**Poster Session Abstracts**

**ASSESSMENT OF FATIGUE BY ERP ASSOCIATED WITH OFFSET OF SACCADIC EYE MOVEMENTS**

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1Integrated Psychological Science, 2Applied Psychological Science

Descriptors: ERP, ergonomics, attention

Eye fixation related potential (EFRP) associated with an eye fixation pause is obtained by averaging EEGs at offset of saccades. EFRP changes with cognitive factors. EFRP can be measured under the conditions where a participant moves eyes. In this study, we examined the effect of fatigue on EFRP in a long lasting visual task. The task was a computer game of a train driving (TD task) for one hour. The participant became a motorman and was asked to start a train and stop it at a given position and time at various stations. Before and after the task, the participant was assigned to perform a saccade test. The saccade test was to move eyes between two targets on a vertical stripe pattern. In addition, the participant completed questionnaires for subjective fatigue and a subjective transient stress scale. The EEGs (Fz, Cz, Pz and Oz) were recorded with a linked ear lobes reference. Horizontal and vertical eye movements were recorded by means of EOG. EEG epochs time-locked to the fixation pauses of horizontal saccades were averaged to obtain EFRP. The amplitude of the biggest positive component (P100) at Oz was measured as an index of the EFRP amplitude. EFRP showed small changes in amplitude during performing the task. On the other hand, EFRP amplitudes in saccade task after a participant finished TD task were decreased compared relative to pre-task. The scores of subjective fatigue and the transient stress score from questionnaires showed increase of fatigue. EFRP will be a useful measure for assessment of visual fatigue.

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**PRINCIPAL COMPONENT ANALYSIS CLARIFIES THE COMPONENT STRUCTURE OF ERPS FOLLOWING ERRORS**

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Descriptors: error processing, principal component analysis, ERP

Errors elicit an ERP component labeled Error Related Negativity (ERN). Falkensteina et al., 2000 reported that the ERN is followed by a positive component (Pe) that is maximal at parietal electrodes and which they suggested is also a man-
The present experiment investigated the effect of presenting a conditioned stimulus (CS) on the unconditioned pain response in humans. Davis et al. (1989) found that the latency of the conditioned fear reaction in rats was about 50 ms, which is substantially shorter than that observed in human studies. In the present study, a tone conditioned stimulus (CS) signalled an aversive unconditioned stimulus (US) presented 200 ms after CS onset. The US was either a burst of white noise (94 dB) (Paired Noise group) or a heat pulse (53 degrees Celsius) (Paired Pain group) to the arm. The CS and US were explicitly unpaired in two control groups. Fear-potentiated startle was assessed by 85 dB noise presented at SOAs from 10 to 100 ms after CS onset. It was hypothesized that the CS would increase startle in the paired groups compared to the unpaired groups, and the point in time when startle was significantly increased in the Paired groups defined the latency of conditioned fear. The results showed that startle increased from 50 to 100 ms in the Paired noise group, indicating that the latency of the conditioned fear reaction was between 50 and 100 ms. This is substantially faster than what has previously been reported, and suggests that extensive processing of stimuli is not necessary for elicitation of fear. In addition baseline startle was increased in the Pain groups compared to the Noise groups, although the subjects in the Noise groups rated the US to be more unpleasant than the subjects in the Pain groups.

APPRAISAL INFLUENCES ON SOMATOVISERAL RESPONSES AND MOTIVATION
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Descriptors: arm movements, EMG, appraisal

Several appraisal theorists postulate that appraisal outcomes produce specific somatoviseral response patterns. In addition, appraisals are supposed to influence motivational states like approach and withdrawal tendencies. In the context of a task on sensorimotor coordination, participants were presented with pictures displaying unpleasant, neutral, and pleasant stimuli (intrinsically pleasantness manipulation). It was hypothesized that participants desired to increase the size of pleasant and decrease the size of unpleasant images (goal conduciveness manipulation). The performance of arm movements (flexion vs. extension) yielded either an increase or a decrease of picture size. Results for heart rate and facial electromyogram show differential efferent effects of the respective appraisal outcomes. Importantly, the idea of arm flexion and extension as evolutionarily preceded indicators of approach and withdrawal tendencies is strongly questioned by our results.
The present study was designed to evaluate the effects of active and passive attention and the sequence of the experiment on the N400 waveform obtained with a computerized version of the Peabody Picture Vocabulary Test-Revised (PPVT-R). Twenty-two healthy control subjects (mean age = 38.6 y.) free of neurological, psychiatric, visual or audiological disorders were included in the experiment. The subjects were instructed to watch pictures and heard a word that matched or mismatched (0.5 probability) the semantic content of the picture. The stimulus represented the first two levels of vocabulary difficulty in the PPVT-R. In the passive attention condition, participants simply watched and attended to the stimuli, mentally identifying those that matched or mismatched the pictures. In the active attention condition, subjects press a button in response to those spoken stimuli, mentally identifying those that matched or mismatched the pictures. The feedback error-related negativity (fERN) is a fronto-centrally distributed component of the event-related brain potential occurring when humans receive feedback that inform them that they have made an error. A recent theory holds that fERN amplitude is modulated by participants' expectations, such that unexpected outcomes produce larger fERNs than expected outcomes. We used a guessing task to investigate whether the amplitude of the fERN component is affected by probability cues that precede the feedback stimuli. On each trial of the task subjects selected one of twenty doors presented on a computer screen to find a reward. At the start of each trial a predictive cue indicated whether rewards were hidden behind 1 (5%), 10 (30%) or 19 (95%) of the doors. Our results indicate that although the probability cues were differentially processed (as indicated by the P300), the cues did not modulate fERN amplitude. These results are consistent with a previous study that tested the same hypothesis using lower probabilities.

The feedback error-related negativity (fERN) is a component of the event-related brain potential (ERP) associated with feedback processing. The reinforcement learning theory of the fERN (RL-ERN) proposes that the fERN reflects the impact of two separate prediction error signals mediated by the midbrain dopamine system on the anterior cingulate cortex (ACC) for the adaptive modification of behaviour (Holroyd & Coles, 2002). This theory predicts that when negative feedback is predicted by a preceding cue, the fERN should be elicited by the predictive cue and not by the negative feedback. We tested this prediction in two ERP experiments that involved a novel virtual T-Maze task. In experiment one, participants choose between a right and a left alley and received either a reward or no reward at the end of each. Consistent with previous research, we found that a fERN was elicited by negative feedback. Surprisingly, we discovered differential activity between the feedback cues at 180 msec in the medial temporal lobe (MTL). In experiment two, a predictive cue (i.e. reward, no-reward, neutral) was presented immediately prior to feedback onset. We found the fERN was elicited by the no-reward predictive cue, but not by the reverse predictive cue. Further, the fERN was elicited by negative feedback following the neutral predictive cue, and was not elicited by other feedback. These findings support the RL-ERN theory and suggest a possible interaction between the cognitive systems of feedback processing: an early recognition system (MTL) and a later control system (ACC). NSERC RGPIN 312409-05.

A WHOLE-CORTEX MEG STUDY OF FACE PROCESSING IN HEALTHY ADULTS

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Descriptors: face processing, MEG, M170

The N170 component of the ERPs, and its magnetic equivalent, the M170, have greater amplitude in response to Faces than Objects over right temporo-occipital
scalp. Goal of the present study was to characterize the spatio-temporal properties of the M170 to faces and objects at high resolution in a sample of healthy adults (n = 11; age = 25.9 years). Data were collected using an OMEGA 151-channel MEG system (Down Syndrome Research Foundation, Barnaby, BC). Gray-scale pictures of faces and nonface stimuli (butterflies, fishes, guitars) were presented for 500 ms. Subjects categorized the stimuli as faces or non-faces by pressing one of two keys. Event-related fields were selectively averaged for each trial type and subject, and grandaverages calculated for faces and non-faces. M170 was identified for each participant as a source over right and a source over left middle temporal scalp, peaking between 130 and 180 ms. Two virtual sensors (one right, one left) were created collapsing 4 neighboring sensors. M170 mean peak latency and peak amplitude were computed for each subject and condition and entered in two repeated measures ANOVAs. Right M170 latency was significantly shorter in response to faces than non-faces (faces: 147.5 ms, non-faces: 157.3 ms, F(1,10) = 14.5, p = .004). Right mean M170 peak amplitude was significantly greater for faces than non-faces (faces=227 pT, non-faces: -178.5 pT; F(1,10) = 5.2, p = .043. Dipole modeling using event-related Synthetic Aperture Magnetometry (SAM) identified sources in right face fusiform area modulated by faces in the majority of participants.

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**SELECTIVE DISSOCIATION OF FACTOR EFFECTS ON REACTION TIME AND ERP COMPONENT LATENCIES IN AN ERIKSEN FLANKER TASK**

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Descriptors: chronometry, processing speed

Subjects completed a variant of the Eriksen flanker task. The center arrow in a five-arrow array determined the direction of the response. Stimulus-response (S-R) compatibility was varied by presenting the cue word SAME, signaling a compatible response, or OPPOSITE, signaling an incompatible response, before the onset of the array. The center arrow appeared in isolation, or flanked by arrows pointing either in the same (congruent) or opposite (incongruent) direction. Overall processing speed, indexed by the total RT, varied with S-R compatibility and flanker congruence. Compatible responses were slower, whereas incompatible responses were speeded (i.e., the cost of incomparability) when flankers were incongruent. This slowing of compatible responses was accompanied by slowing of P300 latency and the onset latencies of the s- and rLRPs. The reduction in the cost of incompatibility was accompanied by a decrease in P300 latency and in the onset latencies of the r- and sLRPs. These results suggest an exchange of information between the channels activated by the target and flankers as processing unfolds.

**COMPARISON OF VISUAL VS. OLFACTORY DISTRACTIONS ON PAIN THRESHOLD AND TOLERANCE**

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Wheeler Jesuit University

Descriptors: scent, pain, distraction

A variety of distraction techniques (visual, physical, olfactory, etc.) have been effective in mediating pain perception and tolerance. The present study compared the efficacy of visual vs. olfactory pain distraction methods. In a within-subjects design, participants completed four conditions: peppermint scent, high arousal (HA) images, low arousal images (LA), and a control condition. Images were from the International Affective Picture System (IAPS). After an 8-minute exposure, participants completed a cold pressor test and questionnaires assessing mood (POMS), task load (NASA-TLX), and anxiety (STAI). Physiological measurements (O2, pulse, BP) were monitored pre- and post-cold pressor testing. HA produced significantly lower pain intensity ratings than both the LA and the control condition. Peppermint scent produced lower pain ratings than the control and LA conditions. Both peppermint scent and HA promoted increased pain tolerance. HA images led to higher ratings of anxiety. Physiologically, visual stimuli led to lower systolic ratings, and there was an interaction indicating higher post-systolic ratings between the peppermint and control condition. Finally, mean arterial pressure increased following the cold pressor task. Thus, peppermint scent and HA visual images are equally effective in managing pain and altering physiological measurements during a cold pressor task.

**EMOTIONAL MODULATION OF ANTERIOR, SUPERIOR, AND POSTAURICULAR REFLEXES**

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Descriptors: auricular, startle response, emotion

Postauricular reflexes are enhanced during pleasant stimuli relative to those during neutral and aversive stimuli, suggesting an appetitive pattern of modulation for these reflexes. However, the emotional modulation of other auricular reflexes (namely, the superior and anterior auricular muscles) has not yet been investigated. In this study, we found that postauricular reflexes had the greatest overall magnitudes, followed by overall superior auricular reflex magnitudes, with anterior auricular reflexes having the smallest overall magnitudes. Postauricular reflexes were also the only auricular reflexes to show an appetitive pattern of modulation during both pictures and sounds. Both superior and anterior auricular reflex modulations and raw magnitudes were uncorrelated. Additionally, raw postauricular and startle blink magnitudes were uncorrelated, whereas raw startle blink and corrugator EMG magnitudes were correlated. Individuals high in dysphoria showed deficient responses in the EMG measures but not in the reflexive measures. Thus, the postauricular reflex appears to be the only auricular reflex that is reliably associated with reactivity to appetitive stimuli in different stimulus modalities.

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**EMBEDDING THE POSTAURICULAR REFLEX IN A NOMOLOGICAL NETWORK OF EMOTION**

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Descriptors: startle response, EMG, emotion

The postauricular reflex has been investigated as a possible psychophysiological measure of appetitive emotional processing during visual stimuli. However, its relationships with other EMG measures of emotion have not been studied. It is also unclear whether emotional sounds would modulate postauricular reflex magnitudes in the same way as emotional pictures. Furthermore, the effects of individual differences in dysphoria on postauricular reflex modulation have not been explored. In this study, postauricular reflexes were collected along with startle blink reflexes and corrugator and zygomatic facial EMGs as participants attended to emotional pictures and sounds. Consistent with previous findings, postauricular reflexes were greater during pleasant pictures and sounds than during aversive pictures and sounds. In particular, postauricular reflexes were largest during erotic and nurturant pictures. Though zygomatic EMGs were also largest during nurturant pictures, postauricular reflex and zygomatic EMG modulations and raw magnitudes were uncorrelated. Additionally, raw postauricular and startle blink magnitudes were uncorrelated, whereas raw startle blink and corrugator EMG magnitudes were correlated. Individuals high in dysphoria showed deficient responses in the EMG measures but not in the reflexive measures. Thus, the postauricular reflex appears to be a unique psychophysiological measure of appetitive emotional processing across stimulus modalities.

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**BCI-REGULATION OF NEURONAL SUBSTRATES OF EMOTIONS**

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Descriptors: brain computer interface, emotion

Departing from studies demonstrating learned regulation of BOLD, we trained healthy people in a 3 T-MR scanner to self regulate their BOLD- response originating from several cortical and subcortical regions of interest: parts of the anterior cingulate, insula and parahippocampal gyrus and premotor areas. We
demonstrated that healthy individuals gain control of these areas without co-
activation of other areas, excluding non-specific arousal and attention effects.
Using Near-Infrared-Spectroscopy (NIRS), we showed rapid acquisition of local
brain area self regulation in sensorimotor areas, suggesting a cheap and
non-invasive approach of metabolic BCI research for paralyzed and artificially
respirated patients and children. After acquisition of sufficient BOLD-control,
neuropsychological behavioral probes, specific for the regulated area’s function,
were presented while subjects exercised self-control over these particular brain
areas. Significant effects on memory and emotion were demonstrated underlining
the physiological effects of operant regulation of brain blood flow. Initial pilot
data on criminal psychopaths lacking any BOLD-response in the brain’s fear
circuit indicate that voluntary, operant modulation of emotionally-relevant sub-
cortical and cortical brain regions is possible. Effects on social behaviour are also
within reach and metabolic BCIs (fMRI, NIRS) may allow voluntary control of
brain function and BCI-use in the completely paralyzed and in emotionally par-
alyzed such as successful and criminal psychopaths.

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Institutes of Health (NIH).

BRAIN COMPUTER INTERFACE AND RESTORATION OF
MOVEMENT IN CHRONIC STROKE

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Descriptors: brain computer interface, rehabilitation, MEG

Chronic stroke is characterized by poor or non-existing recovery of motor func-
tions and a maladaptive pattern of cortical reorganization. Contrallesional cor-
tical brain regions exert a forceful inhibitory influence on the perilesional brain
areas preventing functional reorganization. Here we describe a new strategy using
BCI to a) demonstrate voluntary control of a hand prosthesis from sensorimotor
cortex adjacent to the lesion and b) improve the reorganization of ipsilesional
cortex after extensive BCI training in chronic stroke lacking residual hand
movement. The BCI used for chronic stroke patients records magnetic fields over
the ipsilesional sensorimotor cortex using a 275-channel magnetoencephalo-
graph. Patients engage in motor imagery of the paralyzed hand. The prosthesis
attached to the paralyzed hand is driven by magnetic brain activity. Desynchro-
nisation and synchronisation of the cortical oscillations induced by the patients’
imagery opens and closes the paralyzed hand. The patients receive continuous
visual feedback of the cortical rhythm, usually sensorimotor rhythm of 8 to 20 Hz
(SMR). Results of extensive training of the first five patients with no residual
hand movement and subcortical lesions clearly show that control of the prosthesis
with SMR near to the lesion is possible: on average patients achieved 80% con-
control, one even 95%. All patients showed improvements in spasticity but no sub-
stantial improvement of hand function without the BCI. Effects on cortical
reorganization needs larger sample sizes before tentative conclusions are possible.

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GENDER STEREOTYPED DISTRACTIONS DIFFERENTIALLY
INFLUENCE PAIN PERCEPTION AND TOLERANCE IN MALES
AND FEMALES

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Descriptors: pain, gender, distraction

Visual and physical distractions can increase human pain tolerance; further, dif-
fences in pain threshold and tolerance are noted between males and females.
The present study examined the effects of gender-stereotyped visual distractions
on pain threshold and tolerance, mood, workload, and physiological response.
In a within-subjects design participants viewed gender-specific videos (one male -
an ultimate fighting video, one female - a dramatic love scene) and a non-video
control condition. Pain was administered via a cold pressor test. Males viewing
male gender-specific video produced the lowest pain ratings. Lower levels of
anger were found when viewing the male video in comparison to both the female
video and non-video control. Higher levels of depression were reported while
watching the female video. Physiological measures were recorded pre- and post-
procedure in each condition. Oxygen saturation was higher during the post-test.
A trend revealed an increase in pulse rate while watching either video compared to
the non-video control. Pulse and systolic blood pressure also decreased over time.
These results indicate gender-specific, differential effects on altering pain per-
ception between males and females. This may be of particular benefit when
applied to individuals suffering from chronic pain.

I KNOW THEY REALLY LIKE ME: DEFENSIVENESS AS A
MODERATOR IN NEUROENDOCRINE RESPONSES TO SOCIAL
REJECTION

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Descriptors: cortisol, social rejection, defensiveness

Belongingness theory (Baumeister & Leary, 1995) states that people should ex-
perience pain and distress when socially rejected due to an inherent need to
belong. Laboratory studies examining self-reports of negative affect/distress fol-
lowing social rejection, however, have reported inconsistent results. This study
therefore measured salivary cortisol before and after social rejection as a more
objective measure of psychological distress. It was predicted that 1) socially re-
jected participants would exhibit significantly higher salivary cortisol relative to
socially accepted and control participants, and 2) individual factors, such as
gender, rejection sensitivity, and defensiveness, might moderate the relationship
between social rejection and salivary cortisol. Results indicated that socially re-
jected participants exhibited significantly higher salivary cortisol than socially
accepted participants controlling for the social rejection manipulation. Rejected participants also reported significantly more negative and less positive
affect than accepted and control participants immediately after the social rejec-
tion manipulation. Defensiveness moderated the relationship between social re-
jection and salivary cortisol, where high defensive rejected participants exhibited
significantly lower salivary cortisol than low defensive rejected participants sub-
sequent to social rejection. These results indicate that social rejection causes a
physiological stress response, and that high defensive individuals may be less
susceptible to increases in cortisol following social rejection.

This research was supported by an F31 predoctoral research fellowship from
NIMH (#MH075319-01A1) awarded to Ginette Blackhart.

IMPACT OF FRONTAL DAMAGE ON NEURAL CORRELATES
OF EPISODIC ENCODING INVESTIGATED WITH EVENT-
RELATED POTENTIALS

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Descriptors: episodic memory, frontal damage, semantic organization

Our goal was to examine the impact of frontal damage (FD) on the neural
correlates of episodic encoding. Event-related potentials (ERPs) were recorded in
persons with FD during a verbal recognition paradigm in which semantic or-
organization in encoding was manipulated. For each of the 3 conditions, partic-
pants memorized 3 lists of 16 pairs of words. In the “Unrelated” condition, partic-
icipants had to memorize unrelated words. In the “Spontaneous” and
“Guided” conditions, words from each list were drawn from 4 semantic cate-
pories. For the successfully encoded items, P200 and Late Positive Component
(LPC) amplitudes were lower in persons with FD than in controls for the “Spon-
taneous” condition (p < .005). No group difference was obtained for other con-
ditions. Although behavioral performance was comparable between persons
with stroke and control participants, these preliminary data suggest that persons
with FD exhibit some neural changes related to the spontaneous involvement of an
elaboration strategy during encoding.
PAVLOVIAN CONDITIONING IN PTSD: INFLATED SHOCK EXPECTANCY AND NEGATIVE APPRAISALS

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Descriptors: anxiety disorders, human pavlovian conditioning, psychophysiological assessment

Learning models play an important role in models of PTSD. However, while some studies found enhanced acquisition and reduced extinction of differential conditioned responses, others found no differences or even a deficit in differential learning compared to controls. To clarify this issue, we tested 30 PTSD patients and 22 control participants with past trauma but no PTSD in a differential aversive conditioning experiment consisting of habituation (unpaired presentation of CSs), acquisition (CS+ paired with shock), and extinction (unpaired presentation of CSs). In addition to skin conductance, heart rate and corrugator EMG, we measured subjective ratings of shock expectancy and valence of the CSs (neutral pictures) throughout the procedure. PTSD patients had higher heart rate during all conditioning phases. However, baseline corrected reactions to the CSs did not differ from controls in any of the psychophysiological channels. By contrast, ratings of shock expectancy were reliably increased during habituation and extinction for both CSs in PTSD compared to controls. Similarly, PTSD patients' evaluative ratings of the CSs were more negative during habituation and extinction. The results point to an overestimation of the probability of aversive events in PTSD during phases of uncertainty (i.e., during habituation and extinction). This expectancy bias was accompanied by more negative appraisals of neutral stimuli. Thus, inflated expectancy of aversive outcomes and negative appraisals could be two cognitive processes involved in the development or maintenance of PTSD.

Swiss National Foundation.

AUDITORY P300 ABNORMALITIES IN BIPOLAR DISORDER: EFFECT OF CLINICAL PHASE

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Descriptors: bipolar disorder, P300

Reduced auditory P300 amplitude and prolonged latency have been observed in Bipolar Disorder, consistent with attentional disturbances. The present study tested whether P300 abnormalities were affected by clinical state. Fifty three subjects with Bipolar Disorder I (current manic or mixed episode N=22) and 75 control subjects were evaluated using an auditory oddball event related potential (ERP) paradigm. ANOVAs were used to assess P300 amplitude differences between groups compared by diagnosis (healthy, euthymic, symptomatic) and electrode site (Fz, Fcz, Cz, CPz, Pz). P300 amplitude was reduced at posterior electrode sites in both symptomatic and euthymic patients (p=.000). Symptomatic but not euthymic patients differed from controls at frontal central sites. P300 latency was prolonged in both groups. P300 amplitude differences were not related to the effects of current medication status, past substance-related disorder, nor gender. The P300 amplitude reduction and latency prolongation commonly observed in Bipolar Disorder persist across clinical phases at posterior electrode sites. Frontal P300 amplitude appears to be sensitive to the presence of current symptoms. These findings indicate that changes in clinical state may be associated with variations in P300 topography.

THE EFFECTS OF 5-HTT GENOTYPE AND STRESS ON HEDONIC CAPACITY

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Descriptors: stress, reward, depression

Stress, one of the strongest risk factors for depression, has been linked to hedonic-like behavior and dysfunctional reward-related neural circuitry in preclinical models. Furthermore, variations in serotonin transporter (5-HTT) genotype have been associated with an increased risk of depression following stressful life events. The goal of this study was to investigate the relationship between stress, 5-HTT genotype, and reward processing as well as underlying brain mechanisms. To this end, central (ERP) and peripheral psychophysiological (EMG, SCR) data were recorded while 36 healthy subjects completed a signal-detection task coupled with a differential reinforcement schedule under both stressful (shock) and control conditions. Consistent with our recent work (Bogdan and Pizzagalli, Biol. Psychiatry, in press), stress impaired hedonic capacity (p = .07) while not affecting general performance. Preliminary analyses on individuals who have been genotyped (n = 12) revealed a significant gene (5-HTT) x environment (stress, no stress) interaction (p < .05), which was due to higher stress-induced hedonic deficits in individuals with at least one short 5-HTT allele. Thus, subjects characterized by an increased genetic vulnerability to depression showed a blunted hedonic capacity in the presence of a stressor. These findings highlight a promising candidate mechanism linking 5-HTT genotype, stress, and depression.

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EMOTIONAL STRESS, GENDER, AND AGE EFFECTS ON FACIAL SKIN POTENTIAL DISTRIBUTION

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Descriptors: skin potential level, facial skin, emotion

Skin potential level (SPL) is the electric potential difference between human skin surfaces. SPL negativity at the palm is considered an index of arousal level (Leiderman & Shapiro, 1963, Nishimura et al, 1995). It is also related to skin growth and regeneration, barrier homeostasis, local lesions, and integrative autonomic reactions. Headaches, mental disorders, and brain tumors affect the distribution of SPL in facial skin zones of higher density of nerves and blood vessels (Podshibyakin, 1962). Our hypothesis was that the SPL distribution on facial skin is related to emotional tension. We measured SPL using a voltmeter with input resistance of 40 megohm, applying Ag/AgCl electrodes. The data were obtained in a calm group (CG) at summer study practice (men, n = 67; women, n = 117) and an emotionally stressed group (SG) during an entrance examination (men, n = 41); women, n = 124; age 14 – 26). The SPL between forehead (positive electrode) and nasal (positive electrode) electrodermal gradient (FNG), varied from +8 mV to –4 mV on the average (p < 0.001). Using ANOVA and Mann-Whitney U Test, FNG was more positive in women than in men (p<0.01), in SG than in CG (p<0.001), and in younger than in older subjects in the SG group (p<0.001). These findings and other psychological and sensory threshold data support the hypothesis that the FNG in facial SPL distribution may be an indicator of emotional tension. The mechanisms of these phenomena need further study.

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EYEBLINK CONDITIONING DEFICITS INDICATE CEREBELLAR TIMING ABNORMALITIES IN BIPOLAR DISORDER

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Descriptors: bipolar disorder disorder, cerebellum, learning

Bipolar disorder (BD) may be associated with fundamental disturbances in neural timing, which could underlie characteristic symptoms of BD such as emotional dysregulation and behavioral lability. Converging evidence suggests that structures and neurotransmitter systems that subserve neural timing processes may be impaired in BD. The present study used a cerebellar-dependent eye-blink conditioning (EBC) task to investigate the functional integrity of cerebellar timing in BD subjects. Electromyographic recordings were used to monitor eyeblink responses of 43 BD patients (16 manic, 13 mixed, and 14 euthymic) and 43 age- and sex-matched non-psychiatric controls in a single-cue, delay EBC experiment.
The conditioned stimulus was a 400 ms tone, which on paired trials co-terminated with a 50 ms air puff to the left eye. Each experiment was comprised of 10 blocks, with 10 trials in each block (9 paired & 1 CS-only). BD subjects produced significantly fewer conditioned responses (CRs) compared to controls. Moreover, the latencies of CRs in the BD group were significantly shorter, indicating more poorly timed responses. BD subjects were impaired in both the acquisition and timing of CRs compared to controls. These results suggest that cerebellar-dependent internal timing mechanisms may be impaired in BD. This cerebellar timing deficit may be related to poor temporal coordination of affective states intrinsic to BD.

INTENSE EMOTIONS: DEVELOPMENTAL DIFFERENCES IN COGNITIVE/EMOTIONAL PROCESSING OF THE VISUAL PORTRAYAL OF THREAT IN SUBSTANCE ABUSE PREVENTION MESSAGES

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Descriptors: attention, emotion, media

This study was designed to examine how vivid portrayal of threat in substance abuse messages evokes different cognitive/emotional responses in adolescents (aged 12 – 14) and young adults (aged 22 – 24). Vividness of threat was operationalized as the degree to which an ad features the concrete portrayal of consequences of drug abuse. The study design was a 2 (Vividness) × 3 (Message) within-subjects repeated measures experiment. Participants (n = 30 adolescents, n = 50 young adults) viewed six 30-second substance abuse prevention messages (3 high-vivid and 3 low-vivid). Corrugator muscle activity was used to measure negative emotional response and heart rate was used to measure cognitive resources allocated to encoding the message. Physiological data was collected for a five second baseline period and time-locked to presentation of each ad. Results indicate that the vivid portrayal of threat in substance abuse messages evokes more intense negative emotional response and more cognitive resources allocated to encoding the message for adolescents compared to young adults. This was evidenced by adolescents’ significantly higher corrugator activity and greater cardiac deceleration during exposure to highly vivid messages. These results are consistent with theory suggesting adolescents have less developed pathways for regulating emotional response and therefore experience more intense emotions. This study also suggests that developmental differences play a significant role in cognitive emotional processing of emotional features included in media messages.

This study was funded by the University of Missouri-Columbia Research Council.

HAPPINESS CANNOT BE IGNORED: A STUDY ON EMOTION RECOGNITION THROUGH EYE MOVEMENTS

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Descriptors: emotion, eye movements, implicit task

Two main processes can be considered as fundamental in the decoding of emotions through facial expression: a perceptual analysis and a cortical elaboration of the meaning conveyed by a specific pattern of traits (Adolphs, 2002). We hypothesized that two components contribute: an implicit vs. explicit judgment and we investigated pattern of eye movements. Subjects (n = 17) were asked to press a key for a target emotion (e.g. happiness) and another key to discard distractors (e.g., sadness, anger, fear). The task was articulated in four blocks (total of 128 trials) so that each emotion was tested in both conditions. Eye movement patterns were measured with an infrared pupil-centred corneal-reflective eye tracker (ASL 504). Each picture from JACFEE database (Matsumoto & Ekman, 1988) remained on the screen until a response was given. Repeated measure ANOVAs on the total fixation time spent on internal features showed an effect of type of emotion (p < .05) and condition (p < .05) plus an interaction emotion × condition (p < .05). For all emotion except happiness the time spent fixating internal features (eyes and mouth) was higher in explicit judgments. Happiness showed a reversed pattern, with more time spent looking at the internal features in the implicit condition. We can speculate that negative emotions are easier to discard because they are processed preferentially by subcortical routes. Conversely, happiness is processed by different neural pathways, particularly in the left hemisphere, which may facilitate explicit recognition and interfere with implicit judgments.

INTERACTIVE EFFECTS OF CAMERA CHANGE INDUCED ORIENTING REFLEX AND ACOUSTIC INDUCED STARTLE REFLEX IN AFFECTIVE TELEVISION CONTENT

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Descriptors: startle response, prepulse inhibition, television

This study examines Graham’s (1979) conceptualization of the functional role of the startle reflex (SR) as a cognitive interrupt and the orienting reflex (OR) as a perceptual protector. By using affective television as a stimulus, cognition of a dynamic stimulus is examined over time. This study attempts to build upon work with affective pictures that shows that when the inter-reflex interval between OR and SR is fewer than 1,000 ms, the SR appears to index attention, and when the interval is greater than 1,000 ms, the SR appears to index motivational state (M. M. Bradley, B. N. Cuthbert, & P. J. Lang, 1993). An experiment tested hypotheses about motivational activation, the protective function of the OR, and the interruptive function of the SR. Physiological data (SC, EKG, EMG) were collected in addition to audio and visual recognition measures. The experiment examined the effects of varying the time between evoked pre-attentive reflexes while participants watched a television drama with scenes previously rated as pleasant, neutral, or unpleasant. Protection and interruption of encoding was tested by recognition of precisely timed screen captures and audio clips. Results show an interesting interaction between the two reflexes that suggests that when the OR precedes the SR by fewer than 1,000 ms, the OR creates a zone of protection during pleasant TV content and a zone of disruption during unpleasant TV content. Unlike work with pictures, startle magnitude was greatest during unpleasant television at every inter-reflex interval.

DEFICITS IN THE MEMORY PHASE OF A VISUAL SPATIAL DELAYED MATCH-TO-SAMPLE TASK IN SCHIZOPHRENIA

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Descriptors: memory, Schizophrenia, ERP

Background: Patients with schizophrenia exhibit widespread and severe cognitive deficits, including abnormal visual feature integration and working memory dysfunction. It is unclear, however, what impact visual processing deficits have on working memory performance.

Methods: Electroencephalographic (EEG) recordings were made during a visual spatial delayed match-to-sample paradigm. Measuring neural activity during this task enabled the differentiation of large scale network activity during visual stimulus encoding and during the delay interval, when a stimulus must be maintained in memory.

Results: Behaviorally, schizophrenia patients had a higher visual threshold on the task. ERP amplitudes (P1, N1 and P2) to the first and second stimulus did not differ between groups, however negative slow wave amplitude during the delay interval revealed greater slow wave negativity by the end of the delay interval by control subjects compared to schizophrenia patients.

Conclusions: These findings suggest that deficits in visual spatial working memory exhibited by patients with schizophrenia may not be related to abnormal sensory registration, and that patients use similar functional mechanisms once task difficulty is held constant across subjects. However, the negative slow wave may represent deficits in the maintenance and rehearsal stage of working memory in schizophrenia patients.

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P3 MODULATION: THE ROLE OF MOTIVATIONAL RELEVANCE AND AROUSAL
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Descriptors: emotion, motivation, ERP

P3 amplitude as an index of attentional resource allocation has been shown to be more pronounced in response to both pleasant and unpleasant stimuli compared to neutral, however a number of studies have also shown larger P3 amplitude in response to unpleasant stimuli. A series of experiments were conducted to investigate the influence of arousal and motivational relevance on P3 amplitude. Brain potentials were recorded from 36 participants in Experiment 1 and 34 participants in Experiment 2 while responses were made to target stimuli of varying levels of valence, arousal, and motivational relevance. In Experiment 1, P3 amplitude was enhanced for highly arousing unpleasant stimuli, however the addition of a highly arousing sexual category in Experiment 2 showed that P3 amplitude was more pronounced for sexually explicit material. Consistent with motivated attention models of emotional processing, P3 amplitude was larger in response to highly arousing and motivationally relevant pleasant and unpleasant stimuli compared to stimuli of lower arousal level and motivational relevance. Larger amplitudes for sexually explicit material however were not consistent with research showing a quadratic relationship for P3 amplitude (larger amplitudes for pleasant and unpleasant stimuli compared to neutral) or a negativity bias. It was therefore concluded that sexual arousal influences cognitive processing differently to other forms of affective arousal, and that variables other than the motivational relevance of sexual stimuli are responsible for P3 amplitude modulations.

MULTIVARIATE AND NON PARAMETRIC DETECTION OF EVENT-RELATED BRAIN DYNAMICS
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Descriptors: brain dynamics, ERP, time/frequency plane

Until recently EEG analysis in psychophysiology has been, almost exclusively, dedicated to event related potentials (ERP) based on tests for changes in the means of trials in the time domain between several conditions. An alternative view is that of Event Related Brain Dynamics (ERBD), which extends analysis to the time/frequency domain and evaluates, in addition to ERP other aspects such as partial phase resetting and induced activity. Our goal is to demonstrate that an independent, internally consistent set of measures for ERBD comprises tests for the mean and variance of complex wavelet coefficients. An example of the use of these techniques is to detect and interpret the effect of manipulation of incongruence on the EEG at each frequency and time. The measure set is a) the univariate complex t statistic for the presence of an ERP at a single derivation; b) the complex Hotelling’s T² test for all derivations; c) the non parametric multivariate sign test; and d) tests on the variances and covariances of the complex wavelet coefficients. With the complex t a N400 is detected in the Incongruent condition though at somewhat high frequencies (15 – 25 Hz). Hotelling’s T² was very insensitive. Induced activity was picked up in the theta and alpha band with the tests on the variances. The nonparametric Multivariate Sign Test was able to pick up all the components described above, and others at 400 msc at physiologically more plausible lower frequencies. In addition, this test revealed an earlier component at 100 msc. Thus we recommend the use of nonparametric tests.

WORKING MEMORY CAPACITY AND AGE DIFFERENCES IN THE ANTISACCade TASK: AN EROS STUDY
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Descriptors: aging, working memory, individual differences

Attention control is affected by aging, especially in tasks that require the inhibition of prepotent responses. In this study we examined whether these attention control decrements may be related to working memory (WM) capacity. Thirteen young (ages 18 – 25) and 23 old (ages 65 – 86) participants were run in prosaccade and antisaccade tasks during which the event-related optical signals (EROS) was recorded. Subjects in each age group were sorted into high and low WM groups using the operation word span task. The behavioral results revealed that accuracy in the antisaccade task was greater in young than old adults and, more importantly, greater for subjects with high WM capacity for both age groups. The EROS data showed that during the prosaccade task both young and old adults activated the middle frontal gyrus. In the antisaccade task both young and old adults activated the right frontal eye-field, but at different latencies. Further, when subjects were divided according to WM capacity, for both age groups the high WM subjects exhibited larger activations in fronto-parietal attentional areas than the low WM subjects. The results of this study suggest that individual differences in WM capacity may be related to the effective use of attentional networks in the brain.

ENVIRONMENTAL ENRICHMENT IMPROVES FUNCTIONAL AND NEUROPATHOLOGICAL INDICES FOLLOWING STROKE IN YOUNG AND AGED RATS
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Descriptors: stroke, functional recovery, rats

Aging is associated with a temporally dysregulated cellular response to ischemia as well as poor functional recovery. While environmental enrichment has been shown to improve the behavioral outcome of stroke in young animals, the effect of an enriched environment on behavioral and neuropathological recovery in aged animals is not precisely known. Focal cerebral ischemia was produced by electrocoagulation of the right middle cerebral artery in 3 month- and 20 month-old male Sprague Dawley rats. The functional outcome was assessed in neurobehavioral tests conducted over a period of 28 days following surgery. Brain tissue then was immunostained for proliferating astrocytes and the infarct volume and area occupied by the scar tissue were measured. Aged rats showed more severe behavioral impairments and diminished functional recovery compared to young rats. Most infarcted animals had disturbances of sensorimotor function, with recovery beginning later, progressing more slowly, and reaching a lower functional endpoint in aged animals. However, the enriched environment greatly improved the rate and extent of recovery both in young and aged animals. The beneficial effect of the enriched environment was associated with a reduction in the infarct size, a lower number of proliferating astrocytes and a smaller glial scar area in both age groups. These results suggest that temporally modulating astrocyte proliferation and the ensuing scar formation might be a fruitful approach to improving functional recovery after stroke in aged rats.

AEROBIC FITNESS AND EXECUTIVE CONTROL IN PREADOLESCENT CHILDREN
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Descriptors: executive function, ERP, fitness

The relationship between aerobic fitness and executive control (i.e., interference control, action monitoring) was assessed in 38 higher- and lower-fit children (Mage = 9.4 yrs; 18 females) who were grouped according to their performance on a field test of aerobic capacity. Aerobic fitness was assessed using the PACER test of the Fitnessgram, and executive control was measured via event-related brain potential responses (N2, P3, ERN, Pe) and task performance (response speed, accuracy, post-error slowing, post-error accuracy) to congruent (e.g., HHHHH) and incongruent (e.g., HHHSSH) conditions of a flanker task. Results indicated that higher-fit children performed more accurately across conditions of the flanker task and following an error when compared to lower-fit children, while group differences were not observed for response speed. P3 amplitude was larger at the Pz electrode site for higher-compared to lower-fit children across conditions of the flanker task. Further, consistent with previous action monitoring studies related to fitness, higher-fit children exhibited reduced ERN amplitude and increased Pe amplitude compared to lower-fit children. These findings suggest that fitness may be associated with better cognitive performance.
on an executive control task by increasing top-down attentional control, resulting in greater allocation of attentional resources to the stimulus and a subsequent reduction in conflict for higher-fit children during task execution.

BACKWARD RECOGNITION MASKING AND AUDITORY N1 ERP ENHANCEMENTS AT BRIEF STIMULUS INTERVALS

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Descriptors: auditory, ERP, perception

The paradoxical increase in N1 amplitude to a repeated sound for intervals less than 300 ms is thought to reflect a process of temporal integration of rapid sounds within early auditory sensory memory (Cowan, 1984). The present study directly examined the temporal correspondence between N1 enhancements and a behavioural measure of temporal integration, auditory backward recognition masking (ABRM). Auditory ERPs were measured for 21 participants in response to brief sounds presented at random intervals (50 - 1000 ms ISI). N1 amplitude measures for three mid-line scalp sites (Fz, Cz and Pz) as a function of inter-stimulus interval (ISI) were compared with a d-prime measure of ABRM performance for target-mask intervals between 50 and 500 ms. The results replicated previous ERP studies showing N1 enhancements at ISIs less than 300 ms. Similarly, ABRM performance showed a dramatic decrease when target-mask interval was decreased below 300 ms. Curve-fitting of d-prime and N1 x ISI function revealed a close correspondence between N1 amplitude at Fz only, and d-prime time constants for stimulus intervals between 50 and 500 ms. The present results are consistent with previous claims that N1 enhancement reflects the integration of sensory information at rapid stimulus rates. These results are discussed in term of models of auditory sensory memory.

TRAIT-ANGER MODULATION OF EMOTIONAL PROCESSING

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Descriptors: anger, ERP, skin conductance

The investigation of aggressive behavior is almost exclusively confined to sociopathic, ADDH and traumatized patients. The common feature shared by these patients is their impairment in impulse control. Overall, aggressive-impulsive individuals show a) abnormal information processing, leading to inadequate understanding and regulation of their emotional states and activation levels; b) low peripheral activation, particularly during unpleasant situations. The aim of the present study was to investigate psychophysiological emotional reactivity in non-clinical subjects differing in trait-anger levels, as measured by the State-Trait Anger Expression Inventory (STAXI). Twenty high- and 20 low-trait-anger individuals were selected. They scored above the 75th and below the 25th percentile of the STAXI sample distribution, respectively. Participants viewed 72 emotional pictures taken from the International Affective Picture System. Heart rate, skin conductance response (SCR), and event-related potentials (ERPs) were recorded. High trait-anger individuals showed reduced SCRs associated with enhanced N100, but reduced ERPs late positivity. In line with the literature on impulsive subjects, high trait-anger individuals also show dysfunctional emotional information processing associated with low arousal levels.

RESTING HEART RATE AND AUTONOMIC CARDIAC CONTROL IN DEPRESSED ADOLESCENTS

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Descriptors: depression, adolescence, cardiovascular

A number of previous studies have reported higher resting heart rate in depressed samples. Despite the consistency of this finding, the role that autonomic cardiac control plays in this effect remains unclear. Furthermore, previous studies have generally recruited severe or chronically depressed samples, making it difficult to conclude if the observed heart rate difference is inherent to depression or a result of depression-related lifestyle factors and/or treatment effects. We examined resting heart rate, respiratory activity, and autonomic cardiac control in a group of 50 adolescents selected from the community who met criteria for Major Depressive Disorder, and a matched sample of healthy adolescents. Cardio-respiratory measures were taken during a resting baseline and during a standardized talking baseline condition. Consistent with previous research, depressed participants demonstrated a significantly higher resting heart rate than did the non-depressed group. Depressed participants also showed lower respiratory tidal volume. There were no group differences, however, on a range of putative measures of sympathetic and parasympathetic activity, including respiratory sinus arrhythmia, pre-ejection period, finger pulse transit time, and blood pressure. These findings replicate the well established association between higher heart rate and depression in a community sample at an early phase of illness, and, consistent with some previous research, suggest that autonomic cardiac control cannot explain heart rate differences between depressed and non-depressed groups.

CORTICAL SLOW WAVE REACTIVITY DURING EXPLICIT AND INCIDENTAL AFFECTIVE PROCESSING

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Descriptors: emotion, ERP

Previous research using picture-viewing paradigms has shown late increased cortical slow wave activity for affective pictures relative to neutral. This modulation is maximal in centro-parietal areas and reflects enhanced attention and evaluation. The current study compared this slow wave across two task conditions: (1) explicit attention, in which participants viewed prolonged (6-s) presentations of affective pictures with no concurrent task; and (2) incidental attention, in which brief (100 ms) presentations of affective pictures served as task-irrelevant novel stimuli in the context of a visual oddball task. Analyses revealed a similar slow wave pattern of affective modulation in both tasks, suggesting the attention manipulation did not fundamentally change the response. Additionally, the most biologically relevant thematic contents (scenes of erotica and threat) evoked the strongest slow wave increases in both tasks. Frequency characteristics of the affective differences were also examined. In both tasks, affective differentiation was primarily evident within a low frequency band (< 1 Hz), and thus, not reflected within typically measured components, such as the P3a to novel stimuli. The finding of similar affective modulation across the two attention conditions suggests an automatic mechanism for the increased processing of emotional stimuli, particularly for representations with direct biological significance. This pattern of results suggests a bottom-up affective process that is less sensitive to top-down cognitive manipulations.

SPECTRAL ANALYSIS OF EEG IN PERSONALITY DISORDER SUBJECTS

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Descriptors: EEG

Functional alterations of the Central Nervous System constitute one of the neurobiological related factors to personality disorders. The aim of the investigation is to contribute to characterization of the subjects with personality disorders. The resting electroencephalogram was recorded in 18 subjects, with personality disorders evaluated for forensic psychiatries. They were compared with 10 subjects without personality disorders (Control Group). The features at visual inspection of the Electroencephalogram and the use of frequency domain quantitative analysis techniques (Broad Band and Narrow Band Spectral Measures) are described. 53.6% of personality disorder subjects had electroencephalographic abnormalities. The most frequent were the background activity organizational alterations, low amplitude electrogenesis, and an attenuated alpha rhythm. The quantitative analysis showed differences between the frequency spectrums and between the broad band spectral measures from both groups and between experimental groups and the Cuban norms. The theta-delta
frequencies predominate in the personality disorders whereas alpha activity predominates in the Control Group.

GHRELIN EFFECTS UPON MEMORY RETENTION AND FOOD INTAKE WERE INHIBITED BY FLUOXETINE

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Descriptors: ghrelin, memory, feeding behavior

It has been demonstrated in our laboratory that the intra-hippocampal administration of the orexigenic peptide Ghrelin (Gr) increased both food intake and memory retention. In the present work we analyzed if serotoninergic (5HT) neurotransmission participates in the above mentioned effects by using pharmacological and behavioral approaches (step down test). Short and long term memory retention (STM, LTM), as well as food intake were measured 1 and 24 h after different doses of Gr intra-hippocampal administration in Wistar rats pre-treated intraperitoneatly with a selective 5HT reuptake inhibitor, Fluoxetine (FX). The treatment with FX alone decreased both LTM and food intake, at 1 h post treatment. FX also inhibited the effect on STM, LTM and orexigenic effect induced by Gr administration. In conclusion, these results provide functional evidence about the participation of the brains 5HT system in the increase on food intake and memory retention induced by Gr. The results also reinforce previous findings about the role of Gr in extrahypothalamic structures, such as the hippocampus (Hi), modulating feeding and memory. Considering that previous reports have demonstrated that Gr reduces 5HT release in vitro, it can be postulated that the ingestive and memory effects of Gr in Hi could be related to the inhibition of 5HT release induced by the peptide.

CONTINGENT NEGATIVE VARIATION AS AN INDICATOR OF AFFECTIVE PROCESSING IN MOOD DISORDERS

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Descriptors: emotion, depression, ERP

Cortical indicators of affective processing were examined in nondepressed controls (n = 15) and individuals diagnosed with current Major Depressive Disorder (MDD, n = 16) or Dysthymia (n = 14) using a two-stimulus imperative response paradigm. Warning stimuli indicated whether the affective valence of subsequently presented adjectives would be positive, neutral, negative, or random, and participants judged whether these adjectives were self-descriptive. The contingent negative variation (CNV) component of the event related potential, which indexes attention and response preparation, differentiated individuals with Dysthymia (Hi), modulating feeding and memory. Considering that previous reports have demonstrated that Gr reduces 5HT release in vitro, it can be postulated that the ingestive and memory effects of Gr in Hi could be related to the inhibition of 5HT release induced by the peptide.

P300 AMPLITUDE REDUCTIONS, BEHAVIOURAL IMPLUSIVENESS, AND SELF-REPORTED IMPULSIVE ANTISOCIALITY

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Descriptors: P300, psychopathic personality, impulsive antisociality

Previous research reported reduced amplitude of the P300 Event-Related Potential component in clinical and forensic samples of psychopathic individuals. Psychopathy is a heterogeneous construct described by multiple underlying dimensions. Two major super-ordinate dimensions of psychopathic personality have been labeled Fearless Dominance and Impulsive Antisociality (Benning et al., 2005). Fearless Dominance reflects traits related to interpersonal and affective deficits while Impulsive Antisociality is related to social deviance. In the present study a sample of undergraduate men and women between the ages of 19 – 22 completed a well-validated and reliable self-report measure of psychopathic personality traits, the Psychopathic Personality Inventory (PPI; Lilienfeld & Andrews, 1996). P300 amplitude was measured during the Rotated Heads Task and a modified version of the AX Continuous Performance Task. Significant negative correlations were observed between P300 amplitude on both tasks and traits related to Impulsive Antisociality. Behavioural measures of impulsivity also were related to Impulsive Antisociality. Fearless Dominance was not related to reduced P300 amplitude. These findings provide further support for a multidimensional conceptualization of psychopathy, with P300 amplitude reduction and behavioural impulsivity being related only to one aspect.

EMOTIONAL RESPONSE TO SOCIAL EVALUATIVE THREAT: IMPLICATIONS ON PERFORMANCE MONITORING

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Descriptors: emotion, executive function, frontal asymmetry

Individual differences in reactivity to social evaluative threat have been commonly studied using the Trier Social Stress Task. The ability of this task to elicit strong emotional reactions may prove useful for investigations into the affective and cognitive consequences of stress reactivity. This study examined frontal EEG asymmetry and ERPs related to performance monitoring to measure individual differences in emotional reactivity during: 1) a baseline Erikson flankers task, and; 2) a variant on the Trier using a stressful mathematical task designed to elicit response competition and failure feedback. Baseline relative right frontal activity significantly predicts self-reported fear and nervousness during the task. Asymmetry metrics gathered during a two minute rest period in the middle of the stress task significantly predict self-reported shame, embarrassment, humiliation and worry at the end of the task, with greater left frontal activity predicting greater reporting of these self-conscious emotions as well as scores on an aggregate anger scale. Higher scores on an aggregate fear scale significantly correlate with a larger error Pe -? correct Pe difference amplitude during the math task, even after controlling for baseline Erikson flanker error Pe - correct Pe difference amplitudes. These results suggest a differential response of emotion on these measurements of CNS activity, with the Pe reflecting an increased salience of errors during fear, and relative left frontal cortical activation underlying emotional responses related to rumination and anger.

AWARENESS AND CONDITIONING: WHO BECOMES AWARE

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Descriptors: conditioning

Awareness of the CS-UCS contingency is often held to be necessary for automatic classical conditioning of human subjects. Research on this issue has frequently employed the use of distracting masking tasks in which CS-UCS pairings are embedded. With such tasks, it is usually found that approximately half of subjects become aware of the CS-UCS contingency and half do not, with conditioning being seen only among aware subjects. However, research has not addressed the question of which subjects become aware and which remain unaware. The data reported here were taken from subjects in a previously reported study of evaluative conditioning. The purpose of the present report was to determine whether aware and unaware subjects differed in initial levels of arousal or orienting. Skin conductance level (SCL) and rate of nonspecific skin conductance responses (NS-SCRs) were measured in college student subjects during a rest period preceding a conditioning trial series that employed a distracting masking task, and the elicited SCR-OR on the first acquisition trial was measured. Awareness was assessed using trial-by-trial and post-conditioning recognition measures. Of 41 subjects, 17 became aware and 24 were unaware. Unaware
subjects had significantly higher SCL and NS-SCR rates during resting than did aware subjects, but did not differ on SCR-OR magnitude. Results were interpreted as suggesting that heightened arousal is associated with a narrowed focus of attention, a reduced range of cue utilization, and lowered incidental learning. This research was supported by NIH grants R01 MH46433 and K02 MH01086 (PI: Michael Dawson).

VALIDATING MODIFICATIONS TO THE SENSORY GATING ERP PARADIGM

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Descriptors: sensory gating, gender, adults

We investigated sensory gating using the modified EEG/ERP paradigm which recently has been utilized in schizophrenia and child studies where the participants watch a silent movie and compared it to the traditional gating paradigm where participants stare at a fixed target. We also examined gating at 2 intensities, 50 vs 20 dB above threshold. In each paradigm clicks presented in pairs (500 ms ISI) every 10 seconds. Participants were 31 adults with no known disorders (16 females) between 20 and 38 years of age (M = 26.24; SD = 3.69). ANOVA analysis of the P50 T/C ratios for Cz site revealed a significant main effect for Intensity, F(1,27) = 4.70, p = .039 but not for Paradigms or Gender. While the Paradigm x Gender interaction was not significant, F(1,27) = 3.096, p = .09, planned comparisons showed that females had significantly higher P50 T/C ratios than males in the traditional paradigm but not in the modified paradigm. Similar results were found for the N100 T/C ratios. Correlations between the two paradigms were significant for P50 T/C ratios (r = .73, p < .001) and N100 T/C ratio (r = .77, p < .001) measures independent of intensity. Thus, participants demonstrated stronger gating for the high intensity compared to low intensity clicks. Differences in the gating performances between paradigms as measured by mean T/C ratios were minimal but the standard deviations were 46% lower in the modified paradigm compared to the traditional paradigm. Based on our findings, the modified paradigm is as valid and reliable as the traditional paradigm for studying sensory gating in adults.

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EMOTION-MODULATED RESPONSE MONITORING IN SCHIZOPHRENIA

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Descriptors: schizophrenia, emotion, ERP

Response-monitoring anomalies have been implicated in the etiology and maintenance of schizophrenia. A parallel literature indicates that individuals with schizophrenia may be particularly impaired by negative environmental cues. The current study thus measured the late positive potential (LPP), error-related negativity (ERN), and error-related positivity (Pe) of the event-related brain potential during an affective flanker task to examine the mechanisms and degree to which error-processing in schizophrenia may be influenced by emotional context. Twenty healthy controls and 17 individuals with schizophrenia performed the affective flanker task in which the presentation of neutral, positive, or negative distractor images was followed by emotionally congruent or incongruent targets. Participants were asked to categorize the valence of the targets as quickly and accurately as possible. The LPP assessed neutral/attentional engagement to the emotional images; and the ERN and Pe quantified generic error detection processes and subjective responses to the errors. In the schizophrenia group, LPP was inversely related to ERN magnitude specifically in the Negative condition. In addition, enhanced LPP to affective images was associated with decreased accuracy, whereas enhanced ERN to errors was correlated with increased accuracy. In controls, LPP was inversely related with ERN only in the Positive condition. Results are discussed according to implications for understanding the role of affective engagement in disrupting error monitoring in schizophrenia.

EFFECT OF TASK DIFFICULTY AND TIME OF DAY ON HEART RATE AND SUBJECTIVE TIME EVALUATION

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Descriptors: cardiovascular, time perception, mental load

The research reported here deals with the cardiovascular correlates of human time perception. Cyclic physiological response like heart rate and respiratory was assumed to be the pacemaker of human internal clock. For instance, most people preferred tempi ranging from 70 to 100 beats per minute. The aim of the experiment was to analyze whether heart rate dynamics (acceleration vs deceleration) would show any relationship with subjective passage of time (speeding vs slowing of the internal clock). We were also interested whether time of day affects subjective time evaluation during cognitive activity. Three independent variables were manipulated, namely attentional task difficulty (2 vs 6 elements), task objective duration (6 sec or 36 sec) and time of day (experimental session was carried out at 8 a.m. vs 8 p.m.). Sixty Ss performed visual search task. The results indicated that Ss showed a strong tendency to underestimate objective time. Task difficulty appeared to be very important factor in subjective time judgments. Also, time of day significantly affected time perception, but only in interaction with Ss’ chronotype (morningness-eveningness). Cognitive activity affected cardiovascular measures (HR showed significant acceleration during difficult tasks performance). It also appeared that HR acceleration (which means shorter interbeat intervals) was accompanied by shorter subjective task duration. The results suggest that temporal perception is affected not only by cognitive activity, but also by physiological processes.

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INFLUENCE OF PARITY ON NEUROLOGICAL FUNCTIONING

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Descriptors: EEG, parity, reproduction

Hormone exposures during pregnancy, birth, and lactation have persisting effects on neurological function. Increasing evidence from animal models suggest that the experience of motherhood permanently remodels the female brain. Parous females display changes in brain structure and function that are specific to maternal behavior, and those changes may aid in maximizing the survival of young. These effects appear to be cumulative that is, they are enhanced with repeated reproductive experience and may influence neurological integrity across the lifespan (Gatewood et al., 2005). We explored whether or not parity influences neurological function in humans. The P50 component of the auditory evoked potential was assessed in parous and nulliparous women (N = 20). Electroencephalographic activity was recorded from three midline electrodes and referenced to linked mastoids and a forehead ground. P50 amplitudes in response to S1 were larger in the nulliparous women compared to parous women (p = .05). Amplitude patterns were similar for the S2 stimulus. Peak amplitude was larger for nulliparous women, although the differences were not significant (p = .13). Amplitude differences between S1 and S2 contributed to a larger suppression ratio, or less sensory gating, in the parous as compared to nulliparous women. Findings suggest that in humans, like other mammals, neurological function is altered as a result of reproductive experience.

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ERP AND BEHAVIOURAL INDICES OF SEX DIFFERENCES IN MENTAL ROTATION

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Descriptors: gender, mental rotation, ERP

Males typically outperform females in mental rotation, except for letter rotation which is performed equally well by both sexes (Desrocher et al., 1995). This study
investigated whether these sex differences are mediated by females’ familiarity with letters or by females drawing on language-related cognitive processes. Males (n = 18) and females (n = 18) performed three mental rotation tasks, each with different image types (letters, symbols, unfamiliar abstract figures). There were no significant sex differences in performance for any image type. ERP results indicated that males performed the task in the same way irrespective of image type, whereas for females ERPs differed dependent on image type. Specifically, P2 latency was significantly later for letters than for other image types, which suggests it was modulated by language-related processes. In addition, P3 amplitude differed on the basis of image familiarity, with amplitude lower for abstract figures than other image types and right lateralized for abstract figures but bilateral for letters and symbols. Mental rotation itself is indexed by the modulation of P3 by a simultaneous negative slow wave, with P3 amplitude reducing as more rotation is undertaken (Heil, 2002). In this study, amplitude modulation did not differ dependent on image type for females. These data suggest that the enhanced performance for females in letter mental rotation tasks found in previous studies, is not due to improvements in mental rotation itself but to other processes involved in mental rotation paradigms.

**REDUCED NOVELTY-P3 ASSOCIATED WITH INCREASED BEHAVIORAL DISTRACTIBILITY IN SCHIZOPHRENIA**

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Descriptors: schizophrenia, attention, P3

Behavioral and electrophysiological brain responses (ERPs) to the occurrence of task-irrelevant auditory stimuli during the performance of a visual discrimination task were studied in 25 schizophrenics and 24 matched healthy controls. Subjects were instructed to ignore the auditory stimulation and classify capital letters and digits presented on a computer screen by pressing the corresponding response button. The visual stimuli were preceded (300 ms) by a standard tone (200 ms, 85 dB, 600 Hz; p < 0.8) or a unique novel sound (200 ms, 85 dB; p < 0.20). Reaction time (RT) data revealed increased behavioral distractibility in the schizophrenic group. This was confirmed in two ways, first by an ANOVA (stimulus × group interaction; F[1,42] = 17.752, P < 0.001) and second by a t-test on the difference in RT scores (RT to novel sounds minus RT to standard tones; t[42] = -2.613, P < 0.001). Standard minus novel ERPs showed the novelty-P3, which had a longer latency at P2 in the schizophrenic subjects (t[47] = -2.616, P = 0.012). In addition, the ANOVA run on the normalized mean amplitudes of the two phases of novelty-P3 revealed a reduced early phase over the right-frontocentral region in the patients (group × phase × laterality × interaction; F[3,876] = 4.057, P = 0.004, Epsilon = 0.475). These results confirm the vulnerability of schizophrenic patients to distraction and suggest a brain dysfunction in the cerebral network involved in novelty detection.

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**ELECTROMYOGRAPHIC ASSESSMENT OF UNAWARE CONDITIONING TO CONSCIOUSLY PERCEIVED ANGRY FACES**

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Descriptors: conditioning, learning, emotion

Experimental exploration of nonconscious classical conditioning has long struggled to define its parameters. Previous research has established that when a biologically-prepared stimulus, such as an angry face, is used as the conditioned stimulus (CS) in a backward masking paradigm, conditioning can occur without awareness. Backward masking prevents awareness of the CS, and thus prevents awareness of the contingency between the CS and unconditioned stimulus (UCS). The effects of permitting conscious perception of a biologically-prepared CS while preventing awareness of the CS-UCS contingency were explored in this study. Participants engaged in a cognitively demanding memory task in which CS-UCS pairings were embedded. One group was exposed to angry male Caucasian faces and the other group viewed neutral male Caucasian faces. Each participant, over a series of 24 trials, was consistently exposed to one particular face (CS+) preceding highly aversive picture UCSs and a different face (CS−) before affectively neutral picture UCSs. Contingency awareness was verbally assessed trial by trial as well as by a post-conditioning questionnaire. To assess conditioning, eyeblink responses to acoustic startle stimuli were analyzed. Initial results show stronger startle responses while looking at CS+ compared to responses while viewing CS− in both aware and unaware participants in the angry face group but not in the neutral face group. This finding indicates that unaware conditioning may occur when the CS is a consciously perceived biologically-prepared stimulus.

