposal is that dyslexics can be divided into those suffering deficits in phonology or orthography (Castles & Coltheart, 1993). These proposals are plausible under either a dual-route or triangle model approach, but have not been subjected to debate. In principle, there should also be a third group relying on both processes in a balanced manner ("Phoenese") that would need to call on additional cognitive processes to integrate sometimes divergent outputs from orthography and phonology. In this experiment, we test the proposal (Dien et al., 2008; Dien, 2009) that the Recognition Potential index such a mechanism. Participants (n = 28) read sentences, presented wordwise, that favored orthographic processing (letter transpositions), phonological processing (pseudo-phonons), or both (normal). They then indicated which of two probe words appeared in each sentence. Accuracy rates were not significantly different between orthographic and phonological conditions (82% versus 80%). The Recognition Potential was significantly greater for the "Phoenese" (quadratic trend between orthography-phonology accuracy and Recognition Potential amplitude, p = 0.0455). These results suggest that studies of acquisition of reading skills could benefit from distinguishing between these three groups.

**Symposium 3.3**

**TO FEAR OR NOT TO FEAR: EXCITATORY AND INHIBITORY CONDITIONING IN THE LABORATORY AND THE CLINIC**

Chair: Vladimir Miskovic
University of Florida

The ability to learn about sources of danger in one’s environment is necessary for adaptive behavior and depends on the formation of excitatory associative links between sensory cues and aversive outcomes. Equally important to adaptive function is learning to make fine discriminations between danger and safety information, along with the capacity to restrain fearful behavior when coming into contact with cues that predict the absence of threat. The latter process depends on inhibitory learning and its dysfunction may be particularly relevant to fear and anxiety disorders. Although much is currently known about the mechanisms of excitatory fear conditioning, we know relatively little about safety learning or the dynamics that accompany situations where danger and safety information is present simultaneously. The contributions to this symposium will address these questions using a range of psycho-physiological and neuroscience approaches. The first paper summarizes startle and neuroimaging evidence implicating impaired safety processing as an intermediate phenotype with relevance for PTSD. The second paper combines measures of defensive reflex activation and amygdala imaging to probe threat/safety conditioning with distinct motivational outcomes in high and low anxious subjects. The third paper will review findings on generalization gradients in anxiety disorders, with emphasis on the association between learning and behavioral outcomes. The final paper employs frequency-tagging of visuospatial processes to probe sensory competition between conditioned danger and safety.

**IMPAIRED SAFETY SIGNAL PROCESSING AS A BRAIN-BASED INTERMEDIATE PHENOTYPE**

Tanja Jovanovic & Seth D. Norrholm
Emory University

The neural underpinnings of fear and fear inhibition are clinically relevant issues that are poorly understood in humans; however animal research offers tools that can be used to investigate these phenomena. We translated a conditional discrimination procedure (AX+/BX−), previously validated in animals, to a human fear-potentiated startle paradigm. This paradigm allows for an assessment of fear-potentiated startle during threat conditions (reinforced conditioned stimulus, CS+), as well as inhibition of fear-potentiated startle during safety conditions (nonreinforced conditioned stimulus, CS−). This paradigm also includes an inhibition transfer test. A response keypad is used to assess contingency awareness on a trial-by-trial basis. The results show that PTSD is associated with impaired inhibition of fear-potentiated startle in the presence of safety signals, even when patients are cognitively aware of safety. We have also used simple discrimination (CS+ vs. CS−) and extinction (CS+ without reinforcement) paradigms with fear-potentiated startle in traumatized populations and have found deficits in safety signal learning and extinction in individuals with PTSD. These deficits in fear inhibition are related to reduced activation of the prefrontal cortex during a functional magnetic resonance imaging response inhibition task. Taken together, these psychophysiological and neuroimaging data suggest that impaired safety signal processing may provide a brain-based intermediate phenotype for PTSD.

