Poster 3-021

ACUTE STRESS AND DECISION-MAKING: AN FRN STUDY

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Descriptors: stress, decision making, FRN

A recent hypothesis states that acute stress induces faster and more risky decisions. This hypothesis was tested by exposing 22 young, healthy subjects to the *Social Evaluated Cold Pressure Test* (SECPT) and 10 control subjects to a hand-warm water condition before all subjects were performing the *Balloon Analogue Risk Task* (BART). This test evaluates subjects' risk decisions and behaviors. In the BART, subjects were requested to stepwisely inflate a balloon in order to earn money. However, with growing balloon size (max. 6 steps), the risk increased that the balloon busted. Based on subjects' cortisol level before and during the SECPT, they were divided into high and low cortisol responders. While exposed to the BART, EEG was recorded from 61 electrodes for later offline-analysis of subjects' FRN (feedback-related negativity) amplitudes a sensitive biological marker for feedback processing in response to non-busting inflations and busts. Behavioral data revealed no negative effect of acute stress on decision making. In contrast, subjects with high cortisol levels in the SPECT showed reduced risk and highest risky behaviors as compared to low cortisol responders. FRN-amplitudes were more negative for negative than for positive feedback but this effect was not moderated by stress. Thus, acute stress does not always affect decision making negatively but depends on the type of stress, subjects' stress task, personality, stress experience, and coping behaviors.

Poster 3-022

OUTCOME PROCESSING IN THE CONTEXT OF GAINS VERSUS LOSSES: THE INFLUENCE OF FEEDBACK VALENCE IN FEEDBACK-P3

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Descriptors: decision-making under risk, prospect theory, risk-aversion

The valence of outcomes has great influence on risk preference in economic decision-making. In the present study, we examined the effects of the valence of outcomes on the feedback-P3 (fb-P3), an ERP component considered an indicator of motivational significance of rewards. To this end, we used a gambling task in which participants opted between two gambles in the context of possible gains (where a zero-value outcome is the worst possible outcome) or losses (where a zero-value is the best possible outcome). EEG was recorded for 27 participants (16 females) while they completed this task. The fb-P3 was quantified as the mean amplitude in the time window of 350–450 ms post feedback onset. Behavioral results are in accordance with Prospect Theory, showing that participants were risk-averse for gains and risk-seeking for losses. Regarding electrophysiological results, we found a significant interaction between context and valence. However, significant differences occurred only in the context of gains, where outcomes with positive valence elicited higher amplitudes than those with negative valence. As the fb-P3 is associated with motivational significance of the outcomes, our results suggest that higher relevance is given to possible outcomes obtained in the context of gains in contrast with the context of losses, where similar relevance appear to be given to loss or not. This effect may underlie differences in reward learning in both contexts, which may explain the opposite economic preferences revealed by behavioral results.

Poster 3-023

NEURAL CORRELATES OF SYSTEM I AND SYSTEM II JUDGMENTS WHEN DIAGNOSING DISEASES

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Descriptors: System I and System II decisions, diagnosing diseases, theta

Understanding how clinicians make diagnostic decisions is imperative to the health of their patients. Within the medical literature, judgments that are quick and reflexive have been termed System I decisions, while judgments that are slow and contemplative are System II decisions. In the current study, we had participants diagnose liver and biliary tree diseases from patient medical cards while electroencephalography data was recorded. To analyze the neural correlates of system I and system II decisions, the diseases were characterized by their degree of conflict within the disease set in that diseases that were easy to distinguish would recruit system I judgments, while diseases that were difficult to distinguish would require system II judgments. We found that less distinct diseases (i.e., high conflict) corresponded to enhanced theta activity within the medial-frontal cortex in relation to more distinct diseases (i.e., low conflict). This is in line with recent evidence that theta activity may reflect the need for cognitive control (Cavanagh & Frank, 2014). Thus, this indicates that theta activity may be used as a measure of System I and System II judgments within a medical context.

Poster 3-024

REWARD POSITIVITY AMPLITUDE TO FEEDBACK STIMULI THAT PREDICT MONETARY REWARDS AND ELECTRIC SHOCKS IN A GOAL-DIRECTED TASK PARADIGM

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Descriptors: EEG, reward positivity, goal-directed

The reward positivity (RewP) is a component of the event-related brain potential generated in anterior cingulated cortex (ACC). Many studies have shown that RewP is more positive-going following feedback with positive rather than negative valence. Consistent with this view, we found in a previous study that stimuli predicting the *omission* of pain elicit a RewP, albeit a delayed one. Yet, other researchers have reported that the RewP is elicited by stimuli that indicate forthcoming pain. To investigate this disparity, we recorded the RewP from participants as they navigated a virtual T-maze. Unlike a more typical experiment in which they are told to find rewards and avoid pain, they were told that the task would terminate after they found a fixed number of rewards and shocks in reward and pain conditions. We predicted that the RewP would be elicited by rewards in the reward condition, and by stimuli that predicted forthcoming pain in the pain condition, since in the latter case each painful stimulus indicated progress toward achieving the larger task goal (ending the task ASAP). These predictions were statistically confirmed. An exploratory analysis also revealed that RewP amplitude increased across blocks in the pain condition, suggesting that the task goals became more relevant as people approached the end of the task. We interpret these results according to a recent theory that holds that the ACC sustains extended sequences of actions to effect goal-directed effortful behaviors – in the present case, to withstand getting multiple shocks in order to finish the task.

Poster 3-025

UNDERLYING MECHANISMS FOR FATIGUE-RELATED PERFORMANCE DEFICITS IN COGNITIVE TASKS: AN INVESTIGATION OF THE IMPACT OF FATIGUE ON THE REWARD POSITIVITY.

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Descriptors: fatigue, reward-processing, learning

Fatigue related impairments in motor coordination, judgment, and decision making are well documented and are associated with greater risks for personal injury, automotive crash, and medical errors. Yet, the neuropsychological mechanisms underlying these effects are not well understood. Here, we provide evidence to support a theory of fatigue-induced reward blunting within medial frontal systems that results in behavioral deficits in learning tasks. Specifically, we collected ERP data from 60 university students while they completed an experimental reward-based learning task. Following data processing participants were binned into two groups: high and low fatigue, based on self-report measures. We then assessed the magnitude of the ERP component termed the Reward Positivity between groups and found that it was reduced ($p < 0.01$) in the high fatigue group. Performance on the learning task was also reduced in highly fatigued subjects. Finally, our results showed a strong correlation between fatigue level and the magnitude of the Reward Positivity (Pearson's $r = -0.06$, $p < 0.01$). Given the importance of reward-evaluation in learning as posited by reinforcement learning theory, as well as the evidence to support the reward positivity as a reflection of neural activity within medial frontal systems for reward evaluation and processing, these data suggest that such systems are impaired during high levels of fatigue, and further, that this may be one mechanism through which fatigue leads to impairments in judgment and decision-making as well as learning and motor performance.