**EVALUATING THE IMPACT OF EMG SIGNAL CHARACTERISTICS ON AFFECTIVE STARTLE MODULATION**

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University of Florida

Descriptors: startle response, signal processing, emotion

Recently published guidelines for the electromyographic (EMG) measurement of the human blink reflex recommend a recording bandwidth intended to retain the full spectrum of the EMG signal. The present study assessed how spectral properties of the blink reflex impact the observation of affective startle modulation during picture viewing. Acoustic startle probes (50 ms, 96 dB) were presented while 24 participants viewed 6 presentations of pleasant, neutral and unpleasant pictures. The raw EMG blink response was acquired using an 8—1000 Hz analog filter prior to digitization and sampled at 2000 Hz. The resulting signals were filtered offline, using a variety of bandwidth widths implemented with Hamming windowed, non-recursive filters and then rectified and smoothed using a Butterworth filter with time constants ranging from 20 ms to 120 ms. Fourier analysis indicated that EMG signal power in the blink response was maximal in a bandwidth from 90—150 Hz, and blinks were overall largest in amplitude when the EMG signal was filtered with these bandwidth settings. To assess affective modulation, the blink response was scored either by determining the peak on each trial and averaging by picture content, or determining the peak after signal averaging across trials for each content. Regardless of filter setting, time constant or scoring method, significant affective modulation of the blink reflex was obtained, suggesting that effects of emotion on the startle response in the picture viewing paradigm is relatively immune to differences in EMG signal acquisition and processing.

**VIEWING PREFERENCES FOR DIFFERENT EMOTIONAL CATEGORIES**

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Descriptors: emotion, eye movements, disgust

Selective attention to different emotional picture contents was assessed by tracking eye movements during free viewing. On each trial, an emotional and a neutral picture were simultaneously presented while eye movements were monitored. The emotional contents included mutilations, threat, disgust, erotica, or food, and were always paired with a neutral picture. Each pair of pictures was presented in grayscale (matched for other physical characteristics) to the left and right of a fixation cross (counterbalanced across subjects) for 3 seconds on each trial. Two rectangular regions of interest were determined that corresponded to the boundaries of each picture, and the total duration of region-specific fixations was calculated for each subject and each trial. Results indicated that, overall, emotional targets were viewed longer than the neutral pictures, suggesting heightened selective attention to motivationally relevant cues. This viewing pattern was consistent across scenes of threat, mutilation, and food. However, when viewing pictures depicting disgusting events or objects (e.g. vomiting, feces), participants did not demonstrate heightened fixation durations or selective processing. Moreover, whereas men selectively attended to pictures of opposite sex erotica, women did not show a preference. These data suggest that selective attention to emotional pictures varies as a function of specific content.
NEURAL PROCESSES IN RACIAL CATEGORIZATION AND INDIVIDUATION
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Descriptors: ERP, face processing, race categorization

Processes involved in racial categorization and individuation were investigated using event-related brain potentials (ERPs). Participants viewed photographs of famous and non-famous White and African American faces. When the task required a race categorization judgment, the ERPs differentiated White from Black faces (across all pictures) in the N100, P200, and N200 components. However, when the task required judgments of whether the face was famous or not, race differences in the P200 and N200 were only evident for non-famous faces. The findings suggest that early processing of racial cues is attenuated for familiar targets when attention is directed toward identity information.

CORRESPONDENCES BETWEEN PSYCHOPHYSIOLOGICAL AND SELF-REPORT MEASURES OF EMOTION REGULATION IN A PRE-ADOLESCENT SAMPLE
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Descriptors: respiratory sinus arrhythmia, emotion regulation, psychopathology

A large body of research has indicated that emotion dysregulation is a central component of most psychiatric disorders. Numerous studies have also suggested that respiratory sinus arrhythmia (RSA), measured both at baseline and in response to appropriate stimuli, marks emotion regulation capabilities. Recently, efforts to measure emotion regulation skills through self-report measures such as the Difficulties in Emotion Regulation Scale (DERS) have also emerged. However, few studies have addressed correspondences between physiological and self-report measures. In the present study, we examined correlations between RSA during mood induction and self-report measures of emotion regulation in a sample of children recruited for depression, conduct disorder, both conditions, or no psychological problems. Thirty-four children (ages 9–13) who completed the study for these analyses. Physiological assessments were conducted while participants viewed a three-minute film clip that was selected to evoke sadness. In the present region of interest (ROI) analysis of imaging data correlated with PPI of the startle reflex. This work is funded by a grant from the Tourette Syndrome Association to Michael Crowley and Michael Bloch.

FUNCTIONAL NEUROIMAGING OF PREPULSE INHIBITION IN TOURETTE SYNDROME
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Descriptors: functional neuroimaging, prepulse inhibition, tourette syndrome

The precise neuropathophysiology of Tourette Syndrome remains to be fully delineated. The animal literature, as well as recent functional neuroimaging studies of humans, implicates cortico-striato-pallido-thalamic neurocircuitry as a neurophysiological basis for prepulse inhibition (PPI) of the startle response. Converging evidence from structural and functional neuroimaging studies as well as neuropsychological testing data implicates basal ganglia dysfunction and, more precisely, dysfunction of cortico-striato-pallido-thalamic circuits in the pathogenesis of Tourette Syndrome. Our work implements a tactile PPI paradigm in a functional magnetic resonance imaging (fMRI) context to study sensory gating mechanisms among patients with active Tourette Syndrome (n = 10), remitted Tourette Syndrome (n = 8), and normal controls (n = 14). PPI of the startle reflex was assessed behaviorally outside the fMRI with the same paradigm. Neuroimaging data indicate striatal and motor circuitry involvement in PPI with remitted Tourette Syndrome patients blood-oxygen-level dependent (BOLD) fMRI responses resembling control subjects. We will present region of interest (ROI) analysis of imaging data correlated with PPI of the startle reflex.

TRAIT ANXIETY AFFECTS THE APPRAISAL OF NOVEL STIMULI: EVIDENCE FROM AN EMG RECORDING OVER THE ZYGOMATIC REGION
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Descriptors: anxiety, appraisal, EMG

According to appraisal theorists, emotions arise after an appraisal of the environment triggering variations in peripheral parameters and muscular contractions. Past research has mainly investigated these reactions as function of the situation parameters. The general hypothesis of the present work is that personality has also an impact on the appraisal process and therefore on the bodily activity. Trait anxiety reflects the constant expectation of threatening situations (e.g. unknown situations). In this study, images (either known or unknown) were presented to two groups (low vs. high anxiety). A double task paradigm permitted to indirectly show the amount of resources invested in the appraisal. Moreover, EMG was recorded for the Corrugator, Zygomatic and Frontalis regions during the second following image onset. Results show that, for the low anxiety group, appraisal resource allocation is transient whereas it persists for the high anxiety group. EMG data show an interaction effect for the Zygomatic region indicating activation of this muscle only in low anxiety group when viewing new pictures. This could be interpreted as a positive reaction to novelty for non-anxious participants that is not present for anxious participants, probably because for these latter, new stimuli provoke threat. Globally, these results confirm differences in appraisal process and muscular reactions for individuals with different levels of anxiety in response to new stimuli, showing that personality is an essential factor in the unfolding of appraisal process leading to emotional reactions.
CHILDHOOD TRAUMA: MODERATING EFFECTS ON THE RELATIONSHIP BETWEEN EMOTION REGULATION, AFFECT AND PHYSIOLOGICAL REACTIVITY

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Descriptors: childhood trauma, emotion regulation, psychopathology

Traumatic events during childhood have lasting effects on emotion. In particular, childhood trauma (CT) survivors may struggle with physiological dysregulation and with regulating and expressing emotions. Emotion regulation can influence physiology. This study examined the moderating effects of CT on the relationships among physiological reactivity, emotion regulation, and affective style. Forty-tired policemen were assessed for trauma history, psychopathology, mood regulation expectancies (NMR), emotion regulation styles, and affective styles. Psychophysiological reactivity in response to a film depicting traumatic events was monitored. In particular, we examined participants’ RSA as a preliminary indication of PNS activity. Officers with and without CT did not differ on any measures of emotion regulation, affective style or psychopathology, or on reported distress during the video task. However, CT moderated the relationships between physiological reactivity and affective style and emotion regulation. In particular, higher emotion suppression was related to earlier RSA peaks in the CT group (r = .65), while higher emotion reappraisal was related to later RSA peaks in the non-CT group (r = .52). Greater NMR (r = .60) and lower negative affect (r = .73) was related to later peaks in RSA for the CT group. These findings indicate that emotion regulation and affective styles may have differing physiological inter-relationships for groups with and without CT. Furthermore, these findings lend support to the growing importance of examining the PNS in traumatized groups.

None.

A GRADED ERP FRONTAL POSITIVITY INDEXING EXPECTATION FOR A PART OF SPEECH

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Descriptors: ERP, language, sentence processing

In addition to a graded posterior N400, DeLong et al. (2005) observed a prolonged, late positivity over frontal sites to unexpected nouns (e.g., “check” in “Dale was sorry for what he said to Bernadette. He knew he owed her a check…”). We proposed that this positivity was elicited by the violation of a contextual expectancy for a particular part of speech (an adjective), which the parser activates once the low cloze article appears. This strategy would allow the parser to salvage the most contextually activated noun, presumably because it was difficult to readily activate an alternative noun. To test this hypothesis, ERPs were recorded while participants read such sentence contexts, which, across four conditions, continued not only with high cloze article/high cloze noun (“an apology”) and low cloze article/low cloze noun (“a check”) endings, but with high cloze article/low cloze noun (“an answer”) and low cloze article/semantically-consistent adjective/high cloze noun (“a sincere apology”) endings. In conjunction with an N400 effect over posterior sites, we found a positivity between 400 – 1200 ms to nouns like “check” at frontal sites. This positivity was highly correlated not with the cloze of the presented noun (“check”), but rather with the cloze of the expected, but not presented, noun preceded by an adjective (“sincere apology”), determined through offline-norming with the low cloze article supplied. This graded late frontal positivity may be related to the P600, which under various conditions has been shown to exhibit a more frontal distribution.

EMOTIONAL EFFECTS OF ODOURS: A MULTICOMPONENTIAL EXPERIMENTAL INVESTIGATION

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Descriptors: emotion, odours, EEG

The aim of this research consists of investigating the effects of odours on appraisal processes and consequent emotional responses. The temporal sequence of novelty detection and intrinsic pleasantness evaluations is the main interest of this experiment. The main hypothesis is that a stimulus is detected as perceptually novel before being evaluated as pleasant or unpleasant. In order to tackle this issue, we have adopted a multicomponential approach consisting of measuring motor (facial EMG), physiological (ECG, respiratory frequency and EDA) and brain reactions (EEG) to odours. Participants were engaged in a delayed matching to sample recognition task in which several pairs of unpleasant or pleasant odours (composed by a sample and a target odour) were presented. Within a pair, the sample and the target could be either identical or different. The effect of novelty was tested by comparing identical and different target odours. The effect of pleasantness was examined through the comparison between unpleasant and pleasant sample odours. Preliminary results suggest earlier differentiations on behavioural and brain indices in response to novelty detection as compared to pleasantness evaluation, suggesting the existence of a sequence of appraisal process in the emotional reaction.

RESPIRATORY SINUS ARRHYTHMIA DURING COMPLEX PROBLEM SOLVING IN LOW AND HIGH INCOME CHILDREN

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Descriptors: RESPIRATORY SINUS ARRHYTHMIA, executive function, low-income

Children from low-income families are at an increased risk for delays in academic achievement and cognitive development. We assessed the possibility that this might be expressed in executive functioning by presenting complex problems (Tower of London task) in 110 kindergartners (49 low-income and 61 high-income). Three sets of 10 problems were presented, with a range of difficulty levels included in each set. Both behavioral performance and respiratory sinus arrhythmia (RSA = power of heart rate variation in the respiratory band) were assessed. Analyses of behavioral data reveal that high-income children significantly outperformed low-income children on proportion solved, solution time, and move efficiency at all problem difficulty levels. Preliminary RSA data indicates that low-income children have significantly higher RSA at every difficulty level. As expected, RSA significantly decreased as problem difficulty increased for both groups on the initial two sets. On the final set of problems this pattern was maintained for the task low-income children, but high-income children no longer showed the difficulty effect. Higher overall RSA for low-income children may suggest lower sustained attention and/or motivation for these children. RSA results on the final set of problems suggests low-income children continued to require more attention to difficult problems whereas high-income children did not. More generally results indicate that executive functioning skills are an important aspect of school readiness and the potential importance of executive skills training.

The Esther Katz Rosen Fund, American Psychological Foundation.

APPETITIVE NATURE OF SMOKING-CUES RECONFIRMED WITH PHYSIOLOGICAL MEASURES: THE ROLE OF STAGE OF CHANGE

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Descriptors: startle response, smoking, stage of change

Recent research has begun to investigate how drug cues may modulate the startle reflex. Geier, Mueha, and Pauli (2000) examined the effect of smoking cues on the startle reflex via presentation of smoking cue pictures to dependent smokers. Smokers showed significant startle attenuation in the presence of smoking cues. However, more recently, Orain-Pelissolo, Perez-Diaz, Jouvent, & Grillon (2004) also investigated the appetitive nature of smoking cue images on the startle reflex, finding no modulatory effect for smoking cue pictures. Given that these two studies utilized different methodology and stimuli, it is difficult to extrapolate from the disparate results. The current study sought to better understand these results through partial replication of the Geier et al. (2000) study, while also considering the influence of motivational factors. Affective modulation of startle was examined in 22 nicotine-dependent male undergraduate students with presentation of standardized positive, negative and neutral images (IAPS, 2000) as

Descriptors: startle response, smoking, stage of change

None.
well as smoking images utilized by Geier et al. (2000). It was hypothesized that smoking cues would be perceived as appetitive, inhibiting startle response, for those participants not considering quitting smoking (Precontemplators), but not for those participants considering quitting within the next 6 months (Contemplators). Results supported this hypothesis. Additionally, affective modulation was more salient among Precontemplators, and an atypical pattern of positive picture modulation found among Contemplators.

This work was funded by a SSHRC grant to Laurent Dube and a SSHRC doctoral award to Remi Desmeules.

COGNITIVE CONSEQUENCES OF EMOTION REGULATION: AN ERP INVESTIGATION

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Descriptors: emotion regulation, ERP, cognition

Recent experimental research suggests that specific emotion regulation (ER) strategies can be effectively manipulated in a laboratory setting. However, no published research investigating the cognitive consequences of ER has used methodologies capable of evaluating the temporal unfolding of these processes. Event-related brain potentials (ERPs) and subsequent source localization analyses were used to probe the relationship between ER strategies (enhance, maintain, suppress) and information processing among 32 subjects. Participants regulated their emotions to negative and neutral pictures and then judged whether a subsequently presented word was negative or neutral. Electromyographic (EMG) measures were used to ascertain the success of participant ER and results indicate that individuals experienced more negative affect when told to enhance, less negative affect when asked to suppress, and no change in negative affect when asked to maintain their emotion. ERPs suggest that brain regions hypothesized to play a role in ER processes and conflict monitoring continue to be engaged after the ER period and during the presentation of additional emotional information. Larger early ERPs (52–140 ms) occurred to negative words after suppressing versus maintaining negative emotions in the anterior cingulate cortex. Larger ERPs (232–436 ms) were noted in response to negative words after enhancing negative emotion in the right superior frontal gyrus relative to neutral words. Additional results are discussed in the context of the ER and information processing literatures.

DOES THE DEGREE TO WHICH THE COMMISSION OF AN ERROR VIOLATES EXPECTATIONS AFFECT THE ERN?

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Descriptors: ERN, expectancies, executive function

Horst et al. (1980) reported, using a classic paired associate task, that a stimulus indicating the correctness of the response elicits a P300 when the feedback violates the subject’s expectations. The waveforms published by Horst et al displayed a small negative going wave whenever a subject erred. We replicated the Horst study with two purposes: (a) to determine if this negative wave is, in fact, an error-related negativity (ERN) and (b) to determine if the amplitude of the ERN also varies with the degree to which the feedback violates expectations. Nine subjects learned a set of arbitrary pairings between two nonsense syllables (CVC). Each trial began with the display of a CVC. The subject typed a CVC and indicated the confidence in the correctness of the response; the correct CVC was then displayed. The data were analyzed by Spatiotemporal PCA which identified a parietal P300 as well as a negative and a positive frontal component. The pattern of variance in P300 replicated Horst et al. The negative frontal component is most likely an ERN as it is relatively robust between-level factors (measures based on amplitude and area under the curve for multiple measures of electrodermal activity will load on the same within-level and between-level factors (measures based on amplitude and area under the curve for original and difference-scored waveforms). The data are anticipatory and appraisal arousal obtained from 98 subjects who completed 80 trials on the Iowa Gambling Task. We find that the measure with the greatest reliability at both levels is a measure of the area under the curve based on difference scores and smoothed data, an approach favored by Bechara and colleagues. In our sample, individual differences scores are found to explain some of the variability of the between-level (subject-specific) factor. Specifically, subjects with higher scores for the Behavioral Activation System (BAS) are found to have higher levels of skin conductance responses (SCR) and higher levels of performance on the standard task. But higher levels of SCR from the “subject-specific” factor will not predict performance. The conclusions from several papers in this area may be too simplistic, not having controlled for the two-level structure of the data. We suggest that work in the area of psychophysiological correlates of decision making would profit from more sophisticated statistical methods and theories.

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AN ERP INVESTIGATION

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Descriptors: dyslexia, ERP, attention

This study used a Posner-like paradigm in search of impairments in visual attention processing in adults with dyslexia. A group of subjects with dyslexia and a group of normal controls were compared on a Posner-like orienting task. Three cue conditions were used: no cue, incongruent cue and congruent cue (correctly predicting target location). The cue appeared either to the left or to the right of a
central fixation point and was followed by a target after 40 or 150 ms. The participants responded by pressing a left or right button corresponding to the position of the target. Percentage of errors and reaction times were measured. ERPs were recorded from 74 scalp positions. Compared to the controls, the dyslexic group showed slower reaction times accompanied by a greater number of errors. A smaller P3, with a parieto-occipital maximum, to targets was found in the dyslexic group.

FUNCTIONAL NETWORKS IN EPISODIC MEMORY RETRIEVAL

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Descriptors: functional neuroimaging, episodic memory

To investigate episodic memory, Tulving (1985) introduced the remember-know-task. Participants in this procedure indicate with a remember judgment those stimuli that evoke recollection of a specific episode in which the stimuli were experienced previously. Aggleton and Brown (1999) suppose that the hippocampus is only critical for remembering (episodic) not for familiarity-based recognition (knowing, non-episodic). Brain imaging data by Eldridge et al. (2000) and Henson et al. (1999) support this assumption. Additionally, Aggleton and Brown (1999) suppose strong interactions between the prefrontal cortex and the medial temporal lobes. In our study we replicated the study by Eldridge et al. (2000). 30 healthy subjects performed a verbal remember-know-task using 1.5 Tesla functional magnetic resonance imaging (fMRI). The fMRI data partly support previous findings by Eldridge et al. (2000) and Henson et al. (1999). The data show activations in left hippocampus, left posterior cingulate gyrus, left preuneus, left caudate gyrus and right lateral frontal lobe in remembering. Additionally we found right middle temporal gyrus, left thalamus and anterior cingulate gyrus involved in episodic retrieval (remembering). Functional connectivity (psychophysiologically interaction, PPI) analyses point to a distributed prefrontal-hippocampal network involved in episodic recognition memory.

DOES BACKGROUND NOISE AFFECT HEMISPHERE ASYMMETRY FOR SPEECH PROCESSING? - AN FMRI STUDY

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Descriptors: hemisphere asymmetry, dichotic listening, functional neuroimaging

In this study we explored the influence of different background noises (BN) on leftward hemisphere asymmetry for speech processing. Hemisphere asymmetry, or laterality, was operationalized using a dichotic listening task where CV-syl-lables were presented to the right or left ear through headphones, either without any BN or with two different background noises, traffic (BNT) or babble (BNB). BOLD-fMRI images were acquired in 17 healthy right-handers using a 3.0 T GE Signa scanner. An event-related design was used with a TR of 7 s revealing a silent gap of 5.5 s, during which the stimuli were presented and verbal responses were collected. All stimulus conditions activated bilaterally the superior and middle temporal gyri, pre-frontal areas and the pre- and post central gyri. Based on the size of the activated clusters, leftward lateralization was more prominent in the CV alone and BNB conditions, whereas the weakest asymmetry activation was observed in the BNT condition. A similar shift of asymmetry was seen in the behavourial data, measured by the laterality index LI. While the CV and BNB conditions showed the expected right-ear advantage (LI = 17.02 and 13.12, respec-tively), the BNT condition revealed a significantly reduced ear advantage (LI = 1.73). These results indicate that the presence of verbal or non-verbal BN, when the subject is listening to dichotically presented CVs, has a differential effect on the lateralization of speech processing, depending on the nature of the BN, with traffic noise causing greater interference than verbal (babble) noise.

NEURAL PROCESSES DETECTING UNATTENDED SOMATOSENSORY TARGET STIMULI

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Descriptors: attention, somatosensation, threat

The amplitudes of three somatosensory evoked potential components; a central negativity at 70–115 ms (CN70–115), a contralateral temporal negativity at 130–180 ms (CTN130–180), and a frontocentral negativity at 160–200 ms (FCN160–200); are larger when the strong, potentially threatening sural nerve electrical evoking stimulus is unattended than when it is attended. Here we investigated whether this effect is specific to strong evoking stimulus levels. There were 2 groups. Each group performed 2 tasks, a color discrimination and an electrical intensity discrimination. One group received color and strong electrical target stimuli, and the other color and weak electrical target stimuli. The targets were validly cued on 75% of the trials, where a cue at the beginning of the trial directed attention towards the target, and invalidly cued on 25%, where the cue directed attention towards the other stimulus modality. CN70–115 and FCN160–200 amplitudes were largest in the invalidly cued condition for both the strong and weak electrical targets. This suggests that the CN70–115 and FCN160–200 generators are involved in detecting and/or redirecting attention towards any unexpected somatosensory target. The CTN130–180 was largest in the invalidly cued condition for the strong electrical targets but not the weak. These data suggest a role for the CTN130–180 generators in detecting unattended, potentially threatening somatosensory targets.

EFFECTS OF PHARMACOLOGICAL BLOOD PRESSURE ELEVATION ON CEREBRAL BLOOD FLOW AND COGNITIVE PERFORMANCE IN CHRONIC HYPOTENSION

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Descriptors: blood pressure, cerebral blood flow, attention

A number of studies have provided evidence for reduced cognitive performance and diminished cerebral blood flow due to chronically low blood pressure. The present study explored if these deficits can be reduced by pharmacological blood pressure elevation. Effects of the sympathomimetic midodrine were investigated in 50 hypotensive persons based on a randomized, placebo controlled double blind design. The participants were presented with a paper-pencil test assessing performance in selective attention. By means of transcranial Doppler sonography, blood flow velocities were recorded in both middle cerebral arteries at rest and during the execution of a cued reaction time task. The administration of the vasopressor agent led to an increase of blood flow velocities at rest and enhanced performance on the attention test. The degree of the blood flow rise was positively correlated with performance enhancement. The increase of flow velocities observed during the execution of the cued reaction time task was stronger after drug administration. The results show that pharmacological blood pressure elevation in hypotension results in beneficial effects on cerebral hemodynamics and cognitive performance. Moreover, the positive association between the increase of resting perfusion and cognitive enhancement underlines the importance of cerebral blood flow for the mental deficits in hypotension.

AN EEG RESPONSE TO LINGUISTIC AMBIGUITY

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Descriptors: language, ERP, negativity

We used event-related brain potentials (ERPs) in order to investigate the interpretation of ambiguous sentences such as (i) Every kid climbed a tree. Using 2-sentence dialogues, we employed a 2 × 2 design. The first factor manipulated was the type of context sentence: it was either Ambiguous as in (i) or Unambiguus as in (ii) Every kid climbed a different tree and (iii) Every kid climbed the...
same tree. The second factor manipulated was Number, where either the first noun phrase was plural as in (iv) The trees were in the park or singular as in (v) The tree was in the park. An example of the stimuli is given below: S1: Every kid climbed a tree S2a: The trees were in the park S2b: The tree was in the park. Previous behavioural studies have shown that S2a is the preferred continuation of S1 (e.g., Kurtzman & MacDonald, 1993). Results showed that waveforms for S2a were similar when the context sentence was ambiguous as in S1 compared to the unambiguous context sentence (ii). This is expected since S2a is the default interpretation. Waveforms were different for S2b when this followed S1 vs. its control (iii). Namely, a slow negative shift was observed over anterior and posterior sites, reminiscent of Van Berkum et al.’s (1999) findings for referentially ambiguous sentences. We assume that the negativity is a marker of the increased cost associated with computing the non-preferred meaning of the ambiguous context sentence (e.g., Kuender & Kutus, 1993). Furthermore, we discuss the timing of this shift and its support for Garrod and Sanford (1994).

TRAIT INHIBITORY CONTROL IS ASSOCIATED WITH AN ENHANCED EARLY ERP RESPONSE TO NOGO STIMULI

University of Minnesota

Descriptors: EEG

In this study we examined relations between the Constraint factor of the Multidimensional Personality Questionnaire, a measure of trait inhibitory control, and event related potential response in a simple Go-NoGo Task. This task is a useful method for assessing neural activity involved in motor response inhibition, as it requires periodic inhibitory control over preset responses. Individuals high in Constraint evidenced greater ERP amplitude during the first 300 ms following presentation of task stimuli on NoGo trials specifically (i.e., this effect was not found on Go trials). This enhanced early ERP reactivity on NoGo trials (in which motor inhibition is required) implies that individuals high in Constraint allocate more neural resources to performance during the early stages of response inhibition. These results suggest a neural correlate of heightened inhibitory control in these individuals. Time-frequency analyses of the data from this study will also be presented to further elucidate this effect. Findings are discussed in relation to processes underlying cognitive control and the bases of individual differences in behavioral inhibition/dishabituation.

CHRONIC CANNABIS USE IMPAIRS ACQUISITION AND TIMING OF THE CONDITIONED EYEBLINK RESPONSE

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Descriptors: eyeblink conditioning, cannabis, EEG

Delta-9-tetrahydrocannabinol (THC), the principal active compound in herbal cannabis, is a hydrophobic CB1 cannabinoid agonist. The CB1 receptor has been shown to mediate depolarization-induced suppression of inhibition in cerebellar Purkinje cells, a mechanism thought to be necessary in eyeblink conditioning. To assess the functional role of CB1 in learning related plasticity within the cerebellar cortex in humans, chronic cannabis users and healthy non-users were examined in a delay eyeblink conditioning task. The task used a single auditory cue (400 ms) paired with a 50 ms (co-terminating) ocular air puff. Orbicularis oculi EMG activity and EEG were recorded. Compared to controls, the cannabis group exhibited reduced acquisition and impaired timing (shorter peak latencies) of the conditioned response. Further, there were no group differences in the N100 event-related brain potential amplitude to the conditioned stimulus, suggesting that registration of the conditioned stimulus and related attentional processes had little or no contribution to observed group differences in eyeblink conditioning. This data provide the first evidence that chronic cannabis use impairs learning related plasticity in the cerebellum.

SEX-RELATED ELECTROENCEPHALOGRAPHIC DIFFERENCES OBSERVED DURING POSITIVE AND NEGATIVE AFFECTIVE VERBAL LEARNING

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Descriptors: emotion, learning, EEG

This study examined sex-related regional EEG differences that were observed during completion of the Affective Auditory Verbal Learning Task (AAVL). The AAVL contains two 15-word lists where one list is comprised of positive affective words and the other of negative affective words. Right-handed men (N = 16) and women (N = 16) participants completed both AAVL lists in a counter-balanced manner, and were asked to recall the affective words over the course of five trials. EEG data were recorded from 19 scalp sites before and following learning trials. Initially, seven different EEG bandwidths were analyzed, but only the low beta (13 to 21 Hz) bandwidths produced a reliable interaction involving sex. Specifically for low beta activity, main effects for learning trial [F(3, 90) = 3.901; p = .032] and scalp site [F(5, 130) = 44.82; p = .000] were observed, as was a significant sex x word list interaction [F(1, 30) = 5.714; p = .023]. Regarding the sex x word list interaction, post hoc analyses revealed that women evidenced greater low beta power in comparison to men for both word lists (p < .05). In examining within the group differences for the positive versus negative lists, women evidenced greater low beta power during the presentation of the negative versus positive word list (p < .05), while men evidenced a trend toward the opposite pattern (p = .06). Consistent with other reports, these differences indicate that men and women process emotional stimuli differently. Implications for sex-related differences in cortical function are discussed.

EMOTIONAL RESPONSES TO KISSING: FACIAL EMG ACTIVITY AND PREFERENCES FOR SAME-RACE, DIFFERENT-RACE, AND MIXED-RACE ROMANTIC COUPLES

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Descriptors: social processes, facial EMG, prejudice

Although recent national surveys report that today’s university students have more favorable attitudes toward mixed-race dating and marriage than in the past, the prevalence of mixed-race couples in U.S. society is still fairly low. A possible explanation for this discordance between attitudes and behaviors is that self-reported attitudes about mixed-race couples are prone to motivations tied to social desirability and other self-presentational concerns. Facial electromyography (EMG) has been demonstrated in prior research to serve as a valid marker of race-related attitudes that can differ from self-reports. In this study African American and White participants viewed 40 photos of couples embraced in a romantic kiss while facial EMG activity was recorded from the cheek and brow regions. The couples in the photos were composed of either (a) a White male and a White female, (b) a Black male and a Black female, or (c) a Black male (or female) and a White female (or male). After viewing the photo for 6 s, the participant rated how romantic the photo was. Analyses revealed that participants exhibited the most positive affect (i.e., increased cheek and decreased brow EMG activity) when viewing a couple of the same race as the participant and the most negative affect (decreased cheek and increased brow EMG activity) when viewing a couple of a race different from the participant. Mixed-race couples elicited facial EMG responses that were intermediate. We discuss the results with respect to intergroup relations theories about cross categorization effects.

USING AFFECTIVE STARTLE MODIFICATION TO INVESTIGATE THE FACIAL FEEDBACK HYPOTHESIS

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Descriptors: facial expression, startle response, emotion

The goal of this study was to test the facial feedback hypothesis, the proposal that facial expressions can influence intensity of emotional experience, using methods...
that would provide evidence regarding the mechanism of that influence. We man-
nipulated the facial muscles of 63 student participants, without their awareness, into: 1) a smile (held a pencil in their teeth), 2) inhibition of a smile (frown, held a pencil in their lips), or 3) no manipulation. During this facial manipulation, we measured emotional state using both controlled and automatic measures. The controlled measures were subjective ratings of emotional pictures (valence and arousal) and the automatic measures were the startle eye blink reflex and skin conductance response. As expected, our results indicated a significant relationship (p < .05) between the content of pictures (positive, negative, neutral) and ratings of emotional valence and arousal, as well as magnitude of the startle eye blink and skin conductance response. However, the only evidence directly supporting the facial feedback hypothesis was a significant interaction (p < .05) between facial expression and content of pictures for the startle eyeblink measure. These results indicated that smiling participants viewing positive pictures had the smallest star-
tle response while frowning participants witnessing negative pictures had the largest startle response. The results suggest that facial expressions of emotion can affect emotional state relatively automatically and outside of subjective awareness.

USING STARTLE MODIFICATION AND DOT PROBE REACTION TIME TO ASSESS PROCESSING BIASES AMONG INTERPERSONAL VIOLENCE SURVIVORS

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Descriptors: anxiety disorders, dot probe, startle response

Persons with PTSD demonstrate attention biases towards trauma-related infor-
mation. However, it is unclear 1) whether these biases occur at both early and late stages of information-processing and 2) whether these findings extend to persons with sub-syndromal levels of PTSD. Thus, we examined early and late stages of attention towards trauma-related pictures among interpersonal violence (IV) sur-
vivors reporting a wide range of PTSD symptoms. Twenty-eight IV survivors and 26 comparison persons completed a dot probe reaction time (RT) task with acoustic startle probes occurring on a subset of trials at either 300 or 3500 ms following the presentation of a picture array (either a positive, negative, or trauma-
related picture paired with a neutral picture). There was a significant main effect of valence on RT (p < .05), with both IV survivors and controls showing greater attentional capture to arrays containing trauma or negative pictures compared to those with positive pictures. For startle modification, there was a significant 3 way interaction (p < .05), with the IV group showing greater blink inhibition than con-
trols to picture arrays containing negative stimuli at the 300 ms lead interval, and more inhibition than controls to trauma arrays at the 3500 ms lead interval. The eyeblink pattern at both lead intervals was consistent with attentional rather than emotional modification of startle. Thus, our results suggest that IV survivors with low levels of PTSD show a complex pattern of attention to emotional stimuli that is not revealed in the analysis of RT alone.

STARTLE EYEBLINK MODIFIED BY EMOTION WORDS DISTINGUISHES INTERPERSONAL VIOLENCE SURVIVORS FROM CONTROLS

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Descriptors: anxiety disorders, startle response, stroop

The emotional stroop task has been used to demonstrate that persons with PTSD show attention biases towards trauma-related information. We examined early and late stages of attention towards trauma-related words among interpersonal violence (IV) survivors reporting a wide range of PTSD symptoms. Twenty-eight IV survivors and 26 comparison persons completed a emotional stroop reaction time (RT) task with acoustic startle probes occurring on a subset of trials at either 60 or 3500 ms following the presentation of words that were either positive, negative, or trauma-related. There was a significant main effect of word valence on RT (p < .05), with both IV survivors and controls showing the slowest RTs (most attention) towards negative words, and then, in order: positive, trauma, and neutral words. For startle modification, there was a significant word valence x group interaction (p < .05), with both the IV survivors and the controls showing a pattern of greater facilitation towards the negative words at the 60 ms lead interval, a pattern similar to that seen in the RT data. However, at the 3,500 ms interval, IV survivors continued to show greater startle facilitation to negative compared to other words, but the controls did not.

VIOLENT VIDEO GAME PLAY AND EMOTION MODULATION OF STARTLE

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Descriptors: video games, emotion, startle response

The effects of violent video game playing on behavior have drawn much research attention. The literature generally supports the view that violent video game play increases aggressive thoughts and behavior. One mechanism proposed to explain these phenomena is desensitization. Specifically, emotional reactions to violence are reduced or blunted with increased exposure. The present study was designed to investigate transient changes in emotional reactivity following violent video game play. Our hypothesis was that participants exposed to violent video game play would subsequently have reduced startle reactivity to violence-related images compared to participants playing a non-violent video game. Seventy undergraduate volunteers were randomly assigned to play either a violent first-person shooter video game (Perfect Dark) or a non-violent puzzle video game (Tetris) for 15 minutes. Emotion modulation of startle was assessed pre- and post game play comparing emotional reactions to three types of images selected from the International Affective Picture Set: guns (negative), flowers (positive), and household objects (neutral). A 3 (image content) by 2 (trial block) by 2 (game type) mixed model repeated measures ANOVA was conducted. The results provided no support for a desensitization mechanism, revealing no difference in the emotion modulation of startle across the violent and nonviolent video game con-
ditions. Individual differences with respect to emotion modulation of startle and self-reported mood state (i.e., Mood Adjective Checklist) will also be explored.

EMOTION REACTIVITY IN WOMEN WITH RESTRICTIVE EATING PATHOLOGY

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Descriptors: emotion, eating disorders

Emotional impairments are speculated to play a pivotal role in the development and maintenance of eating pathology, yet there is limited research examining emotional reactivity in eating pathology. The present study examined emotional responses (physiology and self-report) to 54 affect-evoking pictures (18 pleasant, 18 neutral, 18 unpleasant) in 28 college women who displayed symptoms of restrictive eating (i.e., fasting, calorie counting, preoccupation with weight and shape) and 29 non-eating pathology college women. Results indicate a significant group effect for all of the physiological indices included in the study (heart rate, skin conductance, zygomatic and corrugator facial electromyographic activity), with restrictors displaying significantly less physiological activity in response to the pictures compared with non-eating pathology women. Significant group ef-
fects were found for self-reported emotion, with restrictors reporting greater unpleasantness and less arousal in response to the pictures relative to non-eating pathology women. These findings reflect a conflicting pattern of emotional res-
ponding and underscore the complex nature of emotional impairments in wom-
en with eating pathology.

BRAIN FINGERPRINTING IN LABORATORY CONDITIONS

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Descriptors: ERP, detection, P300

Farwell et al. reported near-100% accuracy using Brain Fingerprinting to detect concealed information in laboratory and field/real-life conditions (Farwell and
Donchin et al. (2004) used fundamentally different stimuli, instructions, statistics, and data acquisition procedures, resulting in as low as chance accuracy and also susceptibility to countermeasures. For details of the differences see Farwell and Smith (2001). We used Brain Fingerprinting to detect concealed information in laboratory mock-crime conditions. Subjects committed a mock espionage crime and were tested on stimuli consisting of 3 types of pictures presented on a computer screen: targets (1/6), irrelevants (2/3), probes (1/6). ERPs were recorded from Fz, Cz, and Pz. Bootstrapping on double-centered correlations computed a determination of ‘information present’ or ‘information absent’ and a statistical confidence for each subject. All 29 subjects showed P300-MERMER brain responses to targets and not to irrelevants. Only knowledgeable subjects who committed the mock crime showed P300-MERMER responses to probes. Accuracy was 100%; no false negatives, no false positives, no indeterminates. Results show Brain Fingerprinting can accurately detect concealed information in laboratory settings when proper procedures are followed; accuracy depends on following proper procedures for acquisition, instruction, and analysis; and pictorial information is effective in eliciting the requisite responses. 

Central Intelligence Agency.

**BRAIN FINGERPRINTING IN FIELD CONDITIONS**

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Descriptors: ERP, lie detection, P300

Farwell et al. reported near-100% accuracy using Brain Fingerprinting to detect concealed information in laboratory and field/real-life conditions (Farwell and Donchin 1986, 1989, 1991; Farwell, 1992a,b; Farwell and Smith 2001). We used Brain Fingerprinting to detect concealed information in laboratory mock-crime conditions. Subjects committed a mock espionage crime and were tested on stimuli consisting of 3 types of pictures presented on a computer screen: targets (1/6), irrelevants (2/3), probes (1/6). ERPs were recorded from Fz, Cz, and Pz. Bootstrapping on double-centered correlations computed a determination of ‘information present’ or ‘information absent’ and a statistical confidence for each subject. All 29 subjects showed P300-MERMER brain responses to targets and not to irrelevants. Only knowledgeable subjects who committed the mock crime showed P300-MERMER responses to probes. Accuracy was 100%; no false negatives, no false positives, no indeterminates. Results show Brain Fingerprinting can accurately detect concealed information in field settings including actual crimes.

Central Intelligence Agency.

**PERCEPTUAL FLUENCY SPEEDS UP AFFECTIVE MODULATION OF ERPS**

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Descriptors: emotion modulation, late positive potential, masking

Motivationally relevant stimuli prompt a larger late positive potential (LPP) in the event-related potentials (ERPs) compared to neutral pictures. The present study used a backward-masking paradigm to investigate the effects of stimulus exposure time on evaluative and ERP measures of affective processing, with the goal of determining the minimal exposure time needed to obtain affective modulation of the LPP. Using a 64-channel montage, ERPs were recorded from 26 participants while pleasant, neutral and unpleasant pictures were presented for varying durations and then followed by a nonsense masking stimulus. Stimulus-onset asynchrony between picture and mask were varied in five different intervals, ranging from 25 to 77 ms. Following exposure, hedonic valence was rated. Overall, results indicated significantly larger late positive potentials when viewing emotional, compared to neutral pictures in all conditions, including pictures presented for only 25 ms. Evaluative judgments similarly showed differentiation at all durations. When ERPs were divided into blocks, however, results indicated that modulation developed across trials: In the first block, affective modulation of the LPP was not evident until pictures were displayed for 51 ms, whereas, by the third block, affective modulation occurred following a 25 ms exposure. Taken together, the data suggest that perceptual fluency develops with more exposure to masked pictures, and that the LPP might serve as an index of perceptual recognition.

**THE RELATIONSHIP OF PREPULSE INHIBITION TO EVERYDAY SENSORY EXPERIENCE**

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Descriptors: startle response, prepulse inhibition, attention

Prepulse inhibition of startle (PPI) is hypothesized to reflect a sensorimotor gating process that is protective of early stimulus processing. PPI is also hypothesized to index a more general ability to inhibit distracting stimuli, thoughts, and impulses. To test the latter hypothesis, the current study investigated the relationship between PPI and self-reports of everyday sensory experience. Thirty-five undergraduates had PPI assessed in a task-based protocol in which the prepulse stimuli were attended and ignored high and low pitched tones that preceded a startle-eliciting noise burst at lead intervals of 60 and 120 ms. Participants also completed the Adult Sensory Profile (Brown & Dunn, 2002), a standardized instrument on which participants self-report their everyday sensory experiences in five domains (auditory, visual, movement, touch, taste/smell). In each domain, items are used to index the extent to which the respondent exhibits sensory sensitivity, sensory registration, sensation seeking, and sensation avoiding. Correlations were computed between the attended and ignored PPI scores and scores from the Sensory Profile. Results revealed two significant correlations: PPI scores for the 120 ms lead interval, for the attended prepulse and the ignored prepulse, were significantly correlated with the auditory sensory sensitivity score. These significant correlations indicate that low PPI scores for the 120 ms lead interval were associated with self-reports of being easily startled and being highly distracted by noisy environments.

**P300 AMPLITUDE INDEXES VIOLATIONS OF ALCOHOL EXPECTANCIES**

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Descriptors: alcohol expectancies, P300, addiction

In the field of addictions, it is well established that expectancies (i.e., beliefs about outcomes of drug consumption) have an active influence on level of substance use. However, the bulk of support for this relationship comes from studies assessing expectancy with verbal self reports. We report a test of this model using the amplitude of the P300 which is proportional to the degree to which the eliciting stimulus violates expectancies. When presented with a choice between outcomes of alcohol consumption, heavy drinkers tend to impute positive/arousing effects to alcohol (e.g., outgoing, happy), while light drinkers endorse more sedating/negative effects of alcohol (e.g., woozy, drowsy). In the present study 26 college students were presented with statements asserting effects of alcohol consumption, which either violated or confirmed the subjects’ alcohol expectancies (e.g., sedating items for individuals with high positive expectancies). Statements describing effects of tobacco smoking were also used. Data were recorded from 128 electrodes. The ERPs in response to the words terminating the sentence were averaged according to the outcome they reflected (positive vs. negative). Using spatiotemporal Principal Component Analysis (PCA), a parietal P300 was identified. Variations in the amplitude of the P300 were consistent with the model of Alcohol Expectancies. Words imputing negative/sedating effects of alcohol elicited a large P300 in heavy drinkers, and a small P300 in light drinkers. Similar results were observed with regards to smoking.
Moving the Phantom: Mind Over Matter?

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Descriptors: functional neuroimaging, pain, phantoms

Amputation-related changes in primary somatosensory (SI) or motor cortex (MI) may play an important role in phantom limb pain. In two experiments we examined brain activation in upper limb amputees employing functional magnetic resonance imaging with a 1.5T Siemens Vision scanner. In study 1 persons who reported varying degrees of telescoping (retraction of the phantom towards the amputation stump) imagined movements with the phantom hand. The activation of the perceived hand movements was located in the area of SI where the hand movement was perceived (hand, elbow, shoulder) not only the hand area. The more telescoping, the more phantom pain was present and the more was the activation of the movement of the phantom hand shifted in a region outside of the original representation zone. This suggests that persons who create input to the corical amputation zone via imagery might be able to alter the cortical map and thus phantom limb pain. In study 2 we asked patients to move the intact hand and imagine movements of the phantom hand while we presented a mirror that created the illusion that the phantom was moved. The most interesting group difference emerged in the mirror illusion condition where pain-free amputees but not patients with phantom pain activated MI suggesting that they might be able to continuously elicit activation in this region that might then counteract phantom limb pain. Further investigations will be necessary to evaluate if training of illusory phantom movements can reduce phantom pain for extended periods of time.

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MEDIATORS OF THE RELATIONSHIP BETWEEN PTSD AND HEART RATE RESPONSE TO TRAUMA CUES: THE ROLES OF NEGATIVE AFFECTIVITY, DISCONSTRANT, AND ANTISOCIALITY

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Descriptors: anxiety disorders, cardiovascular, personality

Physiological reactivity to trauma-related cues is a criterion symptom, and point of intervention, for posttraumatic stress disorder (PTSD). Prior psychophysiological research suggests that heart rate increase is the most reliable indicator of this reactivity in individuals with PTSD. In this study we used structural equation modeling to examine the hypothesis that antisocial traits and the personality dimensions negative emotionality (NEM) and disconstraint (DCON) mediate the association between PTSD and heart rate response during exposure to trauma-related stimuli. Data for secondary analysis were drawn from a large sample of Vietnam combat veterans (N = 1,325) who underwent a psychophysiological assessment procedure involving exposure to combat-related stimuli via script-driven imagery and presentation of audiovisual cues. Analyses revealed that PTSD, DCON, and NEM fully mediated the relationship between combat exposure and cardiac reactivity to combat-related audiovisual stimuli. The mediation model accounted for 14% of the variance in cardiac reactivity vs. 4% for PTSD and combat exposure alone. PTSD and DCON predicted higher levels of reactivity, whereas NEM predicted lower levels. Antisociality was positively correlated with DCON and NEM, and predicted lower levels of heart reactivity, but did not significantly relate to combat exposure or PTSD. These findings underscore the role of personality factors in mediating the association between psychopathology and its psychophysiological correlates.

STAY TUNED: EFFECTS OF SENSATIONAL TV NEWS CONTENT AND TABLOID STRUCTURAL FEATURES ON INFORMATION PROCESSING AND CHANNEL SURFING BEHAVIOR IN YOUNG ADULT VIEWERS

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Descriptors: attention, arousal, memory

This study investigates effects of sensational television news story content and tabloid style presentation features on viewing behaviors and responses for young adult viewers. Study participants were able to switch back and forth between four television channels. One channel presented sensational news stories with tabloid structural features, one had the same sensational stories with standard formal features, one had public affairs news stories with tabloid structural features, and one had the same public affairs stories with standard formal features. Arousal (skin conductance level) was higher when viewers watched channels with tabloid features. In addition, individual differences in motivational activation predicted viewing behaviors and responses. Specifically, those with high positivity offset paid more attention (lower tonic heart rate) while viewing all channels compared to those with low positivity offset. “Risk takers” with high positivity offset and low negativity bias spent more time viewing channels with sensational stories than “risk avoiders” with low positivity offset and high negativity bias, although all viewers spent more time watching sensational channels than public affairs channels. There was no difference in recognition for sensational story content among the two groups. “Risk avoiders” had better recognition than “risk takers” for information from the public affairs channel without tabloid structural features, but recognition was equally good for both groups for information from the public affairs channel with tabloid structural features.

EFFECTS OF PREPULSE INTENSITY RELATIVE TO BACKGROUND NOISE ON STARTLE INHIBITION AND ELICITION

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Descriptors: startle response, prepulse inhibition, eyeblinks

Startle eyeblink reactivity and its inhibition by a prepulse (PPI) are sensitive measures of stimulus processing, and have been used to investigate a wide variety of research issues in neuroscience. However, this sensitivity means that startle reactivity can vary with small differences in methodological procedures. Factors such as stimulus intensity and signal-to-noise ratio relative to background noise may affect the results. In the present study, we varied prepulse intensity, background noise level, and signal-to-noise ratio of the prepulse above that background noise (varying two of these three parameters determines the value of the third parameter). Eyeblink EMG responses were measured in 56 college students who were presented with either 50, 60, or 70 dB background noise throughout a testing session, with acoustic prepuasses that were 5, 15, and 25 dB above the background noise, followed by startle probes at 95 and 105 dB. PPI was more pronounced for more intense prepuasses, but this was determined more by actual dB level than by signal-to-noise ratio relative to background. That is, a prepulse that was 25 dB greater than the background noise was more effective when the background noise was 70 dB than 50 dB. Prepuasses also elicited larger responses based on intensity, not signal-to-noise ratio. These results suggest that it is the physical intensity of the prepulse, not the signal-to-noise ratio between prepulse intensity and background noise level, that determines the effectiveness of a prepulse as an inhibitor and elicitor of acoustic startle responding.

EFFECTS OF BACKGROUND NOISE AND ATTENTION ON STARTLE REACTIVITY AND PPI

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Descriptors: startle response, background noise, attention

The effects of background noise and directed attention on prepulse inhibition of the startle response (PPI) were examined in 39 college students who listened to a series of 105 dB startle stimulus noise bursts, with 5 or 7 sec long 85 dB noises that began either 120 ms before (prepulse condition) or 1 sec after (control condition) startle stimulus onset. A constant background noise (BN) was presented at 30 dB for half the session and 70 dB for the other half (counterbalanced order). Five seconds before stimulus presentation, participants were instructed to attend to or ignore the prepulse, or to relax. Eyeblink EMG and finger skin conductance responding were recorded. The attend and ignore conditions showed larger skin conductance responding than did the relaxed condition. Eyeblink response onset latency was shorter for the attend than for the relax condition. Inhibition of
startle blink magnitude was unaffected by attentional instructions in the 30 dB BN condition. However, in the 70 dB BN condition, PPI was slightly less pronounced in the relax condition than in the attend condition. The high level of PPI (80 percent) in the 30 dB BN condition may have been close to the ceiling of the dynamic range for PPI, making it impossible for attention to increase this PPI further. Increasing background noise interfered with PPI, but that impairment was compensated for by having participants pay attention to the prepulse. This is an example of a cognitive task decreasing the impact of peripheral masking on stimulus processing.

NEUROTICISM AND HEART RATE VARIABILITY IN RESPONSE TO EMOTION ELICITATION

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Descriptors: cardiovascular, neuroticism, emotion

Autonomic measures are often used to gauge both nomothetic and pathological response patterns during emotional experience. Moreover, personality can be reflected in patterns of emotion expression. For example, trait neuroticism has been related to chronic negative affect and anxiety (Larsen & Ketelaar, 1991; Gross, 1998), and anxiety in turn has been linked with low heart rate variability (HRV) and reduced cardiac vagal control (Friedman, in press). The present study explored the relationship between trait neuroticism and autonomic activity, as assessed by HRV, during the viewing of emotion-eliciting film clips (Gross & Levenson, 1993). Eighteen college-aged men and women were classified as either low or high trait neuroticism as measured by Goldberg's (1999) Big Five Inventory. HRV was assessed by calculation of root mean squared successive differences (rMSSD) of HR (derived from the electrocardiogram), a time-domain HRV index of cardiac vagal control. rMSSD was calculated over the last 30 seconds of viewing 10 emotion-eliciting and 1 neutral film clips, and averaged across these clips. The high neuroticism group showed significantly lower rMSSD (M = 95.0, S.D. = 16.9) than the low neuroticism group (M = 121.2, S.D. = 24.1) (p = .017), indicating that neuroticism is associated with reduced cardiac vagal control. A trend toward a negative relationship between neuroticism and rMSSD was also found (r (16) = -.44, p = .06), further supporting this inference. These results are consistent with the reported negative relationship between anxiety and HRV/cardiac vagal tone.

EFFECTS OF APPETITIVE ATTITUDES TOWARDS AFFECTIVE PICTURES ON ASYMMETRICAL FRONTAL CORTICAL ACTIVITY

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Descriptors: frontal asymmetry, emotion, EEG

Previous studies measuring EEG alpha power over the prefrontal cortex have found that greater left than right frontal cortical activity (inverse of alpha) relates to approach motivation. Although much research has found asymmetrical frontal activity to relate to affective traits and states, experiments examining asymmetrical frontal activity in response to affective pictures have produced inconsistent results (Harmon-Jones et al., 2006). Inconsistencies in past research may have occurred because the pictorial stimuli may not have been personally relevant and not have evoked approach motivational tendencies. We predicted that individual differences in appetitive attitudes toward stimuli would relate to increased left frontal activity toward the stimuli, within the first second of picture viewing. By examining the first sec of picture viewing, the present research would extend past research that had only examined activity over the first 3 sec of picture viewing. In the current study, participants were asked to indicate their liking for dessert then shown a series of attractive dessert pictures while EEG activity was recorded. Results indicated that greater self-reported liking for dessert predicted greater left than right frontal activity within the first second of picture presentation. These results suggest that individual differences in approach-related attitudes potentiate the effects of pictures of desirable objects on asymmetrical frontal cortical activity.

SEMANTIC ORGANISATION IN VERBAL EPISODIC ENCODING: AN ELECTROPHYSIOLOGICAL STUDY

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Descriptors: episodic memory, language, ERP

The objective of this experiment was to study neuronal mechanisms associated with semantic strategies in episodic encoding using event-related potentials (ERPs). Eight participants (M age = 21.4 years) were administered a verbal recognition task manipulating three levels of semantic organization: Unrelated (memorizing 3 lists of 16 words without semantic links); Spontaneous Organization (words of each list could be semantically categorized, but no instructions given to participants to do so); Guided Organization (semantically related words, but participants received explicit instructions to categorize words). ERPs were recorded in central, centro-parietal and parietal areas using a Geodesic system. Results indicated a higher hit percentage in the Guided (76.2%) than in the Unrelated condition (70.6%). Performance in Spontaneous condition (74.6%) was similar to other conditions. The P200 amplitude was greater in the Guided than in the Unrelated condition (p = .000). Furthermore, the Late Positive Component (LPC) amplitude was larger for the Guided than the Unrelated condition (p = .038). For the Guided condition, frontal sustained activity was greater in the left than the right hemisphere (p = .032). Results suggest that a guided semantic organization strategy is associated with greater P200 and LPC amplitudes. These components may be involved in strategies of elaboration and the level of success in encoding. Consistent with neuroimaging and neuropsychological data, left frontal areas were also activated when a semantic strategy of organization is required.

NEUROIMAGING EVIDENCE FOR OBJECT MODEL VERIFICATION THEORY: ROLE OF PREFRONTAL CONTROL IN VISUAL OBJECT CATEGORIZATION

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Descriptors: object categorization, functional neuroimaging, top-down processing

Although the visual system rapidly categorizes objects seen under optimal viewing conditions, the categorization of objects seen under impoverished viewing conditions not only requires more time but also may require top-down processing, as hypothesized by object model verification theory. Two studies, one with functional magnetic resonance imaging (fMRI) and one behavioral with the same stimuli, tested this hypothesis. FMRI data were acquired while people categorized more impoverished (MI) and less impoverished (LI) objects. FMRI results revealed stronger activation during the MI than LI condition in brain regions involved in top-down control (inferior and medial prefrontal cortex, intraparietal sulcus), and in posterior brain regions involved in processing properties of objects (ventral and dorsal occipitotemporal, and occipitoparietal cortex). The behavioral study indicated that taxing visuospatial working memory, a key component of top-down control processes during visual tasks, interferes more with the categorization of MI objects (but not LI objects) than does taxing verbal working memory. Together, these findings provide evidence for object model verification theory and implicate prefrontal cortex in top-down control of posterior visual processes required to categorize impoverished objects.

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LOOKING FOR EMOTIONAL INTERFERENCE IN A STROOP-LIKE PARADIGM: BEHAVIORAL AND EVENT-RELATED POTENTIAL (ERP) FINDINGS

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Descriptors: emotional stroop, ERP

Behavioral interference of emotional content has been found in Stroop-like paradigms, but rarely studied using ERPs. We recorded 67-channel ERPs (average reference) from 28 right-handed adults (15 men) to foveal presentations of colored words (ANEW norms). Content (emotional, neutral) and valence (positive, negative) were systematically manipulated by carefully matching words for arousal and valence (negative vs. neutral and positive vs. neutral), length, and frequency. Color was indicated by 4-choice button press. Response latencies did not reveal emotional interference effects. A clear component structure with a distinct ventro-posterior N140 and parietal P500 was present in all ERPs. Spatially and temporally overlapping components were identified and measured by temporal, covariance-based PCA (unrestricted Varimax). Factors of interest within the N2/P3 complex corresponded to: a bilateral negativity over inferior temporoparietal sites (215 ms peak latency), which was reduced in men; a relative negativity over left temporal sites (285 ms), which was greater for emotional than neutral words; and a broad parietal positivity (508 ms), which interacted with emotional content, valence, and gender in a complex fashion that did not readily correspond to emotional interference effects. Whereas the lack of emotional interference effects casts doubt on the generalizability of the phenomenon for healthy adults, the difference between emotional and neutral words between N2 and P3 may reflect physiological processes preceding overt behavioral interference.

MANIPULATION OF ATTENTION IN THE SENSORY GATING ERP PARADIGM

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Descriptors: sensory gating, attention, adults

To determine if manipulating the participants’ attention towards rather than away from the auditory stimuli affects sensory gating, we investigated gating performance by recording EEG during two different ERP paradigms from 20 adults (11 females) between 21 to 33 years of age (M = 25.7; SD = 3.53) with no known disorders. In the focused attention paradigm (FA) 160 paired clicks and 80 single clicks were randomly presented while participants stared at a fixed point on the CRT screen and pressed a button to the single click. In the second gating paradigm (SG), subjects passively viewed a silent movie while listening to 160 paired clicks. In both paradigms the paired clicks (500 ms ISI) were presented every 8 seconds and half way through the paradigm click intensity was shifted from 50 dB to 20 dB above HL or vice versa. A 2 x 2 x 2 repeated measures ANOVA with the peak-to-peak amplitude of the P50 component as the dependent measure revealed significant main effects for Paradigm (FA & SG), F(1,19) = 14.026, p < .001; Click (1st & 2nd click), F(1,19) = 25.627, p < .0005; and Intensity (high & low), F(1,19) = 47.472, p < .0005. Interaction effects of Paradigm x Intensity, F(1,19) = 6.671, p = .018 and Click x Intensity, F(1,19) = 21.058, p < .0005 were also found. Similar results were found for the N100 component. The focusing of attention to the auditory stimuli produced an increase in the amplitude of the P50 component for both the first and second clicks but evidence for gating as seen in the traditional sensory gating paradigm was still found. Funded in part by the Department of Occupational Therapy, Colorado State University.

A COMPARISON OF READING ON COMPUTER SCREENS AND PRINT MEDIA: MEASUREMENT OF ATTENTION PATTERNS USING EEG

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Descriptors: attention, EEG, media

Purpose of Study: This study explores whether media affect attention patterns for subjects reading text. Typography studies show typography for the computer screen does differ from print standards. A review of the literature suggests a difference in how the brain reacts to various media and to elements such as flicker resulting in a decrease in attention and ability to concentrate. However, no studies have been done to confirm whether reading varies significantly dependent on media, nor has the research studied brain patterns of subjects’ attention to reading materials using various media. Research Questions: Does the media source, and therefore the source of light, create different brain patterns in the visual processing areas of the brain when reading? Are these differences traceable to mechanical artifacts such as flicker or lighting source. Preliminary Findings: An exploratory study measuring the EEG of 15 female subjects indicates that 60% of the subjects showed greater attention to reflective print media, 20% to CRT computer screens and the remaining subjects showed mixed reactions. Statistically significant differences appear in the information processing in the parietal lobes when comparing attention of readers using CRT and print and CRT screen and LCD screens. It appears that flicker from the CRT screen, while not consciously noticed, may be the cause of these differences. This study extends these previous findings by increasing the sample size to 50 subjects and provides a more thorough statistical analysis of the data.

Institute for Science and Society, Iowa State University.

POSTERIOR CINGULATE ACTIVITY PREDICTS INDIVIDUAL DIFFERENCES IN BLOOD PRESSURE DURING STRESS

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Descriptors: blood pressure, functional neuroimaging, stress

The posterior cingulate is thought to process emotionally self-relevant information and support vigilance for environmental threats. In an initial report, we found that larger stressor-induced systolic blood pressure reactions correlated with increased activation of the posterior cingulate (Psychosom Med, 67, 31 – 39, 2005). In this IMRI study, we attempted to replicate these findings. Participants were 50 healthy postmenopausal women (aged 65 – 71 years) who completed a performance-iterated Stroop color-word interference task as part of a larger battery of tests. During the Stroop task, we acquired simultaneous estimates of IMRI BOLD activation and oscillometric blood pressure. As expected, the Stroop task engaged a network of dorsolateral and medial prefrontal brain regions that support effortful cognitive processing. The Stroop task also increased average systolic pressure by 13.4 (SD = 9.1) mmHg compared with baseline, t = 9.98, p < .001. Replicating earlier findings, increased posterior cingulate activation correlated with larger increases in systolic pressure (r = .58, p < .001). Building on earlier findings, larger increases in systolic pressure correlated with greater activation in the perigenual cingulate cortex, insula, orbitofrontal cortex, and medial thalamus (range of rs = .42 – .55, p < .001). These results suggest that individual differences in blood pressure reactivity to stress may be mediated by activation of the posterior cingulate and other brain systems that dually regulate autonomic-cardiovascular function and process emotional information.