**WHEN SAFE IS NOT ALWAYS SAFE**

Alfons Hamm, Julia Wendt, Elisa Steinfurth, & Christiane Pané-Farré
University of Greifswald

In a differential conditioning paradigm, one cue (CS+) is paired with an aversive US while the other (CS−) predicts the absence of the US. We will present two studies, one using an exteroceptive pain stimulus as the US and one study using an interoceptive stimulus as the US where we analyzed the responses to the threat and safety cues using startle probe methodology and the BOLD response to the CS+ and the CS−. What will be demonstrated is that the CS− not only leads to a relative potentiation of the startle probe to the CS−, particularly among participants with high fear (for the exteroceptive US) and high fear of body symptoms (in case of the interoceptive US condition) but also increased activation of the amygdala. We will also present data showing that the context is an important modulator, particularly for safety learning.

**THE ROLE OF CONDITIONED FEAR GENERALIZATION IN THE ANXIETY DISORDERS: A MOVE TOWARD STUDYING BOTH PAVLOVIAN AND INSTRUMENTAL CONTRIBUTIONS**

Shmuel Lissek
University of Minnesota, Twin Cities

Meta-analytic results of Pavlovian fear-conditioning studies in the anxiety disorders imply generalization of conditioned fear to stimuli resembling the conditioned danger-cue as a robust conditioning marker of anxiety pathology. Follow-up studies have begun employing generalization-gradient methods to more systematically quantify the degree to which Pavlovian conditioned fear is over-generalized in clinical anxiety. Generalization gradients refer to slopes of conditioned responding that decline as the test stimulus gradually differentiates from the conditioned danger-cue. The current talk will first review results from generalization gradient studies demonstrating overgeneralization of Pavlovian fear-conditioning in the anxiety disorders. The talk will next turn to the potentially harmful behavioral consequences of generalization by presenting data from a new instrumental paradigm designed to capture maladaptive behavioral avoidance precipitated by Pavlovian generalization. The clinical value of studying this kind of Pavlovian-to-instrumental transfer will be discussed in light of the extreme paucity of such data in the anxiety disorders.

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**PERCEIVING THREAT IN THE FACE OF SAFETY: EXCITATION AND INHIBITION OF CONDITIONED FEAR IN HUMAN VISUAL CORTEX**

Vladimir Miskovic & Andreas Keil
University of Florida

A wealth of findings suggest that cortical perceptual systems are dynamically attuned to environmental contingencies linked to threat, showing experience-dependent perceptual amplification of fear-associated stimuli at the cost of other sensory information. Few studies, however, have been specifically designed to distinguish cortical perceptual biases when participants learn about threat and safety, or when learned threat and safety cues are combined. In this study, we recorded steady-state visual evoked potentials (ssVEPs) using dense–array electroencephalography (EEG), while participants performed a conditional discrimination task using low-level visual cues. A frequency-tagging approach was used to label distinct responses of the visual cortex to conditional stimuli. Trial-by-trial assessments collected online revealed that participants successfully discriminated between the learned threat and safety cues. Conditioning was associated with heightened activation within extended visual cortex in response to the threat-, but not the safety-related, stimulus. Cortical facilitation for the fear-associated stimulus was not perturbed by simultaneously presenting cues indicating safety or associative novelty, suggesting that perceptual systems may err on the side of caution when threat is uncertain. Our findings shed some light on the brain dynamics associated with experience-dependent acquisition of perceptual biases for signals of danger and safety.

**Symposium 4.1**

**THE DEVELOPMENTAL NEUROBIOLOGY OF ADOLESCENCE: IMPLICATIONS FOR EMERGING AFFECTIVE AND BEHAVIORAL DISORDERS**

Chair: Nicholas B. Allen
University of Melbourne

Adolescence is a period of profound developmental change across the biological, psychological and interpersonal domains, and is also a time of life when many major mental health problems emerge. In this symposium new data on the link between the developmental neurobiology of adolescence and emerging affective and behavioural disorders will be presented. First, Morgan and colleagues will explore the prospective relationship between neural reward responsiveness and longitudinal changes in depressive symptoms. Next,