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SENSITIVITY OF THE FEEDBACK ERROR-RELATED NEGATIVITY TO REWARD PROBABILITY

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Descriptors: ERN, reward, prediction error

The error-related negativity (ERN) is a component of the event-related brain potential that is sensitive to error commission (response error: rERN) and negative feedback (feedback error: fERN) and appears to be generated within anterior cingulate cortex (ACC) (Holroyd & Coles, 2002). The reinforcement learning theory of the ERN (RL-ERN theory: Holroyd & Coles, 2002) holds that the ERN is elicited by the impact on ACC of a reward-prediction error signal carried by the midbrain dopamine system. The RL-ERN theory predicts that the amplitude of the fERN is larger for unexpected than for expected errors. Counter to this prediction, Hajcak et al. (2005) found that fERN amplitude was the same following both expected and unexpected negative feedback. The goal of the present research was to examine whether fERN amplitude is sensitive to reward expectancy. Subjects learned probabilistic stimulus-response mappings by trial and error. We demonstrate that, as predicted by the RL-ERN theory, the amplitude of the fERN is larger for unexpected than for expected negative feedback. These findings indicate that the sensitivity of the error processing system to the probability of error commission depends on the particular task employed.
HEMISPHERIC LATERALIZATION OF EVOKED POTENTIALS IN AN AUDITORY ODDBALL TASK

Casey S. Gilmore, & Brett A. Clementz
University of Georgia

Descriptors: P300, laterality, auditory

Hemispheric lateralization of early auditory evoked responses (AERs; P1, N1) is largely based on anatomy of the afferent pathway; lateralization of later AERs (P2, N2, P3) is less clear. Using 256-channel EEG, the present study examined hemispheric laterality of AERs by comparing binaural and monaural versions of an auditory oddball task. P1 and N1 showed differences over auditory cortex as a function of ear of stimulation: P1 showed a binaural summation and N1 a contralateral effect over left hemisphere. Monaural stimuli, especially left ear standards, elicited larger N1 responses over right temporo-parietal cortex, suggesting right hemisphere control of sustained attention. As is expected, standards elicited P2s and targets elicited N2s, indicating different cognitive operations associated with task-related stimulus evaluation and classification. An area over right prefrontal cortex showed larger potentials with left ear and binaural stimuli. Finally, targets elicited a bilaterally symmetric P3/Novelty P3 response, suggesting interhemispheric integration during target detection and updating of working memory. As this response returned to baseline, the classic parietal P3 emerged, at which time right ear stimuli resulted in higher amplitude responses over a left parietal area. Thus, different P3 components may result from differing degrees of hemispheric laterality. These results demonstrate that AERs are lateralized through the time of stimulus evaluation, but that interhemispheric integration is necessary for generation of at least some P3 components.

SPATIOTEMPORAL REPEATABILITY OF EVOKED POTENTIALS IN AN AUDITORY ODDBALL TASK OVER TIME

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University of Georgia

Descriptors: P300, reliability, auditory

Event-related potentials (ERP) elicited during an auditory oddball task are useful indices of perceptual capacity, cognitive processing efficiency, and working memory resource allocation. Variations in these ERPs, especially the P3 elicited by task-relevant targets, are proposed as endophenotypes for psychopathological conditions and as indices of cognitive changes across the lifespan. Understanding the reliability of these ERPs over time is critical to their use as both trait and state markers of cognitive processing. The present study used 256-channel EEG to examine the repeatability of P1, N1, P2/N2, and P3 spatiotemporal distributions in an auditory oddball task. Thirty-two subjects were tested three times over a six-week period. P1 and N1 were stable across time. Amplitude of P2 and N2 components, which index task-related stimulus evaluation and classification, decreased across time (specifically from the 3rd to the 6th week measurements) primarily in frontal channels. The P3 to targets also significantly decreased over the same time interval as the N2. This P3 amplitude decrease occurred specifically at channels over prefrontal cortex. Results of the present study demonstrate that top-down processes related to stimulus evaluation and target detection involve less prefrontal cortex involvement over repeated measurements. The tempo-parietal parts of the N2 and P3, however, remained stable across time, suggesting greater reliability as trait markers of aspects of cognitive processing supported by these brain regions.

TEMPERAMENT AND CHARACTER CORRELATES OF THE STARTLE REFLEX

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Descriptors: startle response, personality, emotion

Evidence suggests that the startle reflex is sensitive to individual differences in temperament. For example, Harm Avoidance (HA) (from Cloninger’s Temperament and Character Inventory (TCI), includes both character and temperament subscales each proposed to reflect biological dispositions such as susceptibility to anxiety. We hypothesized an inverse association between scores on the character scales and Startle Magnitude (SM) while viewing negative-valence pictures including a replication of the association between HA and increased startle. Undergraduate students (n = 73) underwent a standard emotion modulated startle reflex paradigm using pictures selected from the IAPS and completed the TCI. As expected, SM increased from the positive to the negative picture condition. Moreover, picture ratings of valence and arousal as well as viewing times paralleled previous reports providing a manipulation check. Nevertheless, we failed to replicate the previous finding that higher levels of HA predict an increase in the startle response to negative pictures. Population differences and the possibility that HA may better predict SM in clinical populations might explain these differences. Exploratory Excitability, Sentimentality, and Self-Acceptance were positively correlated with SM to positive images, while Novelty Seeking and Disorderliness vs. Regeneration were negatively correlated with SM to negative images.

THE EFFECTS OF CARDIOVASCULAR FITNESS IN OLDER ADULTS ON A STERNBERG MEMORY SEARCH PARADIGM: AN FMRI STUDY

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Descriptors: memory, aging, fitness

Cognitive function declines steadily with advancing age. Impairments are especially prevalent on tasks requiring the use of working memory. It is surmised that higher levels of cardiovascular fitness may help stave off this decline, whereas low fitness may hasten the decline. By recording fMRI in a Sternberg memory search task, we examined the effects of age and cardiovascular fitness on the brain activity related to working memory load. Older adults showed a greater cost with increasing set size as indicated by reaction time and accuracy. All three groups showed linear increases in blood flow with increased memory set size. However, the areas contributing to the linear trends differed in the three groups. The younger adults showed activation graded as a function of memory load bilaterally in visual and superior parietal cortex, and on the left hemisphere in Broca’s area. Both of the older adult groups exhibited increased bilateral activation in frontal areas compared to the young adults. Different patterns of activation were also evident within the older population based upon fitness level. These results suggest that age and low fitness level are associated with an increase in the number of the brain regions that are activated in conditions of high working memory load.

THE EFFECTS OF SMOKING, OBESITY, ALCOHOL CONSUMPTION AND PHYSICAL ACTIVITY ON ENDOTHELIAL FUNCTION

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Descriptors: endothelial function, health, cardiovascular disease

While it has been established that poor health behaviors including smoking, excessive alcohol-consumption, poor diet, and physical inactivity impact endothelial function (EF), the effects of combinations of these factors has never been explored. This study examined the magnitude of smoking, excessive alcohol consumption, poor diet (inferred from measures of waist circumference), and physical inactivity on the variability in EF. A total of 116 outpatients referred for myocardial perfusion exercise stress tests underwent a nuclear medicine examination hemispheric laterality of AERs by comparing binaural and monaural versions of an auditory oddball task.
PICTURING KNOWLEDGE: ERPS REVEAL THE ACQUISITION AND RETRIEVAL OF INFORMATION ABOUT NOVEL OBJECTS

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Descriptors: ERP, knowledge acquisition, N400

The N400 is an ERP component that has been associated with the access and integration of world knowledge accumulated over time and stored in long-term memory. Recent work using this component suggests that the adult brain can relatively rapidly form links between extant knowledge and new verbal labels, as words acquired in a second language over the course of a few weeks come to be recognized as familiar (McLaughlin et al. 2004). The present study expands upon this work by examining how adults acquire, store, and retrieve knowledge about - and verbal labels for - novel objects. In a study phase, participants were given pictures of novel artifacts (with distinctive features demarcated), accompanied by a verbal label and a paragraph describing the object’s function (Lin & Murphy, 1997). After participants learned to describe and label these objects to criterion, ERPs were recorded during a test phase in which participants categorized new exemplars by responding yes or no after being cued by the artifact’s name. Test exemplars had all the learned features (complete prototypes), were missing one feature (incomplete), or had two features modified so the object would not function as learned (impossible). ERPs to impossible exemplars differed from those to the other exemplar types in the time window of the P200. An N400-like component manifested a graded response, most positive to complete prototypes and most negative to impossible exemplars. The results suggest rapid acquisition of new words and their links to new knowledge, including the number and quality of object features.

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AN EVENT-RELATED POTENTIAL INVESTIGATION OF AUDIOVISUAL INHIBITION OF RETURN

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Descriptors: inhibition of return, multisensory, ERP

Inhibition of return (IOR) – the slowing of responses to stimuli that appear at previously attended spatial locations – has been found to occur within the visual and auditory modalities as well as between these two modalities. Recent work in our lab has associated IOR with a reduction of the N2pc component of the visual event-related potential (ERP). The N2pc appears as a negativity in the ERP at occipital electrodes contralateral to an attended stimulus in a visual search display, and is reduced in amplitude when the target appears at the same location as the previous target compared to when the target appears at a new location. Here we investigated whether the same N2pc reduction would be observed when the visual stimulus display was preceded by either a visual or auditory stimulus. We used a target-target paradigm in which bilateral visual displays containing a target and a distractor on opposite sides of fixation were preceded by either a visual or auditory target at the same or opposite location. We found similar slowing of response times and reduction in the N2pc for visual targets appearing at a repeated location regardless of the modality of the preceding target. These results suggest that attending to the location of a lateralized sound can suppress attentional processing of subsequent visual stimuli at nearby locations.

DEFENSIVE REACTIONS TO NATURAL HUMAN SCREAMS AND AVERSIVE WHITE NOISE (II)

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Descriptors: cardiac defense, white noise, skin conductance

Presentation of white noise elicits a cardiac defense response in which the heart rapidly responds with an initial acceleration that is followed by a secondary acceleration about 30 seconds after stimulus presentation. In a previous study, we measured defensive reactions to intense white noise and human scream, obtaining an identical cardiac pattern for both stimuli. In this study, we assessed cardiac and other defensive reactions to the same stimuli but with a lower intensity to test whether under these conditions the human scream would prompt larger defensive reactions. Following a 10 minute baseline, participants (n = 31) were presented with a burst of white noise or a human scream (both at 85 dB, order counterbalanced) for 2 seconds, followed by an intertrial interval of 90 seconds. Heart rate, skin conductance, corrugator EMG, and sensor (32) ERPs were measured before, during and after stimulus presentation, and the reflexive startle response was measured following stimulus onset. Preliminary results indicated that only the white noise elicited the typical cardiac patterns that consisted of early and late accelerative components. Significant skin conductance responses were also elicited by presentation of both the natural human scream and the more artificial white noise stimulation. Finally, white noise and the scream elicited measurable startle blinks which were larger for the noise stimuli. These data indicate that, at a lower intensity, artificial acoustic stimuli elicit a larger defensive profile.

ABNORMAL SELECTIVE ATTENTION EFFECTS ON NEURAL SYNCHRONY DURING VISUAL STIMULUS PROCESSING IN SCHIZOPHRENIA

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Descriptors: EEG, attention, schizophrenia

Schizophrenia is associated with abnormalities in selective attention and visual processing. Time/frequency analyses of EEG data provides us with a tool to detect when these deviations may emerge. Based on evidence suggesting links between theta power and selective perception, we investigated theta power and phase synchrony during selective attention. Subjects with schizophrenia (n = 14) and healthy controls (n = 13) participated in a cross-modal selective attention task where they were presented with four equiprobable stimuli: two auditory (soft and loud phoneme) and two visual (dim and bright checkerboard). Subjects pressed a button to dim checkerboards during visual and to soft phonemes during auditory condition. We calculated inter-trial coherence (ITC) and induced event-related spectral perturbation (iERSP) to the bright checkerboard (non-target) onset during two conditions. We found an attention X time X group interaction (p = 0.02) for theta ITC at Cz. Controls showed increased ITC 50 ms after visual stimuli onset that was greater during visual attention. While patients showed an increase in ITC early in processing, it never reached normal levels, and did not distinguish between conditions until later (300 ms; p < .06). For theta power, there was also attention X time X group interaction (p = 0.04) early in the epoch, the attention effect was smaller in schizophrenia. In spite of normal task performance, patients with schizophrenia fail to achieve adequate phase synchrony and power in theta band early in visual processing during cross modal selective attention.

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DO NEUROPSYCHOLOGICAL TESTS OF EXECUTIVE FUNCTIONS PREDICT ABILITY TO DOWN-REGULATE EMOTION?

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Descriptors: emotion, executive function

Problems with emotion regulation are common features of a number of neurological disorders, and are often thought to relate to deficits in executive functioning. We assessed both instructed and spontaneous emotion regulation to an aversive (110 dB acoustic startle stimulus in a sample (N = 64) of patients with frontotemporal and Alzheimer's dementia and age-matched controls to determine whether ability to down-regulate emotion could be predicted by three different standard neuropsychological tests of executive functions (Verbal Fluency, Stroop, Trail-making). Down-regulation (in coded emotional facial behavior and directly measured general somatic activity) was assessed in three startle conditions: (a) "unwarned" (no information given), (b) "warned" (participants told when the startle would occur), and (c) "instructed" (participants explicitly told to minimize emotional response). None of the tests of executive functioning predicted differences in response to the unwarned condition. Verbal Fluency (but not Stroop or Trail-making) predicted down-regulation in the other conditions, with high Verbal Fluency associated with reduced behavioral and somatic response in the warned condition and reduced behavioral response in the instructed condition. These results provide converging evidence that individual differences in emotion regulatory ability (both in warned and instructed conditions) in response to an aversive stimulus known to elicit a strong emotional/defensive response can be predicted by impaired executive function in the domain of verbal fluency.

THE MODERATING EFFECTS OF FITNESS AND FATNESS ON CARDIOVASCULAR STRESS RESPONSIVITY

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Descriptors: exercise, obesity, stress

The modifiable risk factors of cardio-respiratory fitness and fatness are both important determinants of cardiovascular health. These risk factors may also mediate psychosocial disease pathways, such as cardiovascular responsivity to mental stress. However, whether or not being acrobically fit is protective against psychophysiological dysfunction in the presence of overweight or obesity is undetermined. We hypothesized that being overweight, yet fit would be associated with normal psychophysiological function compared with overweight and inactive. Forty-eight healthy men (mean age 21.7 ± 3.6 years) were recruited. Cardio-respiratory fitness was assessed from a maximal oxygen uptake test on a cycle ergometer and body composition was evaluated using skin fold measures and body mass index (BMI). Peripheral blood flow, blood pressure, and cardiac responses were measured during a 2 min mental stress task. Mental stress evoked increases in mean arterial pressure and heart rate, forearm vasodilatation, and cardiac parasympathetic withdrawal (p<.001). Multiple linear regression analysis, adjusted for age, maximal oxygen uptake, and baseline forearm vascular resistance, revealed that higher BMI and greater fat mass was related to a blunted vasodilatation response to mental stress (p<.05). There were no interactive effects of fitness and fatness. These findings suggest fatness is related to impaired vascular stress responsivity independently of fitness. The association between fatness and cardiovascular risk may be partly mediated by psychosocial factors.

AMYGDALA CORRELATES OF EXAGGERATED STARTLE EYEBLINK DURING UNPLEASANT STIMULI IN BORDERLINE PERSONALITY DISORDER

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Descriptors: startle response, borderline personality disorder, amygdala

A core feature of Borderline Personality Disorder (BPD) is affective dysregulation which is characterized by unusually strong reactions to emotional stimuli. Affective modulation of startle provides a reliable measure of emotional valence or processing. Animal models show that the amygdala is a key brain structure mediating the startle response during an aversive state. BPD patients (n = 27) and healthy controls (n = 23) viewed an intermixed series of 16 unpleasant (e.g., “suicidal”) and 16 neutral (e.g., “view”) words each presented on a computer screen for 6 sec. Participants were instructed to think about the meaning of the word for them personally. Startle probes were presented during some words (4 or 5 sec post-word onset) and occasionally during the inter-trial interval. Participants had a structural MRI scan and amygdala volume was traced bilaterally on coronal MRI slices using our standard methods. A significant Group x Word Type interaction indicated that compared with healthy controls, BPD patients exhibited larger startle magnitude during unpleasant but not neutral words. Among the patients but not the controls, greater differential startle (unpleasant-neutral words) was associated with greater right amygdala volume. Consistent with the BPD symptom of affective dysregulation, these results provide psychophysiological evidence that BPD patients exhibit exaggerated emotional processing during unpleasant stimuli. These results suggest that individual differences in BPD-related abnormalities in affective startle during unpleasant stimuli are related to the amygdala.

This research was supported in part by the Borderline Personality Disorder Research Foundation and the National Alliance for Research on Schizophrenia and Depression.

DEEP BRAIN STIMULATION IMPAIRS REWARD-BASED LEARNING IN PARKINSON’S DISEASE

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Descriptors: parkinson’s, learning, ERP

Patients with Parkinson’s Disease (PD) demonstrate deficits on implicit learning tasks. Recent research shows that this deficit only occurs in trial-by-trial learning that is based on the appropriate use of feedback and rewards. In this study the effects of subthalamic DBS on performance in a reward-based probabilistic learning task (Knowlton’s weather task) were examined. Patients (N = 7 to date) with advanced idiopathic PD had lower performance on this task than age-matched controls (N = 7). DBS was found to further decrease task performance for these patients, with the first 100 trials at chance levels. Electro-oculographic data indicated that patients spent less time looking at the feedback in the DBS condition. In a similar previous study at this lab, medication-withdrawn patients with mild to moderate PD were found to have a reduced amplitude Stimulus Preceding Negativity (SPN). The more advanced patients of the present study exhibited no prefeedback SPN whatsoever, regardless of whether the subthalamic stimulator was on or off. The lateralized readiness potential (LRP) was greatly attenuated in PD patients compared to age-matched controls. Preliminary analysis indicates that DBS does not increase the amplitude of the response-locked LRP but may extend its time course. The negative effects of DBS on reward-based learning has implications for learning models (e.g., Frank et al., 2004) that distinguish direct versus indirect striato-pallidal pathways.

COMPARISON OF DIFFERENT METHODS AND PARAMETERS TO DESCRIBE THE EMG STARTLE EYEBLINK RESPONSE

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Erasmus MC

Descriptors: EMG, startle response, methodology

We investigated the differences and relationships between 3 different methods for EMG signal processing and 6 different eyeblink parameters of auditory startle responses, since only a few studies have systematically investigated this before. During the intertrial intervals of an affective startle modulation task, 12 startle stimuli (100 dB, 50 ms) were presented to healthy controls (n = 33), which were used for the present study. Six eyeblink parameters were computed, 3 size-variables: peak amplitude, peak magnitude, blink area; and 3 time-variables:
onset latency, amplitude latency and response duration. Three methods were compared: smoothing, integrating, and the envelop method. Data were analysed using correlational analyses and factorial ANOVA’s. Except for amplitude latency, all response parameters were highly correlated to each other within each method: Pearson’s r ranged from .44 to .99. High correlations were also found between methods, Pearson’s r ranging from .74 to .99. However, the ANOVA’s showed significant Parameter × Method interaction effects both for the time-variables (F = 148.02, p < .001), and the size-variables (F = 36.27, p < .001). These results indicate that although the methods and parameters are highly correlated with each other, they may lead to different results, which is important to consider when selecting parameters and methods for applied research.

DEATH AND PREJUDICE: ERPS REVEAL OUTGROUP BIASES FOLLOWING MORTALITY SALIENCE

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Descriptors: ERP, social cognitive neuroscience, person perception

Awareness of one’s own mortality can increase prejudice-related behavior against members of outgroups. The current studies investigated the neurocognitive mechanisms underlying this phenomenon. Participants were randomly assigned to write about their own death (MS condition) or to write about dental pain (control condition) before viewing pictures of racial ingroup and outgroup faces with varying expressions (happy, angry, neutral) while ERPs were recorded. Study 1 showed that outgroup angry faces elicited more accurate categorizations and larger P300 in the MS compared to the control condition. Study 2, which included an additional outgroup condition (Asians), showed that the MS manipulation evoked larger P300s and longer latencies of the P3 for angry faces. In both studies, the P300 was larger to all stimuli in the MS condition compared to the control condition, suggesting that death awareness invokes heightened attention and evaluative processes. Taken together these results highlight the potential role played by the psychological state of death awareness on the cognitive processing of outgroups. The utility of a psychological approach for studying the effects of mortality salience on outgroup bias, and on how such research can be applied to understanding instances of outgroup bias following reminders of death (e.g., terrorist attacks, natural disasters) is discussed.

GIVING ADVICE IN BLACKJACK

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Descriptors: ERP, EGN, blackjack

In a recent study we presented a computer based Blackjack paradigm in order to examine the error-related negativity (ERN) in a realistic gambling paradigm. Other recent studies reported on an ERP in participants who observed someone else making a mistake in a reaction time task. In the present study we investigated an active observer’s reaction to the decisions, wins, and losses of their co-player. Event-related potentials to the co-players deviation from the participant’s advice. In addition, increased ERN activity was observed after losses when the co-player had contradicted an advice in that same trial.

A LIFE LONG DEVELOPMENT OF ENDOGENOUS EYEBLINKS (2):

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Descriptors: eyeblinks, development, gender

This report is a part of our series of studies on a life long developmental change of endogenous eyeblinks. We have already reported the eyeblink behaviors of 617 adults from the 20s to the aged (Sugiyama and Tada, 2005), which provided a standard eyeblink rate and indicated the gender difference but no gender difference in normal adults. The purpose of the present study is to investigate the developmental changes of eyeblink behaviors of 780 healthy subjects from 3mo. Infants to 15 yrs old school students in the same manner. The task of subjects, except 3 months and 3yrs infants, was to watch the 3-minute edited video program and the eyeblink behavior of each subject was video-taped. The video-taped data was analyzed with special software. The results showed: 1) blinking was virtually absent at birth, increasing steadily until elementary school age, reaching a plateau at that point and thereafter that level was maintained until high school age. Blink rate, opening duration, blink duration on eight-year-old children had already showed like adult’s values(readings). 2) Blink rate had been not gender difference until 15 years old. 3) The change of blink rate’s development was similar to the curve what Scammon described neural maturation.

AGE-RELATED ATTENTIONAL BIASES FOR EMOTIONAL STIMULI ASSESSED USING A NOVELTY-ODDBALL PARADIGM

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Descriptors: attention, emotion, aging

The emotional valence of a stimulus affects how the stimulus is subsequently remembered – a phenomenon that interacts with age. In particular, younger adults (aged 18 – 30) tend to exhibit a negativity bias such that they remember negative emotional stimuli better than positive stimuli. In contrast, older adults (aged 60 + ) often exhibit better memory for positive than for negative stimuli – a positivity bias. It has been suggested that both of these biases reflect differences in the deployment of selective attention to emotional stimuli. That is, younger adults may attend more to negative stimuli and consequently remember them better. Likewise, older adults may either attend more to positive stimuli or withdraw attention from negative stimuli, and thus tend to remember positive stimuli better than negative ones. In this study, we examined biases in attention and memory updating for emotional stimuli using a novelty-oddball task with geometric shapes as standards and targets and pictures of angry and happy faces as irrelevant oddballs. We examined positivity and negativity biases using event-related potentials (ERPs) recorded from younger and older adults. We assessed visuospatial selective attention by comparing the amplitudes of the P1 component of the ERP elicited by the novel angry and happy emotional faces. Moreover, we assessed working memory update by comparing P3 amplitudes for the negative and positive oddball stimuli. Initial results support the hypothesis that attention may contribute to age-related differences in memory for emotional stimuli.

REFRESHING MEMORY FOR DETAILS OF A MOCK CRIME DOES NOT ENHANCE THE ACCURACY OF A P300 GUILTY KNOWLEDGE LABORATORY TEST ADMINISTERED AT 1 MONTH AND 1 YEAR LATER OF THE MOCK CRIME

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Descriptors: detection of deception, P300, GKT

A feature of field Guilty Knowledge Tests (GKTs) is that the interval between the commission of the crime and the testing is much longer than in laboratory GKTs (usually at least 1 month vs. a few minutes). This fading of memory through time
suggestions that field accuracy is reduced relative to lab accuracy. The present study, with P300 as the dependent variable, was designed to test whether refreshing the memory of lab mock-crime details just before the administration of the GKT would enhance GKT accuracy. The mock crime involved entering a room, and stealing an item (ring) from one of five desk drawers. The GKT was administered about 1 month and 1 year after the mock crime. Just before the GKT, the refresh-memory group (RM) of 8 subjects viewed a video which depicted the room in which they had committed the mock crime about 1 month ago, while the 8 subjects in the no-RM (NRM) control group viewed a video of the same length that depicted scenes from other parts of the college. Both groups of 8 subjects were tested 1 year later on the same condition. GKT accuracy in both groups was high, with the critical items elicited significantly larger P300s than non-critical items (Bonferroni, p < .05), and the P300 measure identifying 27 of the 32 subjects correctly as guilty. However, mean P300 amplitude did not differ between the RM and NRM groups. Future studies will test the hypothesis that the accuracy of a P300 GKT in the refreshing memory procedure is emphasized in not a central memory (e.g. ring) but a peripheral memory.

ORDER INFLUENCES BY PICTURE TYPE IN AFFECTIVE MODULATION OF THE STARTLE REFLEX: DOES RANDOMIZATION REMOVE ALL INFLUENCE?

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Descriptors: startle response, order effects, randomization

Randomization in scientific research so as to control for order influence is virtually ubiquitous. For example, order effects have been documented in fields as varied as cognition (Schifferstein, & Frijters, 1992) to taste perception (Conner, et al., 1987). Research in the area of affective modulation of the startle reflex does not differ in the common practice of randomization to control for order effects in picture-type presentation (e.g., Bernat, Patrick, Benning, & Tellegen, 2006, Bradley, Cuthbert, & Lang, 1990). However, the potential influence of order effects of picture type in affective modulation of the startle reflex has yet to be investigated. The present study was conducted to investigate the influence of presentation order in standardized positive, negative, and neutral images (IAPS, 2000) using the acoustic startle modulation paradigm. It was hypothesized that neutral images immediately preceded by negative images would have startle magnitudes significantly higher than neutral images immediately preceded by positive images. This influence was hypothesized despite randomization of picture presentation. In other words, it was hypothesized that neutral images would be perceived as more unpleasant if preceded by negative images and more pleasant if preceded by positive images. Results from the present study supported this hypothesis [F(1, 21) = 5.45, p = .030]. It appears, therefore, that randomization in the affective modulation paradigm is indeed warranted and researchers should be mindful of this influence in future studies, despite randomization.

Center for Tobacco Prevention and Control, Texas Tech University Health Sciences Center.

THE CORRESPONDENCE BETWEEN PROBLEM BEHAVIOR AND CARDIAC MEASURES DURING CLASSROOM BASED FUNCTIONAL BEHAVIORAL ANALYSES

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Descriptors: basic prevention science, childhood, behavioral analysis

Three children with problem behavior (aggression, self-injury and destruction) in special education classrooms participated in functional behavioral analyses (FBA) and real-time heart rate (HR) measurement examining the effects of arousal and reinforcement on problem behavior. FBA conditions were alternated between conditions in which reinforcement (i.e. adult attention, escape from task, access to toys) was made freely available and conditions in which reinforcement was provided contingent on problem behavior. The observed frequencies of problem behavior and FBA condition were correlated with mean HR, and heart rate variability measures (RMSSD, high frequency power and sample entropy) at one second resolution in within-subject ANOVA analyses. Results showed the FBA condition accounted for more variance in HR measures than problem behavior, whether or not problem behavior was differentiated across the FBA conditions. All predictors showed highest correlations with mean HR. Results suggest autonomic reactivity to the FBA conditions through sympathetic activation in response to reward over parasympathetic reactivity in these participants. Results extend basic research to classroom settings.

Supported by the Center for Neurobehavioral Development and the Office of the Vice President for Research at the U of MN and NICHD grant #44763.

ELECTROPHYSIOLOGICAL INDICES OF PROCESSING SYMMETRY AND AESTHETICS AS A RESULT OF JUDGMENT CATEGORIZATION RATHER THAN JUDGMENT REPORT

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Descriptors: evaluative processing, aesthetic processing

Evaluation of aesthetic judgments and descriptive symmetry judgments were compared, differentiating between processes of judgment categorization and judgment report. Electrophysiological activity was recorded while participants judged the aesthetic value (beautiful/not beautiful) or the symmetry status (symmetric/not symmetric) of novel graphic black and white patterns. In order to experimentally separate judgment categorization processes and judgment report processes, participants were instructed to misreport their true actual judgment in half of the trials. Three effects found in a previous study were examined: (1) an early frontoentral effect for the evaluation of beautiful patterns, interpreted as an early impression formation (2) a more pronounced ERP lateralization to the right for the aesthetic judgment task in comparison to the symmetry judgment task, interpreted as an evaluative categorization (3) a sustained posterior effect for the visual analysis of symmetric patterns. It was hypothesized that these effects should not be influenced by the validity of the response if they reflected central processes of judgment categorization. In this study, (1) and (3) were replicated independent of the validity of the response. (2) was affected by the validity, i.e. the effect was abolished in the false condition. Thus, results allowed further specification of cognitive processes involved in judgments of symmetry or aesthetics. Given present data, the ERP effects predominantly reflect judgment categorization and not judgment report.

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THE DEMAND-WITHDRAW INTERACTION PATTERN AND PHYSIOLOGICAL AROUSAL

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Descriptors: close relationships, communication

The demand-withdraw interaction pattern, a common, destructive pattern in intimate relationships, takes the following form: one partner tries to discuss problems, blames their partner, or demands change, while the other partner tries to avoid or withdraw from the discussion. Although research with heterosexual couples suggested that wives typically demand and husbands typically withdraw, our work with same-sex couples suggests that these behaviors are more closely linked with power in the relationship rather than biological sex. The demand-withdraw pattern may also be associated with couples' attempts to regulate their level of physiological arousal. To test this, heterosexual, gay, and lesbian couples (N = 65) engaged in a 15-min conflict conversation during which multiple physiological measures were collected. Demand and withdraw behaviors were coded by independent observers. Results revealed that for same-sex and mixed-sex couples: (a) there were equal levels of demand/withdraw behavior; (b) greater manifestation of the demand-withdraw pattern was associated with greater differences in the level of physiological arousal between partners. Examining this pattern more closely, demand behaviors were associated with increased physiological arousal while withdraw behaviors were associated with decreased arousal regardless of the sex of the partner. This suggests that the demand-withdraw pattern may be associated with regulation of the physiological climate of the interaction in ways that provide the benefits of lowered physiological arousal for the withdrawing partner.
ACTION MONITORING AND FEEDBACK EFFECTS IN MAJOR DEPRESSIVE DISORDER: A 128-CHANNEL EEG STUDY

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Harvard University

Descriptors: depression, action monitoring, ERP

Major depressive disorder (MDD) has been associated with dysfunction in various cortical regions implicated in executive function, including the anterior cingulate cortex (ACC). Recent research has demonstrated the importance of these regions in cognitive control processes necessary for behavioral adjustments following errors or response-conflict. Interestingly, patients with depression show abnormal reactions to negative feedback as well as dysfunctions in error processing. The goal of this event-related potential (ERP) study was to investigate the electrophysiological correlates of action monitoring dysregulation in MDD. To this end, participants with MDD (n = 20) and controls (n = 20) performed a Stroop task incorporating positive and negative feedback. As hypothesized, and consistent with recent work in our laboratory, participants with MDD (p = 0.03), but not controls (p = 0.22), displayed lower accuracy following incorrect relative to correct trials (Group × Condition, p = 0.01). ERP analyses focused on the error-related negativity (ERN) revealed differences between MDD and control subjects for incorrect, but not correct, trials. These findings are consistent with possible dysfunction within the ACC and support the hypothesis that depression is linked to impairments in behavioral adjustments after internal (perceived failure) and external feedback about deficient task performance.

WATCHING THE FEARFUL BRAIN DURING ANTICIPATION OF HYPERVENTILATION

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Descriptors: anticipatory anxiety, hyperventilation, anxiety sensitivity

Anticipatory anxiety and fear of anxiety-related arousal symptoms (high anxiety sensitivity) are proposed to play an important role in the etiology of panic disorder. The current study was designed to test whether highly anxious sensitive persons react with increased anxiety during short periods of anticipation of hyperventilation. Moreover, it was investigated, whether this paradigm can be used in an fMRI scanner. Subjects high and low in anxiety sensitivity were exposed to repeated short periods (18 sec) of anticipation of either hyperventilation (threat) or normal ventilation (safe). Different colored squares indicated safe or threat conditions. During the anticipation several psychophysiological measures were obtained. Afterwards, the same subjects completed a second session in an fMRI scanner, where the study procedure was repeated. In contrast to subjects low in anxiety sensitivity, only highly anxious sensitive subjects exhibited an augmentation of startle response during anticipation of hyperventilation compared to anticipation of safety. A threatening environment was also successfully created in the fMRI scanner. Data will be presented, indicating activation of central fear networks. The data indicate that the proposed short anticipation paradigm may be a powerful tool to study anticipatory anxiety using peripheral as well as brain imaging measures. Possible clinical applications of the paradigm will be discussed.

This work is part of the International Center for Integrated Neuroscience at the Alfred Krupp Wissenschaftskolleg and is supported by grant of the Alfred Krupp von Bohlen und Halbach-Stiftung.

STATE AND TRAIT ANXIETY ATTENUATE PPI AND ALTER LATERALITY OF RESPONSE

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Descriptors: prepulse inhibition, anxiety, stress

Although PPI is well characterized in healthy subjects, it has not been well examined in anxiety disorders other than PTSD. In addition, activation asymmetry and possible shifts in asymmetry related to state and trait anxiety remain understudied. This research assessed laterality associated with state and trait anxiety using a dichotic listening task and bilateral eye recording during baseline and stress conditions in 18 high trait anxious and 22 low trait anxious right-handed females. Greater PPI was shown in the eye contralateral to auditory stimulation across groups at all lead intervals (60 ms, 120 ms, 240 ms, 480 ms). For each lead interval, across condition and ear delivery, all participants also showed greater PPI in the right eye. Across groups, a main effect of stress was observed at each lead interval for PPI when probes were presented monaurally, and at 60 ms, 120 ms, and 240 ms lead intervals when probes were presented binaurally. Main effects of eye and stress were qualied by an interaction with auditory source at the 60 ms, 240 ms, and 480 ms lead intervals across groups. PPI was found to be similar in both eyes during stress for both groups and for high anxious participants, and was found to be greater in the right eye for low trait anxious participants during baseline at the 60 ms lead interval. In summary, stress or state anxiety and trait anxiety both exert effects on laterality and PPI.

PROCESSING EMOTIONAL FACE EXPRESSIONS IN POST-TRAUMATIC STRESS DISORDER

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Descriptors: anxiety disorders, ERP, emotion

Posttraumatic Stress Disorder (PTSD) occurs following a severely traumatic event and is characterized by re-experiencing, avoidance, emotional blunting and hyper-reactivity. Of particular interest to this study are emotional blunting which is the reduced responsiveness to cues unrelated to the traumatic experience and hyper-reactivity which is an increased sensitivity to event-related cues. The N170 was recorded in response to emotional faces (happy, sad, angry, surprise, neutral) and objects in two groups of individuals who reported experiencing a traumatic event. One group scored in the clinical range on the PTSD checklist (civilian version). The other group scored low on this scale. Angry faces are considered a generalized threat and it was expected that the clinical group would show larger N170 (hyper-reactive) to these emotional expressions, while responses to the other emotions would be reduced (emotional blunting). Preliminary analysis suggests that both of these processes are present. Results will be discussed in terms of possible deficits in processing emotional information in PTSD as well as the development of a clinical tool to aid the diagnosis of PTSD.

New Brunswick Innovation Foundation.

FUNCTIONS OF AGGRESSION AND P3 AMPLITUDE IN COLLEGE STUDENTS

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Descriptors: aggression, P3

The Impulsive/Premeditated Aggression Scales (IPAS) were developed to characterize functions of physically aggressive behavior as predominantly impulsive (IA) or predominantly premeditated (PM) in nature. Event-related potential (ERP) studies of IA indicate decrements in P3 amplitude, which have been linked to deficits in executive cognitive function (ECF). Studies of premeditated aggression are rare, but suggest relatively normal cognitive function. The present study was conducted to replicate and extend prior studies by comparing aggression subtypes on an auditory task designed to assess cognitive set-shifting. The IPAS was used to group an ethnically diverse sample of college students into IA (n = 24) or PM (n = 12) groups. Rare stimuli (I.e., white noise burst) that signaled a change in stimulus-response mapping were used to elicit the P3. Repeated measures analyses indicated that the IA group exhibited significantly smaller P3 amplitudes compared to the PM group [F(1,34) = 7.0, p < .01]. Across both groups, P3 amplitude was larger at anterior electrode sites, emphasizing the executive function aspect of this task. Additional analyses indicated a greater lifetime history of physically aggressive behavior for the PM group [F(1,34) = 8.6, p < .01]. No significant gender effects were detected. These findings extend previous evidence of ECF impairment associated with IA. The severity of aggressive behavior was not related to P3 amplitude, suggesting that the function of the aggression, rather than severity, may better account for differences in neurocognition.
EFFECTS OF IMPULSIVE AGGRESSION AND SUBSTANCE DEPENDENCE ON COGNITIVE SET-SHIFTING: A P3 STUDY

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Descriptors: aggression, addiction

P3 amplitude and executive cognitive function (ECF) deficits have been consistently demonstrated in individuals who display impulsive aggression. Interestingly, individuals with a history of substance use disorders (SUD) also exhibit reduced P3 amplitude and ECF deficits. A handful of past studies have suggested that a history of violence may exacerbate P3 decrements associated with SUDs. However, no studies to date have attempted to characterize aggressive behavior within the context of SUDs. The present study was designed to examine the specific effects of impulsive aggression on neurocognitive function in individuals with and without a history of substance dependence (alcohol and cocaine). Men and women were recruited into 1 of 4 groups: 1) impulsive aggressive, substance dependent; 2) non-aggressive, substance dependent; 3) impulsive aggressive, non-substance dependent; and 4) non-aggressive, non-substance dependent. P3 was recorded while subjects performed an auditory task designed to assess cognitive set-shifting. P3 amplitude and latency were measured in response to rare stimuli (i.e., white noise burst) that signaled a change in stimulus-response mapping in succeeding trials. Repeated measures analysis indicated a main effect of impulsive aggression. Individuals with a history of impulsive aggressive behavior (regardless of substance dependence) exhibited significantly smaller frontal P3 amplitudes than those without such a history. These results support previous findings of frontal lobe impairment specifically associated with impulsive aggression.

DISTURBANCE OF ACTION CONTROL IN MAJOR DEPRESSION

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Descriptors: action monitoring, ERN, depression

Actions performed by patients suffering from a major depression disorder (MDD) are habitually slow, not well planned, and inadequately controlled. How to explain this disturbance in action control? A central mechanism for learning and adapting actions can be found in a network of brain regions involved in error detection or action monitoring. We studied the activity of this network by recording EEG brain potentials when people make errors in speeded response tasks. We will present the outcomes of a study in which we investigated the event-related potential associated with these errors, the so called error-related negativity (ERN). In addition, we measured the speed of simple movements in various psychomotor tasks. Sixteen patients with a major depression (Hamilton Depression Rating Scale > 18) and 16 controls (matched on age, sex and educational level) were tested in a standard Eriksen Flanker task. The first results show a significant reduction of the ERN in these patients. Controls had a peak to peak amplitude which was more than twice as high as that of the MDD patients. Interestingly, the following Error Positivity (Pe) was about equal in both groups. In our poster we will discuss the RT, ERN and ERP results of our current experiment in more detail and also extensively relate them to movement speed in the psychomotor tasks and to results from our previous work. Part of this research was funded by the Fund for Scientific Research - Flanders (F.W.O. België).

EVENT-RELATED POTENTIALS IN A LATERALIZED TACTILE GO/NOGO TASK: EVIDENCE OF GENDER DIFFERENCES

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Descriptors: go/nogo, anterior cingulate

The Go/NoGo task is known to provoke response conflict and thereby reliably taps dorsal anterior cingulate functioning. Recent morphological studies emphasize differences between females and males regarding the neuroanatomy of this region. While gender effects are usually not observed in behavioral interference paradigms, electroencephalographic studies in this field often do not assess effects of gender due to small sample sizes. Hence, we investigated whether such effects can be found by means of a lateralized tactile Go/NoGo task during which event-related potentials were recorded. Frontocentral N2 and P3 components were augmented in Nogo as compared to Go trials. The Nogo N2 was modulated by an interaction of gender and side of stimulation. An asymmetry was found in male subjects only, reflecting attenuated amplitudes when stimulation was delivered to the left hand. Amplitudes of the Nogo P3 were also modulated by an interaction of gender and side of stimulation. Male subjects again showed reduced amplitudes with left-hand stimulation. Behaviorally, faster responses were found for the right as compared to the left hand regarding both side of stimulation and response hand. Although an interaction of these factors with gender did not reach statistical significance, effect size measures advise further investigation. The number of false alarms seemed to be modulated by an interaction of stimulation and response side. Overall, our data suggest a stronger functional lateralization of processes involved in the execution of the Go/NoGo task in males as compared to females. This work was supported by the Alfred Krupp von Bohlen und Halbach-Stiftung (International Center for Integrated Neuroscience, Alfred Krupp Wissenschaftskolleg).

EMOTIONAL PICTURE VIEWING MODIFIES THE AMPLITUDE OF CONDITIONED EYEBLINKS IN HUMANS

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Descriptors: emotion, eyeblink conditioning, humans

The inner motivational state has proven to have an impact on subjects’ readiness to react to certain biologically important stimuli. During averesively motivated state, defensive reactions are potentiated and reduced during appetitive state. The inner state of subjects can be manipulated by presenting them with pictures of emotional contents. This study investigated whether processing of the emotional foreground stimuli affect the amplitude of the learned eyeblink responses acquired through classical eyeblink conditioning in humans. Twenty-seven participants volunteered in this study. The eyeblink responses were recorded by measuring electromyographic activity of the orbicularis oculi muscle below the right eye. In the first, acquisition, phase the subjects were given paired tone - air puff pairings during presentation of neutral images. In the test phase, paired trials were given during presentation of pleasant, neutral and unpleasant images. Results showed that, in the test phase, the amplitude of the acquired eyeblink CR was smallest during the neutral images. However, in line with a body of results acquired in related startle modification experiments, the eyeblink amplitude during unpleasant images was significantly bigger that during pleasant images.

EFFECTS OF EMOTIONAL AND NONEMOTIONAL ERROR FEEDBACK ON BRAIN AND CARDIAC REACTIVITY

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Descriptors: ERN, cardiovascular, emotion

In this experiment, the effects of emotional versus non-emotional feedback on ERPs, heart rate, and task performance were examined, along with relationships between these physiological and behavioral indices. 10 participants were asked to do an operant learning task, in which they had to learn contingencies between keypressing and consequences (gain or no-gain) for each target pattern and maximize total scores. As performance feedback stimuli, we used two types of emotional faces (Happy for correct, Neutral for error), and two types of symbols (‘O’ for correct, ‘X’ for error). Error rates were lower in the Face feedback condition than the Symbol feedback condition. Error feedback in both conditions evoked a Feedback related negativity (FRN/Ne) followed by a positivity (FRN/Pe), and a heart rate acceleration over the next four seconds compared to correct trials which were associated with heart-rate decelerations. Face feedback following errors evoked a larger amplitude FRN/Pe compared to Symbol feedback stimuli. The correlation between FRN/Pe and heart rate changes immediately after feedback (200 – 500ms) was significant only in the Symbol condition (r = .45). Potentially, the lack of a strong relationship in the Face condition reflected involvement of
multiple emotional systems. Together these data suggest that performance, brain, and cardiac indices of error-responding are modulated by the nature of feedback.

CONTINGENCY JUDGMENT AND P3 AMPLITUDE IN A RULE DISCOVERY TASK

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Descriptors: contingency judgment, P3

We examined whether the P3 amplitude correlates with the contingency judgment between examples of two inconsistent hypotheses and yes/no feedback (FB) in a rule discovery task. Ten college students were required to guess a rule concerning triple numbers (e.g., ascending numbers) that the experimenter had in mind (Watson’s 2-4-6 task). The following information was given: for example, (1) “2, 4, 6”, (2) hypothesis A, which was induced from the example (e.g., even numbers), (3) hypothesis B, which was the opposite of A (e.g., odd numbers), and (4) an example of hypothesis B. Subjects were instructed to read the information out loud. They were visually shown yes/no FB, which indicated whether the example of hypothesis B was consistent with the rule, 500 ms after pressing a button (“no” means there was a contingent relationship between the hypotheses and the FB). In addition, we arranged other trials to confirm the hypothesis. Subjects performed 15 blocks of 9 trials each. EEG was recorded from Fz, Cz, and Pz. Vertical and horizontal EOGs were also recorded. The EEG and EOG signals during 1500 ms were averaged starting at 200 ms (baseline) before the button-press. The mean amplitude at Pz from 400 ms to 500 ms after the FB was significantly greater in trials where the contingent relationship was established than in the confirmation trials. This result suggests that P3 might correlate with the contingency judgment in a rule discovery task.

THE INFLUENCE OF MORNINGNESS - EVENINGNESS AND TIME OF DAY ON HEART RATE REACTIVITY TO HEAT STIMULUS

Konrad S. Jankowski, & Wanda Ciarkowska
Warsaw University

Descriptors: cardiovascular, time of day

The aim of the study was to determine a time of day effect in individuals with different preferences in morningness and eveningness (M and E) on heart rate (HR) in response to heat stimulus. Sixteen extremely morning types and fifteen extremely evening types were selected from a group of five hundred men with the Polish version of Horne Östberg Morningness-Eveningness Questionnaire (MEQ). They took part in two testing sessions (at 8.00 a.m. and at 8.00 p.m.) from 400 ms to 500 ms after the FB was significantly greater in trials where the contingent relationship was established than in the confirmation trials. This result suggests that P3 might correlate with the contingency judgment in a rule discovery task.

A HIGH-DENSITY ERP STUDY OF THE EMOTIONAL STROOP TASK IN HEALTHY VOLUNTEERS

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Descriptors: emotional stroop, ERP, depression

fMRI evidence points to a dorsal/ventral differentiation of Anterior Cingulate Activity associated to Cognitive vs Affective conflict monitoring (Bush et al., 2000). Further, rostral and subgenual cingulate have been implicated as main areas of abnormality in clinical depression. Dorsal/ventral differences have never been explored with ERPs. In the present study, 64 Chan EEG activity was recorded in 27 healthy young adults during the Color Stroop Task and the Emotional Stroop Task (Sad words). EEG activity was artifact rejected and ERP were selectively averaged for each subject and condition. In the Cognitive Stroop Task, RT was longer for Incongruent than Congruent color words, F(1,26) = 50.5, p < .0001. As in previous studies, midcentral N450 and the left LPW showed greater amplitude for Incongruent than Congruent Words. In the Emotional Stroop Task, RT did not differ in the entire group. However, when subjects were grouped according to BDI scores (low: < 8 = 19; high: > 8 = 8), the group x BDI interaction approached significance. Grandaverage ERPs for depression words were more positive in the 200–400 ms range over bilateral frontal and frontopolar scalp, displaying a more anterior scalp distribution than the N450 effect in the Cognitive Stroop. The effect was most significant over frontopolar scalp (F > 30, p < .0001). Furthermore, there was a significant Emotion x BDI interaction, with the high BDI subjects showing greater frontopolar positivity than low BDI subjects (F = 5.4, p < .03).

PHYSIOLOGICAL STRESS REACTIVITY ASSOCIATED WITH ANXIETY SYMPTOMS IN CHILDREN AND ADOLESCENTS WITH AN ANXIETY DISORDER

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Descriptors: anxiety disorders, stress, anxiety

Anxiety disorders in childhood and adolescence may be related to altered physiological reactivity in response to stress. This may be a factor in the maintenance of the disorder throughout life. We studied physiological responsiveness (skin
conductance level: SCL, heart rate, blood pressure: BP) to a Mental Arithmetic task (MA) and the Social Competence Interview (SCI) in 97 8- to 16-year-olds with an anxiety disorder. Anxiety symptoms were assessed by means of the Multidimensional Anxiety Scale for Children (MASC). To investigate associations between psychophysiological measures and anxiety symptoms, linear regression analyses were applied. Generalized anxiety was significantly associated with decreased baseline heart rate variability and increased SCL during the SCI, whereas separation anxiety was significantly related with increased SCL responses to both stressors. Harm avoidance was significantly associated with decreased diastolic BP during the MA, but social phobia was significantly related to a stronger diastolic BP response to the SCI. These data show that severity of anxiety symptoms in children and adolescents with an anxiety disorder appears to be related to reduced baseline parasympathetic cardiac control, whereas in response to stressors, anxiety symptoms appear to be associated with sympathetic reactivity.

PRIMING “WE” OR “THEY” AFFECTS LEVEL OF ORBICULARIS OCULI ACTIVITY IN RESPONSE TO FUNNY FILMS

Arid Kappas, & Dennis Küber 
International University Bremen

Descriptors: EMG, emotion, implicit sociality

Fridlund (1991) demonstrated that facial activity to funny stimuli was moderated not only by the physical presence of friends, but that believing a friend was watching the same stimuli in another room was sufficient to affect Zygomaticus Major activity. Furthermore, Hess, Banse, and Kappas (1995) replicated these results for activity at the Zygomaticus Major and Orbicularis Oculi sites and demonstrated that this effect of implicit sociality was moderated by both the intensity of the stimulus and the interpersonal relationship (friends vs. strangers) between pairs of participants. To investigate the underlying cognitive mechanisms of this effect, we had 31 participants complete a priming procedure based on circling either first person plural pronouns (we, our, us) or third person plural pronouns (they, their, them) in a text describing a walk through a city. In a second part of the experiment, participants watched a block of funny stimuli while EMG was recorded (Orbicularis Oculi, Corrugator Super RI li, Zygomaticus Major). “We”-priming led to significantly higher level of activity at the Orbicularis Oculi site compared to “They”-priming. These results provide first evidence that priming very general concepts like “We” or “They” may be sufficient to activate an implicit audience of friends and strangers that induces behavioral effects comparable to the results obtained by earlier studies using co-scheduled pairs of participants.

THE USE OF PHYSIOLOGICAL MEASUREMENT IN THE ASSESSMENT OF FLIGHT TASK DIFFICULTY UNDER SIMULATED CONDITIONS

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Descriptors: mental workload, aviation psychophysiology, heart rate variability

The purpose of this study was to develop physiological measurements to balance the inherent biases in self-report indices. Seven pilots ages 34 – 60, participated in a one-session test on the Boeing 737 – 800 simulator. Physiological data was collected while pilots wore the LifeShirt®. Measures included heart rate, respiration rate, CO2, skin temperature, electro-oculogram and blood pressure. Pilots flew a set of simulation flight tasks, rated a priori difficulty. Evaluative measures included: Pilot performance rated for each task by an expert in a flight training environment. The NASA-TLX scale. A multiple regression analysis was used to calculate whether physiological assessment added significant explained variance in measures of task difficulty and evaluator score, over that provided by the TLX. For predicting task difficulty there was a significant contribution (at p < .001) for the standard deviation of cardiac interbeat intervals, and the minimum normal RRI during each trial, after effects of TLX prediction were removed. Also minute volume ventilation was a significant predictor of residual variance in a priori ratings of task difficulty (p < .004). For predicting evaluator scores, there was a significant negative residual prediction for VLF HRV (p < .0001) and the LF:HF ratio (p < .001). This suggests that participants with high sympathetic arousal performed more poorly. Consistent with the prediction of difficulty scores, there is a negative (p < .02) relationship with minimum normal RRI (p < .001).

THE TRUTH ABOUT LYING: INHIBITION OF THE ANTERIOR PREFRONTAL CORTEX IMPROVES DECEPTIVE BEHAVIOR

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Descriptors: moral cognition, lie detection, transkin conductance/direct current stimulation (tDCS)

Deception is a complex cognitive act, with crucial legal, moral, political and economic implications. Recent neuroimaging studies have revealed that the anterior prefrontal cortex (aPFC; BA 9/10) and the anterior cingulate gyrus are predominantly involved in deception. The goal of the present study was to investigate, if inhibiting the aPFC by cathodal transcranial direct current stimulation (tDCS) would modulate deceptive behavior. 27 healthy subjects were asked to participate in a thief role play, in which they were supposed to steal money and then to attend an interrogation, in which a modified version of the Guilt Knowledge Test (GKT) was used. In addition, the skin-conductance response (SCR) and the reaction time during verbal response (lie vs. truth) were measured. In a double-blind repeated measures design the subjects received during the interrogation cathodal tDCS or placebo tDCS. Furthermore, in order to measure skilful lying, we developed a so called lying quotient (LQ) relating the frequency of lies on critical questions to the frequency of lies on uncritical questions. Remarkably, cathodal tDCS of the aPFC improved deceptive behavior (higher LQ, shorter reaction time and smaller difference in SCR between truthful and false responses). These findings give causal support to recent correlational data obtained by fMRI studies indicating a predominant role of BA 10 in moral cognitive tasks. Moreover, our findings suggest that inhibition of BA10 reduces the moral conflict during deception, presumably evoked by performing a self-perceived wrongful act.

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META-ANALYTIC REVIEW OF STRUCTURAL BRAIN ABNORMALITIES IN PTSD

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Descriptors: anxiety disorders, hippocampus, meta-analysis

PTSD has been related to a number of explicit and implicit processing alterations which may be due to structural changes in several cortico-limbic structures. However, recent findings are controversial and a systematic quantitative review has been missing so far. This series of meta-analyses examined structural abnormalities of the hippocampus and other brain regions in persons with PTSD compared to trauma-exposed and non-exposed control groups. The findings were significantly smaller hippocampal volumes in persons with PTSD compared to controls with and without trauma exposure, but group differences were moderated by MRI methodology, PTSD severity, medication, age and gender. Trauma-exposed persons without PTSD also showed significantly smaller bilateral hippocampal compared to non-exposed controls. Meta-analyses also found significantly smaller left amygdala volumes in adults with PTSD compared to both healthy and trauma-exposed controls, and significantly smaller anterior cingulate cortex compared to trauma-exposed controls. Pediatric samples with PTSD exhibited significantly smaller...
corpus callosum, septum, and frontal lobe volumes compared to controls, but there were no group differences in hippocampal volume. The overall findings suggested a dimensional, developmental psychopathology systems model in which: (1) hippocampal volumetric differences covary with PTSD severity; (2) hippocampal volumetric differences do not become apparent until adulthood; and (3) PTSD is associated with abnormalities in multiple frontal-linguistic system structures.

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TASK DIFFICULTY MODIFIES THE VISUAL DISTRACTION EFFECT ON P300 ERP

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Descriptors: visual distraction effect, P300, ERP

Unexpected change in task-irrelevant stimulus features impairs the processing of task-relevant features. In this study, the effect of task difficulty on visual distraction was examined. Circles were presented with either small (Go) or large (No-go) size every 1200 ms in equal probability and random order. The size difference between Go and No-go circles was large in the easy task condition and small in the difficult condition. Most of the circles (42% each) were presented in gray and infrequently (deviant, 8% each) they were presented in red. ERPs were recorded while the participants made a size discrimination; quick button press to small circles, regardless of their color. Longer reaction times (RTs) and lower hit rates were observed in the difficult condition. In addition, RTs for deviant stimuli were longer than for frequent stimuli in both conditions; i.e., the behavioral distraction effect was observed. Go stimuli elicited a centro-parietal P300, whereas No-go stimulus elicited a fronto-central P300. The amplitude of these P300s was smaller in the difficult condition. Furthermore, both Go and No-go P300s were enlarged to the infrequent deviant circles. This effect on Go P300 was not affected by task difficulty, while the effect on No-go P300 was smaller when the task was easy. No-go stimuli in the easy condition required shorter processing time for size discrimination than those in the difficult condition. Thus, the results indicate that when the stimulus is not a target, the distraction effect on P300 amplitude is related to the later parts of processing.

ELECTRICAL DISTANCE AS A REFERENCE-FREE MEASURE FOR IDENTIFYING ARTIFACTS IN MULTICHANNEL ELECTROENCEPHALOGRAM (EEG) RECORDINGS

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Descriptors: dense electrode array, artifact, reference-free

Multichannel EEG, with hundreds of scalp placements now common, has increased the likelihood of recording artifacts in one or more channels within any given time epoch. Reliable artifact detection is mandatory because of distortion in signal topography. This becomes increasingly difficult as the number of sites and epochs increases. A systematic statistical approach for dense electrode arrays uses threshold criteria (amplitude, etc.) and their observed distributions to identify artifacts as median-based deviations (Jungthörfer et al., 2000). Whereas this elegant approach eliminates the subjectivity of visual artifact screening, it is based on criteria requiring the choice of a particular recording or offline reference. Moreover, if the reference is contaminated, an artifact will be “detected” in all other channels. These problems can be circumvented and simplified with a reference-free electrical distance measure, which quantifies signal similarity through variances of waveform differences for all pairwise combinations within a given montage. Because spatial (recording sites) and temporal (sample points) proximity warrants highly intercorrelated surface potentials due to volume conduction, a low signal similarity at nearby electrodes strongly implies an unrealistic deviation (i.e., artifact). Electrical distance frequency distributions, both within and across individuals, thereby provide an easy, objective, and reference-free approach to identify recording artifacts, including those affecting the reference site. Implementations are shown for 31-, 67- and 129-channel montages.

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ERP GENERATOR PATTERNS IN SCHIZOPHRENIA DURING TONAL AND PHONETIC ODDBALL TASKS: EFFECTS OF RESPONSE HAND AND SILENT COUNT

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Descriptors: ERP, schizophrenia, response mode

P3 amplitude in schizophrenia has been reported to be more reduced over left than right hemisphere during auditory oddball tasks, which has been interpreted as left-lateralized dysfunction. However, the contributions of methodological factors (stimulus properties, response mode, recording reference), which affect event-related surface potential (ERP) topographies, remain unclear. We recorded 31-channel ERPs from 20 schizophrenia patients and 20 age- and gender-matched healthy adults (all right-handed) during tonal and phonetic oddball tasks, varying response mode (left press, right press, silent count) also within subjects. Patients performed adequately but were slower. ERP generator patterns were summarized by temporal PCA (unrestricted Varimax) from reference-free current source density (CSD; spherical spline Laplacians) waveforms used to sharpen scalp topographies. CSD factors were unambiguously related to known ERP components and highly comparable between groups. Both groups showed asymmetric frontolateral and parietotemporal N2 sinks and asymmetric centroparietal P3 sources for targets (tonal R > L, phonetic L > R), but patients had reduced frontotemporal N2 sinks and reduced midparietal P3 sources. In both groups, left or right press produced opposite, region-specific asymmetries originating from central sites, modulating the N2/P3 complex, and a larger parietal P3 source compared to silent count. Data suggest overall reduced neural generators in schizophrenia during auditory oddball tasks, with both groups showing comparable topographic effects of task and response mode.

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REVERSIBILITY OF METAPHOR PROCESSING: IMPROVING RELIABILITY USING ITEMS ANALYSIS

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Descriptors: language, ERP

Conflicting theories explain how metaphorical meanings emerge. Structure mapping suggests that at the initial stage the meanings of the topic and vehicle are aligned in a symmetrical process. Whereas, dual reference models suggest that the topic and vehicles have different roles from the start. In this study, we presented participants with literal sentences, and high and low conflict metaphors that were in a normal or reversed order. In behavioral studies reliable effects can be seen with a small number of items (4 – 8) but ERP studies require many items. In the current study, we attempted to increase our understanding of the metaphor’s characteristics by conducting an items analysis in which ERPs to each utterance were averaged across many participants. Response times were similar for normal and reversed order overall, supporting the structure mapping approach, but further work showed that similarity interacted with order. ERPs for normal and reversed conditions differed by 200ms after presentation of the final word. Neither model can completely explain the pattern of results. The ERP data demonstrate that when confronted by research designs that have a limited stimulus-pool available, reliability checks can be made by analyzing the data by the stimuli as well as by subjects. This is particularly useful when it is easier to recruit more subjects than to create new stimuli.
Affectively arousing visual stimuli have been suggested to automatically attract attentional resources, thus being associated with optimized sensory processing. Although converging evidence has amassed to support this perspective, it is unclear which processes mediate such facilitation. We used steady-state visual evoked brain potentials (ssVEPs) together with a source projection method and Granger causality analyses to examine this question. Granger Causality is a concept that describes directional prediction of time series using lagged regression. It is therefore suitable to examine the predictive value of oscillatory processes at one brain region for other regions. Sixteen participants viewed a set of 60 colored affective pictures from the International Affective Picture System, presented in a flickering mode at a rate of 10Hz in order to elicit ssVEPs. Six picture categories were used: threat and mutilation (unpleasant), families and erotica (pleasant), household objects and persons (neutral). Averaged EEG epochs were projected to a set of regional sources that provided a low dimensional solution space. Viewing affectively arousing (unpleasant and pleasant) pictures was associated with greater connectivity between parieto-occipital areas on the one hand, and tempo-frontal regions on the other. In particular, temporal and frontal regions Granger-caused changes at posterior source locations. These findings are consistent with re-entrant modulation of visual cortex, enhancing primary visual processing as a function of emotional arousal.

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AN EVENT-RELATED POTENTIAL STUDY OF CATEGORY MEMBERSHIP VERIFICATION IN SCHIZOPHRENIA

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Descriptors: schizophrenia, ERP, semantic priming

Symptoms of schizophrenia like disorganized speech and delusions have been hypothesized to result from abnormalities in how concepts activate one another in semantic long-term memory. We assessed this hypothesis using a component of event-related brain potentials - the N400 - known to be sensitive to semantic priming. Schizophrenia patients (n = 18) and age-matched controls (n = 18) performed a category-membership verification task, viewing category definitions (A type of fruit) each followed by a target that was either a high-typicality exemplar (apple), low-typicality exemplar (prune), or non-exemplar (clump) of the category, and indicating via button-press whether or not the target was a category member. As expected, N400 amplitudes were largest for non-exemplars, smallest for high-typicality exemplars, and intermediate for low-typicality exemplars. N400 effects did not differ significantly between patients and controls, though there was a trend toward reduced N400 amplitude difference between non-exemplars and low-typicality exemplars in patients (p = 0.10). Within patients, psychotic symptoms correlated with reduced N400 amplitude difference between high- and low-typicality exemplars (typicality effect) (p = 0.005). This result raises the possibility that a reduced difference in the degree to which a meaningful stimulus activates concepts strongly and weakly related to it may be associated with the development of delusional beliefs.

CIHR, NIH, NIMH, VA MIRECC.

STRESS-INDUCED NEGATIVE EMOTIONAL ACTIVATION AND AGGRESSIVE BEHAVIOR IN MEN AND WOMEN

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Descriptors: emotion, startle response, aggression

Research suggests that men and women's behavioral responses, but not their physiological responses, to stress may differ (Taylor et al., 2000; Verona & Curtin, 2006). The current study examines gender differences in stress-induced startle responses and aggressive behavior and the moderating role of gender in the negative emotion-aggression link. Participants were first exposed either to high pressure (high stress) or to very low pressure (low stress) air blasts to manipulate the experience of negative affect. Subsequently, they engaged in a laboratory aggression paradigm, in which the mean level of shock participants delivered to a confederate was recorded as our measure of aggressive behavior. Participants' emotional responses during stress exposure and during the aggression procedure were measured using eye-blink startle magnitude. Men and women showed equivalent and heightened startle magnitudes in high stress relative to low stress. Additionally, startle responses during stress-exposure predicted increasing levels of subsequent aggression in men, whereas women's startle responses were negatively associated with subsequent aggression. These findings suggest that whereas basic negative affective activation in response to general stress is similar in men and women, this activation leads to more withdrawal and inhibited behavioral responses in women and more aggression in men.

AN ERP STUDY OF VISUAL CHANGE DETECTION: EFFECTS OF FEATURE AND SPATIAL ATTENTION ON THE CHANGE-RELATED POSTERIOR POSITIVITY

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Descriptors: visual change detection, ERP, attention

In ERP studies using a visual S1-S2 matching task, change stimuli elicit a posterior positivity at around 100 – 200 ms (change-related positivity). In the present study, to test whether or not change-related positivity reflects preparventive processing of visual changes, we investigated the effects of feature and spatial attention on this component. Five types of bilateral S1-S2 trials were presented in random order with equal probabilities (20% each): no change in either left or right figure, color change in the left, color change in the right, spatial frequency change in the left, and spatial frequency change in the right. Participants’ (N = 10) task was to respond to changes in a given feature at a given spatial location in separate blocks. Change-related positivity in three attention conditions was assessed for each feature dimension: changes in an attended feature at an attended location, changes in an attended feature at an unattended location, and changes in an unattended feature at an unattended location. For color changes, change-related positivities were observed with similar amplitudes regardless of the feature and spatial attention conditions, while for spatial frequency changes, this component was observed only when the stimulus changes occurred at an attended location. These results suggest that although change-related positivity reflects preparventive processing of stimulus changes at least in color, this component in response to spatial frequency changes is sensitive to participants’ attention condition. The theoretical implications are discussed.

VOWEL DURATION PROCESSING IN SPEAKERS OF FINNISH AND GERMAN: AN MMN STUDY

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Descriptors: language, MMN, phonetic processing

Language specific phoneme processing can be probed using the mismatch negativity (MMN) component of the auditory event-related potential, elicited by an unpredictable change in an auditory stimulus sequence and an indicator of the auditory discrimination accuracy. Using the MMN we studied the processing of vowel duration in a language with high (Finnish) vs. low (German) functional load of phonemically relevant distinctions between vowel length categories. Acoustically equivalent vowel duration changes were presented in the first and second syllable of a disyllabic pseudoword as decrements as well as increments of
A LINEAR DECREASE IN THE NEGATIVITY BIAS DURING ADULT LIFESPAN DEVELOPMENT

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Descriptors: aging, emotion, late positive potential

Studies of young adults have found that negative information generally has a stronger influence than positive information (ie, a “negativity bias”) in a number of domains including perceptual processing, decision making, and memory. This is generally not true in older adults, but it remains unclear whether aging is associated with the development of a unique “positivity bias” (Carstensen & Mikels, 2005, Curr Dir Psych Sci, 14:117–121) or simply a gradual reduction in the negativity bias (Wood & Kisley, Psych Aging, in press). Here we provide electrophysiological evidence for the latter interpretation. We studied healthy adults ranging in age from 18 to 80 years. Visual ERPs were recorded in response to affectively neutral, positive and negative images during an evaluative categorization task (after Ito et al., 1998, J Pers Soc Psych, 75:887–900). Participants rated the valence of images taken from the International Affective Picture System. Amplitude of component LPP (peaking around 500 ms post-stimulus) in response to negative images was found to decrease linearly with advancing age (r = −.32, p < .05). No linear change was found for LPP amplitude evoked by the positive images. In other words, for this particular measure, the neural response to negative information changed across the adult lifespan but the response to positive information did not. This led to a convergence of LPP amplitudes evoked by negative and positive images (i.e., the absence of a "bias") for the oldest adults in the study.

FRONTAL ASYMMETRY, MOOD, AND FIRST IMPRESSIONS: EXPERIMENTERS LIKE LEFT FRONTALLY ACTIVE PARTICIPANTS WHO ARE HAPPY

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Descriptors: EEG asymmetry, interpersonal processes, gender

Relative left frontal activity in the EEG has been linked to the behavioral approach motivation. Such motivation can manifest in positive affect, such as happiness, or negative affect, such as anger. Emotional expression impacts interpersonal relations, including how much people are liked or disliked. The present study examined how behavioral approach motivation and emotional valence in a participant correlated with how much the participant was liked by the experimenter. Participants were right-handed undergraduate students (33 men, 41 women). Experimenters were 6 female and 6 male graduate and undergraduate students. Both the participant mood and experimenter feelings toward the participant were measured using the Self Assessment Manikin (SAM). Six minutes of EEG, three with eyes open and three with eyes closed, were recorded from a standard 10–20 montage of 19 electrodes referenced to linked ears. Alpha power (8–13 Hz) was extracted from the EEG, and log transformed for normalization. [Ln(F4)]-[Ln(F3)] asymmetry scores were computed, and participants were divided into right frontally active (n = 27), symmetrical (n = 18), and left frontally active (n = 36) groups. ANOVA revealed that experimenters rated female participants more positively than male participants (p < .05). Experimenters also rated left frontally active participants more positively than the other groups (p < .01). Among left frontally active individuals (13 men, 19 women), participant moods pre-cap application correlated positively with experimenter moods post-cap application (r = .37, p < .05).

METHODS FOR EXAMINING CIRCADIAN PSYCHOPHYSIOLOGY IN CLINICAL POPULATIONS OUTSIDE THE LABORATORY

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Descriptors: respiration, anxiety disorders, ambulatory monitoring

Ambulatory monitoring is an appropriate method for validating ecological validity of laboratory results and examining circadian patterns. However, ambulatory studies are limited by confounding effects of physical activity. An ambulatory monitoring system (LifeShirt) was used to collect and analyze various autonomic and respiratory variables in patients with panic disorder (PD, N = 18) and posttraumatic stress disorder (PTSD, N = 12), and in healthy controls (N = 17) during 24 h periods. To control for motility, multiple unsupervised quiet-sitting baseline measurements were taken. In addition, paced breathing and tidal volume measurement were used to control for respiratory confounds when employing circadian respiratory sinus arrhythmia changes as vagal markers. Preliminary analyses demonstrated circadian patterns in many psychophysiological variables. However, distinct group patterns were not found. Group main effects were evident in certain autonomic and respiratory measures: PD patients showed higher heart rates than healthy controls (p < .05); PTSD patients showed more out-of-phase movements between thoracic and abdominal breathing (phase angle) than healthy controls (p < .01), pointing to strained breathing. These preliminary results support the utility of procedural control for physical activity variation in ambulatory monitoring of clinically anxious populations. The use of semi-structured ambulatory assessment can serve to disambiguate findings and move toward chronobiology methods, like constant routine assessment, without imposition of significant burden on subjects.
THE EFFECT OF ANTICIPATION LEVEL ON THE STIMULUS-PRECEDING NEGATIVITY: AN EVENT-RELATED fMRI STUDY

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Descriptors: stimulus-preceding negativity, functional neuroimaging, anticipation

Stimulus-preceding negativity (SPN) is a slow potential that precedes task-relevant stimuli. One of the factors that elicits SPN is anticipation, and this SPN can be recorded when subjects anticipate the occurrence of a stimulus. In the present study, we manipulated the level of anticipation and employed the event-related fMRI to investigate the effect of anticipation level on the SPN. Twenty-six participants performed a time estimation task. In this task, they had to push a button when they thought a predetermined time (4, 6, or 8 seconds) had elapsed. After the button press, feedback stimulus was presented, informing them as to whether their response was undershoot, correct, or overshoot. We changed the pre-stimulus interval between the button press and feedback stimulus to manipulate the level of anticipation. There were three experimental conditions: (a) Low anticipation condition (Low) where the pre-stimulus interval was randomly changed in each trial, (b) High anticipation condition (High) where the pre-stimulus interval was fixed to 3 seconds, and (c) No feedback condition (NFB) where the feedback stimulus was omitted. The experiment was conducted inside a 1.5 tesla GE scanner. In High-NFB contrast, the fMRI results showed significantly increased activations in the thalamus and the middle occipital gyms. In Low-NFB contrast, widely spread increased activations in the visual cortex were observed. The effect of the anticipation level on the SPN will be discussed, comparing the fMRI results between the contrasts.

EXPLORING EXECUTIVE FUNCTIONS IN CHILDREN WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER USING EVENT RELATED POTENTIALS

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Descriptors: ERP, executive function, ADHD

ADHD is a prevalent neurobehavioral disorder affecting individuals in early childhood and characterized by cognitive impairments associated with executive functioning. However, the exact nature of the impairment(s) is unclear. Miyake et al. (2000) demonstrated that there are at least three separable frontal executive functions: set switching, working memory updating, and response inhibition. Here we used ERPs to investigate whether the cognitive impairments seen in ADHD are specific to one of these executive functions or rather represent a global executive functioning deficiency. The current studies examined the time course and scalp localization of executive functions in Combined Type ADHD and control children by implementing modified versions of three of the executive tasks used by Miyake et al. (2000); versions more appropriate for the ADHD population. An additional non-executive task (visual oddball) was included to demonstrate that the deficits in ADHD are specific to executive functioning. The current findings show that ADHD impacts only a subset of cognitive operations in the executive functions, leaving the other ERPs in the executive tasks and the visual oddball unaffected. Specifically, the ADHD group was impaired on tasks involving allocation of attention and response inhibition, cognitive operations most closely related to the diagnostic criteria for this subtype of ADHD. These findings may extend our knowledge of the time course and localization of executive functions and provide a tool for studying the nature of disrupted executive functioning in ADHD.

DIFFERENTIAL EFFECTS OF FILM-INDUCED FEAR AND SADNESS ON ACOUSTIC STARTLE

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Descriptors: startle response, emotion, film

The Bradley and Lang (2000) model of affective space predicts startle response facilitation during negative emotional states compared to positive emotional states. This model is principally based on paradigms using slides or imagery, but also appears to be valid in the context of emotions elicited by film (Jansen & Frijda, 1994). The present study examined acoustic startle modulation using fear and sadness inducing films matched on valence and arousal. According to the Bradley and Lang model, these two negatively valenced emotional states would be expected to affect the startle response similarly. To test this hypothesis, 32 subjects viewed two sets of 10-min film clips selected to induce fear, sadness, and a neutral emotional state. Startle indices (response magnitude, response latency, pre-startle baseline amplitude, and their variability) associated with brief bursts of white noise with approximately 60-sec intertrial-interval were assessed. Results indicated that during fearful clips, blink magnitude was larger than during sad or neutral clips (all p<.001). Correlations between startle indices and emotion experience indicated covariation of blink magnitude with self-reports of fear but not valence or arousal. We discuss the implications of findings for the affective space model and consider the relevance of alternative startle indices.

Merck & Co., Inc. and Stanford University.

HIERARCHICAL ERROR PROCESSING DURING MOTOR CONTROL

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Descriptors: ERN, motor control, medial-frontal cortex

Motor control appears to depend on a system of hierarchically organised neural mechanisms that can detect and correct movement errors. Our previous research (Krigolson & Holroyd, 2006) has shown that high-level motor errors elicit the error-related negativity (ERN), a component of the event-related brain potential (ERP) thought to be produced by a frontal-medial system for error processing. It remains unclear whether or not low-level errors (e.g., trajectory adjustments) elicit an analogous ERP component. To address this question, we recorded the ERP from participants engaged in a discrete manual aiming task. Participants manipulated a joystick to move a cursor from a start position to a target position. On some trials the target unexpectedly jumped to a new location during the movement, and on half of these trials the joystick was disabled such that participants were unable to correct for the target perturbation. We found that target perturbations elicited a P300 (a component of the ERP associated with context updating), but only the cursor adjustments that were blocked elicited an ERN. Importantly, the parietal distribution of the P300 is consistent with literature associating this neural region with online motor control. In sum, our results suggest that high-level motor errors elicit an ERN when a goal is not obtainable (in this case, when the cursor adjustment was blocked), and that low-level motor errors elicit a P300, irrespective of whether or not the goal is obtainable (in this case, when the target location was perturbed).

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THE ROLE OF MEDIAL-FRONTAL CORTEX IN SEQUENCE LEARNING

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Descriptors: ERN, sequence learning, medial-frontal cortex

Medial-frontal cortex is thought to play an important role in sequence learning. Recent research suggests that medial-frontal cortex also plays a role in
reinforcement learning. The error-related negativity is a component of the event-related brain potential that is sensitive to both response errors (rERN) and negative feedback (fERN). One recent theory holds that the rERN and fERN reflect the impact on medial-frontal cortex of a reinforcement learning signal carried by the midbrain dopamine system (Holroyd & Coles, 2002). In the present research, participants were asked to learn a seven-item sequence by trial-and-error. Our results indicate that errors made during the acquisition phase of the experiment elicited a fERN. During this experimental phase feedback provided the earliest indication of success, and as such negative feedback elicited a fERN. Importantly, these data suggest a possible mechanism by which the midbrain dopamine system could train medial frontal cortex to learn novel sequences.

MODULATIONS OF THE LATE POSITIVE POTENTIAL VIA COGNITIVE EMOTION REGULATION TO PLEASANT STIMULI

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University of Delaware

Descriptors: late positive potential, emotion regulation, attention

Research indicates that individuals can regulate their emotions to negatively-valenced stimuli using cognitive techniques in order to both increase and decrease emotional expressivity and subjective experience of negative emotions. Studies also indicate that these increases and decreases in emotional experience are associated with changes in brain activity and autonomic responses. Recent ERP studies conducted in our laboratory have elucidated candidate electrophysiological correlates, particularly the late positive potential (LPP) to index emotion regulation processes. The present study attempts to replicate and extend our prior work by measuring the LPP during regulation of emotional responses to positively-valenced stimuli. Twenty participants completed a blocked emotion regulation task; the first block consisted of passively viewing randomly presented pleasant and neutral pictures, while the last two blocks consisted of either downward- or up-regulating emotions to pleasant pictures. Results indicate that ERPs for each condition differentiated themselves at the onset of the LPP; with the magnitude for the down-regulation condition significantly attenuated. This effect is most prominent at the positive-going slow-wave time window of the LPP, indicating that attentional resources allocated to the perceptual processing of pleasant stimuli may be modulated via emotion regulation.

BRAIN RESPONSES TO NOVEL SOUNDS IN DEPRESSION: AN ERP STUDY

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Descriptors: ERP, depression, novelty

Although reduced P3 amplitude has frequently been reported for clinically-depressed individuals, little is known how depression affects subcomponents of the late positive complex. ERPs (30-channel; nose reference) were recorded from 18 depressed, unmedicated outpatients and 21 healthy adults (all right-handed, 8 men each) during a novelty oddball task (Fabiani & Friedman, 1995). Eight 50-trial blocks consisted of two 300-ms tones (350 Hz nontargets, p = .76; 500 Hz targets, p = .12) and novel sounds (e.g., dog bark, human cough: 100–400 ms, p = .12) presented in pseudorandom order at 1000 ms ISI. Participants responded as quickly as possible to target tones only. Response hand was counterbalanced across blocks. Both groups performed well (hits vs. false alarms: controls 99.5% vs. 1.5%, patients 98.5% vs. 2.6%), yielding comparable ERP components: N1, P2/N2 and early P3 (325 ms peak latency; 220–365 ms integrated time window amplitude) and late P3 (490 ms; 400–650 ms). Early P3 was most prominent for novel stimuli (novelty P3) and had more a frontal topography than late P3, which showed a parietal topography for targets consistent with classic P3b. Although both positive potentials were reduced in depressed patients, the reduction attained statistical significance only for early P3. Moreover, analysis of simple effects confirmed that the group reduction was present only for novel stimuli. Data are compatible with the hypothesis that clinical depression is associated with a reduced frontocentral response to novel stimuli, likely reflecting a deficit in orienting and alerting.

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EFFECTS OF PERSONALITY Traits ON HEMISPHERIC ASYMMETRIES IN EMOTION PROCESSING - A FUNCTIONAL MAGNETIC RESONANCE IMAGING (fMRI) STUDY

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Descriptors: functional neuroimaging, emotion, laterality

Objectives: Interindividual differences in personality traits (e.g. extraversion, neuroticism) have been associated with differences in emotional processing. The present study investigates the moderating effect of personality traits on hemispheric asymmetries in the processing of emotional stimuli. The major focus of how each individual hemisphere reacts separately to emotional valence is addressed by comparing activation patterns following lateral vs. central stimulus presentation. Methods: A sample of 40 healthy, right-handed, male students completed an event-related fMRI experiment in which they viewed a counterbalanced randomised sequence of pictures with negative (mutilation), positive (erotic) or neutral valence. Picture stimuli were presented for 200 ms either lateralized (2° left or right from a fixation cross) or centrally. Several personality questionnaires (NEO-FFI, 17, AISS, STAI, PANAS, TAS-26) were administered. In addition, resting heart rate variability and electrodermal activity (EDA) was measured as peripheral physiological parameter of personality. Results: Preliminary results show unilateral or bilateral activation patterns, depending on the valence and location of the presented stimuli. Ongoing analyses of correlations between personality traits and cerebral activation patterns during emotional processing seem to emphasize the role of frontotemporal structures and will be presented and discussed in detail.

Funding provided by the International Center for Integrated Neuroscience, WIKO Greifswald, Germany.

THE INDEPENDENT PROCESSING OF RACE AND EMOTION CUES WHEN PERCEIVING FACES

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Descriptors: race, emotion, ERP

Models of face perception have previously been interpreted as supporting the hypothesis that race and emotion information are processed independently and in parallel, but this conclusion had not yet been empirically tested. We examined the issue by assessing attentional orientation to racial cues and facial expressions as participants viewed Black and White happy, angry, and neutral faces during a race categorization task and an emotion categorization task. In addition to addressing whether race and emotion information are processed independently, we also examined the time course of this processing and determined how these early perceptual processes impact later explicit categorization judgments. Specifically, we focused on four components previously measured in race and emotion perception research: the N100, P200, N300, and P300. At each time point, we replicated past race and emotion effects. That is, initially participants attend to Black faces and angry expressions at the N100 and P200. Attention then shifts to those they would prefer to individuate in the N200 (White faces and happy expressions). Finally people reorient to angry expressions that are goal relevant in the emotion task. These effects also predict response latencies. Importantly, we find no interaction between race and emotion effects at any point in time. These findings support past posits that race and emotion are processed fast and independently.

CHILDHOOD TRAUMA AS A MODERATOR OF THE RELATIONSHIP BETWEEN RESPIRATORY SINUS ARRHYTHMIA AND POST-TRAUMATIC STRESS SYMPTOMS IN RETIRED POLICE OFFICERS

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Descriptors: anxiety disorders, RSA, police officers

Prior research suggests that adult survivors of child trauma are more likely to suffer psychiatric distress and to show abnormalities in emotion-related physiology. This poster asks whether childhood trauma moderates the relationship...
between respiratory sinus arrhythmia (RSA) and Post-traumatic Stress Disorder (PTSD) symptoms among 40 retired police officers with high occupation-related trauma exposure. Participants viewed a video depicting police-related traumatic events while their respiratory physiology was continuously monitored. Child trauma moderated the relationship between RSA and PTSD symptoms. In particular, significant relationships between peak RSA during the stressful video and hyperarousal symptoms \((r = .82, p < .01)\), avoidance symptoms \((r = .59, p < .05)\), and total PTSD symptoms severity \((r = .57, p < .05)\), and between peak RSA after the stressful video and re-experiencing symptoms \((r = .52, p < .05)\), were observed among retired officers who experienced child trauma. These relationships were not found in the group without childhood trauma. These elevated RSA findings associated with higher PTSD symptoms suggest that those officers with both childhood trauma and high PTSD symptoms had greater difficulty regulating their emotions, particularly while exposed to trauma cues. These findings identify an important correlate of PTSD symptoms in officers exposed to childhood trauma.

**CHANGES IN BREATHING PATTERN DURING THE PRESENTATION OF EMOTIONAL FILMS AND PICTURES IN ASTHMATIC AND NON-ASTHMATIC PARTICIPANTS**

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Descriptors: respiration, asthma

Previous studies suggest that emotions cause changes in breathing pattern, but findings are inconsistent. We suspected that part of this inconsistency is due to variations in emotion induction methods. We therefore compared effects of films and still pictures in one study. We also sought to study differences between healthy participants and patients with respiratory disease, and whether an anticholinergic medication would affect these differences. Two parallel subsets of unpleasant, neutral, and pleasant films and pictures were shown three to eight days apart. Forty minutes prior, participants (53 asthmatics, 25 controls) inhaled a placebo or the medication (ipratropium 40mcg) in a randomized, double dummy, cross-over design. Indices of timing, volume, and flow were extracted from the recorded breathing patterns (LifeShirt System). Findings confirmed method specific changes in timing parameters, with overall faster breathing during films compared to pictures. Also, inspiratory flow and minute ventilation increased during films and decreased during pictures. In addition, an emotional arousal effect was found with an increasing in ventilation (respiration rate, respiratory drive, and minute ventilation) during pleasant and unpleasant states compared to neutral states. In tendency, this pattern was dependent on the induction method. Medication and group assignment had only minor systematic influences on the observed breathing pattern changes. We conclude that the role of induction methods should be considered when comparing emotion effects on respiration across studies.

**WHO SHOWS ANGER WHEN PLAYING A VIDEO GAME? THE INFLUENCE OF COLLECTIVISM ON FACIAL EXPRESSIVITY IN A CONFLICT SITUATION**

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Descriptors: EMG, emotion, collectivism

Display rules refer to the set of social norms that guide the appropriate display of facial expressions. They tell us to whom and in what context it is appropriate or inappropriate to express various emotions. During a conflict situation, different factors affect the adherence to display rules such as level of collectivism and the type of interaction partner. Matsumoto (1996) suggested that people with a collectivist orientation suppress negative emotion displays to maintain a good relationship with in-group members, but are more likely to display negative affect towards out-group members, for individualistic individuals the reverse is expected.

**EFFECTS OF MOTIVATIONAL ACTIVATION ON PROCESSING OF HEALTH MESSAGES**

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¹Indiana University, ²Texas Tech University

Descriptors: health, motivation, individual differences

This study investigates the extent to which negative and positive television substance abuse prevention messages activate the appetitive and aversive motivational systems and whether individual differences in resting levels of motivational activation influence that activation and subsequent message processing. The Motivational Activation Measure (MAM) was used to measure individual differences in appetitive and aversive activation and reactivity. Results show that negative messages activate the aversive system (increased corrugator, facilitated startle) while positive messages activate the appetitive system (increased zygomatic activity, inhibited startle). Further, there is strong evidence that individual differences in motivational activation, indexed by MAM, predict differences in the level of appetitive and aversive activation elicited by the messages and the subsequent processing of the message content. As expected, those with more active aversive systems reported feeling more negative (during negative messages) and demonstrated facilitated startle magnitude, greater corrugator activity, increased skin conductance response, and decreased heart rate compared to those with low aversive activation. Similarly those with high appetitive activation paid more attention to and felt more positive during all messages (positive and negative) and had inhibited startles, lower heart rate, less corrugator activity, more zygomatic activity, and remembered more information from the messages.

This research is supported by the National Institute of Drug Abuse (NIDA RO1DA12359-0A).

**REACTIVITY TO RISKY PRODUCTS: IS MOTIVATIONAL ACTIVATION APPETITIVE OR AVERSIVE?**

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¹Indiana University, ²Texas Tech University

Descriptors: risky products, appetitive and aversive motivational activation, individual differences

This paper investigates how images of risky products (alcohol, condoms, cigarettes) activate the appetitive and aversive motivational systems and how individual differences in motivational system activation (measured by MAM) modify those responses. Participants viewed 30 still pictures of risky or non-risky products. Facial EMG, startle, HR, and SC were recorded. Participants rated their emotional responses and completed a recall test. Results show that risky products activate the motivational systems. The findings are in line with research that shows stronger appetitive compared to aversive activation in response to risk related cues indicated by slower HR, less corrugator muscle activity, and higher positivity ratings in response to risky products. In addition, risky products elicited larger SCRs and were remembered better than non risky products. The results also show that individual differences in motivational activation level modified these effects. Those high in appetitive activation had even stronger appetitive reactions to risky products compared to those low in positivity offset indicated by significantly slower heart rate, less corrugator activity, smaller star-
acronyms reveal the effects of familiarity and regularity on the N400 ERP component

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Descriptors: language, ERP, N400

Current views of visual word recognition derived from the electrophysiological literature suggest that orthographic regularity is a key factor for triggering semantic access. These claims are based on the finding that regular pseudowords elicit robust N400 repetition effects regardless of whether or not they were derived from real words (Deacon et al., 2004), suggesting that while orthographic regularity is required to initiate the kind of processing reflected in the N400, stimulus familiarity is not. Past studies have noted, however, fully crossed the factors of regularity and familiarity and therefore cannot assess the independent contributions of each. We completed this cross for the first time by recording ERPs to a novel stimulus class: orthographically illegal acronyms. Acronyms are ideal for revealing the contribution of stimulus familiarity to N400 processing since many are completely irregular and yet highly familiar (e.g., DVD). We find robust N400 repetition effects for familiar, illegal acronyms, which are statistically identical in timing, distribution, and amplitude to the repetition effects for unfamiliar, regular pseudowords, and familiar, regular words; unfamiliar, irregular strings of letters, however, elicit no N400 repetition effects at all. We conclude that orthographic regularity cannot be the sole pre-requisite to N400 processing and suggest instead that regularity is a subcomponent of the more general, and more critical factor, of stimulus familiarity.

EEG PHOTIC DRIVING REACTIVITY IN PARTIAL EPILEPSY

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Oswaldo Cruz Foundation

Descriptors: EEG photic driving, partial epilepsy, antiepileptic drugs

In order to reveal latent features of the brain development and functional state alterations in partial epilepsy not apparent in the spontaneous EEG, intermittent photic stimulation at 11 – 17 fixed frequencies of 2 – 24Hz was applied. In 51 treated patients, aged 5 – 18 years, the total percentage of the leads with driving response in the 12 non-visual areas was lower than in 57 normal subjects of the same age (p<0.001, except for delta band). The latter group demonstrated positive correlation of this characteristic with the age. The ‘individual driving profile’ in the two occipital areas, which combined the EEG amplitude spectra at each stimulation frequency from different EEG epochs in a single graph, showed in the theta and delta bands a higher driving magnitude in the patients than in normal subjects (p<0.05). In the control group, such a higher responsiveness to low stimulation frequencies was characteristic of younger subjects. With respect to epileptic patients, these results suggest a possible delay in brain maturation as well as the effect of the antiepileptic drugs. This was indirectly confirmed by a lower percentage of the driving occurrence observed in the non-visual areas in the group of 24 naïve patients as compared to the normal subjects (p<0.05 for the theta band) and by a higher percentage in comparison with the treated patients (p<0.02 for the theta and alpha bands). In 9 of these naïve patients examined after 1 – 2 months of treatment with Carbamazepine, the above percentage decreased significantly in the alpha and beta bands (p<0.05).

SPATIOTEMPORAL DYNAMICS OF GLOBAL/LOCAL PROCESSING: AN EVENT-RELATED OPTICAL IMAGING STUDY

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Descriptors: global/local, optical imaging, task preparation

Visual attention requires a cortical network of activations specifically involving the interaction of parietal, frontal, and occipital regions. The event-related optical signal (EROS) can provide useful information regarding the spatiotemporal dynamics involved in this cortical network due to the method’s good spatial and temporal resolution. We explored the sensitivity of EROS to changes in activation in response to task preparation. EROS was recorded from 16 young adults while they engaged in a task in which they were required to switch between processing global and local aspects of congruent and incongruent stimuli. The presentation of a precue informed them on which aspect (global or local) of the following imperative stimulus to focus on. Behavioral data revealed the predicted main effects: decreased accuracy and longer reaction times on local, incongruent, and switch trials. EROS data revealed temporal information regarding at least three critical cortical regions. Frontal regions exhibited task specific preparation (right-global; left-local) at 281 ms following presentation of the precue. Additionally, occipito-temporal regions showed hemispheric-specific activation (right-global; left-local) in response to switch trials. Finally, right superior parietal areas were activated early for global switch trials (100 ms) and later for local switch trials (307 ms). In conclusion, EROS was able to provide temporal information about the activation of the cortical regions within the network.

MODULATION OF FERN AMPLITUDE BY REWARD EXPECTANCY

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University of Victoria

Descriptors: ERN, reward, prediction error

The feedback error-related negativity (fERN) is a component of the event-related brain potential (ERP) elicited by negative feedback stimuli. According to the
FEAR VS. HUMOR: COLLEGE STUDENTS’ PHYSIOLOGICAL, COGNITIVE AND EMOTIONAL RESPONSES TO ANTI-ALCOHOL ABUSE MESSAGES BASED ON REBELLIOUS RISK-TAKING TENDENCY
Moon J. Lee, & Mija Shin
Washington State University
Descriptors: attention, cardiovascular, EMG

This study investigates the differences in physiological, cognitive and emotional responses to emotional anti-alcohol abuse messages (Fear vs. Humor Appeal) between high risk takers (i.e., rebellious risk takers) and low risk takers. A 2 (Message Type) × 2 (Rebelliousness) × 4 (Message Repetition) mixed model experiment with repeated measures was conducted with 71 college students. The results based on self-reports indicated that fear messages generated more arousal, interest, and perceived danger of excessive drinking regardless of risk-taking tendency. However, for high risk-takers, humor appeals were liked more than fear messages while no significant difference was found among low risk-takers. Even though it was predicted that the fear messages would receive physiologically greater attention and elicit greater arousal responses than the humor messages, the results showed no significant difference in heart rate deceleration between fear and humor messages as well as no main effect of risk-taking personality on physiological arousal, zygomatic muscle activities, and corrugator muscle activities. One interesting finding was that the participants’ physiological responses regarding arousal (indicated by Skin Conductance Response) showed humor messages elicited more arousal than fear messages while their self-reports (indicated by the SAM scale) showed the opposite direction. The implications of the current study as well as suggestions for future study are discussed.

SLOW MOTION? EMOTIONAL!: THE IMPACTS OF SLOW MOTION ON VIEWERS’ EMOTIONAL, COGNITIVE, AND PHYSIOLOGICAL PROCESSING
Seungjo Lee
Indiana University
Descriptors: orienting, facial EMG, cardiovascular

The current study examined the effects of slow motion on the physiological, emotional, and cognitive responses of college participants while watching negative and positive television messages. Forty-nine subjects watched a total of 12 television messages from various genres. Slow motion and valence were fully crossed to create four different blocks (normal speed-positive, normal speed-negative, slow motion-positive, and slow motion-negative). The slow-motion messages were created by editing slow motion into the middle of the messages. Heart rate, skin conductance, and facial EMG data were collected online during message presentation. Results indicate that the onsets of both normal speed and slow motion segments elicited orienting responses as indexed by phasic heart rate change, but the presence of slow motion did not have a predicted larger orienting response. However, the presence of slow motion did elicit a tonic heart rate deceleration after several seconds of slow motion in viewers. Slow motion did not affect viewers’ ratings of experienced arousal or their skin conductance responses. However, slow motion did have some effect on the valence of viewers’ responses. During positive messages, slow motion had no effect on zygomatic activity but increased positive ratings of emotion. While during negative messages, slow motion elicited increased corrugator activation and significantly decreased the liking ratings.

SLOW MOTION? SENSATIONAL!: EFFECTS OF SENSATION SEEKING ON PROCESSING TELEVISION MESSAGES WITH SLOW MOTION
Seungjo Lee
Indiana University
Descriptors: sensation seeking, cardiovascular, skin conductance

This study investigated how the personality trait Sensation Seeking influences the effects of slow motion in emotional video messages on viewers’ physiological responses. College participants watched six normal speed messages and six messages containing approximately 22 seconds of slow motion in the middle. Some theories suggest that high sensation seekers prefer what are called high sensation value messages. These are messages which include more camera and editing techniques (like slow motion). Results supported this prediction with high sensation seeking individuals exhibiting larger orienting responses, indexed by phasic heart rate change, to the onset of slow motion and longer tonic heart rate decelerations during slow motion compared to normal speed. By contrast, low sensation seeking individuals exhibited smaller orienting responses to the onset of slow motion and faster tonic heart rate during slow motion compared to normal speed. However, the larger orienting response to slow motion in the high sensation seeker tends to habituate across presentations. The high sensation seekers showed greater skin conductance activity in the first several seconds of the slow motion segments and less decrease thereafter compared to the low sensation seekers. Further, high sensation seekers free recalled more information from the messages compared to low sensation seekers.

THE ORIENTING RESPONSE, PHYSIOLOGICAL AROUSAL, AND EMG WHEN PROCESSING EMOTIONAL WORDS IN RADIO ADVERTISEMENTS
Sungkyoung Lee, & Robert F. Potter
Indiana University
Descriptors: emotion, orienting

The memory superiority of emotional words and their context is a robust research finding. However, how emotional words affect information processing during mediated messages hasn’t been investigated. In this experiment subjects (n = 55) listened to 8 positive and 8 neutral 60s radio commercials, each containing 6 target words: 2 positive, 2 negative, and 2 neutral. Target word selection was based on the normative valence and arousal ratings of ANEW (Bradley & Lang, 1999) and the ability to fit the commercial’s context. Heart rate, skin conductance, and facial EMG data were collected during the media presentation. Results show only positive words in positive messages caused significant orienting in listeners. SCL analysis show emotional words are more arousing than neutral words across time. Arousal was also higher in neutral messages compared to positive messages across different valence of target words. Results of corrugator muscle activity showed that negative words led to the greatest frown muscle movement. Neutral messages, negative words elicited greater corrugator activity. In contrast, neutral words in positive messages increased corrugator activity right at the onset of the target word. Recognition memory for individual target words show that emotional words are more memorable than neutral words. These results provide empirical evidence that strategic word selection in mediated messages is a low-cost, efficient way for producers to increase the effectiveness of messages.
CORRELATING THE INFORMATION VALUE OF INDIVIDUAL WORDS IN RADIO ADS WITH LISTENER AROUSAL LEVELS ACROSS DIFFERENT TIME LAGS

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Descriptors: arousal, auditory, word entropy

Skin conductance data were collected at 20 Hz from 55 subjects as they listened to 18 actual radio ads which had been transcribed and reproduced by amateur voice talent to control structural features beyond the words themselves. One second aggregations of the SCL data were then visually inspected to select two ads high in arousal variability but also comparable in narrative tone, speed of delivery, and word count. Scripts of these ads were submitted to a cloze procedure in which every eighth word was deleted from the text and replaced by a blank. Different cloze instruments were systematically created and administered to a separate set of subjects such that each word was induced 16 times from script context. Entropy scores were calculated from these data for each function word (those providing syntactic structure) and content word (those reflecting semantic information). Skin conductance levels from the original 55 subjects were then output in 250 ms increments for each ad, and change scores calculated from each previous time point. Means of these change scores were calculated for each word according to its duration across 250 ms increments. Mean change scores were then re-calculated for each word across lags of 250, 500, 750, and 1000 ms. SCL change scores at each lag were correlated with entropy scores. Results show function word entropy had a zero correlation with skin conductance change across all time lags in both ads. Furthermore, content word entropy was significantly and positively correlated with skin conductance change scores at eight of the ten time lags.

YUCK: THE EFFECT OF FEAR APPEAL AND DISGUST IMAGES ON PROCESSING ANTI-SMOKING ADS

Glenn Leshner, Stephanie Miles, Paul D. Bolls, & Erika Thomas
University of Missouri

Descriptors: attention, emotion, media

The purpose of this study was to explore the interaction of fear appeal and disgusting images in anti-smoking television public service announcements on attention and arousal and negative emotional response. A 2 (Fear appeal) x 2 (Disgust eliciting image) x 6 (Ad) x 4 (Order) mixed model repeated measures experiment was conducted. Participants (N = 46) viewed 24 30-s messages. Heart rate, corrugator muscle activity and skin conductance were collected for a five second baseline prior to each message and time-locked to exposure to the messages. Participants also completed an audio recognition test over the ads. Heart rate and corrugator data were analyzed as change from baseline level. Frequency and amplitude of largest skin conductance response were also analyzed. Disgust had a significant effect on heart rate, corrugator muscle activity and skin conductance response frequency. The effect of disgust was more pronounced for low compared to high fear appeal messages. Further, the presence of disgusting images significantly improved audio recognition for low fear appeal ads but significantly decreased recognition for high fear appeal ads. These results suggest that the combination of disgusting images and high fear appeal may lead to anti-smoking ads that are emotionally intense enough to lead viewers to withdraw from processing the message.

REDUCED ACTIVITY IN VENTROMEDIAL PREFRONTAL CORTEX DURING THE REGULATION OF POSITIVE AFFECT IS A NEURAL MARKER OF ANHEDONIA

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Descriptors: anhedonia, emotion regulation, depression

Anhedonia, a reduced ability to experience pleasure, is a chief symptom of major depressive disorder (MDD). Functional magnetic resonance brain imaging was used to investigate the neural responsiveness of 21 MDD patients (mean age 33, 8 males) compared to 18 age matched controls (7 males) during an emotion regulation task involving positive visual stimuli. Participants viewed a sequence of emotionally positive images taken from the International Affective Picture System. Participants were trained to enhance their positive response to images. It was predicted that patients, relative to controls, would derive less pleasure from positive images and this would manifest as attenuated prefrontal cortex (PFC) activity. In the positive maintain condition, controls showed significantly greater ventromedial PFC (vmPFC; p < .01) activation relative to patients. A higher “reward responsiveness” score (Carver & White, 1994) predicted greater vmPFC activation in the positive maintain condition (r = .39, p = .01). A significant regulation (positive maintain, positive enhance) effect (p = .04), and a marginal regulation by group (patient, control) interaction (p = .06) was present in vmPFC. These results suggest that patients had some ability to up-regulate positive affect via an increase in vmPFC activity, but the level of vmPFC activity achieved by patients in the enhance condition did not reach the level achieved by controls in the maintain condition. In sum, patients were not able to potently recruit vmPFC when presented with a positive stimulus and this may be a neural marker of anhedonia.

BLINK STARTLE MODULATION DURING EMOTIONAL WORDS AND FACES PRESENTED BACKWARDLY MASKED AND UNMASKED

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Descriptors: emotion, startle response, subliminal

Blink startle modulation at lead intervals of 60, 120, 240 and 1900 ms was assessed during backwardly masked or unmasked presentations of happy, angry, sad, or neutral schematic faces (Experiment 1, n = 69) and of social threat, physical threat, pleasant or neutral words (Experiment 2, n = 47). Participants were asked to categorize the faces/words on each trial and performed well on unmasked (97 and 88% correct) but at chance on masked trials (25 and 28% correct). Blinks elicited at 240 ms were larger during happy than during sad faces and blinks at 1900 ms were larger during angry and sad than during happy faces in both masked and unmasked presentation conditions. Moreover, blinks at 120 ms were larger during happy faces in the unmasked condition. In Experiment 2, blinks at the long lead interval were larger during social and physical threat words than during neutral and pleasant words in both presentation conditions. Blinks at pleasant words were larger than blinks during all other words at 240 ms in the unmasked and at 120 ms in the masked condition. Blinks were larger during neutral than during all other words at 60 ms in the masked condition. The present results indicate that backward masking does not preclude the affect startle effect, even at long lead intervals, and that the pattern of blink modulation is remarkably consistent for consciously perceived and for subliminally presented word and face stimuli.

This research was funded by the Bial Foundation.

EFFECTS OF TIME-OF-DAY AND TASK DIFFICULTY ON ERP INDICES OF EFFORT AND RESOURCE ALLOCATION

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University of Tasmania

Descriptors: attention, effort, arousal

Cognitive-energetic models of attention suggest effort may be modulated in order to maintain performance during periods of low arousal. Although arousal and performance may vary throughout the day, few ERP studies have found clear time-of-day differences in resource allocation. To determine whether modulation of effort compensates for variations in resource availability, 45 participants completed two experiments at 9am, 1pm or 5pm. In Experiment 1, participants responded to potential accident scenes during single and dual 3-stimulus oddball tasks. Although time-of-day differences were not expected during the single task, P3 amplitude increased throughout the day during the single and dual tasks suggesting either an increase in effort or resource availability. Experiment 2 was conducted to determine whether modulation of effort could account for these
changes in P3. Participants completed 2- and 4-choice reaction time tasks which required responses to targets preceded by standard and “extra effort” cues. Modulation of effort (CNV) was found such that there was a decrease at 5pm. Task difficulty interacted with time-of-day such that compared to CNV at 9am, amplitude was greater during the hard task at 1pm, but reduced during the hard task at 5pm. Effort appears to be greater when arousal is low, particularly during more difficult tasks. However, increases in resource availability, rather than effort, account for increased resource allocation at 5 pm.

POSTURAL REACTIONS AND SKIN CONDUCTANCE RESPONSE TO AFFECTIVE STIMULI IN THE PANIC DISORDER
Fabiana L. Lopes, Tatiana M. Azevedo, Eliane Volchan, Luiz A. Imbiriba, Rafael C. Freire, & Antonio E. Nardi
Federal University of Rio de Janeiro

Descriptors: panic, fear, visual

Classical conditioning has been used as a model for understanding panic disorder. Since defensive posture and autonomic arousal are measurable conditioned responses, we performed a posturographic study among 29 patients with panic disorder (PD) and 29 healthy controls. Skin conductance and displacement of the center of pressure were recorded. The subjects stood on a force platform while viewing the panic relevant pictures and the neutral ones. The panic relevant pictures were selected by an independent sample of patients with PD. A comparison between the groups showed that patients with PD presented with a decrease in the amplitude of sway (area and standard deviation in both medial-lateral and antero-posterior axes), with an increase in the medial-lateral and antero-posterior mean power frequency and with a significant increase in the amplitude of skin conductance response. These findings presented no relation with the valence of the pictures. When we compared panic relevant pictures to neutral ones in a sample of panic disordered individuals, we observed an increase in area and in antero-posterior velocity of sway. These results suggest that patients with panic disorder have a freezing-like behavior related to the state of anticipatory anxiety and a destabilizing pattern in the specific PD context which might indicate a flight response or a fail of the homeostatic brain.

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ACCELERATORS VS. DECELERATORS: CARDIAC DEFENSE RESPONSE PREDICTS LEARNED FEAR
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Descriptors: aversive conditioning, cardiovascular, startle response

Cardiac acceleration has been interpreted as a component of efferent mobilization, to either avoid an aversive event or to prepare for an overt response. The present study explored aversive learning in subjects differing in their cardiac defense response (CDR; Vila & Fernández, 1989) to an unexpected 110-dB, 500-ms white noise. For this purpose, participants were classified as accelerators (n = 40) or decelerators (n = 33) based on a cluster analysis performed on the 2nd accelerative component of the CDR. In a posterior conditioning task, acquisition consisted of 2 blocks of 3 trials each (4 CS+, 4 CS-), with 6-s presentations of erotic or threat scenes as CSs, and a 500-ms train of electric pulses as US. For each block, 6 probes were presented at 2.5 or 4 s after picture onset and 2 during ITIs. Groups did not differ in their psychophysiological and subjective responses to the signaled US. This classification, however, distinguished between participants who showed conditioned differentiation during acquisition, and those who did not. For accelerators, greater skin conductance changes were obtained to CS+ than to CS- throughout the two blocks of acquisition, whereas for decelerators this discrimination was not observed until the second block. Moreover, fear startle potentiation (greater blinks to CS+ than to CS-) was evident in the second block but only for accelerators. These results suggest that the second accelerative component of the CDR is a reliable predictor of learned fear, extending prior findings about differences in conditioning as a function of cardiac reactivity.

EXPLORING THE SPATIOTEMPORAL DYNAMICS OF BRAIN REGIONS INVOLVED IN TASK PREPARATION: A SYNTHESIS OF FOUR FAST EVENT-RELATED OPTICAL IMAGING STUDIES
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Descriptors: preparation, task switching, optical imaging

A series of four studies was conducted to investigate the brain regions involved in dynamically switching between task instructions. In all studies a precue provided specific instructions about the rule to be used on a given trial, but the type of instruction could change from trial to trial. In the first three studies, the precue provided information about the stimulus dimension to be attended (auditory vs. visual, local vs. global or left vs. right visual field) and in the fourth study the precue indicated the type of response to perform (verbal vs. manual). In all studies we recorded the event-related optical signal (EROS), a functional brain imaging technology that relies on changes in the propagation of light through tissue and provides localized spatiotemporal information of neuronal activity. During the preparatory interval, we found three areas of brain activation involved in task switching: the occipital-temporal junction, prefrontal cortex, and inferior parietal lobe. The order of activation of these three regions was consistent across a number of different switch cues. Thus these areas seem to be somewhat insensitive to the specific task being cued and, instead are engaged whenever the current rule is different from a previous one. The EROS data also revealed several task-specific preparatory effects, that is, brain regions that were active only when a particular modality was cued. Together, these results contribute to current models of task preparation by describing the spatiotemporal relationships across brain regions involved in task preparation.

DON’T BOTHER ME: EFFECTS OF A SECONDARY TASK ON MOTIVATED ATTENTION
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Descriptors: emotion, attention, late positive potential

Affective modulation of central and peripheral measures during picture perception may depend on dedicated processing of the affective cue. To investigate this issue, we added a secondary task to a picture viewing paradigm, and examined the effects of task load on the late positive potential (LPP) and peripheral measures known to be modulated by rated picture arousal. Fifty-eight subjects viewed 3 s pleasant, neutral, and unpleasant pictures blocked by valence, with no inter-picture interval. In the task conditions, a continuous series of numbers were presented at the center of the picture screen, changing every 750 ms. The ‘easy’ task required subjects to make a button press whenever a specific number appeared. The ‘hard’ task required that subjects make a button press whenever the target number appeared following an odd number (“+1-back”). A control condition required that subjects simply view the picture blocks. As expected, during the no-task condition, emotionally arousing picture blocks led to greater heart rate deceleration, skin conductance, and positivity in the LPP. Early analyses of peripheral measures suggest that affective modulation was diminished relative to the no-task condition. In the LPP, overall scalp positivity was reduced as a function of task load, while affective modulation was present in all conditions. These data suggest that modulation of the LPP by picture emotionality does not rely on focused attention and may persist despite ongoing visual tasks.

COUNTERMEASURE-PROOF, ERP-BASED DETECTION OF DECEPTION VIA SUBLIMINAL PRIMING
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Northwestern University

Descriptors: P300, deception, subliminal

This study applied subliminal priming to lie detection, immune to counter-measures because of subliminal presentation of stimuli. In Experiment 1, 5s experienced
1 of 4 acquaintances (Ac) or 1 of 4 non-acquaintances (NonAc) names randomly presented subliminally. A supraliminal name (1 of 4 Ac or 4 NonAc) then appeared for 150 ms after the backward mask. The Ac and NonAc in subliminal and supraliminal stimuli resulted in 4 conditions: 1Ac-2Ac;2NonAc-3Ac;3Ac-Non- Ac;4NonAc-NonAc. Ss pressed ‘’Yes’’ to indicate Ac, or ‘’No’’ to indicate NonAc. Ss pressed ‘’No’’ to deny knowing all except 1 Ac. In Experiment 2 (new Ss), the procedures were the same, except subjects were asked to press ‘’Yes’’ to all names except 1 NonAc name. Exceptional presses in both experiments forced attention. With spatial-temporal PCAs on 30 sites, in Experiment 1, four spatial components, (88.34 % variance), and five temporal components (91.39 % variance) were found. MANOVA showed significantly larger amplitudes for condition 2 than condition 1 at the Occipital-Parietal component at 624 – 768 ms and 1016 – 1496 ms temporal components, and at Central-Parietal component in the 624 – 768 ms temporal component (p < .05, Bonferroni). Individual diagnosis was done by bootstrapping of amplitude difference on components from PCA and group results. 12 of 14 subjects (.85.7%) were detected using Occipital-Parietal component at 624 – 768 ms. The detection rates using Occipital-Parietal at 1016 – 1496 ms and Central-Frontal at 624 – 768 ms were both 11/14 (78.6%). In Experiment 2, there were no significant differences.

SEX, BOOZE AND ERPS: PRELIMINARY DISTINCTIONS BETWEEN IMPLICIT AND EXPLICIT ATTITUDES
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University of Missouri-Columbia
Descriptors: implicit attitudes, health, alcohol
Although much research has examined relations between condom use attitudes and safe-sex behaviors and links between alcohol use and sex, the relationships between implicit and explicit measures of these constructs remain poorly understood. This study aimed to clarify relations between implicit and explicit attitudes toward condoms and how these attitudes relate to implicit and explicit attitudes about alcohol, using event-related potentials (ERPs) coupled with behavioral and self-report measures. Participants were 28 undergraduates who completed measures of alcohol-related expectancies and explicit condom use attitudes several weeks prior to the experiment. Participants completed a visual oddball task in which images of condoms, alcohol, and erotic alcohol images were infrequent targets shown among more frequent neutral, positive, and negative IAPS images. Condom images presented in a negative context produced a smaller and slower P300 than condom images presented in a neutral or positive context, suggesting that implicit condom evaluations were less positive than explicit condom attitudes (which were very positive among all subjects). In contrast, P300 to erotic alcohol images and alcohol cues alone indicated positive implicit evaluations, suggesting an evaluative dissociation between attitudes toward condoms and sex or alcohol. These findings point to the utility of using ERPs to augment traditional self-report measures of health-related attitudes.

SCHIZOPHRENIA AND AFFECTIVE PSYCHOSIS SHOW DIFFERENTIAL REDUCTION OF THE FACE-RELATED N170 ERP AT FIRST-HOSPITALIZATION
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Descriptors: schizophrenia, face processing
Pictures of objects elicit a negative event-related potential (ERP) termed N170 (ca. 170 ms post-stimulus). Faces elicit particularly large N170s. In chronic schizophrenia, N170 is reduced to faces but not to other objects. First-hospitalized schizophrenia patients (SCZ), first-hospitalized psychotic affective disorder patients (AFF) and normal controls (CTL) were examined to determine if N170 deficits were present at first-episode and unique to schizophrenia. ERPs were recorded to faces, cars, and butterflies (a button-press target) from 14 SCZ (2 female), 14 AFF (4 female) and 14 CTL (2 female). Average-referenced N170 was examined at posterior electrodes (P9, P10, C3, C4) for faces and cars. SCZ and CTL did not differ in overall N170 amplitudes. N170 was larger over right hemisphere than left (p < .01), and larger for faces than cars (p < .04). Of primary interest, however, was a group x stimulus interaction (p < .05). CTRL showed larger N170 to faces than cars (p < .03), but SCZ showed no difference (p > .93). AFF showed marginally smaller N170 than CTRL (p = .053), and larger N170 to faces vs cars (p < .03). The reduced N170 previously described for chronic schizophrenia patients is present at first hospitalization. Reduced N170 to faces may not be diagnostic of schizophrenia; it is exhibited in AFF. However, the lack of increased N170 to faces relative to other objects (i.e., cars) may be unique to schizophrenia; it appears to be unimpaired in AFF. Differential face processing may be particularly impaired in schizophrenia, even at first hospitalization.

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INCREASED MODULATION FREQUENCY IMPROVES THE SIGNAL-TO-NOISE RATIO OF THE EVENT RELATED OPTICAL SIGNAL (EROS)
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Descriptors: optical imaging, EROS
The Event Related Optical Signal (EROS) reflects fast (millisecond scale) changes in optical scattering of brain tissue directly related to neuronal activity and has been shown to have sub-centimeter spatial resolution. However, compared to ERPs and fMRI, EROS generally yields a lower signal-to-noise ratio (S/N). Typically, EROS is expressed as changes in the photon time-of-flight measured with a frequency domain method based on near-infrared light modulation at radiofrequencies. Here we present data demonstrating significant improvement in the S/N of EROS data as a result of increasing the modulation frequency of the light sources. Eleven subjects viewed a high contrast checkerboard which reversed every 960 ms. EROS data were collected at 62.5 Hz from 160 channels located over occipital cortex. Each source location held two fibers, one emitting light at 980 nm and one emitting light at 830 nm. The modulation frequency was alternated between 110 MHz and 300 MHz across blocks. The average data indicated a significant response in the S/N ratio for the 300 MHz modulation frequency compared to the 110 MHz frequency as well as some advantage for the 830 nm light compared to the 980 nm light. Taken together these manipulations result in an approximately 65% increase in S/N.

EVENT-RELATED POTENTIAL INVESTIGATION OF VISUAL OBJECT CATEGORIZATION AND MEMORY
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Tufts University
Descriptors: vision, memory
Event-related potentials (ERPs) were recorded to degraded line drawings of objects during an indirect memory test to define the time course of visual categorization and long-term memory. Previous research has found that a frontocentral N350 and posterior, late positive complex (LPC) are modulated with object naming accuracy and repetition during an indirect memory test (Schendan and Kutas, 2002; 2003). The earlier N350 is thought to index object model selection and perceptual implicit memory, whereas the later LPC is thought to reflect secondary categorization processes and conscious recollection. The present experiment aimed to compare the N350 and LPC categorization and repetition effects within the same individuals. In addition, categorization effects were explored based on ratings of image classification and using uniformly degraded pictures so that categorized and unidentified images differed primarily in the success of categorization-related processing. Seventeen participants performed the rating and naming tasks on the objects in a continuous repetition paradigm. Results revealed N350 and LPC categorization effects as a function of image classification and naming. Repetition differentially modulated the N350 and LPC, consistent with prior findings suggesting that N350 repetition effects reflect perceptual implicit memory, whereas the LPC effects reflect explicit conscious
recollection. The N350 and the LPC are thus direct neurophysiological measures of distinct categorization and long-term memory processes with visual objects in the human brain.

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LINKS BETWEEN OVERREACTIVE DISCIPLINE PRACTICES AND LOW ELECTRODERMAL RESPONDING IN MIDDLE CHILDHOOD

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University of Washington

Descriptors: skin conductance, ANS, parenting

Low electrodermal responding (EDR) has been consistently linked with both trait impulsivity and antisocial behavior across the lifespan. Recent evidence suggests that environmental influences including parenting may amplify these EDR deficiencies. However, further research is needed to clarify how parenting relates to children’s EDR functioning. In the present study, a series of hierarchical regression analyses were used to explore links between overreactive parenting (e.g., anger and irritability during discipline encounters) and children’s EDR amplitude during baseline, emotion-evocation, and a monetary reward task. A sample of 170 children (mean age = 9.88; 34% female) were recruited to participate in a study of risk for psychopathology in childhood. Overreactive discipline was linked with lower EDR among children at baseline ($\beta = -.16$, $p < .01$). Furthermore, parental overreactivity was related to smaller changes in EDR from baseline to mood induction ($\beta = -.19$, $p < .01$) and from baseline to reward ($\beta = -.21$, $p < .01$). These findings may have important implications for the development of EDR deficits, and suggest further study of links between parenting and psychophysiological functioning.

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ERP RESPONSES TO FRENCH PHRASE STRUCTURE VIOLATIONS

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Descriptors: ELAN, syntax processing, french

Certain word-category violations causing phrase structure disruptions generate a particular event-related potential (ERP), the early left anterior negativity (ELAN). This negative waveform appears between 100 and 300 ms post-stimulus onset and is reported more in the auditory than the visual modality. The majority of the studies reporting this component utilised German or English stimuli; there are no studies reporting the ELAN using French sentences. The purpose of this study is to determine whether French word-category violations (e.g., a verb in a noun position) elicit an ELAN. University students ($n = 26$) performed a grammaticality task in which 450 sentences of varying length (5, 8 and 15 words) were visually presented word-by-word. The position of the violation was either in the middle (in 8 and 15 word sentences) or at the end of the sentence (5 word sentences). Participants responded by button press on the correctness of the sentence at the end of each sentence. No ELAN could be identified in the different violation positions despite high visual contrast and fast stimuli presentation rate (prerequisites for an ELAN in addition to the phrase structure disruption). Despite the lack of ELAN, the ERPs did produce an N400-like negativity followed by a P600 at centro-parietal electrode sites in mid-sentence position conditions. (The N400 may be due to the violation occurring at the end of a semantic unit [noun phrase], while the P600 would indicate syntactic repair of the violation.) Potential reasons for the lack of an ELAN are discussed.

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THE EFFECT OF CHRONIC TINNITUS ON DIVIDED ATTENTION

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Descriptors: ERP, tinnitus, divided attention

Tinnitus is the conscious experience of sound that originates wholly within the auditory nervous system and has been linked anecdotally with cognitive failures and impaired task performance. Few studies have examined systematically and experimentally whether tinnitus affects core cognitive processes such as attention. Twelve adult male participants who reported having constant bilateral or unilateral tinnitus for more than two years completed a single and a dual task while EEG and behavioural measures were taken. Participants with tinnitus were less accurate in detecting the target in both the single and dual task conditions, and showed larger differences in accuracy between the dual and single task conditions compared to the control group. Participants with tinnitus showed longer latency event-related potential components (P3a and P3b) and larger amplitude P3a particularly in the right hemisphere compared to control participants. Tinnitus sufferers also showed larger amplitude P3b under single in comparison to dual task conditions. These results suggest that tinnitus interferes with effortful, controlled processing.

PERCENTAGE OF CARBOXYHAEOMOGLOBIN IN SMOKERS: ATTENTIONAL BIASES FOR SMOKING CUES

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Descriptors: carboxyhaemoglobin, smoking, attention

Biases in selective attention for smoking-related cues appear to be a key feature of maintenance of smoking behavior. However, little is known about the influence of physiological variables on these biases, such as the % of carboxyhaemoglobin (%COHb) in the blood. Using a visual probe task with 2 durations of pictures (500, 2000 ms), our study examined automatic and voluntary attentional shifts to smoking cues in 43 nonsmokers and 51 smokers. The latter group was subdivided into 34 low %COHb smokers and 17 high %COHb smokers based on expired carbon monoxide concentration (converted to %COHb) just before starting the attentional test. Subjective ratings of valence, arousal and urge-to-smoke of the pictures were also obtained. As expected, smokers, but not nonsmokers, (a) showed faster reaction times to probes replacing smoking cues than to those replacing control pictures at 500 ms duration (but not at 2000 ms), and (b) rated smoking cues as more arousing and prompting greater urge-to-smoke than control ones. Interestingly, this automatic attentional bias towards smoking cues was mediated by %COHb, as only low %COHb smokers were faster to probes replacing smoking vs. control pictures, whereas high %COHb smokers did not. Surprisingly, smoking pictures were rated as more pleasant and arousing and prompted greater urge-to-smoke for high %COHb smokers. In sum, our data suggest that biased visual orienting to smoking cues at an automatic level of processing is more related to smokers’ physiological variables, as %COHb, than to conscious evaluations of smoking-related cues.

DECISION MAKING AND THE SOMATIC MARKER HYPOTHESIS: EMOTIONAL AROUSAL AND AFFECTIVE VALENCE

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Descriptors: emotion

According to Damasio’s somatic marker hypothesis, somatic markers are bodily responses that can provide unconscious signals that precede, facilitate or guide decision making. We studied if somatic markers depend more on the arousal level than on the affective valence evoked by the anticipation of a decision. Thus we...
recorded psychophysiological indices that have been previously related to arousal (skin conductance) and to affective valence (heart rate, and activity of the zygomaticus major and corrugator supercili muscles) from 80 subjects, while they performed a computerized Spanish version of the Iowa Gambling Task. Autonomic responding, increases in skin conductance level and heart rate slowing, anticipated the selection of disadvantageous decks, and this effect was more pronounced in good performers and when high punishment frequency decks were selected. Anticipatory responses are indicating an increased emotional arousal with higher autonomic and skeletal muscle (zygomatic) responding in anticipating, anticipated the selection of disadvantageous decks, and this effect was more pronounced in good performers and when high punishment frequency decks were selected. Anticipatory responses are indicating an increased emotional arousal with higher autonomic and skeletal muscle (zygomatic) responding in anticipation of disadvantageous choices, rather than an affective, valence guided, reaction. These results give also support to the idea that a certain level of arousal is needed for physiological responses to appear.

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A TEST OF FUNCTIONAL SIGNIFICANCE OF THE ERROR-RELATED NEGATIVITY IN OBSERVERS
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Descriptors: ERN, reinforce-learning hypothesis, observed error

Several studies have reported that the error-related negativity (ERN) is elicited not only when participants commit errors but also when they observe others’ errors (Miltner et al., 2004). The functional significance of the observer’s ERN is still unclear. The generic error-detection (ED) hypothesis and the reinforcement-learning (RL) hypothesis predict different results depending on the situational context between a performer and an observer of a choice reaction-time task. In a “Win-Win” situation, both performer and observer are monetarily rewarded for correct responses and monetarily punished for error responses. On the other hand, in a “Win-Lose” situation, the observer receives monetary gain for the performer’s errors and loses for correct responses. The ED hypothesis predicts the observer’s ERN is elicited whenever the performer makes an error regardless of its positive or negative outcome for the observer. In contrast, the RL hypothesis predicts the ERN is elicited by observed errors only in the Win-Win condition, because the performer’s errors are good events for the observer in the Win-Lose condition. We tested if the observer’s ERN supports the prediction of the ED hypothesis or the RL hypothesis. The observed errors elicited a small negative component about 250 ms after error responses in both Win-Win and Win-Lose conditions. However, the observation of correct responses also elicited a small negativity in the Win-Lose condition. The results suggest that the observer’s ERN might represent both the generic error-detection and reinforcement-learning processing.

HAND PLACEMENT AND RESPONSE COMPLEXITY AFFECT INDEPENDENT AND MOTORIC PROCESSING STAGE: AN LRP ANALYSIS
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Descriptors: lateralized readiness potential, motor programming, hand placement

Behavioral studies suggest that hand placement (i.e., uncrossed vs. crossed hands) and response complexity (i.e., simple vs. sequential responses) affect independent motor-related stages of information processing. Here we investigated the functional loci of these variables by using the lateralized readiness potential (LRP). Japanese participants responded to written kanji characters meaning “left” and “right” by pressing left and right buttons, respectively. In the simple condition only index finger presses were required; in the complex condition, responses consisted of sequences of key presses (i.e., index -> ring -> middle fingers). Responses were made either with crossed or uncrossed arms. The four conditions obtained by the factorial combination of hand placement and response complexity were tested block-wise. The EEG was recorded from 128 electrodes and the EMG was recorded from M. interossei dorsales I. LRP onset was measured with respect to the stimulus and the onset of the EMG. Reaction times (RTs) showed strong main effects (F > 35) of response complexity and hand placement but no interaction between these variables (F = 1.39). Very similar effect patterns were present in EMG onsets and in the LRP-to-EMG onset intervals. In contrast, the stimulus-locked LRP was unaffected by the experimental factors. These result patterns are strongly suggestive that hand placement and response complexity indeed affect separate processing stages that are localized between response selection and peripheral muscle activation.

MODULATION OF CARDIAC DEFENSE BY AFFECTIVE SOUNDS
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Descriptors: cardiac defense response, affective stimuli, emotion

Modulation of defensive reflexes, such as eye-blink startle and cardiac defense, by viewing affective pictures has been extensively reported in the scientific literature. Eye-blink startle has also been shown to be modulated by hearing affective sounds. However, no data have been reported concerning modulation of cardiac defense by affective sounds. This study examines the effect of listening to 3 types of emotional sounds (pleasant, neutral, and unpleasant), selected from the International Affective Digitized Sounds, on the subsequent evocation of the cardiac defense response (CDR) by an intense white noise. Participants were 90 students (60 women). The psychophysiological test consisted of a 10 min rest period followed by 3 blocks of affective sounds. Each block consisted of 2 trials presenting the same affective sound during 5 s, either followed or not followed by the defense noise, in counterbalance order. Order of block presentation was also counterbalanced. The defense noise was a white noise of 105 dB, 500 ms, and instantaneous risetime. Results showed a heart rate response to the affective sounds similar to the CDR reported to affective pictures: a greater and more prolonged deceleration to the unpleasant than to the pleasant sound. Results concerning the CDR to the defensive noise showed a clear modulation by the preceding stimulus: a sustained acceleration to the unpleasant sound and a sustained deceleration to the pleasant sound. In both cases, however, the magnitude of the CDR was attenuated compared to the same response when preceded by affective pictures.

AFFECTIVE MODULATION DURING DIFFERENT PHASES OF SCHIZOPHRENIA I: STARTLE EYE BLINK REFLEX
Kristopher I. Mathis1, Gretchen L. Sholtz1, Terrance J. Williams1, Peter Bachman1, Keith H. Nuechterlein1, Tyrone D. Cannon1, Michael F. Green1, Kenneth L. Subotnick2, Peter J. Lang2, & Cindy M. Yee-Bradbury1
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Descriptors: emotion, schizophrenia, startle response

Studies of schizophrenia patients have demonstrated a normal pattern of affective modulation of the startle eye blink reflex, such that images with a more positive valence attenuate the reflex and images with a more negative valence potentiate the reflex (Curtis et al., 1999). Among healthy individuals, an investigation into the effects of specific emotional content revealed a unique pattern of response that largely reflects the motivational activation related to the nature of the image (Bradley et al., 2001). Pictures depicting human or animal attack, for instance, elicited marked defensive activation as compared with responses to unpleasant but less arousing images. Appetitive motivation is similarly engaged, with greater startle modulation associated with more arousing images. To investigate a possible dissociation of valence and arousal on motivational response during different phases of schizophrenia, the current project applied this paradigm in the study of prodromal, first-episode and chronic schizophrenia patients. Examination of the startle eye blink to the specific emotional content of the pictures revealed the expected pattern of effects among healthy comparison subjects, with arousal enhancing potentiation of the blink reflex to aversive images. The patient groups, in contrast, appeared to exhibit much less variability in response across
AFFECTIVE MODULATION OF SPINAL NOCICEPTION AND PAIN: THE EFFECT OF PREDICTABLE NOXIOUS STIMULATION

Lauren J. Maynard, Amy E. Williams, Klanci M. McCabe, Jennifer L. Russell, & Jamie L. Rhudy
University of Tulsa

Descriptors: pain, nociception, motivation

Emotion modulates nociception and pain resulting from unpredictable noxious electric stimulation. Predictable noxious stimulation may reduce negative affect and stress during testing, making pain testing easier to tolerate; however, it is unclear what effect predictability will have on nociceptive outcomes. The present study examined the influence of emotion on pain and spinal nociception (nociceptive flexion reflex, NFR) resulting from predictable or unpredictable noxious shocks to the sural nerve. To induce emotion, IAPS pictures (attack, neutral, erotic) were presented in random order and noxious stimuli were delivered randomly during picture-viewing. NFR magnitudes and pain from stimulations were recorded. For half of the participants (n = 25), shocks were always preceded by a 6 s green light cue (predictable); the others (n = 25) received no cue (unpredictable). Irrespective of predictability, pain was always inhibited by positive emotion and enhanced by negative emotion. However, spinal nociception (NFR) was only modulated in parallel with pain ratings when noxious stimuli were unpredictable. The NFR was not modulated by emotion when noxious stimuli were predictable, an effect that was not due to complete inhibition of the NFR, because the NFR was still elicited by noxious stimulations. These data imply that separate mechanisms are responsible for emotional modulation of spinal nociception and evaluative pain and that predictability may disengage modulation at spinal levels. This work was supported in part by a Faculty Development Summer Fellowship from The University of Tulsa.

ANTICIPATORY FEAR OF A SOCIAL ENCOUNTER DELAYS STARTLE HABITUATION

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Descriptors: fear, startle response, social

The acoustic startle eyeblink response has been used in previous research as an index of fear and aversive affect. The present study investigated the effects of threat of a social encounter and the experience of a social encounter on startle eyeblink reactivity in 34 healthy college participants. Startle eyeblink responses were elicited by a 50 ms duration, 100 dB burst of noise, in 5 blocks of 8 startle trials each. Each participant’s state anxiety (Spielberger’s State-Trait Anxiety Inventory) and emotional affect (PANAS) were measured after each block of startle trials. After the first block of trials, the Encounter group was told that they would be observed later in the experiment by a person who would be in the testing room with them (anticipation). This social encounter took place during the interval between the second and third block of trials. The anticipation of a social encounter delayed startle habituation, compared to that seen in the Control group, and also increased state anxiety and induced more negative mood. However, startle reactivity, state anxiety, and mood did not differ between the groups after the social encounter had passed. These results demonstrate that anticipatory fear and anxiety about a social encounter delay the habituation of the startle response, analogous to fear potentiation of startle, and that completion of the encounter represents a relief from this anticipatory fear.

AFFECTIVE MODULATION OF AUTONOMIC RESPONSES TO NOXIOUS ELECTRIC STIMULATION: VALENCE AND AROUSAL CONTRIBUTE

Klanci M. McCabe, Jennifer L. Russell, Lauren J. Maynard, Amy E. Williams, & Jamie L. Rhudy
The University of Tulsa

Descriptors: nociception, emotion, motivation

Emotional valence modulates nociceptive reactions to noxious sural nerve stimulation (eg, nociceptive flexion reflex, pain). Recent data suggest that valence also
modulates autonomic responses (skin conductance response, SCR; heart rate acceleration, HR) resulting from noxious stimulation. According to motivational priming theory, emotional intensity (arousal) should also contribute to modulation, with more intense/arousing emotions being associated with greater modulation. The present study examined the independent effects of valence and arousal on autonomic reactions to noxious stimuli. Noxious electric stimulations to the sural nerve were randomly delivered during IAPS pictures that varied in valence [unpleasant (loss, attack), neutral (household objects), pleasant (food, erotica)] and arousal [low (neutral), medium (loss, food), high (attack, erotica)]. SCR and short-latency HR acceleration resulting from noxious stimulation were assessed, standardized within individual, averaged by picture category, and ordered for polynomial trend analysis (attack, loss, neutral, food, erotica). It was predicted that responses would be enhanced during unpleasant pictures (more so by attack) and inhibited during pleasant pictures (more so by erotica). Results suggest that valence and arousal both contribute to modulation of autonomic responses, with linear trends explaining 39% of the variance in SCR and 47% in HR acceleration (ps < .05). No higher order trends were significant.

This work was supported in part by a Faculty Development Summer Fellowship from The University of Tulsa.

**AFFECTIVE MODULATION OF AUTONOMIC RESPONSES TO NOXIOUS ELECTRIC STIMULATION OF THE SURAL NERVE**

Klani M. McCabe, Amy E. Williams, Jennifer L. Russell, & Jamie L. Rhudy
The University of Tulsa

Descriptors: nociception, emotion, motivation

Emotional valence modulates nociceptive reactions to noxious stimulation (nociceptive flexion reflex, subjective pain). It is unknown however, if valence also modulates other psychophysiological reactions to noxious stimuli. This study examined the impact of affective picture-viewing (IAPS) on autonomic reactions (skin conductance response, heart rate acceleration) resulting from noxious electric stimulation to the sural nerve. Pictures varying in affective valence (attack, neutral, erotica) were presented to 53 participants, during which electric stimuli were randomly delivered (balanced across picture valence). Skin conductance response (SCR) and short-latency heart rate acceleration (HR) were measured, standardized within-individual, and averaged by picture valence. Results suggest that SCR and HR acceleration were modulated in parallel. Responses were larger during unpleasant pictures than pleasant pictures. Valence linear trends individually explained 14% of the variance in SCR and 23% in HR acceleration. When SCR and HR acceleration reactions were analyzed simultaneously with two other nociceptive reactions (nociceptive flexion reflex magnitudes and pain ratings) using MANOVA, the valence linear trend explained a total of 52% of the variance in the four responses.

This work was supported in part by a Faculty Development Summer Fellowship from The University of Tulsa.

**USING EVENT-RELATED BRAIN POTENTIALS TO STUDY CATEGORICAL SPEECH PERCEPTION IN CHILDREN**

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Descriptors: ERP, categorical perception, language

Eleven university students (23.8 years, SD = 2.27) and 26 children (6 to 12 years) underwent event-related potential (ERP) testing during simultaneous completion of a /ba/-/da/ forced-choice categorical perception task (adapted from Maiste et al., 1995). It was sought to determine if ERPs could be used to index categorical speech perception (CP) in school-age children. The children also underwent phonological awareness (PA) and non-word decoding testing. Stepwise regression was used to determine whether basic reading skill development related to differences in categorical perception. Stimuli were syllables ranging from /ba/ to /da/ on a 9-point place-of-articulation continuum, presented in a modified oddball paradigm (52% standard, 6% each of 8 deviants). Adults perceived the stimuli categorically, shown by the shape of their stimulus ID curves and differentiation between the stimuli in terms of N2b-P3b amplitude. Children under 8 years of age showed no N2b-P3b, but prominent P100-N250 waves and shallower stimulus ID curves. Children over 8 years of age showed ERP configurations and ID curves observed to more closely resemble the adults (though not statistically significant). Regression analysis revealed chronological age (CA) to be the best predictor of ID curve slope (p < .01) and scores on the Elision PA task to be the best predictor of ID curve slope with CA removed from the model, suggesting a maturational link between cognitive processes required for CP and Elision. The ERP paradigm was found to be reliable for studying CP in adults, although not yet for children.

Funding provided by the Nova Scotia Health Research Foundation and the Scottish Rite Charitable Foundation of Canada (Graduate Student Award).

**CREATINE SUPPLEMENTATION, SLEEP DEPRIVATION, CORTISOL, MELATONIN AND BEHAVIOR**

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Descriptors: creatine supplementation, sleep, hormones

The effect of creatine supplementation on cognitive performance, salivary cortisol and melatonin concentrations, effort and mood during and after 36-hours sleep deprivation with intermittent moderate intensity exercise was examined. Creatine plays a major role in energy supply for the brain but is affected by sleep deprivation. Therefore, creatine supplementation should lessen the negative effects of sleep deprivation. Subjects were divided into a creatine group (n = 10) and a placebo group (n = 9). They took 5 g of creatine monohydrate or a placebo, dependent on their group, 4 times a time a day for 7 days immediately prior to the experiment. The study was double blind. Subjects were examined for random number generation (RNG), number recall, choice reaction time, mood, effort and salivary concentrations of cortisol and melatonin at baseline and after 18, 24 and 36 hrs of sleep deprivation. A significant effect of creatine supplementation was shown for RNG at 18, 24 and 36 hrs. Mood deteriorated while effort increased during sleep deprivation. Delta cortisol and melatonin were moderate predictors
of mood. It was concluded that creatine supplementation only affects central executive tasks and that increases in effort can overcome the debilitative effect of sleep deprivation.

This study was funded by the Howard Foundation of Cambridge, UK.

**APPREHENSION, AVOIDANCE, & AGORAPHOBIA: PSYCHOPHYSIOLOGY OF PANIC DISORDER**

Lisa M. McTeague, Craig D. Marker, Joshua R. Shumen, Marie-Claude Laplante, Margaret M. Bradley, Bruce N. Cuthbert, & Peter J. Lang

University of Florida, University of Minnesota

Descriptors: emotion, panic, imagery

According to the diagnostic canon, panic disorder is fundamentally defined by chronic physiological hyperarousal and defense system hypersensitivity. Thus, with increasing endorsement of panic-related apprehension, sensitivity to interoceptive cues, and agoraphobia, clinician-rated severity and functional interference reliably increase. However, these criteria are founded upon verbal report. How does the objective measurement of physiological reactivity covary with dimensional interview and self-report indices of panic symptoms? As symptom-severity worsens, does the defensive physiology of panic disorder show similarly elevated reactivity? To address this possible covariation, individuals experiencing panic disorder with (n = 45) and without agoraphobia (n = 20) were cued by six-second auditory scripts that varied in valence and arousal as prompts for emotional imagery. Psychophysiological measures included the startle reflex and responses in heart rate, skin conductance level, and facial electromyography. Paradoxically, defensive reactivity and symptom-severity showed an inverse relationship such that increasing anxiety sensitivity, agoraphobic avoidance, and apprehension of panic predicted reduced defensive reactivity. Therefore, unlike phobic disorders, which show defense system hyperactivity with increasing symptom severity, the chronic and pervasive apprehension characteristic of panic disorder potentially impairs appropriate physiological mobilization during defensive responding.

**ATTACKING ANIMALS, LEERING AUDIENCES, & THE PSYCHOPHYSIOLOGY OF SOCIAL PHOBIA**

Lisa M. McTeague, Joshua R. Shumen, Craig D. Marker, Marie-Claude Laplante, Bruce N. Cuthbert, Margaret M. Bradley, & Peter J. Lang

University of Florida

Descriptors: anxiety, emotion, anxiety disorders

The diagnostic nosology implies that social phobia confers physiological hyperactivity during perceived social threat, but provides no guideline as to whether the defense system should be expected to show otherwise normative levels of engagement during non-clinically-relevant, unpleasant stimulus processing. To address this question, controls (n = 55) and social phobics (n = 61) were cued by six-second auditory scripts that ranged in hedonic valence and arousal (e.g., panic, anger, social & survival threat scenes), as prompts for narrative, emotional imagery. Measures included the startle reflex and responses in heart rate, skin conductance, and facial electromyography. Although social phobics consistently endorsed elevated negative affect (e.g., fear, anxiety, anger, depression) across self-report measures, group differences in physiological mobilization emerged specifically during disorder-relevant imagery. Consistent with ratings of emotional arousal, social phobics showed greater reactivity than controls to social threat scenes. In fact, social phobics showed commensurate reactivity during social and survival threat, whereas controls showed greater reactivity during survival compared to social threat. Consideration of symptom severity revealed that the aforementioned group differences were augmented with more pervasive social avoidance among phobics. In summary, social phobics appear to have intact and appropriate defensive responding to non-social stimuli, coupled with highly circumscribed, exaggerated responding to social threat that increases with symptom severity.

**CROSS-ETHNIC COMPARISONS OF AUTONOMIC NERVOUS SYSTEM ACTIVITY IN AFRICAN-AMERICAN AND EUROPEAN-AMERICAN PRE-ADOLESCENTS WITH AND WITHOUT BEHAVIORAL PROBLEMS**

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University of Washington

Descriptors: cardiovascular, aggression, electrodermal responding

Research consistently shows that adult African-Americans exhibit lower electrodermal responding compared with European-Americans. Fewer studies have investigated racial differences in cardiovascular responding, particularly among child populations. This study examined cardiovascular and electrodermal responding among a group of African-American and European-American preadolescents (n = 68) with and without behavioral problems. As expected, participants with behavior problems exhibited lower electrodermal amplitudes than controls. However, ethnic group differences were also observed in both amplitude of electrodermal responses (p = .08), and cardiac pre-ejection period (p = .01). Consistent with previous research among adults, African-American children in both behavioral groups displayed less electrodermal responding than European-American children. African-Americans showed shortened pre-ejection periods, indicative of greater sympathetic activity. In contrast, there were no differences in heart rate or heart rate variability across the two ethnic groups.

**COMBINING P300 AND SCR IN THE DETECTION OF CONCEALED INFORMATION**


Maastricht University

Descriptors: concealed information test, EEG, skin conductance

In order to test a combination of P300 and skin conductance measures in the detection of concealed information, 30 undergraduates participated in a mock crime experiment. After the mock crime, all participants underwent a guilty knowledge test during which skin conductance and midline EEG were recorded. The guilty knowledge test consisted of 6 questions. For each question, 64 stimuli were presented (8 targets, 8 crime relevant probes, 40 irrelevants and 8 null events), with an ISI of 2.5 s. Overlap between SCRs to successive stimuli was handled by presenting stimuli in a higher order balanced design using M-sequences (Buracas & Boynton, 2002). As a result, each stimulus type was preceded by every other stimulus type equally often, up to the 5th order. In order to derive SCRs, responses were first averaged across each stimulus type within each question. This way, averages of stimulus types with identical histories were created. The average null event was then subtracted, yielding an average response to each stimulus type that is unaffected by previous stimuli. SCR was defined as the maximal positive deflection in this average in the 1 to 5 s. window following stimulus presentation. The results showed that both P300 area (p < .001) and SCR (p = .01) differentiated between probes and irrelevants. Skin conductance responses were, however, much smaller than typically seen in a GKT (mean SCR to the probe = .05 micro Siemens). The results will be discussed in terms of incremental validity.

**AGE DIFFERENCES IN SELF-REPORT AND PHYSIOLOGICAL RESPONSES TO EMOTIONAL IMAGES OF VARIED CONTENT**

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Descriptors: aging, emotion

It has been suggested that there is an increase in the experience of positive emotion during older age. Few studies have used physiological measures to clarify the
nature of age differences in emotional processes, but there is some evidence for increased amygdala activation in response to positive images in healthy older adults. The present study explored whether age differences would be evident in the response to emotional images varying in content. College students and cognitively normal older adults were exposed to positive, neutral, and negatively valenced IAPS images. Self-report measures of valence and arousal, as well as skin conductance responses, the blink component of the startle reflex, and corrugator and zygomatic EMG activity were recorded. Significant age differences were found in self-report measures of valence, with older adults rating the positive images as more pleasant than younger adults. This greater positivity in valence ratings occurred across positive content categories. Within the older group, females rated negative images as more unpleasant and more arousing than males. However, no differences between age groups were found on any of the physiological measures, with the exception of a marginally significant trend for younger adults to show greater startle potentiation of the startle reflex while viewing negative images. Thus, within the present sample, age differences in self-reported positive emotion were not paralleled by physiological differences.

CORTISOL AND CARDIOVASCULAR RESPONSES TO PSYCHOLOGICAL STRESS: VULNERABILITY AND INDIVIDUAL DIFFERENCES

Ana C. F. Mendonça-de-Souza, Gabriela G. L. Souza, Andre Vieira, Eduardo M. Barros, Nastassia L. Fischer, Ivan L. V. Figueira, Vivian Rumjanek, & Eliane Volchan

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Descriptors: cortisol, cardiovascular, stress

Previous studies showed that glucocorticoids play a central role in stress responses. There are, however, substantial differences in cortisol reactivity among individuals. Cardiovascular activation is also part of the acute stress response but there is uncertainty about the relationship between cortisol release and cardiovascular stress responses. We investigated if affective trait and mood induction influence the reactivity to psychological stress. After adaptation, participants viewed either a block of pleasant or unpleasant pictures to induce positive or negative mood, respectively. Then, they had to prepare and deliver a speech in front of a video-camera. Heart rate and salivary cortisol were measured. Affective scales estimated emotional traits. Compared to basal levels, heart rate accelerated during the speech preparation irrespective to the valence of either mood induction or affective trait. However, cortisol response to acute stress was only present for those that viewed unpleasant pictures and scored above the average in the negative affect scale. In conclusion, the heart rate measure of cardiovascular stress response seemed relatively independent of individual affective predisposition and emotional context. Concerning cortisol reactivity, high negative affect associated with an unpleasant context increased vulnerability to acute stress and was critical to induce cortisol release.

MEANING SELECTION IN THE CEREBRAL HEMISPHERES

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Descriptors: lexical ambiguity, cerebral hemispheres, ERP

It has been argued that the left hemisphere selects an ambiguous word’s meaning based on frequency (Burgess & Simpson, 1988) or context (Faust & Chiarello, 1998), whereas the right hemisphere fails to select a specific meaning. Other work suggests that the hemispheres can select different meanings (Titone, 1998). The current study used ERPs to investigate these issues. Each trial involved the following sequence: a centrally-presented prime (related or unrelated to the next word), a lateralized word (ambiguous or unambiguous), and a centrally-presented target (related or unrelated to the previous word). Participants decided if the target was related to the lateralized word. Ambiguous trials involved either the presentation of a dominant-related (DR) prime and a subordinate-related (SR) target (e.g., deposit-bank-river if both prime and target were related), or the reverse (SR prime, DR target). On unambiguous (baseline) trials, primes and targets were related to the same concept. It was predicted that selection of a meaning that was inconsistent with the target would result in a larger N400 amplitude. With right visual field presentation of the lateralized word, the results indicate that the left hemisphere selects the contextually-consistent meaning, but the right hemisphere failed to discriminate the meaning. The results indicate that the right hemisphere fails to select a specific meaning.

HEART RATE VARIABILITY AS A PREDICTOR OF EMOTIONAL REGULATION

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Descriptors: cardiovascular, affective stimuli, regulation

Previous studies showed that high frequency (HF) power of heart rate variability reflects parasympathetic activity. High HF power has been associated with the ability to sustain attention and regulate emotion. In the present study, we tested whether individual differences in the resting HF power correlate with the capacity to attenuate the impact of aversive stimulation during an attentional task. Participants (N = 26) performed a task in which they had to discriminate the orientation of two peripheral bars presented bilaterally (same/different judgment). Simultaneously, either pictures depicting neutral people or mutilated bodies were presented centrally for 200 ms. Participants performed the task under an “attenuating” context where a prior text described the pictures as cinema productions; and under a “real” context where the prior text described them as real scenes. Under the real context, the mutilation pictures significantly interfered in the discrimination task, rendering it slower. Under the attenuating context, the impact of the mutilation pictures on performance varied. The magnitude of the emotional interference under this context was inversely correlated with the amplitude of the HF power (p < 0.05), that is, for participants presenting higher...
basal HF power, the mutilated pictures interfered less or not at all in the task. These results suggest that high levels of vagally mediated heart rate variability are associated with better capacity to cope with the emotional impact of aversive pictures, provided they are presented as fictional.

CAPES, FAPERJ/PRONEX, CNPQ.

SLEEP, DAYTIME SLEEPINESS, AND ATTENTION IN AMYOTROPHIC LATERAL SCLEROSIS

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Descriptors: sleep, ALS, REM

Amyotrophic lateral sclerosis (ALS) is a neurodegenerative disease leading to complete motor paralysis. Because of respiratory impairment and possible neurodegeneration in the brain stem we expect a change in sleep macrostructure, but most notably in REM sleep. Various studies demonstrated that REM sleep deprivation can impair visual procedural skill learning (1). Consolidation of most sensorimotor skills is dependent on specific sleep stages (2). Intact sleep, alertness and attention are essential to learn brain-computer-interface control (1) which allows communication independent of voluntary muscle movement. To determine the effects of ALS on sleep, we conducted nocturnal polysomnography (PSG) assessing quantity of REM sleep by recording EEG, EOG, muscular activity and oxygen saturation. To address the course of changes in sleep pattern, PSG was repeated after 6 months and one year. A multiple sleep latency test (MSLT), maintenance of wakefulness test (MWT) and an auditory/visual P300 using an oddball paradigm were used to evaluate daytime sleepiness and attention. Questionnaires assessed sleep quality, and results will be related to the physiological data. Analysis of 3 ALS patients’ PSG parameters show a total sleep time reduction, reduced or disturbed REM sleep and a prolonged wakefulness duration. Results of MSLT/MWT exhibit no significant increase in daytime sleepiness and non-impaired attention. (1)Stickgold et al., 2000, Nat Neurosci, 3(12):1237 – 8; (2)Walker et al., 2005, Cereb Cortex, 15(11):1666 – 75; (3)Birbaumer et al., 1999, Nature, 25;398(6725):297 – 8.

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CARDIAC REACTIVITY IN GOOD PERFORMERS ON THE IOWA GAMBLING TASK: “RISK AVOIDANCE” AND “SAFE APPROACH” STRATEGIES

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Jaume I University

Descriptors: gambling task, somatic markers, cardiac reactivity

The Iowa Gambling Task is widely used in the study of Damasio’s somatic marker hypothesis. This study explored psychophysiological correlates of good performance on IGT attending to the number and sequence of risky choices. Participants were classified as 12 bad performers (more than 50 risky choices) and 51 good performers (less than 45). The latter group was subdivided into 36 risk-nonquitters (at least 1 risky choice in each of the 5 blocks of 20 trials) and 15 risk-quitters (at least 1 block of 20 trials with no risky choices). For the first 60 trials, heart rate, cardiac output and skin conductance were analyzed preceding risky and safe choices as well as following outcomes. All three groups were sensitive to outcomes (greater HR deceleration after punishment than reward). Bad performers showed no other outcome nor anticipatory changes, suggesting the absence of somatic markers. Good performers reacted differently to risky and safe choices both following outcome and anticipating, showing somatic markers, but each group in a different way. Risk-nonquitters showed greater HR acceleration after safe choices outcomes and greater HR deceleration preceding them. By contrast, risk-quitters showed greater HR acceleration after risky choices, besides greater HR deceleration and CO and SC increments preceding them. These data suggest that somatic markers may be formed and engaged either by attention and approach to safe cues (risk-nonquitters), or by attention and avoidance of risky cues (risk-quitters), and that these strategies seem to be more evident using cardiac measures.

CAN LYING BE DIAGNOSED USING FMRI?

University of Chicago

Descriptors: deception, functional neuroimaging

Prior research has provided fMRI evidence for neural activation related to deception in VLPFC, DLPFC, MPFC, MSFG, and STS. In an illustrative study, Phan et al. (2005) reported these areas of activation in nomic analyses of 14 Ss who were given a modified version of the Guilty Knowledge Test. Using the same data set, we approached the question of classifying individuals as guilty based on their neural responses related to deception. The classification algorithm was based on nomic maps made from a Lie-Truth response contrast based on 13 of the 14 Ss, which were then used as ROIs for predicting the Lie-Truth contrast of the remaining subject. This analysis was iterated 14 times, once for each subject. Nine significant functional ROIs were obtained at both the group and individual levels by applying individual voxel thresholds (p < .01) with a clustering criterion of five contiguous voxels. Individual ROI maps were overlaid on group ROIs to find points of regional overlap, indicating regions where significant activation co-existed in the group and individual analyses. Regions showing the best overlap between group and individual ROIs were MPFC, MSFG, DLPFC, and VLPFC. Classification results indicated that 57% of the Ss showed the predicted activation in at least 5 of the 9 ROIs, whereas 29% showed activation in 0 or 1 of these ROIs. Results were similar when classification was limited to the five most common ROIs, suggesting that individual classification of guilt or innocence using fMRI in the GKT may be subject to considerable error.

SOMATIC SENSORY STIMULATION DURING SOCIAL SUPPORT ACTIVATES ANTERIOR CINGULATE AND INSULAR CORTICES IN CHRONIC PAIN PATIENTS

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Descriptors: chronic pain, social support, brain

Our previous research has revealed that pain perception in chronic pain patients may be influenced by the presence of their significant others. Recently, it has been further shown that affective components of the neural pain network are more activated than sensory components during the experience of another’s pain in healthy controls. In the present study, we investigated whether the presence vs. absence of a patient’s significant other may also differentially influence brain activity of the pain network in chronic pain patients. Ten female patients with fibromyalgia (aged 51.2 yrs) and nine female healthy controls (aged 55.3 yrs) were examined using fMRI when somatosensory stimulation was elicited by non-painful vibratory stimuli at the elbow and at the finger. Significantly greater activations were found in the insula, anterior cingulate cortex (ACC), and secondary somatosensory cortex (SI) in fibromyalgia patients compared to healthy controls when stimuli were applied at the elbow (one of the tender points considered by patients with fibromyalgia) in the presence of the patient’s partner; but no group differences in brain activity were observed when stimuli were applied in the absence of the patient’s partner, or when stimuli were applied at the finger. We concluded that social support from a patient’s significant other in chronic pain patients may activate both sensory and affective components of the brain network involved in pain processing.

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INFLUENCE OF SHORT AND LONG TERM MUSICAL TRAINING ON LANGUAGE-RELATED BRAIN

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Descriptors: learning, language, music

Results of Schöhn et al (2004) and Magné et al (2006) show that musical expertise influences pitch processing in language. We conducted two series of experiments
aimed at specifying the influence of short (8 weeks) and long-term (8 months) musical training on pitch processing in language. All 8-year-old children were non-musicians and were first tested on their abilities to detect pitch changes in language. They were then divided into two groups and followed either musical or drawing training. Finally, they were tested again using the same protocol. A decrease in P300 amplitude to strong pitch changes was found after 8 weeks of musical training (Moreno & Besson, in press). The second experiment is still in progress; results will be discussed at the conference. Magne, C., Schön, D. & Besson, M. (2006). Musicians children detect pitch violations in both music and language better than non musician children. J. of Cog. Neurosc. 18, 199 – 211. Moreno, S. & Besson, M. Musical training and language-related brain electrical activity in children. Psychophysiol., in press. Schön, D., Magne, C. & Besson, M. (2004). The music of speech: music training facilitates pitch perception in both music and language. Psychophysiol., 41, 341 – 349.

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ATTENUATION OF THE P300 COMPONENTS DURING THE CROSS-MODAL ATTENTIONAL BLINK
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Descriptors: attentional blink, ERP, P300

Perceivers often miss a distinct target presented in a sequence of distracters. One of the remarkable examples of this is attentional blink (AB) phenomenon. This phenomenon occurs when participants are asked to report two targets embedded in rapid serial visual presentation (RSVP), if a temporal gap between the first target (T1) and the second target (T2) is short (0 – 600ms). In such a paradigm, participants often miss T2. However, in many experiments, both targets are likely to be detected when T2 immediately follows T1. This is called the lag-1 sparing effect. In the present study, participants were presented with concurrent RSVP and rapid auditory presentation (RAP) streams. The RAP stream consisted of a sequence of single pure sounds of the same number as visual stimuli. T1 was a pure sound of deviating pitch in RAP, and T2 was a digit in RSVP. Participants were asked to report both T1 and T2 or only T2 at the end of the stream. As a result, typical AB and lag-1 sparing effect were observed. In addition, the amplitude of the P300 component of the event-related potential (ERP) time-locked to T2 onset was reduced in the dual-task condition, but not related to stimulus onset asynchrony between T1 and T2. Our results were different from that in the previous research (Dell’Acqua et al., 2003) that the amplitude of the P300 component was sensibly reduced when T2 is missed. These ERP results obtained under our experimental conditions suggest that the cross-modal AB in the present study was generated at the stage of motor processing that is later than short-term consolidation.

FEEDBACK NEGATIVITY ON A TIME ESTIMATION TASK IN SCHIZOPHRENIA PATIENTS
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Descriptors: schizophrenia, ERN, feedback

Previous studies of the feedback negativity (FN) have demonstrated that the FN observed following neutral feedback is comparable in amplitude to that elicited by negative feedback. In light of theories of disrupted reward processing in schizophrenia, we compared FN following positive, negative and neutral feedback in schizophrenia outpatients and psychologically healthy comparison subjects. Participants completed a time estimation task in which they received positive, negative or neutral feedback following each response. Patients’ task performance was less accurate than that of comparison subjects. Feedback negativity was reduced in amplitude in schizophrenia patients relative to comparison subjects but FN amplitude following negative and neutral feedback was similar in both groups. The finding of poor task performance despite relatively intact FN generation suggests that schizophrenia patients do not use feedback information efficiently to guide task performance.

FRIEND, FOE, OR I DON’T KNOW? ELECTROPHYSIOLOGICAL EVIDENCE OF ENHANCED PROCESSING OF NEUTRAL FACIAL EXPRESSIONS IN SOCIAL PHOBIAS
Jason S. Moser, Elizabeth Duval, & Robert F. Simons
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Descriptors: anxiety disorders, ERP, P300

Behavioral studies indicate that socially phobic individuals process faces depicting prototypic angry expressions differently than normal controls. Little evidence exists, however, concerning the processing of neutral (or ambiguous) facial expressions in social phobia. Here, we extend these findings by combining behavioral measures with event-related brain potentials (ERPs) to investigate how socially phobic individuals differentially process emotional and neutral faces. Specifically, we measured the P300, an ERP indexing attentional allocation, while socially phobic and control participants viewed pictures of neutral, angry and happy faces. Following ERP recording, participants made judgments regarding each face on both valence and arousal dimensions. Although there were no group differences on subjective ratings of the faces, the P300 results indicated that controls, but not social phobics, preferentially allocated attentional resources, as indexed by the P300, to arousing (i.e., angry and happy) over neutral faces; P300s in the social phobic group were identical for neutral, angry, and happy faces. The current findings underscore the utility of ERPs in elucidating information processing biases in social phobia as well as social phobics’ preferential bias to treat neutral (or ambiguous) facial expressions as motivationally significant.

THE ROLE OF SEGMENTATION CUES DURING RULE LEARNING IN ARTIFICIAL SPEECH AS REFLECTED BY ERPS
Jutta L. Mueller, Jörg Bahlmann, & Angela D. Friederici
Max Planck Institute for Human Cognitive and Brain Sciences

Descriptors: sequence learning, language

Humans can rapidly extract sequential regularities from artificial speech. It is much debated if one single associative learning mechanism accounts for such learning or if an additional rule-extraction mechanism needs to be assumed. A previous study by Pena et al. (2002) highlighted the importance of acoustic cues for triggering rule extraction. In the present study we recorded ERPs for correct and incorrect sequences of synthetic speech after short familiarization phases during which participants listened to speech strings which could be rule-based or not and contain an additional phrase-bracketing cue (500 ms pause) or not. Correct sequences contained the structure AXC. Incorrect sequences were violated on the last element and had the structure AX. Behavioural data suggested that rules were reliably extracted only if the cue was present. In the cued condition, incorrect sequences elicited an early anterior negativity and a later positivity. In the non-cued condition, only the negativity was observed. We interpret the early negativity as correlate of the automatic detection of the incorrect phenomenal categories while the positivity is seen as a reflection of a later, more controlled process during which the critical element is related to the preceding elements of the sequence. The results indicate that acoustic cues may be crucial for the emergence of conscious rule-integration processes, while more automatic mechanisms of violation detection emerge even when only distributional information is present during familiarization.

PSYCHOPHYSIOLOGICAL ASSESSMENT OF PHOBIC FEAR RESPONSES DURING VIRTUAL TUNNEL DRIVES
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Descriptors: fear, anxiety disorders, assessment

An overall assessment of phobic fear requires self-report of fear, but also behavioral tests and physiological measures. In clinical practice however, response
levels are commonly assessed only with questionnaires. The rare use of direct psychophysiological measures may have two reasons: first, in vivo assessments in phobic situations are difficult to realize and frequently associated with methodological problems. Second, standardized laboratory settings hardly elicit clinically relevant emotions. Virtual scenarios can be used to simulate realistic (phobic) situations and therefore should be useful to induce emotions in a controlled, standardized way. In the present study verbal and physiological fear reactions were examined in 15 high-tunnel-fearful individuals and 15 matched control persons in three simulated virtual driving scenarios including an open environment, a half-open tunnel (gallery) and a closed tunnel. High-tunnel-fearful participants were characterized by elevated fear responses specifically during tunnel drives, as reflected in verbal fear ratings, heart rate reactions and startle responses. The need for a full psychophysiological assessment of phobic fear was indicated by low correlations between subjective and physiological assessments. Fear ratings differentiated fearful from non-fearful participants with an accuracy of 93%, heart rate with an accuracy of 88%. The combination of fear ratings and heart rate reached an accuracy of 96%. Results indicate that virtual environments are valuable instruments for clinical diagnoses and experimental research.

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MODULATION OF EYEBLINK AND POSTAURICULAR COMPONENTS OF STARTLE DURING ANTICIPATION OF REWARD (CHOCOLATE)

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Descriptors: emotion, startle response, postauricular reflex

Previous studies have shown that the eye-blink and pinna-flexion reflexes are modulated in opposite directions during affective states induced by viewing photographs, including pictures of food. The present study examined the modulation of these reflexes prior to the consumption of real food which served as rewards and punishments. The 30 young adult subjects were required to abstain from sweets for at least 12 hours and from food of any kind for 6 hours before the experiment. Surface EMGs from orbicularis oculi and retrahens auriculam muscles were recorded along with EEG as subjects performed an implicit learning task. On each trial either one, two or three cards were displayed which the subject used to predict “sunshine” or “rain.” If the judgment was correct, a bowl of chocolate was illuminated for 6 secs; if the guess was wrong, a bowl with banana peel segments was illuminated. At some point during the preconsumption interval, a startle probe (105 db, 50 ms) was presented. The participant then either ate a piece of chocolate or chewed and expatiated a piece of banana peel. A postexperimental inventory confirmed that the subjects liked the chocolate and disliked the banana peels. Preliminary analyses indicate a tendency for postauricular potentiation and blink suppression prior to eating chocolate (reward), but the opposite pattern prior to chewing bananas peels (punishment). This pattern is consistent with previous results using emotion-inducing slides, and highlights the paradoxical finding of opposite modulation for two components of the same reflex.

FRONTAL N2, RESPONSE INHIBITION AND PSYCHOPATHY

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Descriptors: psychopathy, N2, ERP

The frontal N2 has been associated with response inhibition, anticipatory attention, and conflict resolution during speeded attentional tasks. Further, the N2 has been associated with generator sites in the anterior cingulate cortex (ACC), a brain region shown to be activated in response monitoring situations and closely associated with response control. Psychopathy, a personality disorder characterized by atypical affective and behavioural response tendencies, has been hypothesized to involve dysfunction in regions of the ACC and the fronto-limbic system. Some researchers have found that psychopaths demonstrate relatively poor response modulation and a reduced ability to reallocate attentional resources. There is also growing evidence that psychopaths perform more poorly than nonpsychopaths when faced with tasks that require rapid response modulation but, in most such tasks, individual differences in perceived task difficulty might make behavioural and ERP effects hard to interpret. In this study, EEG was recorded while 9 psychopaths and fourteen nonpsychopaths completed a Go/NoGo task that automatically changed the rate of stimulus presentation on an individual basis to maintain a 50% error rate on NoGo trials. Results indicated a more negative N2 in response to NoGo relative to Go trials but there was no evidence that psychopathy affected this outcome in any way. These data suggest that, when task difficulty is controlled in a predominantly cognitive task, the response-monitoring performance of psychopaths may not be specifically affected.

Natural Sciences and Engineering Research Council of Canada.

ACTION-MONITORING SYSTEM REGARDS THE FAILURE TO GAIN AS MORE SIGNIFICANT THAN THE LOSS

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Descriptors: action monitoring, ERN, motivation

The error-related negativity (ERN/Ne), which is observed in the response-locked ERP that accompanies errors, is considered to reflect the activity of a generic action-monitoring system. Recently it has been proposed that motivational factors influence the ERN. This study examined motivational effects on the ERN by comparing the failure to gain money with the loss of money. An arrowhead flanker task with three motivational conditions was employed. In the reward condition, participants gained money only for correct and fast responses. By contrast, in the punishment condition, they were given a fixed amount of monetary reward before the task, but they lost money when responding incorrectly or slowly. The monetary value of gain and loss were equal in both conditions. In the control condition, there was no reward or punishment. The participants were instructed to respond correctly and quickly and to earn as much monetary reward as possible. Error RT was longer for the control than for the reward and punishment conditions, without a significant difference in error rate. The amplitude of the ERN, which was evaluated in the difference waveforms between correct and error trials, was larger for the reward than for the punishment and control conditions. These results indicate that the action-monitoring system is more sensitive to errors associated with the failure to gain reward than with either the loss of reward or in the absence of monetary incentive.

YOU MAY RESPOND WHEN SLEEPY BUT YOUR FRONTAL LOBE MAY NOT: THE EFFECT OF SLEEP DEPRIVATION AND INCENTIVE ON THE CONTINGENT NEGATIVE VARIATION

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Descriptors: sleep, CNV

We investigated the effect of sleepiness and incentive on the contingent negative variation (CNV). Participants (17 F) completed a go/nogo CNV, with and without financial incentives (pay vs nopay), under alert and sleepy conditions (awake and 3 or 20 hours respectively). Subjective sleepiness, effort and performance were also measured. Participants reported increased subjective sleepiness, effort, and decreased performance during the sleepy condition. There was also a trend for increased effort when participants were paid for good performance. Response times were faster under the pay condition, but there was no effect of sleepiness. Initial analyses of the CNV amplitudes (E-wave) for the go trials revealed an increase for the pay condition, but no significant interaction between incentive (pay/nopay) and alertness (alert/sleepy); however, after controlling for nogo trials, CNV amplitudes were significantly larger during the pay trials when alert but
not when sleepy. Thus, despite pay improving performance (response time) when sleep deprived, the CNV (an electrocortical correlate of attention) is only significantly affected by incentives when alert. Also, the fact that this effect was only observed after controlling for the nogo trials indicates a lowered ability to distinguish between important versus unimportant information when sleepy. This has serious implications for any individual required to work extended hours where sustained attention and the ability to distinguish between relevant and irrelevant information is required.

NSERC (to SJS).

GENDER DIFFERENCES IN EMOTIONAL RESPONSE TO SEXUAL SONG LYRICS WITH DIFFERENT GENDER-FOCI

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Indiana University

Descriptors: corrugator response, sexual lyrics, gender

In a previous radio advertising study, 46 subjects (28 females, 18 males) listened to a simulated radio station broadcast which included eight Top-40 songs and 2 commercial breaks arranged in four orders of presentation. Corrugator and skin conductance data were collected during the entire 40-minute experimental session, sampled at 20 Hz and time-locked to the media. Song selection was originally based on pre-test data for popularity among the subject age group and a desire to balance genre. Four of the songs, however, contained lyrics which were patently sexual in nature. Serendipitously, two were sung by male rap singers and contained lyrics where women were presented as tools for male sexual pleasure. The other two songs were by female rap singers and contained lyrics where a man was presented as an instrument for female sexual satisfaction. This resulted in a secondary analysis of the first 3-minutes of each song exploring the Gender-focus of Lyric × Time × Gender of Listener interaction on emotional and autonomic responses. Repeated measures analyses show that females had significantly greater corrugator activity during songs where women were presented as sexual objects. Similarly, males had greater corrugator response during songs where men were presented by women singers as sexual objects. The only significant difference in autonomic arousal was a main effect of gender of listener on SCR frequency, with males showing more arousal than females during songs containing sexual content, regardless of the gender-focus of the lyrics.

AN EVENT RELATED OPTICAL SIGNAL (EROS) STUDY OF LEFT FRONTAL CORTEX ACTIVITY ELICTED BY TASK-IRRELEVANT STIMULUS REPETITION

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Descriptors: optical imaging, repetition suppression, memory

The event related optical signal (EROS) is a measure of the phase changes that occur in frequency modulated near-infrared light as it passes through activated brain tissue. It has a temporal resolution of tens of milliseconds and a spatial resolution of a few millimeters. We used EROS to examine changes in left frontal cortex activity elicited by task-irrelevant stimulus repetition. Participants saw pictures of everyday objects (e.g., a hat), presented one at a time, and indicated whether the real-world equivalent was longer than one meter. Half of the stimuli were presented once and half were repeated. For the repeated stimuli, the repetition was immediate for half the pictures and followed a lag of 3–6 pictures for the other half. Compared to first presentations, stimulus repetitions elicited reduced left frontal activity from 350 to 400 ms after stimulus onset. These results are consistent with earlier ERP and fMRI studies of repetition suppression and provide the first EROS imaging data demonstrating the repetition suppression phenomenon.

Chinese University of Hong Kong Direct Grant for Research. Project ID: 2020820.

MOTOR ACTIVITY DURING SLEEP, SLEEP QUALITY AND SYMPTOM SEVERITY IN ADULTS WITH ADHD OR TOURETTE'S DISORDER

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Erasmus MC

Descriptors: motor activity, ADHD, tourette’s disorder

Attention-Deficit and Hyperactivity Disorder (ADHD) and Tourette’s Disorder (TD) frequently present with sleep problems. Disturbed sleep in ADHD and TD may be related to dysregulation of motor functions. Yet, objective quantification of motor activity during sleep is scarce in both disorders. The aim of this study is to clarify the role of behavioral disturbance during sleep and its relationship with subjective sleep quality and daytime symptom severity in adults with ADHD or TD. Fifteen adults with ADHD, 18 with TD and 39 healthy controls were submitted to a 48-hr ambulatory recording in their natural setting at home. The time spent in bed, body posture, postural transitions and body motility at night were measured by accelerometry. Subjective sleep quality and daytime symptom severity were assessed by self-report questionnaires. Differences between groups were tested by ANCOVAs and correlations within groups by linear regression analysis. The ADHD group showed an increased number of postural transitions, and the TD group an increased body motility while lying in bed. In the ADHD group, daytime symptom severity was positively correlated with motor activity at night, but not with subjective sleep quality. In the TD group, daytime tic severity was negatively correlated with motor activity at night and not with subjective sleep quality. These opposite significant correlations between daytime core symptoms and motor behavior at night in ADHD and TD suggest different pathophysiological dysregulations of motor functions in ADHD and TD.

A COMPARISON BETWEEN AUDITORY AND VISUAL FEEDBACK OF SENSORIMOTOR RHYTHMS (SMR) FOR A BRAIN-COMPUTER INTERFACE (BCI) IN HEALTHY PARTICIPANTS

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Descriptors: brain-computer interface, amyotroph lateral sclerosis, biofeedback

BCIs record signals from the brain and translate them into commands that can control applications. BCI control can be learned by providing feedback about the brain activity. BCI research aims at providing a non-muscular communication method for patients who are completely paralyzed (complete locked-in state (CLIS)) due to injury or disease. Since CLIS patients have limited or no eye sight, the feasibility of a SMR driven BCI based on auditory feedback is evaluated in the current study. Sixteen participants were provided with either auditory or visual feedback of their SMR. In the visual condition a horizontally moving cursor had to be moved into one of two rectangles at the top or bottom of the right margin of the screen by altering the SMR amplitude. In the auditory condition SMR amplitude was fed back by means of instrumental tones (bongos and harps). Participants were trained for 3 daily sessions (30 two-minute runs comprising 23 trials each). In both conditions participants learned regulation of SMR. Although the visual group learned significantly faster and achieved a higher accuracy than the auditory group, four out of eight participants in the auditory group achieved an accuracy over 70 % in the last session, which we regard to be the criteria for using the BCI for communication. We conclude that SMR regulation can be learned when provided with auditory feedback, albeit slower as compared to visual feedback. Patients should be trained with a BCI before they lose eye sight, but may be able to continue using the system on the basis of auditory feedback. Supported by NIH grants HD30146 and EB00856 and the DFG SFB 550/B5.
VOCAL AND INSTRUMENTAL MUSICIANS: ELECTROPHYSIOLOGIC AND PSYCHOACOUSTIC ANALYSIS OF PITCH DISCRIMINATION AND PRODUCTION

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Descriptors: MMN, musicians, vocalists

Evidence suggests that long-term musical training influences pitch discrimination and production. Electrophysiologic and psychoacoustic measures were used to examine pre-attentive and active pitch discrimination as well as pitch production accuracy between non-musicians and two classes of musicians. Participants included 41 formally trained musicians (20 vocalists/21 instrumentalists) with minimum of 5 years instruction and 21 non-musicians. All were right-handed females with normal hearing and mean age of 22. Stimuli were harmonic tone complexes that approximated the physical characteristics of piano tones and represented the mid-frequency range of the untrained female vocal register extending from C4 to G4 (F0 261.63–392 Hz). Pre-attentive auditory discrimination was assessed by auditory evoked potentials (AEPs), including the mismatch negativity (MMN). Three deviants differing in frequency (1.5%, 3%, and 6%) were presented in a multi-deviant paradigm. Difference limens for frequency were obtained by an adaptive psychophysical paradigm. Vocal pitch recordings were spectrally analyzed to measure pitch production accuracy. Although musicians demonstrated significantly better pitch perception and production than non-musicians, the two classes of musicians did not differ on psychoacoustic measures. Results suggest that musical training facilitates both auditory perception and motor production regardless of music specialty. AEP results revealed differences among the three groups and suggest that neural plasticity related to musical training may differ by music specialty.

VENTROMEDIAL PREFRONTAL ACTIVATION AT BASELINE AND IN RESPONSE TO AFFECTIVE PICTURES PREDICTS POSITIVE AFFECTIVE STYLE: A SOURCE LOCALIZATION STUDY

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Descriptors: emotion, EEG, source localization

The ventromedial prefrontal cortex (vmPFC) has been implicated in the regulation of emotion, and in particular the downregulation of negative affect during an instructed emotion regulation paradigm. We sought to examine the role of vmPFC in un instructed emotion regulation, as well as its modulation by affective style. EEG was collected as participants viewed neutral, positive, and positive images. Data were analyzed with a tomographic source localization method that computes the cortical three-dimensional distribution of current density for standard frequency bands. Voxel-wise correlations were conducted between self-report measures of affective style and EEG data, separately for the three valence conditions and each of four trial epochs: baseline (2 s preceding picture onset); picture presentation; early recovery; and late recovery. Results indicated that individuals with a more positive affective style showed greater activation of the vmPFC during the baseline epoch for all three picture valence conditions. Furthermore, activation of the vmPFC was maintained during and immediately following the presentation of negative images compared to neutral pictures for those individuals with a more positive affective style; whereas no vmPFC activation was observed during positive as compared to neutral pictures. In sum, individuals with a more positive affective style may be better regulators of negative affect, and may in general be better equipped or prepared to regulate their emotions.

EFFECTS OF MORNINGNESS-EVENINGNESS AND TIME OF DAY ON STARTLE REACTIVITY

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Descriptors: startle response, circadian, eyeblinks

Several physiological processes follow a circadian rhythm. The present study sought to determine if differences in startle reactivity and prepulse inhibition (PPI) exist between individuals possessing different sleep cycles tested at different times during the day. College student participants (N = 37) were categorized as evening types and non-evening types based on Horne and Ostberg’s Morningness-Eveningness Questionnaire (1976). Eyeblink EMG reactivity to 105 dB startle stimuli and prepulse inhibition to prepulses of 75, 80, and 85 dB were measured. Testing times ran from 6 to 8 AM and from 5 to 8 PM. While no significant effects for PPI were found, control startle magnitude was affected by both circadian type and time of day. Evening types showed larger startle compared to non-evening types, while subjects tested during the evening hours showed larger startle relative to those tested in the morning. Additionally, non-evening types displayed larger eyeblink responses to the prepulse than did evening types in the morning hours, while evening types were more reactive to prepulses during the evening hours. These results suggest that differences in responsiveness to startle probes can occur both as a function of the time of testing and as a result of one’s natural body rhythm. Furthermore, circadian rhythms were also demonstrated to have an effect on startle sensitivity to weaker acoustic stimuli.

PRE-FRONTAL BRAIN ASYMMETRY MODERATES LABORATORY INDUCED HUMAN HELPLESSNESS

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Descriptors: depression, emotion, EEG

The primary goal of this experiment was to investigate the helpless ness/hopelessness theory of depression from the perspective of basic neurophysiological emotional responding. EEG data were collected from 39 participants before (testing) and following (state) administration of an established helplessness induction task (exposure to a series of either controllable noise bursts, uncontrollable noise bursts, or no-noise). Following EEG measurement, participants completed anagram tasks for the purpose of documenting the effect of learned helplessness induction on cognitive-behavioral performance. Results suggest that state, but not resting, prefrontal brain asymmetry moderated the effect of helplessness condition on anagram task performance. Specifically, greater relative left frontal activity (an index of approach motivation) was associated with better performance on the anagram task among individuals exposed to controllable noise bursts, but poorer performance on the anagram task among individuals exposed to uncontrollable noise bursts. No relationship was observed between frontal EEG asymmetry and anagram task performance among individuals in the no-noise condition. Results suggest that increased approach motivation may be adaptive when an individual has perceived control over the environment, but maladaptive when there is perceived uncontrollability.

FRONTAL EEG ASYMMETRY PREDICTS COGNITIVE VULNERABILITY TO DEPRESSION

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Descriptors: depression, EEG, cognitive vulnerability

Cognitive theories of depression propose that the way people typically interpret or explain important life events affects their vulnerability to depression. Addi-
tionally, neurophysiological models of vulnerability suggest individuals at risk for depression tend to show relatively less left frontal brain activity at rest. The objective of the current study was to integrate these two models of depression in order to generate a novel biocognitive model of depression. Resting anterior brain electrical activity and self-report measures of cognitive vulnerability to depression were collected from 71 individuals with no history of major affective psychopathology. The absence of affective psychopathology was confirmed using the Schedule for Affective Disorders and Schizophrenia-Lifetime Version (SADS-L). Participants with relatively less resting left frontal activity were more likely to evidence cognitive vulnerability to depression, as indexed by a composite score on the Cognitive Style Questionnaire (CSQ). Low relative left frontal brain activity and maladaptive cognitive styles may combine to form a biocognitive vulnerability to negative life events, increasing an individual’s risk for affective disorders.

THE LAMBDA RESPONSE FORM IS CHANGED BY SPATIAL FREQUENCY OF VISUAL STIMULI

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Descriptors: lambda response, saccade, spatial frequency

The lambda response is a positive brain potential elicited about 80 ms after the offset of saccades. It shows occipital distribution, known to reflect the post-saccadic visual information processing. In study 1, we found that picture stimuli elicited two positive peaks of the lambda response, but LED stimuli elicited one peak. This morphological difference was likely due to the spatial frequency of visual stimuli. In study 2, we investigated the relationship between spatial frequency of visual stimuli and the lambda waveform. We tested a visually-triggered saccade task, in which one of 5 square stimuli (black-white stripe with 0 Hz, 1 Hz, 2 Hz, 3 Hz, 4 Hz) was randomly presented at left or right side of a fixation. The participant was instructed to shift their gaze as quickly as possible from the fixation to the stimulus, whenever it was presented. EEGs were recorded from 128 scalp sites. The lambda response ranged from 400 ms before to 400 ms after the offset of saccades was averaged. The lambda response showed two clear positive peaks for 3 Hz and 4 Hz stimuli. However, the two peaks were unclear for 0 Hz, 1 Hz and 2 Hz stimuli. This result suggests that the primary processing of visual perception after saccades may be affected by spatial frequency of visual stimuli.

SOURCE COHERENCE ANALYSIS: THE EFFECT OF STIMULUS MODALITY ON THE STIMULUS-PRECEDING NEGATIVITY (SPN)

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Descriptors: stimulus-preceding negativity, time-frequency analysis, stimulus modality

The stimulus-preceding negativity (SPN) reflects anticipation of perceptual inputs. SPN distributions vary by stimulus modality. This study used source coherence analysis to explore the effects of stimulus modality on the SPN based on oscillatory activities sources and oscillatory activities. A time estimation task was performed where a feedback stimulus was presented 3s after a voluntary movement, and the stimulus modality (visual/auditory) of feedback stimuli were manipulated. In the auditory condition, participants received feedback information from computer-generated tones. In the visual condition, they received feedback information via LED patterns. The frequency range was set at 4 – 35 Hz, and the epoch was from – 2500 to 4000 ms before and after the button pressing. Event-related synchronization plots are calculated from EEG waveforms obtained in each condition. In the visual condition, the results indicated that decreased oscillation in the alpha frequency range was observed at parietal area. In the auditory condition, decreased oscillation in the alpha frequency range was observed at frontal and temporal areas. These differences are in agreement with the amplitude distributions of SPN that are caused by stimulus modulation. The frontal SPN amplitudes were high in the auditory condition, and the occipital SPN amplitudes were increased in the visual condition. Further analysis of the implications between oscillatory sources and the effect of stimulus modality on the SPN will be discussed.

BRAIN ACTIVITY DURING REWARD LEARNING: SIMULTANEOUS RECORDING OF PET AND ERN

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Descriptors: brain, ERN, learning

In reward learning, the involvement of some prefrontal areas (orbitofrontal, anterior cingulate, lateral prefrontal cortices, and striatum) has been elucidated in earlier neuroimaging studies. On the other hand, a component of event-related brain potentials, called the error-related negativity (ERN), has been reported to reflect processes of such learning. To investigate directly the correspondence of brain activity and ERN during learning, we recorded simultaneously regional cerebral blood flow (rCBF) using positron emission tomography (PET) and ERN onset to a signal for feedback of correct or error responses during a typical stochastic learning task. We manipulated the stochastic characteristics of the task, specifically a learnable (70% reinforcement) condition and an unlearnable (50% random reinforcement) condition. When subjects could learn a general rule (70% reinforcement), rCBF increased in the lateral prefrontal cortex, whereas when subjects had to continue to seek for the rule (50% reinforcement), rCBF increased in the orbitofrontal and anterior cingulate cortices. Furthermore, especially in the unlearnable condition, rCBF in the orbitofrontal and cingulate cortices correlated with amplitudes of ERN. Thus, the present study suggested that the feedback-related ERN should reflect activity of the orbitofrontal and cingulate cortices accompanying the progression of learning.

NEURAL SUBSTRATES OF VOLUNTARY REGULATION OF NEGATIVE AFFECT IN ADOLESCENCE

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Descriptors: regulation, adolescence, functional neuroimaging

Previous studies have identified the amygdala and areas in prefrontal cortex (PFC) as critical components of a neural system underlying the regulation of negative affect. We used functional magnetic resonance imaging to probe the neural circuitry of emotion in a population of adolescents (N = 30, 16 male, mean age = 14.3 years). The aims of the present study are 1) to examine whether adolescents display the neural signature of emotion regulation as identified for adults in previous reports, and 2) to explore the relation between this neural activity and an individual’s vulnerability to internalizing psychiatric symptoms (i.e., anxiety & depression). We used a GLM-based deconvolution to estimate the hemodynamic responses for each of three emotion regulation conditions (suppress, maintain, enhance), and calculated the area under the curve, which was then used to generate linear contrast maps. The results are consistent with previous findings, showing that the amygdala and PFC are recruited during voluntary regulation of negative affect in adolescence. We also report a significant positive correlation between the response of the left middle frontal gyrus (as revealed by the suppress – enhance contrast), and the mother’s rating of her child’s internalizing symptoms. If, in future work, we find that recruitment of the PFC-amygdala circuit during emotion regulation in adolescence prospectively predicts the onset of internalizing disorders, then emotion regulation may prove to be a useful screening tool for early detection of internalizing psychopathology. NIH #5P50MH069315-04.
THE EFFECT OF THE PRESENCE OF ANOTHER PERSON ON SPONTANEOUS EYEBLINKING WHILE RECEIVING PLEASANT-UNPLEASANT VISUAL STIMULI

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Jinai University

Descriptors: eyeblinks, emotion, presence of another person

This study aimed to investigate the spontaneous eyeblink rates during pleasant-unpleasant visual stimuli in the presence of the other in the same room. Twenty-four university students, 11 males and 13 females, participated in the experiment in pairs with their same sex friends. They saw a series of 36 photos on a 29-inch monitor, which were divided into three categories: pleasant, neutral, and unpleasant photos, consisting of 12 photos respectively. They repeated two sessions, with a 20 second duration for each stimulus. The subjects were given 18 stimuli alone in the room without the partners in one session, and the other 18 stimuli with the friends next to them in the other session. Eyeblinks were identified with the video recordings of the subjects’ faces, and heart rates were measured with the ECG recordings. After viewing each photo, the subjects were required to rate their emotions on three scales for valence, arousal, and dominance. The results showed that blinking rates when receiving the pleasant and unpleasant stimuli with the partners were significantly lower than the ones without partners. Although the eyeblinks occurred frequently during neutral stimuli, there have hardly been found differences in the presence and in the absence of their friends. Furthermore, heart rates were significantly lower in the condition of being alone than in the condition of physical co-presence. Therefore, it is suggested that the spontaneous eyeblinking can be used as a reliable physiological index to exhibit emotions in terms of social factors.

SYSTOLIC BLOOD PRESSURE AND EXECUTIVE FUNCTIONS

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Descriptors: blood pressure, cognitive functions

Elevated blood pressure (BP) has been associated with impairment in cognitive performance including frontal-executive functions. Although some studies have reported a complex, nonlinear association between BP and cognitive performance, the preponderance of the evidence supports a linear relationship. The current study examined the relationship between BP and performance on a cognitive measure that assessed executive function. Forty-six African American participants (29 women and 17 men; 27–65 years of age) from the Minority Organ Tissue Transplant Education Program (MOTTEP) at Howard University Hospital, were tested. A casual measure of resting BP and several psychophysiological measures were administered, including the Trail Making Test-Part B, a measure of executive function. Analyses determined that both diastolic blood pressure (DBP; r = −.246, p < .05) and systolic blood pressure (SBP; r = −.41, p < .01) evidenced a significant inverse relationship with participants’ performance on the Trail Making Test-Part B. A hierarchical regression analysis revealed that body mass index, age, education accounted for sixteen percent of the variance in Trail Making performance. Systolic pressure accounted for an additional eleven percent of the variance in Trail Making scores when added to the equation. Thus the relationship between executive cognitive functioning and blood pressure persists even when body weight and demographic variables are controlled.

PSYCHOPATHIC TRAITS AND AUTONOMIC RESPONSES TO EMOTIONAL STIMULI

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Descriptors: psychopathy, emotion, cardiovascular

Previous findings with forensic samples suggest that high emotional detachment psychopaths failed to show the normal large startle reflex while looking at unpleasant slides, and psychopaths with high antisocial behavior were associated with autonomic hyporeactivity during fearful imagery (Patrick et al., 1993, 1994). The present study investigated these abnormalities in the two facets of psychopathy with a Japanese undergraduate population. In study 1, smaller changes of HR and fingerprint skin temperature while watching unpleasant movie scenes were related to the higher antisocial behavior factor of psychopathy. In study 2, on the other hand, smaller HR orient responses to unpleasant slides were related to the higher emotional detachment factor. Consistent with previous findings, these findings with noninstitutionalized samples also suggested that the affective dysfunction in psychopathy is based on the two specific physiological mechanisms.
BLOOD PRESSURE REGULATION: THE NEED FOR A MULTIPLE ASSESSMENT

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Descriptors: ambulatory blood pressure, hemodynamic patterns, epinephrine

Increased sympathetic activity is considered the neural source of cardiovascular reactivity, and reduced catecholamine clearance has been proposed as a mechanism for delayed recovery. Our aim was to test the link between endocrine measures, hemodynamic patterns, and ambulatory blood pressure (ABP). We previously examined patterns of hemodynamic profile and compensation deficit during reactivity and recovery as predictors of ambulatory BP. We tested if the failure to capture lab-to-life generalizability of reactivity measures was due to the focus on simple BP change scores for reactivity and recovery, and showed that hemodynamic profile during reactivity and compensation deficit during recovery improved prediction of ABP after controlling for other variables. Impedance cardiography measures and beat-to-beat BP were recorded in 45 healthy subjects during a 10-min baseline, four 2.5-min tasks, and four 10-min resting periods. ABP measures were obtained combining data from a work and an off day. Epinephrine, norepinephrine, cortisol and insulin concentrations were determined at baseline. Significant correlations (p < .05) were shown for: a) hemodynamic profile during reactivity and epinephrine at rest, b) compensation deficit during recovery and epinephrine at rest. Interestingly, epinephrine was related only to the patterns that were good predictors of ABP, but it was not related to traditional BP measures of reactivity or recovery. Present data strengthen the superiority of hemodynamic patterns in uncovering underlying mechanisms linking stress and risk for illness.

UNDERLYING UNITY: THE RELATIONSHIP BETWEEN THE N200 AND THE FEEDBACK ERN

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University of Victoria

Descriptors: ERN, N200, reward

The oddball N200 and the feedback error-related negativity (fERN) are two components of the event-related brain potential (ERP) with an ambiguous relationship. They share similar polarities, latencies, and scalp distributions, and are elicited under similar conditions. To determine if they are related or independent, subjects completed both an oddball task and a feedback guessing task. A spatial-temporal principal component analysis identified a component with temporal loadings that were maximal at the time of the fERN/N200. The factor scores for this component were large only for conditions that generated a fERN or an N200. These results indicate that the fERN and the N200 share the same scalp distribution and latency, suggesting that they are not different ERP components as previously thought, but rather different manifestations of the same underlying process.

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ELECTROPHYSIOLOGICAL CORRELATES OF PRESACCADIC UPDATING OF VISUAL SPACE

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Georgia Institute of Technology

Descriptors: eye movements, prepulse inhibition, presaccadic potentials

How is a stable visual world maintained despite the occurrence of ballistic eye movements multiple times per second? A possible mechanism underlying visual stability has been revealed from single cell recordings in various cortical regions in monkeys (particularly area LIP). In a phenomenon known as predictive remapping, visual receptive fields remap dynamically to new locations of the visual field prior to the onset of a saccade. In general, this remapping is such that receptive fields shift from their current location to a future postsaccadic location. In this study, electrophysiological (ERP) correlates of predictive remapping were investigated in monkeys by analyzing presaccadic potentials in a cued-saccades paradigm. Subjects made saccades to left and right visual targets in the context of either high- or low-contrast square-wave gratings. Gratings were positionally related to the targets in such a way that the execution of a saccade caused the grating either 1) to remain in the visual field ipsilateral to the saccade direction, or 2) to crossover to the visual field contralateral to the saccade direction. Two presaccadic ERP components were evaluated for amplitude differences: the antagonist potential (AP) and the spike potential (SP). If these presaccadic components index the predictive remapping of visual space, their amplitude should modulate with grating contrast. Furthermore, this modulation is expected to interact with the relative position of the grating (i.e., larger when grating crosses visual field). Our initial results support these predictions.

PLEASANT VS. UNPLEASANT CONDITIONED CUES IN AVERSIVE LEARNING (II): DIFFERENCES IN FEAR STARTLE POTENTIATION

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Descriptors: aversive conditioning, startle response, cardiovascular

The current study (n = 63) explored whether prior differences in the affective value of highly arousing CSs pictures affected on emotional learning, as indexed by startle reactivity, heart rate changes and self-report measured in a differential aversive conditioning paradigm. Half of the participants viewed 2 erotic pictures as CSs, whereas the other half viewed 2 threatening scenes. The US was a 500-ms train of electric pulses. One block consisted of 8 trials (6 presentations of 4 CS+ and 4 CS−), with 6 probes presented at 2.5 or 4 s after picture onset, and 2 probes during ITIs. Habituation phase consisted of 1 block, and extinction of 3 blocks. During the 2 blocks of acquisition, the US was administered immediately after each CS+ offset. Fear-potentiated startle (greater blinks to CS+ than to CS−) was obtained during the second block of acquisition, both for erotica and threatening cues. However, only when viewing erotic cues, participants showed less heart rate acceleration and greater late deceleration to CS+ than to CS− during this block of trials. Moreover, for erotica but not for threatening cues, fear-potentiated startle persisted throughout extinction, in agreement with post-conditioning valence ratings (greater aversiveness of CS+ compared to CS−, only for erotica). These data are consistent with the delta-learning rule, for which a larger difference in initial affective values between CS and US is associated with greater conditioned change, suggesting that evaluative learning persists longer when using pleasant cues in aversive conditioning.

COGNITIVE PERFORMANCE DURING SPACE FLIGHT: HOW PSYCHOPHYSIOLOGY SHEDS NEW LIGHT ON AN OLD QUESTION

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Descriptors: human performance, heart rate variability, space flight

The cognitive performance of astronauts is crucial to the success of space missions. Although astronauts’ self-evaluation of higher cognitive functioning often reports impairments, no experimental confirmation exists. We assessed astronaut’s cognitive performance using interference paradigms. ECG and respiration were recorded and heart rate variability was computed. Results from the odISSsea mission to the International Space Station (2002) are reported here. Cognitive testing included a colour-word Stroop task, a general emotional Stroop task (emotional words) and a specific emotional Stroop task (mission-related emotional words). We analysed reaction times (RT), error rates (ER), the RR-
interval (RRI), respiratory period and the amplitude of respiratory sinus arrhythmia (RSA), computed through the polar representation of RSA. Data were collected on Launch-44 days, L-9, Flight Day 5, FD8, Return + 4 and R + 25. Our results show a significant performance decrement (increased ER) for the tests involving emotional material for in-flight measurements. Furthermore, in-flight data show an overall increase in ER for all tests, with an overall decrease in RT, and a markedly reduced variance for RT, RRI and RSA. Some of our cognitive effects already showed on L-9. This implies that microgravity is not the causal agent, but rather that multiple stressors (increased workload, sleep deprivation, overall stress) are at work. For the first time, we report impairments in higher cognitive functions during space flight combined with a different level of autonomic activation.

This research was supported by a Prodex grant # 90030 (European Space Agency/Belgian Federal Government), grant ERM_HF10 (Belgian Department of Defence) and an Euro Space Foundation grant.

EMOTIONAL STARTLE RESPONSE MODULATION AND ITS RELATION TO GENETIC MARKERS IN HEALTHY PARTICIPANTS AND ADULT ADHD PATIENTS

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Descriptors: startle response, genetics, ADHD

The present study investigated the relation between emotional startle modulation and genetic markers in healthy participants and adult ADHD patients. This affective modulation is supposed to be diminished through a lower availability and debused signal transmission of dopamine caused by the Valine variant of the Valine/Methionine (Val158Met) polymorphism in the catechol-O-methyltransferase (COMT) gene. Positive, neutral and negative pictures of the International Affective Picture System (IAPS) combined with startle tones were presented to 60 medication-free adults with ADHD and 60 matched control participants. Physiological responses (EMG of the M. orbicularis oculi) and subjective picture ratings were recorded. Genomic DNA was extracted from blood samples. Emotional startle modulation was associated with the COMT genotype. Confirming our hypothesis, the Val/Val group showed the lowest and the Met/Met group the greatest emotional modulation of the startle response, the Val/Met group fell in between. This effect was observed in healthy participants and ADHD patients. Independently from the genotype, patients with ADHD evaluated positive pictures as less arousing than controls. We conclude that the COMT genotype modulates emotional reactivity of basic emotion systems, presumably the responsiveness of the amygdala. While ADHD patients do not seem to have general dysfunctions in the responsiveness of this system, they tend to be less aroused specifically from positive pictures.

Funded by the DFG.

LINEAR AND NONLINEAR MEASURES OF HEART RATE VARIABILITY: CORRELATIONS WITH RESPIRATORY VARIABLES

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Descriptors: cardiovascular, nonlinear, respiration

Heart rate variability (HRV) is commonly used by psychophysicologists as a non-invasive assessment of cardiovascular control mechanisms. Traditionally, linear measures have been used to assess HRV, among recent studies have demonstrated the existence of nonlineairities and fractal variability in the heart rate signal. We present the results of a study aimed at examining the relationships between linear (root mean square of successive differences = RMSSD) and nonlinear (alpha exponent of the detrended fluctuation analysis = DFA) indices of HRV and their association with two respiratory measures (tidal volume and PetCO2). Participants were 35 university students tested under resting conditions. The results showed a significant negative correlation between RMSSD and DFA (r = −.513, p = .002). We also found a significant negative correlation between the RMSSD and PetCO2 (r = −.375, p = .026) and a positive correlation between RMSSD and tidal volume (r = .420, p = .021). In addition, we observed that an increase in tidal volume caused a significant increase in the RMSSD (F (1, 34) = 12.529, p = .001) along with a significant decrease in PetCO2 (F (1, 34) = 22.886, p = 0). These findings show that linear measures of HRV such as the RMSSD are highly influenced by respiratory parameters and may correlate positively with hyperventilation. The DFA on the contrary characterizes heart rate fluctuations on all scales, is less sensitive to breathing variables and may be a more valid prognostic tool in clinical practice.

INDIVIDUAL DIFFERENCES IN THE TIME COURSE OF HEART DECELERATION TO PICTURES OF MUTILATION

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Descriptors: bradycardia, affective stimuli, emotion

Previous studies showed that the viewing of unpleasant pictures decelerates the heart. This bradycardia has been interpreted as part of the defensive reaction to distant threat. The present study investigates this reaction along a blocked presentation of 24 different pictures of mutilation. A block of neutral pictures was presented as control. Individual predispositions were estimated by affective scales. Each picture was presented for 3 s every 13 s. Peak deceleration during picture presentation measured the response. The neutral and unpleasant blocks of pictures were divided into 3 sub-blocks to estimate the time course of the bradycardiac response. A mean split of the scores on the trait affect scale divided the participants (n = 42) into low and high sub-groups. We observed a significant three-way interaction between valence of the pictures, block, time course and positive affect trait. During the early sub-block the viewing of either neutral or unpleasant pictures decelerated the heart. The responses to the neutral pictures were not present thereafter while those to the pictures of mutilation were sustained across time. Participants with high positive affect reacted less to the unpleasant pictures and habituated quickly. Participants with low positive affect showed stronger heart deceleration to the viewing of the unpleasant pictures and this reaction was accentuated along the block. These results showed that high and low positive affect traits differentially predispose individuals to a transient or sustained defensive heart rate response, respectively.

CNPq, PRONEX/FAPERJ, CAPES.

DO PERCEPTUALLY CHALLENGING OBJECTS CONSUME MORE WORKING MEMORY CAPACITY?

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Descriptors: working memory, storage capacity, vision

The capacity of visual working memory is well known to be limited to maintaining a small amount of information from the environment. Several studies have shown that subjects are highly accurate at maintaining about 3 objects in memory, which suggests that memory capacity is primarily determined by a limit in the number of object representations that can be active simultaneously (e.g., Alvarez & Cavanagh, 2004). Here, we recorded ERPs while subjects performed a visual working memory task with complex and perceptually challenging objects to examine this question. In particular, we examined the contralateral delay activity (CDA), which has been shown to be a highly sensitive measure of the memory capacity consumption demands during the retention interval of working memory tasks (e.g., Vogel & Machizawa, 2004). In three experiments, we found that
while behavioral performance was often impaired for remembering these complex objects, CDA amplitude was not modulated by the complexity of the objects, despite being highly sensitive to the number of objects currently being held in memory. These results suggest that memory storage capacity may be limited to the number of objects currently being held in memory. These results suggest that memory storage capacity may be limited to the number of objects currently being held in memory.

**P300 IN ALCOHOL NAIVE 11 YEAR-OLDS PREDICTS FUTURE DRINKING**

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**Descriptors:** P300, alcoholism

There is converging evidence that reduced P300 during an oddball task predates pathological drinking behavior and thus underlies a genetic risk (e.g. serves an endophenotype) for disinhibitory behavior. However, longitudinal research on preadolescent youth has focused on male participants and populations at high risk for alcoholism, thus limiting the degree to which findings might generalize to the general population. To address these issues, we recorded parietal EEG during a visual oddball task in a community-based sample of 11 year-olds who were all alcohol naïve (N = 545 Males; N = 436 Females) and collected information on various drinking behaviors at a subsequent age 17 follow-up. We found that the P300 amplitude at age 11 predicted different aspects of alcohol misuse at age 17 and this effect was significant after accounting for gender differences in drinking. This suggests that reduced P300 is a risk marker for drinking in both genders within the general population. Because this sample was alcohol naïve, these results rule out the possibility that the P300 effects stem from the consequences of alcohol exposure. Instead, they appear to reflect the effects of the underlying predisposition to develop alcoholism.

This research was supported by NIH grants RO1AA093067 and RO1DA05147.

**MUCH EARLIER THAN N400: WORD SEMANTIC PRIMING IS REFLECTED IN THE N2PC ERP COMPONENT**

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**Descriptors:** semantic priming, n2pc

Over the past thirty years, a flood of studies on the electrophysiology of language has consistently proposed that the N400 component in the event-related potential (ERP) generated by a verbal stimulus could be taken as a reflection of the processing of such stimuli at a semantic level. It has become traditional to conceptualize the N400 as a temporal landmark of the stage at which semantics modulate the processing of verbal stimuli, and to interpret the relationship between semantic processing and N400 as biunivocal. One experiment is presented that suggests that such an interpretation must be reconsidered. Two horizontally arrayed strings of characters were visually presented in different colors (red and green) on each trial, one to the left and one to the right of a central fixation cross. Participants were instructed to perform a lexical decision on a target string defined by color (e.g., red), while ignoring the other distractor string (green). On half of the trials, both strings were words, and the semantic relation between the word concepts was systematically manipulated. An enhanced negativity at about 200 ms after target presentation was recorded at posterior electrodes contralateral to the visual hemifield occupied by the target word (i.e., N2pc). Crucially for our purposes, the amplitude of the N2pc depended on the semantic relation between the word concepts, being smaller when the word concepts were semantically related. The conclusions relate the present evidence of early semantic activation with past conceptualizations about semantic processing.

**BEHAVIORAL INHIBITION SYSTEM SENSITIVITY PREDICTS RIGHT FRONTAL BRAIN ACTIVITY DURING AND AFTER AFFECTIVE PICTURES**

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**Descriptors:** ERP, frontal asymmetry, BIS

Present research sought to extend past research on frontal brain asymmetry and individual differences by examining relationships of individual differences in behavioral inhibition/approach system (BIS/BAS) sensitivity with asymmetrical frontal activity during affective states. Participants were shown unpleasant, neutral, and pleasant affective pictures, and presented a startle probe either during the picture or one second after picture offset. Individual differences in BIS sensitivity related to relatively greater right frontal N100 amplitude to startle probes presented during pleasant and unpleasant pictures and after unpleasant pictures. These results suggest that BIS sensitivity is related to greater relative right frontal cortical activity during affective states.

National Science Foundation.

**AMBULATORY MONITORING OF RESPIRATION IN PANIC DISORDER AND POSTTRAUMATIC STRESS DISORDER: PRELIMINARY FINDINGS**

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**Descriptors:** respiration, anxiety disorders, ambulatory monitoring

Recent laboratory studies (e.g., Wilhelm, Trabert & Roth, 2001a, 2001b) demonstrated that patients with panic disorder (PD) exhibit pronounced respiratory but not autonomic dysregulation. By using a novel recording system optimized for collecting calibrated respiratory pattern data outside the laboratory (LifeShirt), the present study examined whether these results generalize to the normal daily life of patients. During two 24 h periods, one week apart, a variety of physiological measures were recorded in PD patients (N = 18), healthy controls (N = 17) and a clinical comparison group with posttraumatic stress disorder (PTSD, N = 12). In addition, a Palm-based electronic diary was filled in every three hours to assess explicit processes relating to emotion, cognition and physical symptoms. Preliminary results indicate that PD patients showed circadian pattern and changes in a variety of respiratory measures that differed from healthy controls. However, only some of these alterations (elevated fractional inspiratory time and respiratory rate) were specific for PD. PTSD patients had higher overall minute ventilation than healthy controls (p < 0.05). Stratification of within-subject data by level of physical activity (3-D accelerometer) helped to distinguish circadian rhythms. The results are discussed with reference to their association with self-reported symptoms of anxiety and in relation to theories that emphasize a respiratory pathophysiological basis for PD.

This work was supported by the Swiss National Science Foundation (Grant 105311-105850) and the 6th Framework Project EUCLICK (No. 018741).

**PSYCHOPHYSIOLOGICAL MEASUREMENTS CAN SERVE AS VALID MARKERS OF AFFECT IN IMMERSIVE VIRTUAL ENVIRONMENTS**

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**Descriptors:** immersive virtual environments technology, EMG, affective stimuli

Immersive Virtual Environments Technologies (IVET) are used extensively in psychological research as a means for enveloping participants in realistic environments that may be carefully controlled by researchers. IVET also permits researchers to measure more implicit behaviors of participants (e.g., proxemic behaviors) without participant awareness. Prior research has yet to demonstrate...
the effectiveness of using psychophysiological measurements in conjunction with IVET. The present study presented participants with highly positive and highly negative pictures from the International Affective Pictures System (IAPS) in a virtually rendered lab environment. In half of sessions participants saw two virtually rendered avatars seated next to them facing the presentation screen, and in the remaining sessions participants sat in the virtual lab alone. All participants experienced the virtual lab through a stereoscopic head mounted display. Real-time tracking of participants’ head movements permitted them to look around the virtual lab. During the picture presentation in the virtual lab surface electrodes recorded brow and cheek electromyography (EMG), skin conductance responses, and electrocardiogram. Analyses showed brow and cheek EMG responses were consistent with previous studies that presented IAPS stimuli in real-world settings; brow EMG responses were higher for more negative pictures and cheek EMG responses were higher for more positive pictures. These findings are the first to demonstrate the effectiveness of using psychophysiological measurements in conjunction with IVET.

TOP-DOWN INFLUENCES ON BI-STABLE PERCEPTIONS REVEALED BY ERPS

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Descriptors: bi-stable perception, top-down, ERP

This study investigated the role of ‘top-down’ control on the perception of the Necker Cube by recording EEG using a 128-channel system while 45 participants viewed images under each of three conditions – intentional reversing, intentional non-reversing, and passive viewing. Using the methods defined by Kornmeier & Bach (2004, 2005), a 9-cube Necker lattice was presented for 800 msec with a 400 msec ISI to allow time-locking to stimulus onset. Two early components, the ‘reversal positivity’ and the ‘reversal negativity’ were identified in all three conditions, i.e. when perceptual reversals occurred, significant increases in occipital P1 amplitude (reversal positivity) and decreases in occipital N1, and N2 amplitudes (reversal negativity) were observed. Additionally, significant effects for intention were found as early as 180 ms post-stimulus. Interestingly, the largest intention-based differences occurred when participants tried to hold their percept stable (intentional non-reversal), but were unsuccessful (i.e. reversals occurred contrary to their efforts). While early reversal components have been used to support a model of bottom-up processing of bi-stable figures, the manipulation of intention employed in this study implicates a top-down influence may also be involved. Results will be discussed in terms of individual electrode sites as well as topographic maps.

EARLY INFANT DIET: EFFECTS ON RESTING CARDIOVASCULAR ACTIVITY DURING THE FIRST HALF-YEAR OF LIFE

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Descriptors: cardiovascular, infants, diet

The course of postnatal maturation of cardiac control has implications for later behavioral reactivity and self regulation. To investigate the influence of different infant diets on this process resting heart-rate (HR) and associated heart-rate variability (HRV) were evaluated in awake healthy full-term infants exclusively breast fed (BF), or fed milk (MF) or soy formula with (SF) commercial DHA (docosahexaenoic acid) since at least 2 months of age. Recordings were made monthly (2–6 months) in diet groups matched for gender, gestation period, birth weight, age at visit, and SES at each recording period (2 mo: n = 7; 3 mo: n = 10; 4 mo: n = 11; 5 mo: n = 8; 6 mo: n = 11). Artifact-free recordings were digitized at 1024 Hz and RR intervals determined (~1 ms resolution). Interval data were interpolated, downsampled at 5 Hz, and subjected to power spectral analyses. Data [HR, low (0.04 – 0.15 Hz) and high (0.15 – 0.5 Hz) frequency measures] were analyzed using ANOVA procedures with post-hoc t-tests. Diet-related HR influences were present from 4 – 6 mo, i.e., 4 mo: BF = SF > MF = SF+, p < .05; 5 mo: SF+ > BF = MF = SF+, p < .01; 6 mo: SF+ > SF+ (p < .10); SF+ > BF = MF, p < .02. HRV measures indicated greater parasympathetic influence in all but the SF+ group during this time. These findings are consistent with the reported HR decreasing effect of DHA in adults. It remains to be determined whether these diet-related early developmental differences in cardiac control have long term behavioral effects.

ENDOGENOUS EYE BLINKS, ERP CORRELATES OF EARLY SENSORY PROCESSING AND MORNING NUTRITION

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Descriptors: eyeblinks, P200, nutrition

Processes associated with spontaneously occurring eye blinks have been shown to play an active role in information processing and performance. In this report we consider whether a blink-related influence on ERPs reflecting early sensory processing could be shown and if these processes are influenced by morning nutrition. Blink-free (BF) and blink-associated (BA) P200 responses (F3, F4, C3, C4, P3, P4, O1, O2) to the warning stimulus in a cued visual go-no-go (CPT) task recorded from 107 healthy 8–10 yr old preadolescents recorded first after overnight fasting (BF; n = 98; BA: n = 30) and again after having eaten breakfast (BF; n = 60; BA: n = 23) or continuing to fast (BF; n = 50; BA: n = 20). Blink’s were determined from vertical EOG recordings (> 150 microvolts; > 150 ms). To avoid blink field potential influences on P200 responses, blink trials only included blinks which began 280–600 ms after stimulus onset. Data were analyzed using ANOVA procedures with post-hoc t-tests. Relative to blink-free P200 responses, those preceding blinks were significantly greater in amplitude at frontal (F3, central (C3, C4) and parietal (P3, P4) sites (all p < .01). Compared with children who ate breakfast, those who continued to fast showed a reduction in this effect. These results indicate that endogenous eye blink-associated processes influence early sensory processing and that these effects are modulated by nutritional status.

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PREDICTORS OF PTSD SYMPTOMS SIX MONTHS FOLLOWING THE SEPTEMBER 11TH ATTACKS

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Descriptors: anxiety disorders, ANS, emotion

Many people are exposed to trauma but relatively few develop PTSD. To identify prospective predictors of PTSD symptoms among people exposed to the same trauma, we assessed 17 undergraduates within one week of the September 11th attacks using psychometric measures and bilateral skin conductance (SC), heart rate (HR), and subjective valence and arousal responses to 30 September 11th slides (9–11), 30 other negative events slides (NEG), and 30 neutral slides (NEU). Participants were assessed for PTSD symptoms six months later. We found that six month PTSD symptom level was predicted by greater exposure to traumatic events prior to September 11th, r = .54, p = .02, greater dissociation during the September 11th attacks, r = .59, p = .01, more negative ratings of NEG slides, r = .53, p = .004 and 9–11 slides, r = .54, p = .003, more subjective arousal during NEG slides, r = .47, p = .01, and 9–11 slides, r = .49, p = .008, and smaller left, r = −.51, p = .05 and right, r = −.56, p = .03, SC responses during orientation to the 9–11 slides. A stepwise regression analysis revealed that the following variables were most important in predicting six month PTSD symptoms: dissociation, left sided SC responses, and subjective arousal to the NEG and 9–11 slides. This model, which accounted for 69% of the variance in PTSD symptoms, suggests that dissociative experiences during trauma, reduced orienting and greater subjective arousal in response to trauma-relevant cues in the days following trauma are key predictors of the development of subsequent PTSD symptoms.
STIMULUS-PRECEDING NEGATIVITY IN ANTICIPATION OF AFFECTIVE PICTURES

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Descriptors: stimulus-preceding negativity, emotion, anticipation

The Stimulus-Preceding Negativity (SPN) is a slow potential which reflects the anticipation of an incoming stimulus. Such a component has been proved to be influenced by emotion but it is still unclear if its amplitude and/or its distribution are mainly affected by the valence or the arousal dimension, according to the dimensional model of emotion. The aim of this study was to investigate the SPN modulation to the presentation of emotional pictures selected from the International Affective Picture System. Both valence and arousal were manipulated by presenting pleasant and unpleasant pictures, high and low in arousal. Each picture was preceded by a word indicating its emotional content. The electroencephalogram was recorded together with the electrocardiogram. Results showed that the amplitude of the SPN preceding high arousal pictures was significantly higher than that preceding low arousal pictures, irrespective of valence. A significant heart rate deceleration was observed in anticipation of high arousal stimuli. It then suggested that the SPN does not reflect a generic affective anticipation but the intensity of the motivational engagement associated with affective stimuli.

EXECUTIVE CONTROL AND ACUTE IN-TASK EXERCISE

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Descriptors: executive function, ERP, exercise

This study examined the effects of in-task moderate intensity aerobic exercise on neuroelectric and behavioral indices of interference control, one component of executive control. Forty-one participants (Age = 20 ± 1.6 years; 26 female) completed a VO2max test to determine maximal heart rate (HR). On a separate day, event-related brain potentials and task performance were measured during the counterbalanced conditions of upright cycling at 60% of maximal HR and rest while performing congruent and incongruent trials of a modified flanker task. In-task aerobic exercise resulted in reduced response accuracy for incongruent trials relative to rest; an effect not found for congruent trials or for reaction time. Further, decreased amplitude was observed during exercise for the N1 at parietal sites and globally for N2. In-task exercise also resulted in increased amplitude for the P2 at frontal and central sites, and for P3 at frontal and lateral sites. Lastly, longer N2 and P3 latencies were observed during exercise, relative to rest. These findings indicate that in-task exercise may relate to decreased efficiency of the neuroelectric system, deficits in task performance, and a need for greater top-down attentional control. Finally, these data provide some basis for understanding changes in cognitive function during exercise in real-world settings (i.e., cycling in traffic).

ROLE OF THE FRONTAL P200 IN ENGAGING CORTICAL PROCESSES OF RESPONSE REGULATION

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Descriptors: race, ERP

Research examining neural mechanisms of race bias have reported larger amplitudes of the frontal P200 ERP component in response to Black vs. White faces. Although this P200 effect has been interpreted to reflect automatic categorization on the basis of valence, we proposed and tested the hypothesis that the P200 reflects an early attentional mechanism for engaging frontal cortical processes in the service of response regulation. Subjects reporting high vs. low prejudice attitudes completed a race-priming task that required stereotype inhibition on some trials, while EEG was recorded. We examined P200s associated with the presentation of Black and White face onset and frontal EEG asymmetry EEG coinciding with responses and their subsequent intertrial intervals. Across subjects, Black faces elicited larger P200s than White faces. Among low-prejudice subjects only, larger P200s for Black vs. White faces predicted greater response regulation, as indicated by process-dissociation estimates of control, and this effect was mediated by greater approach-related frontal cortical activity, as indicated by left-sided EEG asymmetry. Among high-prejudice subjects, these relationships were not observed, consistent with the idea that high-prejudice individuals are not motivated to regulate racially-biased behavior. We interpret these results as suggesting that the P200 is not a response to valence per se, but reflects attentional processing of a stimulus that functions to prepare an individual for action.

THE EFFECT OF STRUCTURAL COMPLEXITY AND INFORMATION DENSITY ON COGNITIVE EFFORT AND AROUSAL DURING AUDIO MESSAGE PROCESSING

Robert F. Potter, Zheng Wang, James R. Angelini, Ashley Sanders-Jackson, Satoko Kurita, Jacob Koruth, & Annie Lang
Indiana University

Descriptors: attention, arousal, auditory

Research has identified structural features that elicit orienting responses in radio listeners (voice changes, sound effects, etc.). This study investigated the impact of the relative cognitive load associated with an individual structural feature on message processing. In 24 radio public service announcements (PSAs), each orienting-elicitng structural feature was identified and the relative amount of information introduced was quantified along several dimensions. A 2 (Structural Complexity) × 3 (Information Density) × 4 (Message) experiment was conducted with psychology collected from 168 subjects as they listened to each PSA in a within-subjects design. Skin conductance was sampled at 20 Hz. Heart rate data were collected as IBI and converted to beats per minute as a measure of cognitive effort. After a distraction task, subjects completed a multiple-choice recognition test for information in the PSAs. Results show that due to resource allocation via orienting, recognition improved as structural complexity increased. Furthermore, prior to resource overload, tonic heart rate levels decreased as structural complexity increased indicating greater cognitive effort. Mean cardiac levels were greatest for messages in factor levels where memory data indicated cognitive overload, suggesting disengagement from message processing. Arousal data show SCR frequencies increased with structural complexity at low and medium levels of information density, but remained highest at high levels of information density regardless of changes in structural complexity.

This research is supported by the National Institute of Drug Abuse (NI-DAR01DA-12359-0A).

PLEASANT VS. UNPLEASANT CONDITIONED CUES IN AVERSIVE LEARNING (I): EFFECTS ON EXTINCTION OF ELECTRODERMAL CONDITIONED RESPONSES

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Descriptors: aversive conditioning, skin conductance, EMG

This study re-examined the influence of aversive and appetitive stimuli on electrodermal responses, corrugator activity and self-report during differential aversive conditioning. As CSs, 2 erotic scenes were used in one group (n = 39), whereas 2 equally highly arousing, threatening scenes were used in another group (n = 33). The US was a 500-ms, highly annoying but not painful train of electric pulses. One block consisted of 8 trials (6s-presentations of 4 CS+ and 4 CS-); 6 probes were delivered at 2.5 or 4s after picture onset, and 2 probes during ITIs. Habituation phase consisted of 1 block, and extinction of 3 blocks; US was administered immediately after each CS+ offset during the 2 blocks of acquisition. Skin conductance changes were greater to CS+ than to CS- during acquisition, either for erotic or threat cues, consistent with postconditioning contingency ratings (groups did not differ in awareness of the CS-US relationship). For erotica, CS+ CS- discrimination disappeared after contingency removal, whereas for threatening cues it persisted throughout extinction, both for electrodermal and corrugator responses. The appetitive/aversive context clearly affected on the subjective aversiveness of the US, as appetitive cues somehow reduced the aversive properties of the shock. These results suggest that conditioned responses might be more resistant to extinction when CS hedonic value matches with US valence; Therefore, the maintenance of associative learning (as
indexed by SCR) might depend not only on the CS-US contingencies, but also on the CS initial hedonic valence.

NEGATIVE EMOTION: NOT ALWAYS BAD. HIDING FEELINGS: NOT ALWAYS GOOD

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Case Western Reserve University

Descriptors: emotion, emotion regulation, cognition

The present research studied the influence of negative emotion (i.e. disgust) and automatic emotion regulation on people’s cognitive performance. One hundred and thirty-six undergraduate participants watched a 2-minute movie that was either hedonically neutral or negative and performed two 2-back working memory tasks (verbal and spatial) both before and after watching the movie. Strength of cardiac vagal control (RSA, a physiological index of automatic self-regulation of negative affect) was measured for the two minutes both prior to and during the film. Facial expressions were videotaped during movie presentation and later rated in terms of valence. Analyses revealed that first, after controlling for baseline differences, participants performed better on the spatial 2-back task relative to the verbal 2-back task following negative film presentation. Second, there was a negative relationship between baseline RSA and facial expressivity during the negative film. Last, after controlling for baseline performance, baseline RSA positively predicted participants’ reaction time on the spatial 2-back task after watching the negative movie. That is, the higher RSA participants exhibited at baseline, the longer reaction time they had on the spatial 2-back task following the negative film clip. Results are discussed in terms of the influence of negative emotional states and emotional regulation on cognitive processing as well as the relationship between cardiac vagal control and self-regulation ability.

THE EFFECT OF THREAT OF SHOCK ON PHYSIOLOGICAL AND EVALUATIVE RESPONSES

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Descriptors: threat of shock

Participants were exposed to a differential conditioning design, where the US was threat of shock. Participants were told that they would receive shocks during the experiment, though in actuality only one shock was delivered during the experiment following a presentation of the CS+. One group were instructed, prior to the experiment, that shocks would follow the CS+ but never the CS−; the other group were not instructed. Participants completed ratings and an affective priming task, as evaluative measures, before and after conditioning. Startle eye blink responses were compared for probes presented during CS+ and CS− stimuli, relative to responses for inter trial interval probes. Participants evaluated both CS+ and CS− as more negative than control stimuli after the experiment, and startle responding was facilitated during CS presentations for the instructed group relative to the non-instructed group. The current study suggests that a threat of shock US can produce similar physiological and evaluative responses as does an actual shock US.

AUTOMATIC PROCESSES OF THE REGULATION OF NEGATIVE AFFECT IN BORDERLINE PERSONALITY DISORDER: AN EVENT-RELATED FMRI STUDY

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Descriptors: borderline personality disorder, emotion regulation, functional neuroimaging

Emotion regulation consists of both cognitive and automatic control processes that are thought to be subserved by brain regions including the dorsal lateral prefrontal cortex (DLPFC), anterior cingulate cortex (ACC), and the orbital frontal cortex (OFC). Disruption of the cognitive control of emotion has been identified in Borderline Personality Disorder (BPD) with both phenomenological and neurophysiological measures. In order to test the hypothesis that the neural mechanisms underlying automatic control of emotion are compromised in BPD, we scanned participants using fMRI while engaged in an event-related automatic emotion regulation task (Bishop et al., 2004). Each stimulus event consisted of simultaneous presentation of 4 pictures, with 2 faces (neutral or fearful) and 2 houses arranged in vertical and horizontal pairs. Participants were instructed to either attend to the vertical or the horizontal stimuli. Participants were a community sample of 14 females with BPD who met criteria on both the DSM-IV and the DIB-R (Zanarini et al., 2002). A voxel-wise comparison of 2 conditions of interest [attend to fearful faces, versus attend to neutral faces] indicated significant activation in the following regions: DLPFC, ventral and dorsal ACC, and OFC. As we limited our analysis to specific regions, we used an unadjusted p-value of .01. These preliminary results suggest that neural regions identified in emotion regulation studies with healthy participants are also being recruited in BPD. Future analyses will compare this BPD group with a healthy control group.

Borderline Personality Disorder Research Foundation.

AFFECTIVE MODULATION OF SPINAL NOCICEPTION AND PAIN: VALENCE AND AROUSAL CONTRIBUTE

Jamie L. Rhudy, Amy E. Williams, Klanci M. McCabe, Lauren J. Maynard, & Jennifer L. Russell
The University of Tulsa

Descriptors: nociception, pain, motivation

Affective valence determines the direction of nociception modulation: negative affect enhances nociception and positive affect inhibits it. According to motivational priming theory, arousal (affective intensity) also contributes to modulation, with greater intensity/arousal being associated with greater modulation. The present study examined the independent effects of valence and arousal on spinal nociception and pain by randomly delivering noxious electric stimulations to the sural nerve while participants viewed IAPS pictures (stimulations balanced across picture contents). Pictures were chosen to independently manipulate affective valence [unpleasant (loss, attack), neutral (household objects), pleasant (food, erotica)] and arousal [low (neutral), medium (loss, food), high (attack, erotica)]. Spinal nociception was assessed by nociceptive flexion reflex (NFR) magnitude measured from biceps femoris EMG, and pain was assessed from ratings. Nociceptive outcomes were standardized within individual, averaged by picture category, and ordered for polynomial trend analysis (attack, loss, neutral, food, erotica). It was predicted that nociception would be enhanced during unpleasant pictures (more so by attack) and inhibited during pleasant pictures (more so by erotica). Results suggest that valence and arousal both contribute to nociception and pain modulation, with linear trends explaining 36% of the variance in NFR magnitudes and 36% in pain ratings (ps < .05). No higher order trends were significant.

This work was supported in part by a Faculty Development Summer Fellowship from The University of Tulsa.

EFFECTS OF NICOTINE ON THE ATTENTIONAL MODULATION OF PREPULSE INHIBITION AND CPT PERFORMANCE

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Descriptors: startle response, nicotine, attention

Startle eyeblink modification was measured during a degraded stimulus continuous performance test following ad lib smoking and overnight abstinence among smokers to measure the effects of nicotine on early versus late attentional processes. A group of nonsmokers was tested twice without nicotine manipulation as a comparison. A startling noise was presented either 240 or 1200 ms following target and non-target stimuli presented during the test. Startle inhibition at
240 ms was greater following targets than non-targets following ad lib smoking and during both nonsmoker tests, whereas this attentional modulation of startle was absent following abstinence for smokers. At the 1200 ms probe position, target and non-target stimuli produced non-differential inhibition during both test occasions for both groups. Further, nicotine abstinence among smokers produced reliably lower overall vigilance (d') compared to smoking. Overall the results indicate that in smokers, nicotine abstinence affects the early stages of stimulus processing but not the later stages of attentional maintenance.

This research was supported by NIMH grants MH068093 (PI Anthony Rissing) and R01 MH46433, K02 MH01086 (PI - Michael Dawson).

PHYSIOLOGICAL AND COGNITIVE EFFECTS OF EMOTION REGULATION DURING SADNESS
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Case Western Reserve University

Descriptors: emotion regulation, emotion, physiological reactivity

Despite the last decade of research on emotion regulation, no study has examined both response-focused regulation strategies (suppression and exaggeration) using a within-subjects design. Utilizing this design allows for a direct comparison of physiological patterns and cognitive impairment associated with such efforts. One hundred and nine subjects were recruited from the Introductory Psychology pool at Case Western Reserve University. Each subject filled out a packet of personality questionnaires after which they were exposed to three sad films. Each film was preceded by a 10-second instructional slide (counterbalanced across subjects) which indicated the regulation strategy they were to perform (natural watch, exaggerate, or suppress). Results suggest that exaggeration and suppression not only have very different behavioral manifestations, but physiological outcomes as well. Exaggeration was associated with increased sympathetic activation both peripherally and cardiovascularly as indicated by skin conductance responses (SCR) and pre-ejection period (PEP), respectively. Suppression, much like the natural watch condition, was associated with parasympathetic dominance as evident from interbeat interval (IBI), SCR, and PEP. Both suppression and exaggeration led to a decrease in memory performance, with exaggeration causing the most deficit followed by suppression. Results suggest that response-focused strategies have different physiological reactivity patterns and effects on cognition when used in the context of sadness.

AFFECTIVE REACTIONS TO TRAUMATIC EVENTS AND SUSTAINED POTENTIATION OF STARTLE-BLINK FOLLOWING UNPLEASANT IMAGES
Jordan S. Robinson, & Christine L. Larson
Michigan State University

Descriptors: trauma, startle response

Psychophysiological techniques have been used to extensively study the effects of trauma. Though most of this research concentrates on clinically-defined PTSD, it is also important to understand how a non-clinical, trauma-exposed population responds to traumatic events. We examined relationships between the time course of emotion-modulated startle responses and self-reported affective reactions to traumatic events. Seventy-six students completed an emotion-modulated startle paradigm. Visual stimuli consisted of 120 IAPS pictures, 42 each of positive, negative, and neutral images. Acoustic startle probes were presented at four time points: 1.5, 4.5, 7.5, and 9 s post-stimulus onset. Images were presented for 6 s, with the final two probes presented after picture offset. After picture presentation, participants completed the Traumatic Events Screening Inventory (TESI) to determine the lifetime history of certain traumatic events and their emotional reaction to such events. Several subscales of the TESI correlated significantly with increased startle potentiation to negative compared to neutral pictures following picture offset. Specifically, those participants who experienced particularly emotional events, and those who reacted to these events with intense fear, helplessness, or horror showed even greater startle potentiation to unpleasant images after the offset of the picture than when it was present. These data suggest prolonged maintenance of negative emotion within those individuals who experienced significant emotional distress during a traumatic event.
ASSYMMETRIC ARM MUSCLE REPRESENTATION IN THE PRIMARY MOTOR CORTEX (M1) AFTER A BILATERAL HAND ALLOGRAFT

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Descriptors: motor plasticity, TMS, hand allograft

Body maps in the human brain undergo reorganization in response to amputation. These plastic changes were shown to be reversible after hand allograft. We used transcranial magnetic stimulation (TMS) to evaluate the reorganization of hand representation in M1 in a patient (BY) who benefited from bilateral hand allograft. Patient was tested longitudinally as well as three control subjects. BY evaluation revealed a biceps brachialis (BB) representation shrinkage in M1 across time, approaching control subjects' size for the left, but not the right arm. Moreover, intrinsic hand muscle representation reappeared earlier in M1 for the left than for the right hand, suggesting a graft induced reorganization mostly for the left side. In control subjects, stimulation thresholds to obtain BB mapping also evoke responses in hand muscles (co-activation). The co-activation between BB and flexor digitorum superficialis for BY left arm ranged from 80 to 100%, indicating that forearm intrinsic muscles synergies were close to normal. Nevertheless, for the right side, this value was 30% and 66% at 10 and 17 months after the graft, respectively, and reached 100% at 26 months post-surgery. For the intrinsic hand muscles, 100% of co-activation was found between opponens pollicis and BB as early as 10 months after the graft, attaining only 9 % for the right arm at 26 months post-graft. Interestingly, motor recovery was better for the left compared to the right arm. These results revealed an asymmetrical re-emergence of a functional representation in M1 of the transplanted intrinsic hand muscles.

FOOD PREFERENCE INFLUENCES REFLEXIVE STARTLE MODULATION BY VISUAL FOOD CUES

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Descriptors: startle response, frustrating nonreward, food deprivation

The reflexive startle blink is affected by motivational state; the more pleasant the foreground information, the smaller the startle and vice versa. Although food deprivation increases appetitive ratings of visual food cues, it also enhances startle during their presentation. Frustrative nonreward from unavailability of presented food has been suggested to account for this effect. Our study aims to explore the role of food preference as it has not yet been determined. Participants were asked to indicate their food preferences and eating disorders were ruled out. They were then invited to participate in two different study sessions, once after normal food intake and once after food deprivation (20 hours, crossover design). In each session, subjects repeatedly viewed pictures of preferred and disliked meals. Startle eyeblink responses elicited by sudden acoustic noise bursts were evaluated. In the state of food deprivation, increased startle magnitude was found while viewing preferred meals, but not while viewing disliked meals. After normal food intake, startle responses were diminished during presentation of preferred meals compared to disliked meals (preference*food-deprivation interaction; p<.05). Our results expand on previous findings indicating that frustrating nonreward (i.e. increased startle response) only occurs while viewing preferred meals in a state of food deprivation. Viewing preferred meals after normal food intake results in ‘normal’ affective startle modulation (i.e. decreased startle response).

AESTHETICS OF HUMAN FACES: BEHAVIOURAL AND ELECTROPHYSIOLOGICAL INDICES OF EVALUATIVE AND DESCRIPTIVE JUDGMENT PROCESSES

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University of Leipzig

Descriptors: evaluative processing, aesthetic processing, face processing

We investigated temporal and brain topographic characteristics of processing the aesthetics of faces, using event related potentials and reaction times. Participants judged male and female faces dichotomously for beauty (evaluative) or for head shape (descriptive). Analysis yielded longer reaction times in the descriptive task, suggesting that the judgment of head shape demanded more cognitive effort and may entail greater uncertainty. Electrophysiologically, the evaluative judgment elicited an early negativity (400 to 480 ms) for the judgment “not beautiful”, maximal over central leads, previously reported for evaluative judgments of graphic patterns. It was interpreted as an impression formation when an aesthetic entity is judged intentionally. Besides this effect which was independent of the sex of the face, we report a sex-specific negativity for male faces (280 – 440 ms) and a late positivity (520 – 1200 ms) for female faces concerning “not beautiful” judgments. Thus, the judgment of male and female facial beauty was processed temporally differently. The descriptive judgment “round” elicited a larger posterior positivity compared with “oval” (320 – 620 ms). This P3-like component might be evoked by greater unusualness of the judgment “round” in connection with faces. Different temporal characteristics and diverse positions of maximal voltage deflections reflect that judging beauty was based on different electrophysiological brain activations than the judgment of head shape. Furthermore, sex of the face affected the temporal processing of beauty judgments.

THE DYNAMICS OF FACIAL EXPRESSION DISCRIMINATION

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Descriptors: facial expression, ERP

Despite numerous event-related potential (ERP) studies tracking the time course of emotion processing (e.g. Eimer & Holmes, 2002; Batty & Taylor, 2003), the earliest stage at which facial expressions are discriminated is still unclear. One potential limitation of these studies is that faces are dynamic visual stimuli that may undergo rapid changes of facial expressions in real life, whereas previous studies compared flashed static pictures of faces displaying different expressions. Here we measured the ERP response time-locked to a facial expression change on a face stimulus remaining on the screen rather than to the onset of a flashed picture. Subjects (n = 22) viewed short blocks of alternating faces (A-B-A-B— … 600 ms/stimulation) with morphed facial expression (happy-to-fearful). The first deflection time-locked to a change of facial expression was recorded at occipito-temporal sites at 130 ms, peaking at about 170 ms. critically, this component was larger following between-expression (happy/fearful) than within-expression (fearful/fearful) shifts even though the physical distance between face pairs on the morphed continuum was equal. These results provide strong evidence that the detection of facial expression changes during continuous visual stimulation takes place as early as 130 ms in the human visual cortex.
DO ALL MEN ENJOY LOOKING AT PLEASANT PICTURES?

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1University of Jaen, 2The Ohio State University, 3National Institute on Aging

Descriptors: personalit RY, HRV, resilient

There is a long tradition of research on the physiological correlates of personality. We have previously reported that heart rate variability (HRV) was related to adjectival measures of the five-factor model. Specifically we found that HRV was positively correlated with conscientiousness (C) and negatively correlated with neuroticism (N). Moreover, research in personality suggests that one personality type, the resilient personality, is replicable across numerous studies. This personality type is characterized by low scores on N and high scores on particularly C and Agreeableness (A). In the present study 86 university students completed the Spanish version of the NEO-FFI and also provided 5 minutes of resting heart rate data. Time and frequency domain measures of HRV were derived including normalized high frequency HRV (HF-HRV) as an index of vagally mediated HRV. Pearson correlation revealed that HF-HRV was negatively correlated with N (r = -0.20, p < 0.05) and positively correlated with A (r = 0.20, p < 0.05). In addition, HF-HRV was marginally positively correlated with C. These results largely replicate our previous findings using adjectival measures of personality and suggest that the resilient personality type may be associated with vagally mediated HRV. We have previously shown HF-HRV to be associated with physiological, affective, and cognitive flexibility. These results extend our prior work to suggest that a flexible, resilient personality is also associated with vagal cardiac autonomic control.

AFFECTIVE MODULATION OF SPINAL NOCICEPTION AND PAIN: THE EFFECT OF PICTURE DURATION

Jennifer L. Russell, Lauren J. Maynard, Amy E. Williams, Klanci M. McCabe, & Jamie L. Rhudy

The University of Tulsa

Descriptors: pain, nociception, motivation

Nociceptive reactions are inhibited by appetitive motivation and augmented by aversive motivation elicited by IAPS pictures presented for 6 s. It is suggested, however, that even fleeting images (500 ms duration) can engage motivational drives. The present study examined whether brief visual stimuli modulate nociceptive reactions. Attack, neutral, and erotic pictures were presented in random order for 6 s or 500 ms (duration balanced across picture contents). During pictures, noxious electric stimulations were delivered to the sural nerve (balanced across picture content and duration) and nociceptive flexion reflex (NFR) magnitude and subjective pain reactions were assessed from each stimulus. Nociceptive reactions were standardized within individual, averaged by picture valence and duration, and analyzed. It was predicted that nociceptive reactions would be greatest during unpleasant pictures and smallest during pleasant pictures, regardless of picture duration. Results suggest valence and arousal ratings of pictures were not significantly altered by picture duration. As predicted, subjective pain was modulated by brief (500 ms) and long (6 s) pictures. Long pictures resulted in affective modulation of the NFR; but, brief pictures did not. Thus, longer picture duration may be needed to engage descending modulation of spinal nociception.

This work was supported in part by a Faculty Development Summer Fellowship from The University of Tulsa.

PRIMES AND PREJUDICE: RACE OF THE PARTICIPANT MODERATES THE RELATIONSHIP BETWEEN SUBLIMINAL PRIMING OF RACE AND FACIAL MUSCLE ACTIVITY

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Descriptors: stereotype, prejudice, EMG

This experiment investigated the relationship between implicit measurements of stereotyping and implicit measurements of racial prejudice. Using a subliminal semantic priming paradigm, participants completed a lexical decision task. Words consisted of negative stereotypes of Black and White men and were preceded by a subliminal photograph of a Black or White face. In a subsequent task, participants viewed Black and White faces while EMG activity was recorded from the corrugator supercillii and zygomaticus major regions. Average reaction times were calculated for congruent (e.g., black face-black stereotype) trials and difference scores were computed to estimate stereotype strength bias. Difference
scores comparing activity during presentation of black faces to white faces for zygomaticus and corrugator EMG activity were also computed. Priming data failed to predict differences in facial EMG activity until the race of the participant was introduced as a moderator. Moderation was examined using hierarchical regression and a significant interaction between participant race and priming bias score was found. Simple slopes were examined and showed that stronger stereotypes of Blacks predicted more corrugator activity for White participants, whereas stronger stereotypes of Whites predicted more corrugator activity for Black participants.

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AGE-RELATED CHANGES IN FRONTAL AND PARIETAL INTERHEMISPHERIC CONNECTIVITY REVEALED BY DIFFUSION TENSOR IMAGING

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Descriptors: anatomical connectivity, aging, diffusion tensor imaging

We investigated age-related differences in the distribution of frontal and parietal projections to the corpus callosum (CC) using diffusion tensor imaging (DTI). When performing connectivity-based CC parcellation, the cortex is routinely partitioned via crude manual tracing or using a template. Both methods are not efficient in aging studies due to greater anatomical variability in older adults (OA). We employed DTI probabilistic tractography to construct maps of frontoparietal corticocortical projections in 7 young and 6 old adults. Gray/white matter (GM/WM) segmentation of structural MR images followed by nonlinear warping to a brain atlas yielded individual cortical masks for 7 areas within frontoparietal cortex. Midsagittal CC masks were extracted from segmented WM masks. Fibers projecting to the CC from each cortical region of interest were traced using the FMRIB's Diffusion Toolbox. While all the cortical masks were significantly smaller in OA, the total area of midsagittal CC cross-section was not related to age. The callosal projection from dorsolateral prefrontal cortex was significantly smaller in OA. However, the absolute size of corticocortical projections from ventrolateral prefrontal, motor, and somatosensory cortex was greater in OA. No age-related differences were shown in parietal and orbitofrontal projections. These data complement previous findings of nonlinearity significantly greater in OA. No age-related differences were shown in parietal and orbitofrontal corticocortical projections in 7 young and 6 old adults. Gray/white matter (GM/WM) segmentation of structural MR images followed by nonlinear warping to a brain atlas yielded individual cortical masks for 7 areas within frontoparietal cortex. Midsagittal CC masks were extracted from segmented WM masks. Fibers projecting to the CC from each cortical region of interest were traced using the FMRIB's Diffusion Toolbox. While all the cortical masks were significantly smaller in OA, the total area of midsagittal CC cross-section was not related to age. The callosal projection from dorsolateral prefrontal cortex was significantly smaller in OA. However, the absolute size of corticocortical projections from ventrolateral prefrontal, motor, and somatosensory cortex was greater in OA. No age-related differences were shown in parietal and orbitofrontal projections. These data complement previous findings of nonlinearity in the relationship between age-related changes in corresponding areas of WM and GM, raising questions about mechanisms of plasticity in anatomical connectivity accompanying age-related GM loss.

SELECTIVE NUCLEUS ACCUMBENS AND MEDIAL FRONTAL CORTEX ACTIVATION IN APPETITIVE PICTURE PROCESSING

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University of Florida

Descriptors: emotion, functional neuroimaging, visual

Past functional magnetic resonance imaging (fMRI) studies have identified enhanced visual cortical signal during emotionally arousing, relative to neutral picture perception. Here we focus on subcortical and anterior cortical involvement in affective picture perception, and explore the potential distinctions between appetitive and aversive stimuli. In one study, 22 subjects viewed a mixed series of 24 grayscale pictures, depicting erotic couples, neutral people, and mutilations, while whole-brain functional images were acquired every 3s. Areas showing greater signal during emotionally arousing, relative to neutral picture presentations included amygdala, caudate, lateral geniculate, anterior thalamus, anterior cingulate, and insula. Interestingly, activity in nucleus accumbens and medial frontal gyrus (MFG) showed selectively increased activation during erotic picture perception. In a second study, 24 subjects viewed a series of 30 grayscale pictures, depicting erotic couples, romantic couples (clothed), neutral people, dental scenes, snakes, and human threat. Subcortical effects were consistent with the first sample; nucleus accumbens and MFG showed selectively increased activation to scenes of erotic and romantic couples. This effect was consistent across men and women, and was replicated in a third sample (n = 13) of anxiety patients. These data suggest that while amygdala activation is increased during appetitive and aversive, relative to neutral picture processing, activity in nucleus accumbens and MFG is selectively increased during appetitive picture processing. NIH P50-MH072850.

WIGGLING YOUR EARS TO SMILES? EMOTIONAL MODULATION OF THE POST-AURICULAR AND EYE-BLINK STARTLE RESPONSE TO FACIAL EXPRESSIONS

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Descriptors: emotion, startle response

Emotional facial expressions have affective significance. Thus, smiles are perceived as positive and people tend to respond to them with increased happiness, whereas angry expressions are perceived as negative and threatening. However, previous research on affective startle modulation in reaction to facial stimuli has found inconsistent results, including no effects or opposite effects from predicted for eye blink startle modulation pattern. The present research assessed both post-auricular and eye blink startle modulation in response to happy and angry faces. In this study, 30 male and female undergraduates viewed happy, neutral, and angry facial expressions as well as a series of positive and negative IAPS pictures. Startle reflex at both sites as well as ratings of valence, arousal, and tendency to withdraw were obtained. The post-auricular response was potentiated during viewing of happy expressions and inhibited relative to neutral expressions during anger expressions (the linear component was significant, p = .008). However, the pattern of results for eye blink startle was significant only for male faces and only when compared to ITI. Because male anger is generally perceived as more threatening than female anger, this pattern of results is congruent with the notion that eye-blink startle may be sensitive to threat and imminence of attack as suggested by Lang et al. (1997), and not only to the valence of the stimulus. In contrast the post-auricular startle reaction seems to be more linearly related to perceived positivity.

TASK SWITCHING COSTS WITHOUT RESPONSE SELECTION? AN ERP STUDY

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Descriptors: executive function, task switching, P3

Switching between different tasks results in an increase in response times and error rates compared to task repetitions. In standard task-switching paradigms, a cue, which defines the task, is followed by a target which defines the required response. Thus, participants are able to prepare for the upcoming task but not for a particular response, even if a particular bivalent target requires the same response in both tasks (congruent). When the sequence of cue and target is reversed, no switching costs should be observed for such congruent targets because the response is the same for both tasks and may be selected before the task is defined. Both, CNV and LRP indicate that the required response has been selected in the preparatory interval in case of congruent targets. Also a markedly reduced P3, evoked by the response triggering task-cue for congruent stimuli, indicates that S-R retrieval has been made without knowledge of the task. However, task switch costs were not reduced. Additionally, a positive slow wave following the P3-peak evoked in switch trials both for congruent and incongruent targets indicates that task switching appears to be independent from response selection. The cue (and its assigned task) appears to be unconditionally processed and compared to what has been done before, even when not necessary for responding in the actual task.
INHIBITION OF PRIMED DICHTIC LISTENING STIMULI IN AN ERP STUDY: INFLUENCE OF CONTEXT ON AUDITORY PROCESSING AND ATTENTION

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Descriptors: ERP, attention, dichotic listening

Dichotic listening with simple speech sounds, like consonant-vowel (CV) syllables, is a commonly used methods for studying language and attention. The typical finding is the right ear advantage (REA), indicating a left hemisphere dominance for processing of language. The current study investigated the effect of presenting a prime CV-syllable binaurally is before the dichotic CV stimuli. The prime could be the same as the left or right ear dichotic stimulus, or it could be different from both dichotic stimuli. Participants (n = 15) were instructed to report the CV they heard best from the dichotic CV pair. Behavioral results showed that when the prime was different from both dichotic stimuli, a significant REA was found. When the prime matched one of the dichotically presented CVs, the primed CV was reported less frequently, while the unprimed CV was reported more frequently. Event-related potentials (ERPs) were recorded from 64 electrodes concurrently with stimulus presentations, using ICA and wavelet-denosing to allow for single-trial analysis. Comparisons between ERPs from primed and unprimed trials and from effective and non-effective priming trials showed effects around the time of the N100 onset and during the P300/slow-wave. The results indicate a mechanism suppressing responses to repeated stimuli on the level of phoneme (category) representations, possibly interacting with an additional attentional bias. This mechanism can be thought of as an analog of inhibition of return, however it inhibits verbal representations rather than spatial orientation.

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EXPECTING THE UNEXPECTED: EXPECTANCY TRUMPS ASSOCIATION AND MODULATES N400 ON A NEELLY-TYPE TASK

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Descriptors: expectancy priming, N400, neely

Lexical and semantic priming are likely based on associative links in semantic memory stores. It is well known that words which follow related words are responded to more quickly than words following unrelated words. The N400 ERP seems to reflect this, though it may more directly reflect the ease of integrating related words into contextual representations, rather than the supposed pre-activation in semantic memory. In a classic experiment, Neely (1977) showed that expectation of unrelated words could be reflected in RT priming at longer SOAs, presumably reflecting top-down expectancy effects. N400 evidence for this effect is lacking. The current experiment was undertaken to observe N400 behavior during a Neely-type task. Subjects were required to make a word-word lexical decision as quickly as possible. When no explicit expectancies were established, words that were related to the preceding word generated significantly smaller N400s than words that were unrelated to the preceding word (i.e., the standard N400 word effect). However, when subjects were instructed that one category name would be followed by a specific but unrelated category exemplar, N400 was significantly smaller to the unrelated but expected word than to words semantically related to the category name. These results suggest that expectancies can trump associative strength at the word level, at least at long SOAs, and can modulate the operations reflected in N400 amplitude, even when semantic-based and expectancy-based priming are in opposition.

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MUSCARINIC RECEPTOR SUBTYPE M4 IN SIGNAL TRANSDUCTION AND MEMORY CONSOLIDATION

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Descriptors: muscarinic receptors, cyclic amp, muscarinic toxin 3

Muscarinic receptor subtypes (MACR) display differential brain distribution and are related to learning and memory: agonists facilitate memory and antagonists are amnesic. The specific role of each MACR is poorly understood. M2 and M4 subtypes inhibit the adenylyl cyclase (AC) through Gi protein, while M1 M3 and M5 act through Gq pathway. Muscarinic toxins (MTs) are peptides from a snake venom and represent valuable tools for studying the muscarinic system. MT3 is highly selective for M4. We studied muscarinic regulation of AC activity by measuring cAMP levels in rat hippocampus and striatum and MACR effect on memory consolidation by means of drug administration in CA1 following a learning paradigm. Forskolin increased cAMP synthesis by 1000% in hippocampus and by 2000% in striatum. Muscarinic agonist oxotremorine inhibited this cAMP increment by 25% in hippocampus and by 10% in striatum. MT3 reversed such inhibition. Dopamine (DA) stimulated cAMP production by 15% in hippocampus and by 60% in striatum. Oxotremorine decreased DA stimulation of AC activity by 40%. This agonist effect was completely reverted by MT3. These results suggest that muscarinic modulation of AC is mostly due to M4 receptor. When MT3 was injected in hippocampus after training, it was found to disrupt memory in the inhibitory avoidance task, mimicking the action of the antagonist pirenzepine. These results support the idea of a positive modulation of M4 in memory consolidation.

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THOUGHT SUPPRESSION VS ACCEPTANCE OF INTRUSIVE COGNITIONS IN UNDERGRADUATES WITH OBSESSIVE-COMPULSIVE CHARACTERISTICS

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University of Arizona

Descriptors: ERN, emotion, psychopathology

The error-related negativity (ERN), a negative scalp potential that occurs approximately 50–100 ms after response errors, is associated not only with monitoring actions, but also is sensitive to the emotional significance of stimuli, and may index activity in the anterior cingulate cortex (ACC). An enhanced ERN has previously been observed in undergraduates with obsessive-compulsive characteristics, and the present study extended these findings by comparing two strategies that participants may use in response to intrusive cognitions: thought suppression and acceptance. Intrusive cognitions were prompted in high- and low-OC participants by showing an emotionally evocative video, and then participants were instructed either to suppress or accept any intrusive cognitions during the experiment. Participants monitored the number of intrusions during a 5-minute rest period, and then performed a variant of the Stroop task that included emotion-relevant words. The suppression strategy improved reaction time performance for the low-OC group but slowed them for the high-OC group. The acceptance strategy showed the reverse effect, improving reaction times for the high-OC group, but slowing them for the low-OC group. Self-reported intrusions during rest were greater for the high-OC group. During Stroop task errors, the response-locked ERP was apparent as a maximal frontal negativity, and was significantly larger for the high-OC group than low-OC group. Participants who accepted rather than suppressed intrusive thoughts also showed a trend toward a greater maximal frontal negativity.
POOR ERROR MONITORING RESPONSE IS RELATED TO LACK OF EMPATHY
Diane L. Santesso, & Sidney J. Segalowitz
Brock University

Descriptors: ERN, empathy, executive function

Empathy is a multidimensional construct involving sophisticated cognitive and affective processes (Baron-Cohen, 2004). Neural imaging studies have identified regions of prefrontal cortex (including the anterior cingulate cortex, ACC) mediating empathic abilities (e.g., Shamay-Tsoory et al., 2003, 2004) but to date, no such electrophysiological studies exist. In the present study, we examined cognitive and affective empathy in relation to error monitoring behaviorally and as reflected electrophysiologically in the error-related negativity (ERN) in young adult males during a visual flanker and a go/no-go task. The ERN is thought to reflect activity of the ACC, indexing error detection and is sensitive to affective responses to errors. Previous studies have found that low-socialization (related to lack of empathy) in adults (Dikman & Allen, 2000) and children (Santesso et al., 2005) was associated with smaller ERNs. We examined empathy in relation to the ERN at midline scalp sites in 39 males aged 18 – 19 years. We found that low scores on the empathy measure were unrelated to behavioral measures of error monitoring but were related to smaller ERNs at FCz and Cz on both tasks. Results provide support for the role of the ACC in empathy and suggest that the ERN at midline scalp sites is sensitive to affective processes related to empathy.

PERSONALITY CORRELATES OF THE NEGATIVITY BIAS
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Descriptors: ERP, emotion, late positive potential

Previous research has found evidence for a negativity bias in younger adults. Specifically, negative information seems to have a stronger impact than positive information in several realms including politics, emotion, risk taking, and health (Rozin & Royzman, 2001). Recent studies have also demonstrated a negativity bias by examining the variance in brain activity in response to positive and negative images (Ito, Larsen, Smith, Cacioppo, 1998; Wood & Kisley, in press). The present study investigated whether variance in this brain measure is correlated with variance in personality. Event-related potentials (ERPs) were recorded during an evaluative categorization task that involved viewing neutral, positive and negative images. Amplitude of the late positive potential (LPP) in the ERP waveform at electrode site Pz, was compared to scores on 3 personality instruments. Forty purportedly normal adults, ranging in age from 18 – 35 years, participated. LPP amplitude was significantly correlated with measures of Avoidant Personality traits (r = .42), Paranoid Personality traits (r = .43), Schizoid Personality traits (r = .47), Depression (r = .41), and Detachment (r = .51). Also, the amplitude of the negativity bias (i.e., the numerical difference between responses to negative and positive images) was found to increase linearly with the presence of Depressive Personality traits (r = .43). These findings support the idea that variance in the LPP waveform and the negativity bias observed within groups of younger adults is related to differences in personality.

ELECTROPHYSIOLOGICAL RESPONSE TO FOOD STIMULI WITH DIFFERENT NUTRIENT CONTENT
Isabel Santos1, Patricia Ferreira1, Jorge Oliveira1, Américo Baptista1, Isabel Fonseca2, Susana Pereira1, & Ana Valent1
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Descriptors: food attitudes, attention, N200

Electrophysiological correlates of attitudes toward food were studied using ERPs in a P3 experimental paradigm in a sample of 10 healthy participants with unrestrained eating. Three visual stimuli categories (neutral objects, high caloric and low caloric food) were presented with equal probabilities. Subjects had a counting task. EEG was recorded within the time interval of 100 ms pre stimuli and 1000 ms after stimuli presentation in four derivations (Fz, Cz, Pz and Oz, 10/20 IS) referred to left mastoid. Averaged procedure was computed separately for each class of stimuli. After baseline correction the to the stimuli period amplitude and latency of waves were within the time intervals 180 – 220 (N2) and 250 – 400(P3) ms was measured for maximum negative and positive respectively. Results were compared using Anova repeated measures computed over amplitude values taking as within subject's factor stimuli category. Significant amplitude differences were found in Fz derivation for maximum negative amplitude within the mean latency of N2. Negative amplitudes were significantly more negative to the two food stimuli category (high and low caloric) than to neutral stimuli. This result has been interpreted as an expression of attention allocation to motivational relevant stimuli.

TIME COURSE OF DISGUST PROCESSING ACROSS DIFFERENT DOMAINS
Michela Sarlo, Marianna Munafò, Vania Camerin, Nicole Di Alessandro, & Daniela Palomba
University of Padova

Descriptors: disgust, ERP, blood-related stimuli

Recent fMRI and quantitative EEG studies investigating the neural responses to disgust have highlighted the complexity of disgust processing along its different domains. When tested separately, distinct neural responses to stimuli depicting mutilation and contamination were obtained, with mutilation uniquely activating the right superior parietal cortex. The current study was aimed at investigating the temporal course of this differential processing. Thirty-nine participants saw 48 pictures depicting minor injuries (Blood), vomit and feces (Body Products), attacking humans (Threat), household objects and landscapes (Neutral). EEG was continuously recorded during picture viewing from 58 scalp sites, with linked mastoids as reference, and event-related potentials (ERPs) to picture onset were computed. Each picture was presented for 2 s and was then rated for valence, arousal and the basic emotions. Results showed that Blood, Body Products and Threat were rated as equally unpleasant. Moreover, Blood and Body Products did not differ in reported disgust and arousal. Significantly larger amplitudes of P2 and late ERP components (P3 and Late Positive Complex) were found when subjects were processing Blood than the other unpleasant material. This effect was larger over the anterior cortical areas. These findings suggest that blood-related stimuli receive preferential access to attentional resources both early in emotional perception and in a later evaluation stage, as compared with other unpleasant or disgusting material.

STIMULUS CONTEXT EFFECTS ON DEVIAN T TARGETS AND NON-TARGETS: A P3 ERP STUDY
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Descriptors: stimulus context, deviance, P3

Several studies have demonstrated that standard/target discrimination difficulty determines whether typical non-target stimuli elicit a P3b or P3a, indicating that stimulus context affects deviant non-target processing. However, whether stimulus context also affects deviant target processing is unknown. In the present study, the event-related brain potential (ERP) was elicited from a visual three-stimulus oddball paradigm (small blue circle, 0.70; large blue circle, 0.15; and large red square, 0.15) to clarify the underlying mechanism of the stimulus context effect. The frequent blue circle was the standard and the rare blue circle was the target in all task conditions. The stimulus category of the rare red square (non-target or target) and the frequent/rare blue circle discrimination difficulty (easy or difficult) were manipulated orthogonally. In the three-category tasks (red square was a non-target), the red square elicited a non-target P3b in the easy condition, whereas it elicited a P3a in the difficult condition, confirming that
stimulus context affects deviant non-target processing. In the two-category tasks (red square was a target), the red square elicited a P3b in both conditions, the fronto-central amplitude of which was larger in the difficult condition than in the easy condition, so that stimulus context also affected deviant target processing. The findings indicate that stimulus context influences the attentional set for stimulus processing such that it determines the response to deviant information, regardless of task-relevance.

SENSORY PROCESSING, PHYSIOLOGICAL REACTIVITY AND ADAPTIVE BEHAVIOR IN AUTISM

Roseann C. Schaaf1, Teal Benevides1, Lucy J. a. n. e. Miller2, Sarah Shoen2, Barbara Brett-Green2, L. Diane Parham3, & Teresa May-Benson4,5
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Descriptors: autism, vagal tone, adaptive behavior

This session presents data from two studies that examined autonomic nervous system reactivity during a sensory challenge in children with autism. Specific aims were to determine 1) if children with autism demonstrate unique physiological reactivity to sensory stimuli; 2) if physiological reactivity is a useful grouping factor to address the heterogeneity of autism; and 3) to determine if sensory processing and/or physiological reactivity is related to adaptive behavior. A unique laboratory protocol, the Sensory Challenge Protocol, is used to evaluate reactivity to sensory stimuli via heart period variability (NA vagal tone) and electrodermal reactivity (EDA) in children with autism in comparison to typically developing children. Sensory processing is evaluated using the Short Sensory Profile, a research tool designed to assess the child’s responses to sensory stimuli during daily life activities. The Vineland Adaptive Behavior Scales are used to evaluate adaptive behaviors. Results indicate that children with autism demonstrate lower and flatter vagal tone responses than typically developing children and that these are associated with poorer adaptive behavior and sensory processing. In addition, there is some evidence that children with autism can be grouped into a high and low tonic activity group based on their EDA. Implications of this research for further study of sensory processing in children with autism are presented.

ALPHA2-ADRENORECEPTORS INFLUENCE VOLUNTARY AND INVOLUNTARY MOTOR RESPONSES TO STARTLING STIMULI

Hartmut Schächinger, Christine Philippsen, & Melanie Hahn
University of Trier

Descriptors: startle response, psychomotor reaction time, alpha2-adrenergic antagonism

The same startling stimuli may trigger automatic (involuntary), as well as voluntary motor responses. Both types of responses are able to protect the individual from dangerous objects and collisions. However, little is known about their modulation by the central alpha2-adrenergic system, which represents a key mechanism for acute and chronic stress adaptation. Twelve healthy males (age: 19 to 35 years) participated. According to a single-blinded study protocol the selective alpha2-antagonist yohimbine was administered intravenously (0, 16, 32, 64, 125 μg/kg), as was placebo. Subjects were instructed to push a button as fast as possible when sudden (50 ms duration, instantaneous rise time) noise bursts of various sound intensity levels (60, 70, 80, 90, and 100 dB) were presented binaurally. Reaction time was determined. Startle elicited eye blink response magnitude was assessed at the same time. Sound stimulus intensity facilitated both types of responses: automatic startle eye blink, as well as voluntary button push. Yohimbine was associated with increased automatic startle eye blink responses, as well as reduced voluntary motor reaction time to intense sound stimuli. Data support the existence of a putative alpha2-adrenergic gating mechanism, favoring involuntary automatic brainstem-hosted responses - at the expense of voluntarily controlled startle response strategies.

DFG SCHA 1257/2.

TRAIT ANXIETY AND COPING STYLES MODERATE THE SOOTHING EFFECT OF PHYSICAL CONTACT ON NEURAL THREAT RESPONDING

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1University of Virginia, 2University of Wisconsin-Madison

Descriptors: anxiety, social contact, neuroimaging

Recent evidence suggests relationship status and relational dimensions of personality moderate the soothing effects of physical contact. Less certain are relationships between soothing physical contact and generalized dimensions of personality, particularly trait anxiety and coping strategies. In this event-related functional MRI study, hand-holding was used to examine the effects of positive social contact during stress. Women experienced a threat-of-shock paradigm while alone, holding an anonymous stranger's hand, and holding their husband's hand (order counterbalanced). Self-report questionnaires measured trait anxiety and preferred coping strategies. Low trait anxiety corresponded with less threat-related activation during both spouse and stranger handholding conditions in the cingulate gyrus, thalamus, hypothalamus, putamen and insula, a relationship that was not present in the alone condition. In addition, women reporting high levels of coping strategies involving venting and emotional expression demonstrated greater threat-related activation during stranger handholding, and less attenuation of startle potentiation during stranger handholding versus being alone, specifically in the putamen, thalamus and somatosensory cortex. Results implicate trait anxiety and emotive coping strategies as moderators of the soothing effects of physical touch on neural threat responding, independent of relationship status.

AWARENESS IN TRACE AND DELAY FEAR CONDITIONING

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University of Greifswald

Descriptors: fear conditioning, trace conditioning, awareness

An aversive differential trace and delay conditioning experiment was designed to examine the role of contingency awareness in human conditioning. Twenty-six students were fear conditioned using two neutral faces as conditioned stimuli and an aversive human scream as unconditioned stimulus. Trace and delay conditioning were compared in a between-subjects design, i.e. participants were assigned to either delay or trace conditioning procedure. Startle reflex, skin conductance and heart rate were measured. After conditioning, the participants were debriefed for contingency awareness in a standardized interview. In delay conditioning the presentation of the CS+ elicited larger skin conductance responses compared to CS-, but only in those participants who correctly realized the contingencies. In contrast, startle magnitude was larger during presentation of the CS+ independent of participants' awareness. However, using trace conditioning, conditioned startle potentiation and conditioned skin conductance responses occurred only in aware subjects. Results suggest the participation of different memory systems for trace and delay conditioning, taking into account that conditioned skin conductance responses are an index for cognitive learning of the contingencies and that an augmented startle reflex represents the acquisition of aversion. Unconscious acquisition of fear may be possible in delay conditioning, whereas in trace conditioning the acquisition of fear depends on declarative memory processes.

This work is part of the International Center for Integrated Neuroscience at the Alfred Krupp Wissenschaftskolleg and is supported by grant of the Alfred Krupp von Bohlen und Halbach-Stiftung.

WHAT DO WE AND OUR BRAIN SEE WHEN WE DO NOT EXPECT A STIMULUS? RESULTS FROM A LATERALIZED EVENT-RELATED POTENTIAL STUDY (N2PC)

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Descriptors: attention, awareness, n2pc

Attention is assumed to be a prerequisite of aware processing of visual information. Changes between two successively presented pictures are hard to detect
when their presentation goes along with a simultaneous presentation of distractors (mudsplashes). These distractors might capture attentional resources which prevents an attentional shift towards other changes in a visual display. An ERP component that is assumed to be related to such attentional shifts is the N2pc. It occurs 200–300 ms after stimulus onset and is characterized by a stronger contralateral than ipsilateral activity in reference to the stimulus position. Thus, the N2pc might enable exploration of the role of attention in conscious change detection. In a change blindness experiment, either lateralized or central changes were presented. Mudsplashes which did not overlay the change were presented simultaneously with the change. ERPs evoked by lateralized changes were investigated in three experimental blocks that were identical in stimulation but differed in instruction. Observing only the central change and not knowing about lateral changes elicited no N2pc. Also, if lateral changes were task relevant, an N2pc was observed for detected and undetected changes with a larger amplitude for detected changes. Repeating the first task, lateral changes also evoked an N2pc although they were again not task relevant. Thus, these results indicate that the N2pc reflects the processing of stimuli in visual cortical areas that is modulated by attention. This process does not necessarily lead to aware representations.

The research project was realized at the Max Planck Institute for Human Cognitive and Brain Sciences, Munich, Germany.

THE KALEIDOSCOPE OF AFFECTIVE SPACE: PSYCHOPHYSIOLOGICAL RESPONSE PATTERNS AND FMRI ACTIVITY TO PICTURE CONTENTS

Katrin R. Scharpf, Almut I. Weike, Julia Wendt, Norbert Hosten, & Alfons O. Hamm
University of Greifswald

Descriptors: emotion, picture content, functional neuroimaging

Affective space has been described along the two dimensions of valence and arousal whose impact can be measured with different output systems (e.g., startle amplitude – valence, skin conductance – arousal). The present study introduced a third factor – social content. The effects of these 3 dimensions on autonomic (startle, skin conductance), central (amygdala activity) and behavioral (EMG of corrugator and zygomaticus) emotion indicators were measured while IAPS pictures were presented in a categorically blocked order. 12 categories where used in a 3(valence)x2( arousal)x2(social content) factorial design: erotic, adventure, happy people, cute animals, neutral faces, abstract art, work scenes, objects, mutilation/human attack, accident/gun, loss, and contamination. 30 students participated in the psychophysiological session and 12 of them were invited for the fMRI session a year later. As expected, the response systems showed differential reactivity to the a priori defined factors. There was a clear modulation of the startle response by the valence of the pictures (inhibited during pleasant contents) while skin conductance was modulated by arousal. Pronounced EMG activity occurred during mutilation (corrugator) and cute animals (zygomaticus). Interestingly, the social content of the pictures had the biggest impact on amygdala activity. The contents included in this factor may activate networks with personal relevance and are therefore especially effective in inducing affective reactions.

Stiftung Alfred Krupp Kolleg Greifswald, International Center for integrated neuroscience.

EVENT-RELATED POTENTIAL INVESTIGATION OF TRANSFER APPROPRIATE PROCESSING: ROLE OF MEMORY FOR PERCEPTUAL GROUPING PROCESSES AND GLOBAL SHAPES, PARTS, AND LOCAL CONTOURS IN VISUAL OBJECT COGNITION

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1Tufts University; 2University of California-San Diego

Descriptors: ERP, vision, object categorization

Categorization of visual objects entails object model selection, matching a percept to representations of structural knowledge in long-term memory, but the representational format is largely unknown. Further, people categorize previously experienced objects better than new objects. Transfer appropriate processing (TAP) accounts attribute this memory benefit to reactivation of identical neural processes from the initial to later encounters. In two experiments, event-related potentials (ERPs) to degraded objects were recorded during an indirect memory test to isolate transfer of visual processes from overlap of local features between experiences. Results revealed transfer of both but at different times. In direct support of TAP accounts, an occipitotemporal P200 showed implicit memory modulation to items for which similar perceptual grouping processes were repeatedly engaged but not to items that merely reinstated features. After 500 ms, memory modulation of a late positive complex, indexing secondary categorization processes and recollection, was sensitive to local contour changes. In between, a frontocentral N350, indexing object model selection and implicit memory, showed memory modulation when the same global shape and parts were reactivated, regardless of local contour differences. Thus the representations supporting model selection include knowledge beyond local contours and about higher-order perceptual structures. The overall ERP findings show the format of visual memory representations varies across time with the specific processing and memory system engaged.

Tufts University start-up funds and Research Semester Fellowship from the Faculty Research Award Committee (FRAC) to H.E.S., and grants MHS2893 and AG05914 to M.K. who was a Lady Davis Fellow during the writing of this paper.

CUE MODULATED COGNITIVE CONTROL INVERSELY EFFECTS GO AND NOGO RESPONSES

University of Minnesota

Descriptors: inhibition, cognitive control, cued go-nogo

Go-NoGo tasks have been used to measure response inhibition and develop cognitive control theories. The introduction of cue stimuli preceding the Go-NoGo target stimuli offers a method of manipulating and evaluating preparatory control processes. In the current study, tentative versus certain directional cues manipulated cognitive control during a cued Go-NoGo task. Event-related potential brain responses (N = 66) were measured in the cue period, as well as to the Go and NoGo stimuli (75% and 25% respectively). Time-frequency decomposition using principal components analysis (Bernat, Williams, and Gehring, 2005) was conducted to assess oscillatory ERP activity, and time-domain analysis to assess slow wave motor potentials. Greater cognitive control was inferred from the tentative cue, where participants were uncertain about the directional contingency. Tentative cues were associated with increased midline frontal theta directly antecedent to the targets, suggesting anticipation for task switching. The certain cue was associated with an increased slow wave motor potential, suggesting anticipation of a motor response to the target. Interestingly, target responses were inversely effected by cue type. Certain cues resulted in greater anterior theta and posterior delta to NoGo than Go stimuli, while tentative cues resulted in greater anterior theta and posterior delta responses to Go than NoGo stimuli. Findings are discussed in relation to cognitive control theories and the role of prefrontal brain areas involved in task switching and cognitive control.

ABSTRACT REGULARITY VIOLATION CAUSES DISTRACTION

Erich Schroger, Alexandra Bendixen, & Urte Roeber
Institute Psychology I

Descriptors: attention, distraction, MMN

Regularities in sound sequences are automatically encoded by the auditory system. This has been revealed by the elicitation of the Mismatch Negativity (MMN) component of the ERP when a sound does not conform to the regularity. We investigated whether the non-intentional detection of a sound violating an abstract regularity causes an involuntary shift of attention. Tone pairs were presented to subjects who performed a duration discrimination task (short vs. long)
to the second tone. For each trial, the frequency of the first tone was randomly chosen from a range between 600 and 1200 Hz. The second tone was ascending or descending in frequency by 26% relative to the first tone. One of these two relations was frequent (standard), thus forming a regularity, the other one was rare (deviant). Tone frequencies and frequency relations were task-irrelevant. None of the subjects acquired explicit knowledge of the regularity nor became aware of the presence of deviants. Nevertheless, deviants were detected (MMN) and resulted in electrophysiological (P3a) and behavioral (response time prolongation) distraction effects. Herewith, it is demonstrated for the first time that violations of abstract regularities in sound sequences may lead to attentional orienting.

**DGF.**

**A LACK OF INHIBITORY COMPONENTS IN THE NOGO N2 AND THE ERN**

Sidney J. Segalowitz, & Diane L. Santesso

Brock University

Descriptors: ERN, N2, inhibition

The N2 component in the stimulus-locked ERP waveform is said to be larger on trials during which the participant inhibits a prepotent response. This negativity has been likened to the ERN in terms of neural source and function. We examined the N2 and ERN at midline scalp sites in 35 males aged 18 – 19 years using a visual go/nogo task. Both the ERN and N2 were maximal at FCz. We found that there was a difference in amplitude between the go and nogo N2 but that this disappears when we take into account the P2 component preceding it. Nevertheless, with the preceding positivity partialed out, the ERN was indeed more correlated with the nogo N2 than the go N2, and the correlation with the nogo N2 remained after partialing out the go N2 at both FCz and Cz. Thus, the significant relation between the ERN and the nogo N2 is not related to inhibitory processes. As has been reported before, the P3 amplitude was greater on nogo trials (at FCz and Cz) than go trials showing sensitivity to some aspect of inhibitory effects, yet the Nogo P3 did not correlate with the ERN once the go P3 was partialed out. In conclusion, we find no evidence that the ERN shows a relation with inhibitory processes.

**IS IMMORALITY DISGUSTING? SOCIOMORAL DISGUST, THROAT TIGHTNESS AND HEART RATE DECCELERATION**

Gary D. Sherman, Jonathan Haidt, & James A. Coan

University of Virginia

Descriptors: disgust, morality

When asked what disgusts them, individuals commonly report social phenomena such as cruelty and racism, suggesting that colloquial use of the term disgust has sociomoral features (Haidt et al., 1997). It is unclear, however, whether people are simply using the word disgust figuratively to express anger (Nabi, 2002). To address this, somatic experience and heart rate was monitored in 45 participants while they watched a video depicting Neo-Nazis. The correlation between anger and disgust reports varied as a function of reports of throat tightness (a response often associated with physical disgust) such that the correlation was large (r = .88) among participants who did not report throat tightness and significantly smaller (r = .47) among participants who did report throat tightness. Observation of the Neo-Nazi video led to significant heart rate deceleration, a response commonly associated with physical disgust. In addition, there was a strong negative relationship between disgust ratings and heart rate change (r = -.66) but only among those participants who reported throat tightness. These findings suggest that throat tightness and heart rate deceleration may serve as markers of a felt sociomoral disgust response that extends beyond the use of disgust terminology as a metaphorical expression of anger.

**TRAIT ANXIETY MODERATES EVENT-RELATED POTENTIALS TO UNATTENDED THREATENING FACES IN CHILDREN**

Jessica E. Shackman, Jessica L. Jenness, & Seth D. Pollak

University of Wisconsin-Madison

Descriptors: ERP, anxiety, childhood

Several studies have documented enhanced processing of threat in both anxious adults and children. We investigated whether trait anxious children would show biased processing of task-irrelevant threatening faces. We recorded 128-channel EEG (average mastoids ref.) from 25 children who completed a forced-choice matching task (cf. Bishop, Duncan, Brett, & Lawrence, 2004) while threat-related (angry or fearful) and non-threatening (happy) faces were presented in the periphery, and measured the effect of facial distractor emotion on event-related potential amplitudes. We observed early perceptual effects of threat-related faces (a response often associated with physical disgust) that appear to represent another’s actions with patterns of neural activity identical to those used to represent one’s own actions. Recent ERP work has extended this research to the study of error monitoring, and has detected an event-related potential (ERP) similar to the error-related negativity (ERN) that occurs when one views another person make a mistake. Previous research in our laboratory has used functional magnetic resonance imaging (fMRI) to demonstrate error-related hemodynamic activity in the anterior cingulate and additional cortical and limbic regions. The present study was designed to take advantage of the enhanced spatial specificity of fMRI to identify what brain regions are active when one views another person make a mistake. Participants either performed (performance condition), or observed a video of another person performing (observer condition), a speeded go/no-go task designed to elicit errors. Errors committed in the observer condition activated limbic and cortical regions similar to those activated in the performance condition, including the anterior cingulate, ventral striatum and orbitofrontal cortex. These activations suggest common underlying circuitry for the processing of one’s own and another’s errors, and suggest a possible neural basis for the acquisition of learned behaviors through observational learning.

**AN FMRI INVESTIGATION OF THE BRAIN’S RESPONSE TO WITNESSING ANOTHER’S ERRORS**

Matthew S. Shane1, Michael C. Stevens1, & Kent A. Kiehl2

1OLIN Neuropsychiatry Research Center, 2OLIN NeuroPsychiatry Research Center

Descriptors: error monitoring, empathy, functional neuroimaging

Research in both humans and monkeys has identified a class of “mirror neurons” that appear to represent another’s actions with patterns of neural activity identical to those used to represent one’s own actions. Recent ERP work has extended this research to the study of error monitoring, and has detected an event-related potential (ERP) similar to the error-related negativity (ERN) that occurs when one views another person make a mistake. Previous research in our laboratory has used functional magnetic resonance imaging (fMRI) to demonstrate error-related hemodynamic activity in the anterior cingulate and additional cortical and limbic regions. The present study was designed to take advantage of the enhanced spatial specificity of fMRI to identify what brain regions are active when one views another person make a mistake. Participants either performed (performance condition), or observed a video of another person performing (observer condition), a speeded go/no-go task designed to elicit errors. Errors committed in the observer condition activated limbic and cortical regions similar to those activated in the performance condition, including the anterior cingulate, ventral striatum and orbitofrontal cortex. These activations suggest common underlying circuitry for the processing of one’s own and another’s errors, and suggest a possible neural basis for the acquisition of learned behaviors through observational learning.

**TRAIT AND STATE ABNORMALITIES IN AUTOMATIC AND STRATEGIC PROCESSING DURING SELF-REFERENTIAL ENCODING IN MAJOR DEPRESSION**

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1Harvard University, 2University of Michigan-Ann Arbor

Descriptors: depression, ERP, self

A unique combination of trait-dependent automatic processes (e.g., self-schema activation) and state-dependent strategic processes (e.g., semantic elaboration) may play an important role in the manifestation of self-referential memory biases in major depressive disorder (MDD). This hypothesis was tested by examining...
P2, P3a, P3b and late positive component (LPC) of the event-related brain potentials (ERPs) in individuals with current MDD, MDD in remission, and never-depressed individuals while they were making judgments as to whether a positive or negative word can be used to describe them (self-referential) or former president Clinton (other-referential) in an intentional free recall task. Individuals with current MDD failed to demonstrate a positive recall bias evident in control and remitted participants. Negative processing bias (i.e., greater ERP amplitudes to negative relative to positive stimuli) was evident in individuals with current and remitted MDD at the automatic processing stage, indexed by the P2, and in individuals with current MDD during strategic encoding, indexed by the LPC. Positive processing bias was evident in control individuals at both automatic and strategic stages and in individuals with remitted MDD at the strategic stage.

Group differences were observed only in the self-referential condition. Results are discussed in the context of cognitive and neurobiological theories of MDD.

THE INFLUENCE OF THE TIMING OF AFFECTIVE RATINGS ON SUBJECTIVE AND PHYSIOLOGICAL RESPONSES TO AFFECTIVE PICTURES

Keri Shiel1, Daniel F. Gröss, Joseph B.巴斯chnagel, & Larry W. Hawk
University at Buffalo

Descriptors: ratings, startle response, methodology

Psychophysiological research on emotion sometimes obtains subjective responses immediately after presenting each affective stimulus; other research obtains physiology in an initial presentation and ratings in a second stimulus series. The present research examined the effects of these two ratings procedures on subjective and psychophysiological responses to a series of pleasant, neutral, and unpleasant pictures. Undergraduate participants were randomized to a single series of pictures during which physiology and ratings were obtained (Concurrent Group, CG; n = 44) or to a two-series condition in which physiology and ratings were obtained in separate series (Separate Group, SG; n = 46). Startle eyeblink responses to auditory probes and autonomic and facial EMG responses to pictures were recorded. CG women made more extreme valence and arousal ratings than did SG women, whereas timing of ratings had no reliable effect on men (interaction Fs < 1). Although preliminary analyses provided no evidence that the CG group differed from the SG group in valence modulation of startle, the means were in the opposite direction of the ratings findings, with unprotected tests demonstrating marginal potentiation during unpleasant compared to pleasant pictures in CG women and men (ps < .05). Further analyses will examine autonomic and facial EMG responses to pictures, reliability estimates for the CG and SG groups, and self-report measures of affective response.

LATERALIZATION OF THE P3 RESPONSE DURING STAGES OF VERBAL AND SPATIAL WORKING MEMORY

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Descriptors: working memory, hemispheric lateralization, P3

Working memory (WM) is a network of systems involved in the encoding, manipulation, maintenance and retrieval/selection of information in one’s mind for brief periods of time. Recently, there has been interest in whether or not the processes unique to each stage of WM are lateralized to either hemisphere. In this study, we recorded ERPs during parallel verbal and spatial tasks that parsed the stages of WM. Each task was presented under two WM loads (one or three stimuli). Hemispheric lateralization, measured by the P3 response, was examined during each stage of WM at frontal, central, and parietal sites. The effects of load were also evaluated. Participants were 18 healthy young adults. Results showed that greater right hemisphere P3 amplitudes were seen for the verbal task at frontal sites only during the response selection stage of WM, and for the spatial condition at the parietal sites only during the encoding stage. Both the verbal and spatial tasks produced greater right hemisphere P3 amplitude than left at the central/temporal sites during encoding and response selection. No hemisphere effects were present during the maintenance stage for either the verbal or spatial task.

PERCEIVING MULTIPLE ITEMS AT ONCE: EFFECTS OF WHAT AND HOW

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Descriptors: encoding-related lateralization, stimulus representation, visual short-term memory

Event-related potentials (ERPs) can provide information on how the brain represents items in visual short-term memory. Specifically, the encoding-related lateralization (ERL) isolates ERP effects related to the reactivation of representations of laterally-encoded stimuli. Previously, we found that a series of ERLs, varying in latency and sensitivity to different features of an encoded memory set, reflect multiple levels of stimulus representation. One of them (latency 400 – 600 ms) was modulated by memory set-size, suggesting a form of stimulus representation sensitive to the relationship between items in a set. To clarify this effect, we manipulated the distance and similarity between elements of the memory set. This set comprised 2 different (1 in each hemifield) or 4 letters (2 identical in each hemifield or different). The distance between letters was varied. A test probe, requiring a positive or negative response, was subsequently presented centrally. We found: (a) faster response times and higher accuracy in the identical compared to the different letter condition; (b) higher accuracy in the distant compared to the close condition; (c) the ERL (400 – 600 ms) for the the identical/distant condition matched that of the 2-letter condition, and these differed from all other 4-letter conditions. These ERL effects suggest that contiguity and similarity may affect the strength of memory representations, perhaps through an interference process.

EFFECTS OF AGING AND PHYSICAL FITNESS IN A MEMORY SEARCH TASK

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Descriptors: aging, fitness, working memory

Working memory processes are typically affected by aging. However, such declines may be moderated by cardiovascular fitness (as estimated by VO2max measures). To evaluate this hypothesis we recorded event-related brain potentials (ERPs) in 13 young adults (YA) and 25 older adults (OA; 13 high-fit and 12 low-fit) while they performed a modified Sternberg memory search task. The memory sets comprised upper-case letters and varied in size from 2 to 6 to manipulate working memory load. A positive or negative response was required after a lower-case probe onset. Reaction times (RTs) were slower for OA, and the slope of the RT by load function was steeper in the low-fit OA compared to the YA. The ERP data showed that after the memory-set onset: (a) a posterior P1 component differed across set-sizes in the OA but not in the YA; (b) a frontal negativity by load function was steeper in the low- compared to the high-fit OA. Taken together, these data suggest that age can affect the encoding and scanning of items in working memory and that these effects may be moderated by cardiovascular fitness, perhaps through improved perfusion of brain tissue under load conditions.

THE ROLE OF MOTIVATION ACTIVATION IN PROCESSING EMOTIONAL MEDIA MESSAGES

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Descriptors: attention, memory, EMG

Incorporating various theoretical perspectives on emotion, the LC4MP theorizes that cognitive and emotional processing of media messages is shaped by the differential activation functions of the two motivational systems, known as positivity offset and negativity bias. The appetitive system is more active in a neutral
environment and characterized by its slow and gradual activation with increasing arousing content whereas the aversive system is characterized by its quicker and more vigorous activation. This study attempted to show the role the two motivational systems play in message processing by looking at arousing content as a continuous variable. Results showed that negative messages elicited greater skin conductance and self-reported arousal than positive messages. The difference was biggest during moderately arousing content. Increase in experiential arousal due to increasing activation was greater and more rapid for negative messages than for positive messages. Negative messages elicited greater HR deceleration than positive messages and the deceleration was more rapid and greater for negative messages with increasing intensity. However, results indicated possible cardiac acceleration with highly arousing negative messages. Increasing message intensity helped encoding positive messages whereas it impeded encoding negative messages. Zygomatic responses did not increase much until the stimulus became highly intense for positive messages. However, corrugator responses increased during medium levels of arousing content for negative messages.

THE IMPACT OF POSITIVITY OFFSET AND NEGATIVITY BIAS ON EMOTIONAL MESSAGE PROCESSING

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Descriptors: attention, memory, EMG

The LC4MP theorizes that individuals vary in their motivation activation and that the variation in the motivational systems has an impact on cognitive and emotional processing of emotional media messages. Positivity offset (PO) refers to the likelihood an individual approaches new things while positivity bias (NB) relates to how quickly an individual withdraws from negative stimuli. This study examined differences in message processing between a high and low PO group and also between high and low NB groups. Results showed that compared to the high PO group, the low PO group exhibited greater skin conductance and reported greater experiential arousal. The difference was greater during moderately arousing messages than calm or highly arousing messages. The high PO group also exhibited greater HR deceleration with increasing message intensity than low PO group. The low PO group, on the other hand, showed greater recognition during lower levels of message intensity but no difference in encoding was found during highly arousing messages. The low PO group further exhibited greater zygomatic responses during moderately arousing messages. Compared to the low NB group, the high NB group exhibited greater skin conductance and reported greater experiential arousal than low NB individuals during moderately arousing messages. Low NB individuals also exhibited greater HR deceleration during moderately arousing messages and greater corrugator responses during highly arousing negative messages.

MENSTRUAL CYCLE PHASE RELATED ERP AMPLITUDE AND LATENCY DIFFERENCES IN THE PERCEPTION OF EMOTIONAL PROSODY

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Descriptors: gender, ERP, emotion

Differences in emotion perception during the high and low estrogen phases of the menstrual cycle were examined among ten right-handed women. Participants were tested twice on an auditory prosody perception task in which participants were required to keep a running count of emotional utterances that depicted happiness or fear. Half of the participants were initially tested during the high estrogen phase while the other half were tested during the low estrogen phase. ERPs to emotional stimuli were recorded from ten scalp sites (F3, F4, T3, T4, T5, T6, C3, C4, P3, P4); the amplitude and latencies of the P2, N2, P3/P4, and N3 components were subjected to ANOVA. Regarding menstrual-phase related ERP amplitude differences, a significant phase × hemisphere × scalp site interaction was observed for P2 amplitude (F4,36 = 4.95, p = .001), and a phase × hemisphere interaction was observed for P3 amplitude (F1,9 = 9.32, p = .01). Post hoc analyses of these two interactions indicate greater amplitude over the right hemisphere during the high estrogen phase, with the opposite pattern observed during the low estrogen phase; this varies as a function of scalp site. Analyses of latency differences for the same components yielded only one effect involving phase; the N3 component occurred sooner during the low estrogen phase (F1,9 = 6.03, p = .03). The amplitude and latency differences indicate that changes in emotion perception occur within auditory channels during the phases of the menstrual cycle. These differences may be partially attributable to the changes in sex hormones.

STRESSFUL IMPAIRMENT OF PPI AND ASYMMETRY EFFECTS IN SCHIZOTYPY

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Descriptors: prepulse inhibition, schizotypy, stress

Attenuated pre-pulse inhibition of the startle blink reflex has been found in schizophrenia (Braff et al., 1978) and schizotypy (Cadenhead, Geyer & Braff, 1993) and is thought to reflect impaired sensorimotor gating. Although atypical laterality has been found in dichotic listening tasks for paranoid schizophrenics (for a review, see Romney, Mosley & Addington, 2000), differences in response laterality have not been examined for PPI in schizotypy and schizophrenia. This research examines atypical response laterality in schizotypal subjects by measuring PPI independently from both eyes during a dichotic listening task during both baseline and stressor conditions in 9 controls and 9 psychometric schizotypals. In a repeated measures ANOVA with IV of eye, ear, condition and group, a main effect of condition showed impaired PPI during stress for each of the four lead intervals measured. Across conditions, PPI at each eye was diminished for probes administered through concordant ears at 60 ms, 240 ms and 480 ms but not 120 ms lead intervals across groups. For 120 ms probes across both eyes, the groups showed similar PPI response in right and left ears during baseline but the groups showed opposite patterns of laterality impairment in right and left ears during stress. In a pre-planned comparison of baseline PPI, schizotypals tended to have impaired PPI at 60 ms but not other intervals relative to controls. In summary, this research suggests that stress impairs short lead PPI across groups, and that laterality differences between groups arise during stress at 120 ms lead intervals.

ELECTROPHYSIOLOGICAL CORRELATES OF WORKING MEMORY DEFICITS IN SYSTEMIC LUPUS ERYTHEMATOSUS

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Descriptors: working memory, SLE, ERP

A majority of patients with Systemic Lupus Erythematosus (SLE) have cognitive difficulties including deficits in working memory (WM). In this study, ERPs were recorded during the encoding, maintenance, and response selection (go, no-go) stages of a WM task for 41 SLE patients and 30 matched controls. Behavioral measures of WM performance were also obtained independently. We predicted that the SLE patients would show a hyperfrontality effect for the encoding and maintenance stages as evidenced by greater P3 amplitudes in the frontal cortex (electrodes Fz, F3, F4) compared to controls. In contrast, we predicted that SLE patients would show reduced amplitudes in the parietal cortex (Pz, P3, P4) compared to controls during the response selection stage (go, no-go). Similar findings were reported previously from our laboratory in a small sample of SLE patients. In this larger sample, SLE patients were found to perform more poorly than controls on behavioral measures of WM. Further, as hypothesized, greater amplitudes were found at the frontal sites for SLE patients compared to controls for encoding (p < .01), and reduced amplitudes at the parietal sites for the mainte-
Quantitative electroencephalography may facilitate research in attention and attentional disorders such as AD/HD. Yet the relationship between distinct frequency bands and specific attention abilities has not been fully elucidated. We aimed to investigate EEG activity associated with two basic visual attention abilities, focusing attention at the center of gaze (central focusing) and away from it (peripheral focusing). These abilities were measured (from 12 women and 11 men) using flanker tasks while EEG was recorded at F3, F4, C3, C4, P3 and P4. The EEG data were converted into 9 frequency components using an FFT, 1 – 4 Hz, 4 – 8 Hz, 8 – 12 Hz, 12 – 15 Hz, 15 – 18 Hz, 18 – 21 Hz, 21 – 24 Hz, 24 – 28 Hz and 28 – 42 Hz. Multiple regression analyses were used to compare frequency power and behavioral performance. Increased parietal- and reduced central-delta (1 – 4 Hz) were associated with greater central focusing ability. Additionally, relative strength in low beta (12 – 15 Hz) at P3 was inversely related to relative performance on the two tasks. In other words, if someone’s P3 beta was stronger during central focusing than peripheral focusing, she tended to perform better on peripheral focusing, and vice versa. No other relationships reached statistical significance. These results suggest that the topography of EEG frequency components carries information about specific attention abilities and also about relative strengths in attention abilities.

This work was supported by a NIH grant EY14110 to Satoru Suzuki.

**SELECTIVE ATTENTION MODULATES THE GAMMA-BAND AUDITORY STEADY-STATE RESPONSE**

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Descriptors: attention, steady-state, auditory

Selective attention can increase the amplitude of steady-state evoked potentials to repetitive visual and tactile stimulation. However, examinations of the effect of attention on the auditory steady-state response (ASSR) have proven equivocal. The current experiment therefore utilized electroencephalography (EEG) to examine the effect of selective attention on the ASSR in healthy humans. Brief auditory click-trains (500 ms; 1000 ISI) in the beta (20 Hz) and gamma (40 Hz) frequency ranges were randomly presented binaurally to healthy subjects (n = 15) in a classic oddball paradigm. Two blocks of 200 trials were presented, with each frequency serving as the oddball (target) in each of the blocks (20% probability). As expected, both 20 Hz and 40 Hz target stimuli elicited a strong P300 response, with maximal amplitudes over parietal regions. A Fast Fourier Transform (FFT) was utilized to assess the effect of attention on the ASSR (both signal and noise power). Spectral analysis of the steady-state responses showed that across all frontocentral electrodes, EEG signal power was larger to 40 Hz targets compared to 40 Hz ignored stimuli. No differences in signal power were observed during 20 Hz stimulation. Finally, no differences were observed in noise power between target and ignored stimuli for either frequency. These results provide evidence that selective attention can enhance signal power of the ASSR, particularly to auditory stimulation in the gamma range.

**EFFECTS OF ATTENTION TRAINING ON THE DISTRIBUTION OF ATTENTIONAL RESOURCES**

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Descriptors: attention, attentional blink, meditation

If two targets embedded in an RSVP stream are presented in close temporal proximity, the second target is often not seen. This “attentional blink” deficit is
thought to reflect competition between stimuli for limited attentional resources, albeit not an immutable bottleneck, as most participants are able to report both targets on at least some trials. This study used EEG to examine how the brain controls the distribution of attentional resources, enabling more than one event to be processed at the same time. To this end, effects of intensive attention training, as cultivated during meditation, on blink task performance were examined. Data were collected from 17 participants before and after a 3-month period between which they practiced mindfulness meditation for approximately 10 hours per day. 24 control participants were also tested twice with a 3-month period between sessions. As mindfulness meditation cultivates non-reactive sensory awareness, we predicted that intensive meditation would reduce the attentional blink. Indeed, practitioners showed a significantly smaller blink at time2 vs. 1 than controls. Analyses of their ERP data revealed that the P3 to the first target on no-blink trials was reduced in amplitude at time2, suggesting that attention was less “pulled” by the first target, allowing more effective processing of the second target. As participants were not actively engaged in meditation during the task, our data may suggest that intensive mental training can result in lasting changes in attentional processing.

**WRITTEN DISCLOSURE AS AN INTERVENTION FOR PTSD**

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Descriptors: anxiety disorders, emotion, cardiovascular

This study examined the speculation that the written disclosure procedure can be used as a stand-alone intervention for posttraumatic stress disorder (PTSD). Forty-two adults who met diagnostic criteria for PTSD were randomly assigned to either a written disclosure intervention or a control writing condition. All participants completed a semi-structured diagnostic assessment for PTSD before the writing sessions and at a follow-up assessment. Heart rate was recorded during a resting baseline session prior to each writing session and during each writing session. Participants also completed measures of self-reported emotion in response to each session. Findings indicated that PTSD participants assigned to the written disclosure condition did not show any significant improvement in PTSD diagnostic status (or symptom severity) at follow-up assessment compared with PTSD participants assigned to the control condition. Consistent with the outcome findings, PTSD participants assigned to the written disclosure condition showed significant activation (both heart rate and self-reported emotion) to all three writing sessions relative to the control writing condition. PTSD participants assigned to the written disclosure condition showed significant activation (both heart rate and self-reported emotion) to all three writing sessions relative to the control writing condition. PTSD participants assigned to the written disclosure condition showed significant activation (both heart rate and self-reported emotion) to all three writing sessions relative to the control writing condition.

**HERITABILITY OF THE N1 IN A VISUAL ODDBALL TASK**

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Descriptors: heritability, connectivity

Using graph theory, we investigated individual differences in the extent to which the neural network of the brain shows optimal connectivity. Synchronization likelihood, a measure of nonlinear dynamic coupling, was used to define connectivity between pairs of leads in an eyes closed resting EEG task and converted into a network graph by applying a threshold. Key parameters in graph theory are path length (L, the average shortest path connecting every pair of nodes), and the cluster coefficient (C, a measure of whether nodes connect locally into groups). Optimal “small-world” networks show high C and short L. Regular local connections are interspersed with a few random long range connections. With neuroanatomy, fMRI, EEG and MEG it has been shown that the human brain is a small-world network. C and L values were determined for four 16-sec epochs for 574 subjects: monozygotic and dizygotic twins and their siblings. Clear individual differences in C and L in the upper beta band (20–30 Hz) were found, and these were shown to be largely genetic in nature. Heritability was 59% for C, and 65% for L. The degree of small-world network organization as expressed by C and L appears to be a valid genetic marker for differences in brain connectivity. Further analyses will investigate whether it is also an indicator of individual differences in complex behavioral traits.

**PROCESSING RAPIDLY PRESENTED AFFECTIVE PICTURES: REFLEX PHYSIOLOGY AMONG ANXIETY DISORDER PATIENTS**

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Descriptors: anxiety disorders, emotion, rapid picture presentation

Rapid presentation of affective pictures prompts startle modulation and facial electromyographic changes that vary with emotion despite the fact that each picture is presented only briefly (Smith et al., 2006). Here, we explored differences in emotional reactivity in patients diagnosed with anxiety disorders. Anxiety disorder patients (n = 119) viewed blocks of all unpleasant, all neutral, and all pleasant pictures in a counterbalanced order. The pictures were presented at 3 pictures per second (333 ms each; 60 pictures), and each picture block lasted 20 s and was followed by a 30 s inter-block interval. Anxiety disorder patients who reported greater symptoms of depression showed weaker affective modulation of the startle response during and after picture exposure, and lower corrugator activation during and after the unpleasant picture series, compared to patients who reported moderate symptoms of depression. In contrast, there were no significant differences between the patient groups in skin conductance responses during or after picture viewing, with greater overall reactivity during unpleasant compared to the pleasant and neutral picture series. These data indicate that some aspects of reflexive physiological responding to emotional picture stimuli may be disrupted in anxiety disorder patients who score higher on a dimensional index of depressive symptoms.
IMPAIRED PATTERNS OF SYNCHRONOUS CORTICAL ACTIVITY IN INDIVIDUALS WITH FETAL ALCOHOL SPECTRUM DISORDERS DURING A VIRTUAL SPATIAL NAVIGATION TASK

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Descriptors: EEG, synchrony, fetal alcohol

To investigate hippocampal and prefrontal cortical functioning in individuals with fetal alcohol spectrum disorder (FASD), we used Independent Component Analysis (ICA) to evaluate alpha, theta and gamma band synchronous activity during a virtual Morris water task involving local cue and distal (place) conditions. EEG was recorded at 128 sites for university control, FASD control and FASD participants. Several patterns emerged. First, although several displayed synchronous activity in more than one condition or group, they frequently differed in the timing of the synchronous activity. For example, one component (modeled in the cingulate gyrus) exhibited significant synchronous gamma activity 250 ms earlier in the cue than in the place condition. Second, several components exhibited synchrony across different frequencies. For example, a component (modeled in the temporal lobe) demonstrated theta modulated gamma activity in the place condition. Third, some components exhibited synchronous activity within a “core” group of components in only one condition or group. Typically, the components found in the data for the two control groups were absent in the FASD group. Finally, the FASD group exhibited unique patterns of synchrony across components. The differing patterns of synchronous activity across the three groups allowed us to develop a more detailed spatio-temporal representation of spatial navigation. More importantly, it allowed us to model cortical activity underlying spatial navigation in individuals with fetal alcohol spectrum disorders.

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CONFLICT AND RESOLUTION IN SEMANTIC PROCESSES UNDERLYING COMPREHENSION: AN ERP TIME-FREQUENCY ANALYSIS

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Descriptors: time-frequency analysis, N400, language

Successful comprehension of scenarios requires inference making, or the activation of information that is not explicitly presented. After an inference is made, a conflict detection sub-process of cognitive control may be engaged to a greater degree when subsequent text is unexpected than when it confirms a preceding inference, whereas integration of subsequent text into long-term memory for the text may be greater when subsequent text confirms the inference than when it is unexpected. We used event-related potentials (ERPs) and time-frequency analysis to investigate neural correlates of such processes. Participants read short inference-promoting texts and performed a lexical decision after each text. ERPs were measured to target words, which were either unrelated or inference-related to the preceding text. Consistent with previous reports of semantic processing associated with the N400, unrelated words elicited greater negativity than did words primed by inferences. Using time-frequency analysis, early theta activation associated with conflict monitoring and a later delta activation associated with semantic integration were decomposed. Results suggest that, during text comprehension, dissociable processes underlie the N400 as measured with time-frequency analysis.

FUNCTIONAL BRAIN ASYMMETRY IN LANGUAGE PROCESSING: A FUNCTIONAL MAGNETIC RESONANCE IMAGING (fMRI) STUDY COMPARING CENTRAL AND LATERAL STIMULUS PRESENTATION

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Descriptors: functional neuroimaging

Objective: Even though language is predominantly mediated by the left hemisphere, the right hemisphere of the human brain also plays a role. The present study addresses the question of the extent to which the right hemisphere contributes to language processing. Therefore, fMRI-data were acquired during central and lateral stimuli presentation of three hierarchically structured reading tasks. The advantage of presenting stimuli in either the right or the left visual field (RVF/LVF) is that stimuli presented outside the centre of gaze are initially processed only by the contralateral hemisphere. Methods: Using an event-related fMRI paradigm, 10 male subjects (right-handed, monolingual, native German speakers) were tested. For the three tasks – perception of letter strings (visual processing, baseline), silent reading of pseudowords (visual and phonological processing), and silent reading of words (visual, phonological and lexical processing) – stimuli were randomly presented centrally or laterally for 200 ms. Results: Preliminary results show unilateral or bilateral activation patterns, depending on the location and type of the presented stimuli. Central and RVF presentation of words caused unilateral activation of Wernicke’s area (BA 21 and BA 22) in the left hemisphere, while LVF presentation resulted in bilateral activation in the same region. BA 22 was more strongly activated by RVF compared to central stimulus presentation of words.

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ISI SHIFT IN AUDITORY DELAY EYE BLINK CONDITIONING IN HEALTHY HUMANS

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Descriptors: eyeblink conditioning, ISI shift, conditioning

Accumulating evidence indicates that the cerebellum plays a role in high cognitive functions and may be associated with the structural and functional impairment in some psychological disorders. The functional integrity of the cerebellum may be assessed with eye blink conditioning (EBC) methodology. A form of EBC known as an ISI-shift requires participants to condition to a CS tone of one duration (e.g., 400 ms) before a shift in the CS tone duration is made (e.g., to a 900 ms tone). At each duration, the CS tone co-terminates with a 50 ms corneal air puff. The ISI-shift procedure is hypothesized to tap an anatomically unique adaptive form of cerebellar plasticity. Because this procedure has rarely been studied in humans, the feasibility of the procedure was examined in healthy participants (n = 7). The rate of learning was similar between the 400 and 900 ms CS tones and the ISI-shift produced significant decreases (~40%) in conditioned eye blinks. After this decrease, percent condition responses gradually increased. To our knowledge these are the first data to demonstrate the ISI-shift effect in healthy young adults. This methodology may be applied in clinical populations where the integrity of the cerebellar function is in question.

CARDIOVASCULAR EFFECTS OF MENTAL FATIGUE: DO THEY EXTEND ACROSS INHIBITORY AND NON-INHIBITORY PERFORMANCE DOMAINS?

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Descriptors: active coping, mental fatigue, cardiovascular

We examined the influence of a mental fatigue (performance resource depletion) manipulation involving inhibition on cardiovascular responses to a challenge that included a weak or strong inhibitory component. In an initial work period, participants circled “H”s on pages filled with scrambled letters. Half (Low Fatigue) circled each time they heard “count” sound at 3 sec intervals. The rest (High Fatigue) did the same with the admonition not to circle Hs preceded or followed by certain vowels; that is, with the admonition to inhibit the impulse to circle forbidden Hs. Subsequently, participants were given the chance to avoid a noise by exceeding the 50th percentile of previous performances on a simple math task (inhibitory component weak) or a version of the classic Stroop task (inhibitory component strong). Data analysis indicated that High Fatigue participants rated the second task as more difficult than did Low Fatigue participants, regardless of
the character of the task, and displayed stronger blood pressure responses across the work periods. Findings support the arguments advanced recently that mental fatigue (1) causes relevant behavior to be appraised as more difficult than it otherwise would be, and, as a result, (2) potentiates effort and cardiovascular responsiveness in people striving to attain relevant performance goals. The findings also suggest that mental fatigue effects extend across inhibitory and non-inhibitory performance domains.

This research was supported by National Science Foundation Grant BCS-0450941, awarded to Rex A. Wright.

ANGER STYLE, PSYCHOPATHOLOGY, AND REGIONAL BRAIN ACTIVITY

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Descriptors: anger, EEG asymmetry, psychopathology

Anger has recently been associated with asymmetry of cortical activity, but as a complex phenomenon anger may involve a variety of brain events. Anger experience and anger expression are frequently not distinguished in the emotion literature and presumably involve different brain mechanisms. Furthermore, both aspects of anger may occur in the context of varying types and amounts of comorbid depression and anxiety, making cortical asymmetry findings difficult to interpret in light of current models of emotion and motivation. The present study addressed these issues by comparing resting regional electroencephalographic activity in groups of high anger-in, high anger-out, combined high anger-out and anger-in, and low anger participants with depression and anxiety systematically assessed. High anger-in participants consistently displayed more left- than right-hemisphere activity as well as higher levels of anxious apprehension than high anger-out and low anger participants. The high anger-out and combined groups did not show any lateralization. Anger groups did not differ in anxious arousal, which predicted rightward frontal asymmetry. Findings indicate that anger is not a unitary construct either psychologically or biologically and that an aspect of anger not particularly associated with approach motivation carried the recently reported association of anger with left-frontal and left-central lateralization. Results suggest that anger style should be taken into account in studies of anger and brain asymmetry.

IMPAIRED P50 SUPPRESSION IN TRAUMA AND PTSD

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Descriptors: p50 suppression, trauma, stress

Recent research (e.g., Neylan, 1999) demonstrates that P50 suppression is impaired in PTSD in at least some populations. Impaired suppression may arise from symptoms associated with PTSD or instead may represent a common outcome of trauma exposure. To examine the relationship of traumatic exposure and development of PTSD to sensory filtering, P50 suppression was assessed in 9 psychometric PTSD participants, 6 high trauma history/no PTSD participants and 12 low-trauma controls in baseline and stressor conditions. Consistent with previous research, PTSD subjects tended to have impaired P50 suppression relative to controls across conditions. A comparison of three groups in the baseline and stressor conditions revealed main effects for condition (stressor impaired P50 suppression) and group, but no interaction effects. Subjects with high trauma/no PTSD exhibited more impaired suppression than controls but did not differ from PTSD participants. Symptoms association of three PTSD symptoms (re-experiencing, avoidance-numbing, and arousal) revealed that neither depression (BDI), nor PTSD symptoms (PSS-SR) correlated with suppression, but increased trauma exposure correlated with reduced suppression in both baseline and stressor conditions. Taken together, these preliminary results suggest that impaired filtering may be a function of trauma exposure more than specific symptom patterns associated with PTSD.

LATERALITY OF RESPONSE DISTINGUISHES PPI IN NON-COMBAT PTSD

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Descriptors: prepulse inhibition, anxiety disorders, laterality

Although recent research has failed to find reduced PPI in non-combat PTSD subjects under baseline conditions (Lipschitz et al., 2005), variation in the laterality of response has not been assessed. Other psychophysiological measures, such as spectral EEG, have revealed that the chronic anxious apprehension that may characterize PTSD is associated with shifted laterality at certain sites (Nitschke, Heller, Palmieri, Miller, 1999). This research assessed response laterality for PPI using a dichotic listening task recorded during a baseline condition in 3 groups: 9 non-PTSD subjects, 7 high-trauma no PTSD subjects and 10 low-trauma controls. A main effect of stimulation site revealed that greater PPI was shown in the ear contralateral to recording site at all three lead intervals (60 ms, 120 ms, 240 ms). This effect was qualified by an interaction with group; controls and high-trauma subjects showed a left ear advantage for PPI (recorded from right eye), while subjects with PTSD showed the same level of PPI reduction for both ears. In addition, only PPI from the left ear was associated with PTSD symptoms across groups; the re-experiencing subscale showed an association with PPI at 60 ms, 120 ms and 240 ms lead intervals (1-tailed). Total PTSD symptoms and numbing also tended to correlate with only left-ear responses at 120 ms. Taken together, these results suggest that the level of pre-pulse inhibition in non-combat PTSD subjects may not differ from low-trauma and high-trauma controls, but does suggest differences in the laterality of response.

ATYPICAL LATERALIZATION OF SPONTANEOUS EEG IN YOUNG CHILDREN WITH AUTISM: A TWO SAMPLE STUDY

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Descriptors: autism, gamma oscillations, development

Autism is a largely genetically determined neurodevelopmental disorder, and functional brain abnormalities underlying this disorder remain to be established. We analyzed spectral power and lateralization of EEG in children with autism in comparison with typically developing children. Two cohorts of boys with autism (3 – 8 years) were sampled independently in Moscow (21) and Gothenburg (23). The controls were healthy age-matched boys. EEG was recorded under strictly controlled conditions of stillness and visual attention. The extremely high power of theta2 (5 – 7 Hz) rhythm was observed in a small proportion (3) of subjects with autism. Excessive theta is typical for such genetic disorders as Rett and fragile X syndromes and subjects with the excessive theta endophenotype may comprise a genetically distinct sub-group. In both Moscow and Gothenburg, experimental samples of children with autism demonstrated the abnormal left-hemispheric asymmetry of delta, theta and alpha power over the mid-temporal and frontal scalp regions. On the other hand, the normal left-sided asymmetry of mu rhythm was absent in autism. The latter finding corresponds well with the recent data on the decreased manual lateralization in children with autism and on the absence of normal left-sided asymmetry of cuedate nuclei in adults with this disorder. In general, an anomalous pattern of EEG asymmetry points to the altered cortical specialization in autism. These findings support previous imaging and behavioral data suggesting aberrant brain lateralization in autism spectrum disorders. This study was supported by the BIAL foundation (grant 87/04), Swedish Research Council (proj. no. 12170) and the Gothenburg medical faculty.
LIFE-LONG DEVELOPMENT AND GENDER DIFFERENCE IN ENDOGENOUS EYEBLINKS(2): CHILDHOOD’S DEVELOPMENT FROM INFANTS TO TEEN-AGERS

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Descriptors: endogenous eyeblinks, development, childhood

This report is a part of our series of studies concerning life-long development of endogenous eyeblinks. We have already reported the results of 617 adults from the 20s to the aged (Sugiyama & Tada, 2005), which provided a standard eyeblink rate and revealed the gender difference but no age difference in normal adults. The purpose of the present study is to investigate the developmental changes in eyeblink behavior of 794 healthy subjects from 3 mos infants to 15 yrs high school students in the same manner. The task of subjects, except 3 mos and 3 yrs infants, was to watch an edited video program for 3 minutes and the eyeblink behavior of each subject was video-taped, which was analyzed using some special software, in terms of eyeblink rates, blink duration, synchronization of both eyelids, and temporal distribution of blinks. The results showed; 1) blinking was virtually absent at birth, increasing steadily until elementary school age, 2) after reaching a plateau at about 8 yrs, that level was maintained until high school age, 3) the identical developmental pattern to eyeblink rates was also observed in opening, reopening and blink duration, except 3 mos infants, 4) although there are remarkable age differences mentioned above, no gender difference was observed until 15 yrs, 5) generally speaking, the developmental course of eyeblink behaviors was analogous to that of the neural type in Scammon’s 4 types of growth. These findings supported a part of the previous reports (Knorr, 1929; Zametkin et al, 1979), although the current study utilized a larger sample.

ERROR-RELATED NEGATIVITY, N2, AND FRONTAL MIDLINE THETA ACTIVITY AS CORRELATES OF THE DEVELOPMENT OF RESPONSE MONITORING AND COGNITIVE CONTROL IN ADOLESCENTS

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Descriptors: adolescent brain development, executive function, ERP

Event-related potential (ERP) studies of response monitoring development have shown age-related differences in components associated with response monitoring and cognitive control. This study used ERP time and frequency analyses to investigate response monitoring and inhibitory control during a go no-go task performed by adolescents and young adults. As compared to adults, adolescents showed (a) reduced error-related negativity (ERN) amplitude; (b) larger N2 amplitude to stimuli associated with relatively low response conflict; and (c) frontal midline theta activity that corresponded closely to the time-domain differences. Behavioral data and both time- and frequency-domain ERP measures indicated that adolescents were less able to discriminate stimulus conditions associated with varying degrees of response conflict and less likely to generate distinctive brain responses following errors. The results will be interpreted in relation to developmental interactions between the anterior cingulate and the lateral prefrontal cortex during the period from early adolescence to young adulthood.

The project is supported by the National Institute of Mental Health Neurobehavioral Development Seed Grant awarded to Kristin Sullwold.

AFFECITVE MODULATION DURING DIFFERENT PHASES OF SCHIZOPHRENIA II: AUTONOMIC ACTIVITY

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Descriptors: schizophrenia, emotion, ANS

Research indicates that appropriate affective responding mediates adaptive behaviors, such as social communication and selective attention, and underlies important motivational systems. This study focused on autonomic reactions among prodromal, first-episode and chronic schizophrenia patients to emotionally-charged visual stimuli. Preliminary analyses showed that for pleasant images, prodromal patients exhibited a largely triphasic heart rate waveform, resembling that observed in healthy individuals. In first-episode patients, a similar pattern was observed; however, the magnitude of the response was dampened relative to that of prodromal patients and healthy individuals. In contrast, chronic patients did not demonstrate a triphasic pattern, but rather a sustained deceleration throughout stimulus presentation. In response to unpleasant images, the prodromal group again most closely resembled healthy individuals, with a sustained pattern of deceleration followed by an acceleratory recovery towards baseline. First-episode patients followed a similar pattern, but with delayed onset and decreased magnitude of initial deceleration. Among chronic patients, an atypical pattern was once again observed with a sustained deceleration resembling, but of slightly larger magnitude than, the response observed to pleasant stimuli. These data suggest that schizophrenia may affect normal patterns of emotional responding to pictures, with possible increasing disruption as the illness progresses. Analyses of electrodermal activity are underway and will be reported.

THE RELATIONSHIP BETWEEN SMOKING AND CHOCOLATE CRAVING AMONG FEMALE SMOKERS: AN EXAMINATION OF STARTLE EYE-BLINK RESPONSES TO SMOKING AND CHOCOLATE CUES

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Descriptors: addiction

The interest in female smoking behaviors has grown due to research which have highlighted gender differences in smoking cessation trends. Specifically, female smokers tend to lag behind men in their success of smoking cessation and are more likely to report weight gain concerns and increased food cravings during attempts to quit smoking. The first goal of this project was to examine the effect of smoking deprivation on smoking and chocolate cravings. In examining smoking deprivation and cravings, the goal is to also determine the affective motivational system underlying craving. We investigated these factors by looking at both self-reported cravings and startle eye-blink responses to visual smoking and chocolate cues. Our results indicated that smoking and chocolate cravings are appetitive for both abstinent and non-abstinent female smokers. Both the psychophysiological and self-report data also indicate that female smokers who abstain from smoking for a short duration seem to be less sensitive to positive reinforcing stimuli than those who continued to smoke. The implications of these findings are discussed.

STRESS INFLUENCES LEFT CRADLING BEHAVIOUR

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Descriptors: left cradling, stress

Women hold infants more frequently on the left side of their own body. This behaviour has been explained by enhanced mother-child communication, because left visual field information is more easily transmitted to the right ‘emotional’ hemisphere. Several studies showed reduced left cradling during stressful circumstances, such as mother-infant separation, or domestic violence. However, until now it is not clear whether stress may directly impact cradling behaviour. 64 female subjects participated. Cradling behaviour was assessed by a standardized protocol using a life-like doll. After this, 32 subjects completed a two-minutes bilateral cold pressor test known to induce stress and pain. The remaining subjects performed a non-stressful bilateral control procedure. After the interventions cradling behaviour was assessed again using the same protocol. 63% of subjects showed a left cradling preference prior to the intervention. As expected, cold pressor increased non-invasive cuff blood pressure (middle arterial pressure: p < .01) and heart rate (p < .01) significantly. A repeated ANOVA revealed a
significant interaction (p < .05) of intervention (cold pressor stress vs. control) X assessment period (pre vs. post intervention), indicating that stress reduces left cradling behaviour in female volunteers. These results prompt new research investigating the physiological determinants of this particular mother-child behaviour.

ANTICIPATING ANIMACY? AN EVENT-RELATED BRAIN POTENTIALS STUDY OF GRAMMATICAL AND SEMANTIC INTEGRATION IN POLISH SENTENCE READING

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Descriptors: ERP

Recent studies suggest that the human brain attends to grammatical cues during sentence comprehension. Most of that research is based on grammatical violations, which are raised as a counterargument against conclusions drawn from those studies. The main tool in that research is violating number or gender agreement of local phrases. The present study uses a different approach toward examining the nature and time-course of semantic and grammatical information interplay by means of word-by-word sentence reading. The stimuli utilize a specific feature of Slavic languages: the adjectives describing complements, beside their semantic content, also carry information of animacy of the complement encoded in their suffix. In the present study the complements (consisting of an adjective and a noun) either followed expectations regarding animacy or not. All sentences were grammatically correct, although violating expectations regarding animacy made them semantically implausible. Nouns from animacy-disagreeing complements elicited a N400 component followed by a posterior late positivity (P600), replicating previous findings for words. Animacy agreement had no effect on the adjectives, although suggestion for coming semantic violation was already available for the readers at the adjective. The data seem to suggest that the readers didn’t make use of grammatical cues embedded in the adjectives. Overall it indicates that not all grammatical information is used in real time to build sentence meaning.

EFFECTS OF THE STRESS HORMONE CORTISOL ON FRONTAL BRAIN ACTIVATION DURING FEAR CONDITIONING VARIES BETWEEN MALES AND FEMALES

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Descriptors: fear conditioning, cortisol, sex differences

The hormone cortisol modulates memory and learning performance, as is known from animal and human studies. Animal studies also show sex effects on this modulation. So far the influence of cortisol on learning in humans has mostly been studied using behavioural measures. We therefore aimed to explore cortisol effects on the hemodynamic correlates of associative learning. A differential fear conditioning design was employed with one visual stimulus (CS+) announcing an aversive electrical stimulation (UCS) and one unpaired visual stimulus (CS-). Reactions to the CS and UCS were compared between two groups: one received a single oral cortisol dose (30 mg) before the acquisition, the other a placebo. Parallel to functional data, skin conductance responses (SCRs) were measured. Results revealed impaired SCRs in males under cortisol; yet it had opposing effects on females. However, they did not show significant SCR conditioning. FMRI analyses showed reduced activity for the CS+ > CS- comparison in the anterior cingulate, the lateral orbitofrontal cortex and the medial prefrontal cortex in males under cortisol, but an opposite activation pattern (increase in these regions under cortisol) emerged in females. Independent of sex, cortisol reduced the habituation of the dorsolateral prefrontal cortex in the CS+ > CS- contrast and enhanced activation responses of the anterior as well as posterior cingulate to the UCS. To summarize, these findings demonstrate influences of cortisol on prefrontal brain activation during fear conditioning in humans, that are strongly modulated by sex.

PSYCHOPHYSIOLOGICAL CORRELATES OF PRESENCE: APPLICATION TO VIOLENT VIDEO GAMES

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Descriptors: presence, virtual reality, video games

This study examined the relationship between self-reported measures of presence and physiology while playing two violent video games. The realistic experience one has from a virtual environment is referred to as presence. This includes feeling present in the environment, spatial presence, a sense of realism and a disconnect from the real environment. Most research on presence utilizes self-report after, and sometimes during, the virtual experience. Video games are considered a virtual experience and new technology has allowed remarkable advances in realism. This study compares 55 participants, 26 males (mean age = 20.3) and 29 females (mean age = 19.1) playing an older version of the violent video game DOOM to playing the new version DOOM3, which is more realistic. Results show significantly higher presence, spatial presence and realism scores with DOOM3, as well as significantly greater blood pressure, heart rate and electrodermal response. Respiration was lower with DOOM3. Strong positive correlations on systolic and diastolic blood pressure with presence, spatial presence are seen. Awareness of the real environment was negatively correlated with systolic blood pressure. Strong positive correlations between heart rate and spatial presence and strong negative correlations with real environment awareness are reported. Respiration rate is negatively correlated with presence, spatial presence and environment awareness. This research represents a significant step towards validating self-report measures of presence with physiological measures.

THE MANY SHADES OF LEXICAL AMBIGUITY

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Descriptors: lexical ambiguity, ERP

We examined processing of lexical ambiguity in healthy young adults (n = 14) using an ERP paradigm. Lexical ambiguity is ubiquitous in language and includes homonym (words with identical forms but unrelated meanings, e.g., bank), metaphorical polysemy (words with one literal and one metaphorical sense, e.g., distant star vs. famous star) and metonymy polysemy (words with two literal senses, e.g., chicken meaning meat or animal). A processing advantage is seen for polysemes, although it is unclear whether this obtains for both types of polysemy. Critical stimuli were ambiguous words (n = 45 of each of the 3 aforementioned subtypes), preceded first by a word pair forcing one meaning of the item and then by a word forcing the other meaning (corporate bank - muddy - BANK; related prime condition). Items were also presented with an unrelated prime (soft rug - muddy - BANK; unrelated prime condition). EEG was recorded from 32 channels, with epochs time-locked to onset of the critical stimulus (i.e., the final word). Difference waves were computed for unrelated/related prime conditions for each ambiguity type. N400 amplitude 300 – 500 ms post-onset revealed no effects of ambiguity at midline sites. In a separate region of interest analysis, mean amplitudes were calculated as a function of anteriority and hemisphericity. Significantly more negative difference waves were seen for metaphors and homonyms than for metonyms in posterior sites, 400 – 500 ms post-onset. The results suggest that the lexical representation of metonyms is distinct from that of homonyms and metaphorical polysemes.

THE EFFECTS OF THE PHYSICAL WORK ENVIRONMENT ON CIRCADIAN VARIATIONS IN HEART RATE VARIABILITY

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Descriptors: heart rate variability, circadian variation, work

Decreased vagally mediated heart rate variability (HRV) is an independent risk factor for morbidity and mortality. In healthy individuals there is a prominent
circuitry variation in HRV such that there are significant increases during the night. We have shown that this increase in HRV during the night is blunted by acute stress as well as conditions such as chronic alcoholism. In the present study we investigated the effects of the physical work environment on the circadian variations in HRV. 24-hour recordings of HRV were performed on 63 participants (39 female) in either a traditional work space (a mixture of individual offices with opaque doors and old cubicles; n = 43) or a modern work space (individualized cubicles with improved airflow and lighting, and increased natural light; n = 20). Several indices of HRV were derived from spectral analysis and hourly summaries derived. Mixed effect models were used to estimate both inter- and intra-individual variability. Results revealed a significant quadratic trend by office type interaction for indices of vagally mediated HRV [t(1384) = 2.8, p = 0.004]. Examination of the graphs showed that those individuals in the traditional work space had flatter slopes and thus less circadian variation compared to those in the modern work space. These results suggest that physical features of the work environment may contribute to circadian variations in HRV. These findings have important social, economic, and public health implications for work environment risk factors on health.

This work was funded by the United States General Services Administration and the Intramural Research Program of the National Institutes of Health.

SELF-EFFICACY AND ERN IN OLDER ADULTS

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Descriptors: executive function, ERN, aging

Decrement in executive control function have been observed in older adult populations. However, self-efficacy (SE) has been found to relate to cognitive performance in older adults. In the present study, the effects of SE on action monitoring processes were investigated in 40 older adults (13 male). Behavioral and neuroelectric (i.e., ERN) indices of cognitive processing were collected while participants completed a flanker paradigm under task conditions emphasizing either accuracy or speed. SE relative to task performance during both conditions was assessed prior to each cognitive task. Results indicated a relationship between SE and ERN amplitude in the accuracy condition, with high-SE older adults exhibiting larger ERN amplitude compared to low-SE older adults. Additionally, a moderating effect of SE on the relationship between ERN and post-error accuracy (% correct) was revealed in the accuracy condition, with greater ERN amplitude associated with improved post-error accuracy in the high-SE group. No significant relationship was evident between ERN and post-error accuracy in the low-SE group. Finally, no significant relationships were observed between SE, ERN, and post-error accuracy in the speed condition. The findings suggest that SE processes may be related to neuroelectric and behavioral indices of action monitoring in older adults under task conditions where attentional focus is increased and action monitoring processes are more salient.

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ELECTROPHYSIOLOGICAL CORRELATES OF MODALITY CHANGES IN VISION AND TOUCH

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Descriptors: attention, cross-modal

Within the visual modality the discrimination of a given target is facilitated when it is preceded by a target defined in the same visual dimension. This RTadvantage can be explained by the "dimension-weighting" account (Found & Mueller, 1996), according to which there is a limited amount of attentional weight. Hence, weighting of one visual dimension (e.g. color) results in a facilitated processing of all targets defined in that dimension. As the target dimension changes across trials attentional weight must be reallocated to the new target defining dimension causing prolonged RTs. Importantly, Mueller & colleagues (1996) observed only RT costs when the target defining dimension (e.g. color) changed, but not when the critical feature (e.g. red) changed. The present study was designed to investigate whether a similar intertrial effect can be observed for targets defined within different modalities. While recording EEG, participants had to discriminate (via foot responses) the modality of a target, which could either be defined in the visual (LED’s) or in the tactile (5mV solenoids, attached to index fingers) modality. Similar to dimension changes in visual search tasks, modality changes led to prolonged RTs as compared to repetitions of the target modality. This effect was mirrored by enhanced amplitudes of the N1 component with its maximum at fronto-central sites. This pattern of effects raises the question of whether the "weighting mechanism" found for repetitions and changes of dimensions within the visual modality can also account for cross-modal intertrial effects.

This research was funded by the Wellcome Trust. M.E. holds a Royal Society-Wellcome Research Merit Award.

CARDIOVASCULAR REACTIVITY DURING ANGER EXPRESSION IN WOMEN DEPENDS ON AGE, VOICE QUALITY AND CONTENT OF VERBAL TASK

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UAH

Descriptors: cardiovascular, anger, women

We compared cardiovascular reactivity (CVR) during an anger recall task in women ages 19 to 30 and 31 to 45 in a 2 × 2 × 2 (Age by Content by Voice) mixed design. Participants listed 6 previous angry experiences while systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate (HR) were recorded as they described either neutral content or their angry experiences (angry content) in either a loud or neutral voice. The results indicated that older women were less reactive than younger women with regard to SBP. Also, the loud voice produced greater SBP, especially in younger women. A significant Content by Age interaction indicated that Angry Content resulted in stable increase for younger women, but reactivity fluctuated for the older women. Finally, a significant Voice by Content by Age interaction indicated a stronger DBP increase in older women occurring when using a neutral voice rather than a loud voice as found with younger women. The STAXI-2 scores were then correlated with CV measures for the task with greatest CVR for each age group. The results indicated that only the older women’s SBP and DBP were positively correlated with Trait anger while no significant correlations were found for the younger women. In addition, the older women’s SBP and DBP was significantly positively correlated with the angry reaction subscale of the STAXI-2. The data suggest that investigations regarding the developmental profile of anger expression in women is warranted.

A BETTER ESTIMATE OF THE INTERNAL CONSISTENCY RELIABILITY OF FRONTAL EEG ASYMMETRY

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Descriptors: frontal asymmetry, reliability

Frontal alpha asymmetry is typically computed using average alpha power from many individual spectra, each the result of a Fourier transform derived from overlapping epochs. Previous reports estimated the internal consistency of asymmetry by dividing resting EEG sessions into segments of equal duration (e.g. 1 min) that are considerably longer than the individual epochs, calculating asymmetry scores using average alpha-band power within each segment. Such segments are treated as ‘items’ on a ‘scale’ intended to measure asymmetry, and reliability estimates are obtained with Cronbach’s alpha. Since Cronbach’s alpha increases with the number of items in a scale, estimates of reliability are influenced by the number of segments used. Reliability estimates in the present study were thus obtained by treating asymmetry scores from individual epochs as separate items, thus reflecting the true number of ‘items’ that comprise the total score, avoiding the dependency on an arbitrary number of ‘items’ that are summary scores across many individual epochs. Because the number of available epochs varied across subjects, a randomization procedure was used to estimate Spearman-Brown corrected split-half reliability coefficients, estimating reliabilities across a range of epochs (20 to 400) sampled from resting EEG data (100 subjects, 8 sessions). Asymmetry scores at all scalp sites and reference schemes (average, Cz, and linked-mastoids) approached 0.90 with as few as 100 epochs, suggesting the internal consistency of frontal asymmetry is greater than that previously reported.
AN ACTUARIAL APPROACH TO THE IDENTIFICATION OF ARTIFACTS IN LARGE DATASETS OF FRONTAL EEG ASYMMETRY

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Descriptors: artifact detection, frontal asymmetry

The superiority of actuarial approaches over human judgment in classification is well documented, suggesting their utility in classifying artifact-laden segments of EEG data. In studies of frontal alpha asymmetry, relevant scores are derived from mean alpha-band power across the EEG record. Artifacts in the EEG record will bias such estimates, sometimes drastically. An ongoing study of frontal alpha asymmetry has, to date, collected over 100 hours of 64-channel EEG data. The size of this dataset requires that the process of manually rejecting artifacts be distributed over a number of scorers. Estimates of between-rater agreement on duplicate files are typically high (e.g. percent agreement generally > 99%, and Kappa generally > 0.90), suggesting that many artifacts are easily recognized and reliably rejected across the pool of scorers. Despite this consistency, initial analyses suggest that occasional artifacts still remain, in some cases severely biasing the overall estimate of asymmetry. Manual identification of alpha-band outliers (e.g. via scatter-plots) is not practical, again due to the size of the dataset. Several algorithm-based methods to identify artifacts are discussed, as is the relative performance between methods with respect to identifying known artifacts. These methods can in turn provide an actuarial data-driven set of criteria for artifact rejection (e.g. criteria for deciding when occasionally noisy channels should be corrected by cross-record rejection of noisy segments vs. omitting the channel itself from the entire record).

ADHD, BRAIN FUNCTIONING, AND THE TRANSCENDENTAL MEDITATION PROGRAM

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Descriptors: ADHD, meditation, coherence

This study tested effects of practice of the Transcendental Meditation (TM) technique on brain functioning in 11 – 15 year old children, previously diagnosed with attention-deficit/hyperactivity disorder (ADHD). The study included 18 randomly assigned subjects (13 boys, 11 to 15 years, and 5 girls, 11 to 15 years) and 4 self-selected subjects. The participants were pretrained, stratified on age, and randomly assigned to an experimental group (N = 9), who learned the TM technique immediately, and a control group (N = 9), who learned 3 months later. Three months practice of the TM technique resulted in significant changes in brain functioning: higher central-parietal coherence, increase in frequency of peak power in the 3.5–7.5 Hz theta band, and greater left-hemisphere alpha desynchronization during complex computer tasks. Three conclusions emerge from this study: 1) ADHD students can learn and practice the TM technique; 2) ADHD medication does not appear to interfere with benefits from TM practice; and 3) practice of the TM technique holds promise as a non-drug treatment of ADHD. In these data, TM practice strengthened frontal executive control circuits (higher lateral asymmetry); increased cortex excitation levels (higher frequency theta); and improved communication between brain areas involved in a choice visual/motor task (higher central-parietal coherence).

Thank the David Lynch Foundation for their help in funding this project.

AN EVENT-RELATED OPTICAL SIGNAL (EROS) STUDY OF FRONTAL AND TEMPORAL CORTEXES IN PROCESSING SEMANTIC AND SYNTACTIC ANOMALY DURING SENTENCE COMPREHENSION

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Descriptors: optical imaging, ERP, language

Event-related potentials (ERPs) have been widely used to investigate semantic and syntactic aspects of language processing, but their spatial resolution is insufficient to identify neural substrates. Conversely, functional magnetic resonance imaging (fMRI) studies have shown activation in both the left inferior frontal (IFC) and superior temporal cortices (STC), among other areas, but the temporal resolution of fMRI is insufficient to reveal the timing and sequence of activation across particular brain areas. The present study used the event-related optical signal (EROS) to reveal the temporal dynamics of left IFC and STC activity during the processing of syntactic and semantic information in sentences. Participants were presented with semantically or syntactically anomalous sentences and were required to judge their semantic and syntactic acceptability. Semantically anomalous words elicited increased activity in left posterior STC, from 200 to 600 ms after the onset of the anomalous words, as well as left IFC activity peaking at 600 ms. Left IFC activity was also observed at about 150 ms after the onset of correct words, but was delayed for syntactically anomalous words. In addition, increased left posterior STC activity was elicited at about 600ms with syntactic anomaly. This is the first study to apply EROS to the investigation of the temporal and spatial dynamics of language processing, and thus demonstrates its feasibility in this domain.

VAGAL SUPPRESSION AND PARENTING STYLES PREDICT EMOTIONALITY IN PRESCHOOL

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Descriptors: vagal suppression, parenting, emotion

Biosocial models of development emphasize the importance of joint contributions of physiology and environment to adjustment. Porges’ polyvagal theory contends that vagal suppression to moderate challenges is an indicator of adaptive self-regulation. We tested relations between parental socialization, and preschoolers’ vagal suppression (VS) and emotional expressiveness in 111 families. 67 mothers and 44 fathers reported their authoritarian (ARN) and authoritative (ATV) parenting styles. Each child’s vagal tone (V) was assessed at baseline and during a puzzle task with the parent; VS was the standardized residual after regressing puzzle V onto baseline V. Children’s negative emotions at preschool were measured by teacher-reports and direct observations. Preschoolers’ VS did not differ depending on completing the puzzle with mother versus father. More authoritarian mothers had children who showed less VS, but parenting styles did not predict VS for children with fathers. VS with mothers predicted teacher-reports of less sad affect (r = -.30), whereas VS with fathers predicted teacher-reports (r = -.34) and observations of less fearful affect (r = -.27). VS also moderated relations between fathers’ parenting style and teacher-reports of fearful (beta = -.51, t = 2.92, p < .01) and sad affect (beta = -.46, t = -.25, p < .05). Fathers’ authoritative style predicted significantly less fearful and sad affect at preschool only for children with high VS. These results suggest children’s self-regulation is shaped through parental socialization, influencing emotional adjustment.

TEMPERAMENT TRAITS PREDICT AFFECTIVE CORTICAL REACTIVITY IN BOTH INCARCERATED AND COMMUNITY PARTICIPANTS

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Descriptors: temperament, EEG, cortical reactivity

The late positive (LP) component of the ERP response is enhanced by the processing of affective pictures relative to neutral (cf. Schupp et al, 2004). The current study investigated the relationship between basic personality traits as indexed by the Multidimensional Personality Questionnaire (MPQ; Patrick et al., 2002) and the LP component, in a sample of incarcerated prisoners (n = 139) and age-matched controls (n = 70). Results indicated a strong negative relationship between constraint (CON) and the LP component, indicating attenuated reactivity to affective stimuli in those high on CON. Results also revealed that both positive emotionality (PEM) and negative emotionality (NEM) increased emotional reactivity. This indicates that people who are more sensitive to reward or
punishment exhibit greater reactivity to affective stimuli, further supporting the idea that LP indexes a common arousal effect (cf. Cuthbert et al., 2000). Results replicated independently within the two groups, indicated similar affective processes within incarcerated and community samples. Hence, individual differences in emotional reactivity do appear to modulate emotional responses at the level of the central nervous system. Findings are discussed in relation to emotional reactivity and psychopathology.

SPATIAL COMPATIBILITY EFFECTS WITHOUT AWARENESS OF STIMULUS LOCATION

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Descriptors: dichotic stimulation, stimulus-response compatibility, LRP

We recorded event-related potentials (ERP) while dichotically presenting foveal stimuli which required a left- or right-located response. Despite perceiving the stimuli as centrally presented, completely unaware of the stimulated eye, subjects’ responses were faster when the response location (not the hand operating the device) and the stimulated eye were compatible (compatible trials) than when they were incompatible (incompatible trials). It is concluded that eye-of-origin information was used as a spatial code and it activated the corresponding response, which constitutes a new form of stimulus-response spatial compatibility. There were signs of incorrect response activation on incompatible trials in the lateralized readiness potential (LRP), an ERP measure related to motor preparation. However, detailed analysis showed that the LRP was contaminated with electrical signals originated at occipital and parietal sites and related to the stimulated eye. These results could be expected if the fovea were represented in the contralateral hemisphere, as it is demonstrated in histological studies in animals and functional magnetic resonance studies in humans that support the split of the fovea between the hemispheres. To our knowledge, these results are the first ERP evidence that each fovea is represented in the contralateral visual cortex.


OTHER-ORIENTED PROSOCIAL EMOTIONS AND VAGAL RESPONSE

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Descriptors: emotion, vagal response, dyadic interaction

The mammalian-specific vagus nerve has been associated with love, attachment, and other-oriented behavior (Oveis, Sherman, & Haidt, 2006; Porges, 1995, 1997, 1998). In our multi-method approach, dyads of newly-introduced participants (N = 100) took turns relating their personal experiences of suffering to each other while their respiratory sinus arrhythmia (RSA; fluctuations in the heart rate mediated by vagus nerve activity) and skin conductivity levels were assessed. The two measures respectively index the activity of the parasympathetic and sympathetic nervous system. The disclosure task was designed to elicit self-oriented personal distress or other-oriented prosocial emotions, such as sympathy and compassion. Participants rated the emotions they experienced during the task, estimated their partner’s emotions, and judged their post-task feelings of connection and closeness with their partner. Results indicated vagal involvement in other-oriented prosociality. Increases in participant A’s RSA correlated with the self-reports of prosocial emotions by participant B during the task. Furthermore, RSA increases in participant A correlated with participant B’s post-task closeness and connection ratings as well as B’s attributions of A’s prosocial emotions during the task. Interestingly, increases in participant A’s RSA did not correlate with A’s own self-report of emotions. This suggests that vagal activity is associated with other-oriented cues of prosociality, not necessarily with intrapersonal emotional experience.

SEROTONERGIC MODULATION OF CARDIAC CONCOMITANTS OF PERFORMANCE MONITORING

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Descriptors: executive function, cardiovascular, serotonin

The present study examined the effect of acute tryptophan depletion (ATD), a well-known method to transiently lower central serotonin levels, on cardiac responses to errors, negative feedback and incongruent flanker stimuli. Healthy male participants performed an Eriksen flanker task and a time estimation task. Performance in both the Eriksen and the time estimation task was in line with previous studies, but was not affected by ATD. The expected cardiac deceleration was found to incongruent stimuli, errors and negative feedback. ATD attenuated the cardiac deceleration to negative feedback in the time estimation task, whereas the cardiac deceleration following errors, and negative feedback in the Eriksen task were unaffected. On the other hand, the cardiac deceleration to correctly categorized incongruent stimuli in this task was attenuated. The data seem to confirm a role for the serotonin system in cardiac responses to stimuli signaling an outcome that is worse than expected (negative feedback) and stimuli that are accompanied by conflicting response strategies (incongruent flanker stimuli). The data point in the direction of a dissociation between cardiac and electro-cortical responses for which no effects of acute serotonergic manipulations have been reported thus far. Cardiac responses possibly reflect a different aspect of these stimuli, of which the impact depends on the integrity of the serotonin system.

This work was supported by a TOP grant (No. 912-02-050) from ZonMW-NWO.

GAZE FIXATION PATTERNS EXPLAIN SUBSTANTIAL VARIANCE IN BRAIN ACTIVATION DURING THE VOLUNTARY REGULATION OF NEGATIVE AFFECT

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Descriptors: emotion, functional neuroimaging, eyetracking

A number of studies have identified a distributed network of brain regions underlying emotion regulation in response to affective images. Given the complex nature of the images used in these studies, it is possible that some of the observed variance in brain activation is due to differences in how participants visually scan the images while regulating their emotions. We recorded brain activation using fMRI and quantified patterns of gaze fixation while 29 participants increased or decreased their affective response to a set of affective images. FMRI results replicated previous findings on emotion regulation. In roughly half of the brain areas for which we found a main effect of regulation, including posterior and frontal brain regions, 4 gaze fixations variables (2 timing, and 2 movement) explained 35 – 78% of the variance in BOLD contrast. Furthermore, for some of these regions, only less than 10% of contrast variance could be uniquely explained by the调节 conditions. The inclusion of fixation variables in our analysis helps us to delineate brain activation corresponding to visual attention shifts from those that might be more properly ascribed to affective downregulation and working memory involved in emotion regulation.

Funding provided by NIMH, NIA.

INDIVIDUAL DIFFERENCES IN AFFECTIVE STYLE PREDICT STARTLE EYEBLINK AND POST-AURICULAR REACTIVITY TO VALENCED PICTURES

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Descriptors: emotion, startle response, individual differences

Work from our laboratory has demonstrated that relative left anterior activation, a measure of positive affective style, predicts attenuation of the eyeblink reflex
(EBR) to probes following a negative event. Prior work from others has established emotion modulation of the post-auricular reflex (PAR), with positive pictures enhancing the PAR. Our aim was to replicate the relationship between affective style and EBR attenuation for negative events and to test whether affective style predicts PAR modulation for positive events. We recorded EMG activity over orbicularis oculi and post-auricular muscle regions while participants viewed positive, neutral and negative slides. Acoustic startle probes (50 ms, 105 dB) were presented during and following picture presentation. Measures of EEG activity at rest were taken over 12-1 min epochs. We replicated prior work of the emotion modulation of both eyelblink and post-auricular reflexes, but only for the probe presented during picture presentation. Furthermore, positive affective style as assessed by relative left anterior (fronto-central and anterior temporal) activation was associated with reduced eyelblinks startle reactivity to negative vs. neutral pictures, but only during picture presentation. Relative left asymmetry for mid-central regions was also associated with increased post-auricular reactivity to positive vs. neutral pictures. These data suggest that a positive affective style is not only characterized by reduced reactivity to negative events, but also with increased reactivity to positive events.

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QUANTIFYING STARTLE-INDUCED EYEBLINK RESPONSES IN EMG BY MEANS OF THE ENVELOPE METHOD

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Erasmus MC

Descriptors: signal analysis, startle response, methodology

Many biological signals contain a rapidly oscillating component in combination with a slower varying amplitude. An EMG-signal is a typical example. Such a signal can be uniquely written as a complex signal $A(t) \exp(j\phi(t))$, called the analytical signal, wherein the amplitude or envelope $A(t)$ describes the slowly varying amplitude and the exp-function describes the rapidly oscillating component of the original signal. The real component of the analytical signal equals the original signal and the imaginary component is obtained by means of the digital Hilbert transform applied to the original signal. Applied to an EMG-signal with startle-induced eyelblink responses, the envelope outlines the rapid oscillations in an eyelblink and can be used to quantify eyelblink parameters such as amplitude, area, onset point, peak time and duration. In comparison to other techniques, such as the non-linear rectifying technique (which adds high frequency components) or the integrating technique (which attenuates high frequency components) or the exp-function (which dampens high frequency components), this method does not change the properties of the signal. Furthermore, this method has no smearing effects due to lowpass filtering or smoothing. Therefore, the eyelblink parameters can be quantified more reliably by means of the envelope, which may be advantageous for psychophysiological research.

HEART RATE PARAMETERS TO EVALUATE ALCOHOL CHALLENGE AND PLACEBO EFFECTS

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Descriptors: cardiovascular, emotion, drug

To examine alcohol and placebo effects on autonomic reactivity, heart rate (HR) parameters were compared in control, alcohol, and placebo conditions. 36 men and women (21 – 24 years old) were randomly assigned to one of the conditions. 180 pictures were presented in 6 blocks: negative, positive, neutral, alcohol, marijuana, and ecstasy. Each picture was presented for 10 sec (5sec-picture on, 5s-off), which corresponds to a presentation frequency of 0.1 Hz, in order to sync stimulus presentation to the resonant properties of the cardiovascular system. Standard HR and heart rate variability (HRV) indices, as well as a 0.1 Hz HRV index that we developed were compared across each stimulus block. Our novel HRV 0.1 Hz index not only revealed the influence of cognitive expectancy on autonomic regulation, but also provided a highly sensitive measure of differences in reactivity to emotionally valenced and alcohol pictures versus neutral pictures.

Standard HRV indices in contrast, were not differentially sensitive to the emotionally valenced or alcohol stimuli. As expected, HR increased in the alcohol condition only, and did not vary across stimulus types. Alcohol significantly dampened HRV indices to all stimulus types. Most notable was the finding that placebo also dampened these indices significantly compared to control, yet did not differ from the alcohol condition. These results are important in yielding a more articulated understanding of the mechanisms through which placebo may affect emotional regulation and behavioral change.

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ALCOHOL INTOXICATION SELECTIVELY AFFECTS NOVELTY-P3A AMPLITUDE AND TIME-FREQUENCY THETA ACTIVITY: A PLACEBO CONTROL DESIGN

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Descriptors: alcohol, P3, theta

Previous research has demonstrated moderately low doses of alcohol attenuate both novelty P3a and target P3b ERP responses in a novelty-oddball experiment, but suggests that novelty P3a responses related to orienting may be selectively reduced (Marinkovic et al., 2001). The current study assessed whether acute alcohol intoxication differentially impacts the amplitude of novelty P3a vs. target P3b. Additionally, time-frequency energy was decomposed into theta and delta components and evaluated. Finally, intoxication effects on the affective differentiation in the processing of unexpected emotional stimuli were assessed. A visual novelty-oddball paradigm in which IAPS pictures served as the novel affective stimuli was employed. Participants were randomly assigned to receive alcoholic or placebo beverages. Mean blood alcohol concentration in the alcohol group was .089%. Behavioral performance (accuracy and reaction times) was not significantly different between groups. Alcohol significantly reduced novelty P3a amplitude to a greater extent than target P3b amplitude. Despite the reduction in novelty P3a, the alcohol group showed the same ERP differentiation of emotional content relative to neutral in the IAPS pictures as placebo. Finally, time-frequency delta and theta components around the time of the P3a and P3b were identified using principal component analysis of time-frequency data (cf. Bernat et al., 2005). Results suggest that alcohol impacts midline-frontal theta more than parietal delta, particularly during orienting to novel stimuli.

CRIMINALITY, UNDERAROUSAL AND THE VALIDITY OF THE CONCEALED INFORMATION POLYGRAPH TEST

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Ghent University

Descriptors: hyporesponsivity, lie detection, psychopathy

The Concealed Information polygraph Test has been advocated as the preferred method for the physiological detection of deception. In this study, we examined the validity of the Concealed Information Test in antisocial individuals. Physiological responding to concealed information was assessed in 48 male prisoners, and compared with responding in 31 male community volunteers. Based upon the association between antisociality and autonomic hyporesponsivity, lower detection rates could be expected in the prisoners. Participants were questioned on 5 personally significant items (e.g., day of birth), and instructed to deny recognition of this information. All participants were promised a financial reward when able to hide recognition. Prisoners showed reduced autonomic reactivity in comparison to the community volunteers. Thus hyporesponsivity had, however, little impact on the sensitivity of the Concealed Information Test. Detection efficiency in the prisoners was significantly above chance (area under the ROC curve of .82) and did not differ significantly from that obtained in the community volunteers (area under the ROC curve of .85). The present data further support the validity of the Concealed Information Test.

Bruno Verschueren is a postdoctoral fellow of the Fund for Scientific Research Flanders, Belgium (FWO).
EMOTIONS INFLUENCE THE AFFECTIVE BUT NOT THE SENSORY DIMENSION OF PERCEIVED BREATHLESSNESS

Andreas von Leupoldt, Corinna Mertz, Sarah Kegat, Svantje Burmester, & Bernhard Dahme
University of Hamburg

Descriptors: dyspnea, perception, emotion

Breathlessness is an impairing symptom in various disease conditions. Recent research has shown that the perception of breathlessness, like pain, consists of a sensory (i.e., intensity) and an affective (i.e., unpleasantness) dimension. However, little is known about the specific impact of different emotions on these distinct dimensions. We therefore examined the influence of emotions on the sensory and affective dimension of perceived breathlessness. Twenty healthy volunteers were viewing three affective picture series (IAPS) of positive, neutral, and negative valence while breathlessness was induced by breathing through an inspiratory resistive load. Simultaneously, inspiratory time (T_i), breathing frequency (f) and oscillatory resistance (R_os) were measured. After each condition, the experienced intensity and unpleasantness of breathlessness were rated on separate visual analog scales (VAS), followed by ratings of experienced mood. ANOVAs for mood ratings showed successful induction of emotions. T_i, f and R_os remained unchanged across conditions. Perceived unpleasantness of breathlessness increased from positive to neutral to negative series, while perceived intensity of breathlessness showed no changes across conditions. The results suggest that the affective dimension of the perception of breathlessness is particularly vulnerable to emotional influences, irrespective of objective lung function.

von Leupoldt, Corinna Mertz, Sarah Kegat, Svantje Burmester, Bernhard Dahme.

ATTENTIONAL DISTRACTION REDUCES THE AFFECTIVE BUT NOT THE SENSORY DIMENSION OF PERCEIVED BREATHLESSNESS

Andreas von Leupoldt, Nadine Seemann, Tatiana Gugleva, & Bernhard Dahme
University of Hamburg

Descriptors: dyspnea, perception, attention

The perception of breathlessness is a complex interpretation process of sensory input that is also influenced by psychological factors. Recent research has suggested that attentional distraction might reduce the perception of breathlessness, but results are conflicting. Furthermore, the specific impact of attentional distraction on distinct dimensions of perceived breathlessness has not yet been studied. Therefore, we examined the specific impact of changes in the attentional focus on the sensory (i.e., intensity) and affective (i.e., unpleasantness) dimension of perceived breathlessness. Breathlessness was induced in forty-four healthy volunteers by breathing through an inspiratory resistive load, while attention was directed either to breathing or distracted by reading texts. Inspiratory time (T_i) and breathing frequency (f) were measured continuously. After each condition the experienced intensity and unpleasantness of breathlessness were rated on separate visual analog scales (VAS). ANOVAs showed that attentional distraction during loaded breathing reduced the perceived unpleasantness of dyspnea, while the perceived intensity of dyspnea as well as T_i and f remained unchanged. The findings show that attentional distraction reduces the affective, but not the sensory dimension of induced breathlessness in healthy volunteers. Future studies are needed to clarify whether attentional distraction can effectively be used as intervention technique for reducing the unpleasant aspects of breathlessness in different patients groups.

EFFECTS OF POSTTRAUMATIC STRESS DISORDER STATUS AND HOSTILITY ON CARDIOVASCULAR RESPONSE TO RELIVED ANGER IN FEMALE VIETNAM VETERANS

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Descriptors: anxiety disorders, anger, cardiovascular

This study examined the effect of posttraumatic stress disorder (PTSD) status and covert hostility on cardiovascular responses to and recovery from a re-lived...
anger task in female military veterans. 121 female Vietnam veterans (69 with PTSD and 52 without PTSD) completed standardized diagnostic and hostility measures and relived through imagery a self-identified anger memory while heart rate (HR), systolic blood pressure (SBP), and diastolic blood pressure (DBP) were measured continuously using an Ohmeda Finapres monitor. Compared to the non-PTSD control group, veterans with PTSD had greater resting heart rate baseline. No group differences were found in SBP and DBP. During the re-lived anger task, veterans diagnosed with PTSD reported feeling more anger and anxiety than those veterans without PTSD, although no group differences in cardio-vascular reactivity were obtained. In a result similar to that found in male Vietnam veterans, a significant relationship was found between covert hostility and HR during recovery from relived anger for the PTSD group, such that greater covert hostility was associated with greater HR during recovery from relived anger. This relationship was not found in the control group. Furthermore, veterans in the PTSD group reported greater levels of covert hostility and hostile beliefs compared to their non-PTSD counterparts.

COMPARING CARDIOVASCULAR RESPONSING DURING ANGER MEMORY VERBALIZATION AND ANGER IMAGERY IN VIETNAM VETERANS WITH AND WITHOUT POSTTRAUMATIC STRESS DISORDER

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Descriptors: anger, cardiovascular, imagery

Some researchers conceptualize the role of vocal expression of anger as a feedback mechanism that incites greater physiological responding and increased anger affect. In this study male Vietnam combat veterans with (n = 49) and without (n = 52) Posttraumatic Stress Disorder (PTSD) read a neutral paragraph, recalled and described a time they felt angry, and then imagined themselves in the same anger situation. Heart rate (HR) and systolic (SBP) and diastolic (DBP) blood pressure were sampled during baseline, a neutral reading task, anger recall and verbalization, and then later anger imagery. Heart rate and blood pressure increased during neutral passage reading relative to resting baseline. Blood pressure (but not HR) increased over and above neutral speech while subjects described an anger episode. Anger imagery increased cardiovascular response above a resting baseline. Anger verbalization increased SBP and DBP more than anger imagery, even when controlling for different metabolic activity levels in verbalization versus imagery. The two methods of anger induction produced different results when PTSD diagnosis was considered: Veterans without a PTSD diagnosis exhibited greater cardiovascular increases than did veterans with PTSD during anger verbalization, but veterans with PTSD exhibited greater cardiovascular reactivity than those without PTSD during the PTSD diagnosis during anger imagery. These results are discussed in terms of emotional regulation in these different subject groups.

AGE-RELATED DIFFERENCES IN ACTIVATION OF THE PREFRONTAL CORTEX IN RESPONSE TO MODULATION OF LEVELS OF CONFLICT

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Descriptors: aging, prefrontal cortex, task difficulty

Research with older participants has provided evidence of neural deterioration in the aging brain. To compensate for these age-related declines, older adults are found to activate additional cortical resources while performing different cognitive tasks. In this study, older and younger participants were scanned using fMRI while performing a modified version of the Stroop task. For the incongruent condition, we manipulated the level of conflict such that for half of the incongruent trials, subjects saw an incongruent color word, which was part of the response set (eligible condition) and for the other half of the trials the incongruent color word was outside the response set (ineligible condition). Both of these conditions produce semantic conflict, but only the eligible condition produces conflict at the response level. The regions that were recruited by the younger adults in the eligible condition (bilateral MFG and ACC) were the same regions recruited by the older adults in the ineligible condition (i.e. the less difficult condition). As a result, a direct comparison between eligible and ineligible conditions resulted in a greater difference for younger adults than older adults, suggesting that the neural circuitry of older adults is unable to respond effectively to a manipulation in task difficulty. This data provides support for the hypothesis that older adults are likely to over-recruit neural resources at lower levels of task demands than younger participants resulting in an unavailability of cortical resources for more complex tasks.

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CARDIORESPIRATORY FITNESS: A PREDICTOR OF CORTICAL PLASTICITY IN MULTIPLE SCLEROSIS

University of Illinois-Urbana-Champaign

Descriptors: multiple sclerosis, fitness, cognition

In the last decade, fMRI studies have provided evidence for the existence of active processes of neuroplasticity in multiple sclerosis (MS) patients. Despite this cortical adaptability, very few studies have tapped this potential strength in order to ameliorate the cognitive declines commonly observed in the MS population. In this study, we investigated the relationship between cardiorespiratory fitness, cerebrovascular functioning and cognition in 30 participants with relapsing remitting MS using event-related fMRI. Participants undertook an incremental exercise test using a computer-driven cycle ergometry and an open-circuit spirometry system to measure cardiorespiratory fitness as peak oxygen consumption (VO2peak). During the fMRI session, echo planar images were collected while the subjects performed the Paced Visual Serial Addition Test (PVSAT). The participants were divided into high-fit and low-fit groups based on their VO2peak scores (high-fit average = 25.5 ml kg-1 min-1, low-fit average = 16.5 ml kg-1 min-1). Behavioral performance on the PVSAT yielded a significant benefit for the high-fit participants. Both high-fit and low-fit participants were found to recruit left MFG, ACC, and bilateral parietal lobes during the performance on PVSAT. Notably, low-fit participants were found to recruit those areas to a much greater extent than the high-fit participants. Our results suggest that increased cardiorespiratory fitness might be associated with more flexible allocation of cortical resources during cognitive tasks in the MS population.

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WHAT TELL MEG-SIGNALS ABOUT THE ENCODING OF MOVEMENT DIRECTION IN HUMAN?

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Descriptors: BCI, MEG, motor systems

Nine right-handed subjects were instructed to move a joystick towards one of four self-chosen targets (center-out paradigm) using right hand and wrist only. MEG, EOG, and EMG were recorded. Tuning strength was computed for low frequency activity (<3 Hz). MEG low frequency activity was decoded on a single-trial basis by regularized discriminant analysis and the percentage of correctly decoded trials (decoding power, DP) was calculated for each subject. Temporal
evolution of the amplitude of different frequency bands was investigated by time-resolved spectral analysis. Sensors showing significant (p < 0.001) tuning strength between -150 ms and 300 ms around movement onset cumulated above contra- and ipsi-lateral motor cortex. On average, sensors not located above the motor cortex showed no significant tuning. Significant (p < 0.05) amplitude variation was found between rest and movement in three distinct frequency bands (6 Hz, 10 – 30 Hz, 60 – 86 Hz). Single-trial DP was calculated using low-pass filtered activity of all channels above motor cortex between -150 ms and 350 ms around movement onset. The DP was on average 67% (range: 53.6 – 84.9%, chance level 25%) across all subjects. We have shown that movement direction can be correctly decoded with an average probability of 67%, which is clearly above chance level. Decoding was achieved by sensors located over the motor cortex. Because the DP for MEG was only somewhat smaller as for invasive ECoG recordings, MEG may be used for investigations of movement encoding in the cerebral cortex and possible applications for brain-machine interfaces.

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MONOAMINE OXIDASE (MAO) ACTIVITY AND SENSORY GATING IN FEMALE TEENAGE SMOKERS
Li Wan, Bruce H. Friedman, & Helen J. Crawford
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Descriptors: sensory gating, smoking

Sensory gating refers to the brain’s inhibition of irrelevant sensory input. This filtering function can be assessed by the conditioning-testing ERP paradigm, which measures cortical response (P50) suppression to a second stimulus following an identical first stimulus. Sensory gating has been found to be enhanced in chronic cigarette smokers (Crawford et al., 2002). A hypothesized pathway for this effect is through increased dopaminergic activation by MAO inhibition, which has been observed in smokers. This hypothesis was tested in a sample of teenage girls (22 smokers and 25 non-smokers, ages 14 – 18 years) who were assessed on sensory gating (P50 suppression paradigm), platelet MAO-B activity, and various cognitive and temperamental indices. Contrary to prediction, within smokers, sensory gating (averaged over 15 frontal and central electrode sites) was better in the high than low MAO group (t (20) = 2.11, p < 0.05). Across all subjects, MAO activity was positively associated with sensory gating (r (45) = 0.30), but negatively correlated with the Frustation (r (45) = -0.29) and Perceptual Sensitivity (r (45) = -0.34) scales of the Early Adolescent Temperament Questionnaire (p = 0.05 for all rs). Consistent with the literature, the associations of MAO with temperament indicate low dopaminergic activity is related to impulsivity and sensation seeking. The unexpected relationship found between MAO and sensory gating may reflect age and gender differences between the present sample and that of Crawford et al., 2002, which consisted of older men who were chronic heavy smokers.

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AD PLACEMENT MATTERS: A PSYCHOPHYSIOLOGICAL EXAMINATION OF PROGRAM CONTEXT EFFECTS ON ADVERTISING PROCESSING
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Descriptors: arousal, valence, interaction

Previous research concerning the effects of program emotion on embedded ads focuses on only one dimension of program emotion; arousal or valence. This study uses a Limited Capacity Model of Motivated Mediated Message Processing to examine the influence of program arousal and valence simultaneously. Seventy undergraduate students participated in the 2 (Valence) × 2 (Arousal) × 3 (Ad Block) repeated-measures experiment. As predicted, physiological arousal (measured by skin conductance response) was greater during ads following arousing compared to calm programs, although arousal in both conditions decreased across blocks. Cognitive effort was high (indicated by slow heart rate) during ads immediately following the positive arousing program and was low (indicated by fast heart rate) immediately following the negative arousing program. All the memory data supports the prediction that immediately following the program, encoding and storage were at the levels that would be predicted by the motivational activation elicited by the program. The self report data of attitude toward ad (AaA) suggest that immediately following the programming, strong appetitive activation increases AaA and strong aversive activation decreases AaA. There were no significant effects of program valence on either zygomatic or corrugator muscle activity. One possibility is that these EMG variables are very tightly tied to immediate experience and were responding to the neutral ads.

AGING AND THE PROCESSING OF IRRELEVANT INFORMATION: AN ERP STUDY
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Descriptors: aging, IOR

The inability to filter out irrelevant information impairs information processing of elderly people. However, irrelevant information does not necessarily lead to a behavioral deficit with higher age. In tasks using non-informative cues, delayed responses to a target presented at the cued location (inhibition of return = IOR) is observed in young and elderly subjects. The contradiction between assumed deficit and observed behavior was further investigated here by varying the cue-target interval (CTI) between 60 and 900 ms in an IOR-task. For the longest CTI, IOR is observed for both groups. While young people showed IOR even with the shortest CTI, the effect reversed with decreasing CTI in elderly subjects, i.e. responses were faster for targets at the cued location compared to targets at the uncued location (facilitation). For young people, the ERP evoked by the cue was characterized by a sharp fronto-central negativity around 350 ms which was entirely missing in elderly subjects. The latter group showed a posterior peak instead that peaked only marginally later (400 ms). Anterior negativities might be correlates of the efficient suppression of irrelevant information. This mechanism appears to be deficient with higher age. Elderly people took the irrelevant cue more seriously, as indicated by a P3-like positivity. This misinterpretation of irrelevant information declined over time (indicated by increasing similarity of waveshapes between groups with longer latencies), enabling efficient behavior of elderly subjects whenever they have enough time to deal with information.

EFFECT OF A FAMILIAL HISTORY OF ALCOHOLISM ON THETA AND ALPHA PHASE SYNCHRONIZATION DURING VISUAL TARGET PROCESSING
Todd D. Watson, Suchitra Krishnan-Sarin, Stephanie S. O’Malley, Elsa Daurignac, John H. Krystal, & Daniel H. Mathalon
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Descriptors: alcoholism, ITC, phase synchrony

We examined the effect of a familial history of alcoholism on changes in EEG phase synchronization related to target processing during a visual oddball task. Event-related intertrial coherences (ITCs) to target and standard stimuli were calculated for non-treatment seeking, alcohol-dependent subjects with a positive (FH+, n = 51) or negative (FH-, n = 34) family history of alcoholism and in healthy control subjects (HC, n = 25). Significant Condition × Electrode (Fz/Cz/ Pz) × Group (FH+/FH−/HC) interactions were found for ITCs in the theta (4 – 8 Hz) and alpha (8 – 14 Hz) bands during a latency window 325 – 400 ms following target presentation. Relative to standard stimuli, the target stimulus was found to enhance phase synchrony for all groups of subjects. However, this effect was more pronounced in HC and FH− individuals. Target processing was related to greater phase synchrony in the theta band in HC subjects than in alcoholics at Cz, while HC and FH− subjects had significantly greater theta synchronization at Pz than FH+ subjects. For the alpha band, target processing was related to greater phase synchronization at Fz and Cz in HC subjects than in alcoholics. Both HC and FH−-subjects had significantly greater alpha synchronization at Pz than FH+ subjects. The data suggest that alcoholism is related to decreases in intertrial phase synchronisation of frontal (alpha) and central (theta/alpha) oscillations during target processing. A positive family history of alcoholism is associated with a further reduction of target-related synchrony of posterior theta and alpha activity.
USE OF PULSE TRANSIT TIME IN THE PSYCHOPHYSIOLOGICAL DETECTION OF DECEPTION
Andrea K. Webb, & John C. Kircher
University of Utah

Descriptors: pulse transit time, deception

The purpose of this study was to determine if pulse transit time is correlated with the systolic points of the cardiograph, if pulse transit time is diagnostic of deception, and if pulse transit time can be used instead of the cardiograph in a polygraph examination with little or no reduction in decision accuracy. Six pulse transit time measures were computed for each of 60 subjects. Thirty guilty subjects participated in a mock crime; 30 innocent subjects did not commit the crime. Pulse transit time was moderately correlated with the systolic points of the cardiograph. Five of the six pulse transit time measures were diagnostic of deception. One measure was retained for further analysis. A discriminant function that included pulse transit time was as valid as a function that included the cardiograph. In addition, the cardiograph did not improve the accuracy of prediction when added to a discriminant function that included pulse transit time. These results suggest that pulse transit time may be used in lieu of the cardiograph for the detection of deception.

OCULOMOTOR MEASURES OF READING REVEAL DECEPTION IN A MOCK-CRIME EXPERIMENT
Andrea K. Webb1, Sean D. Kristjansson2, Dahvyn Osher1, Anne E. Cook1, John C. Kircher1, Douglas J. Hacker1, & Dan J. Waltz2
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Descriptors: eye tracking, deception

20 participants committed mock crimes and 20 did not. Of the 20 who committed mock crimes, 10 participants stole money from a secretary’s purse and 10 participants stole credit card information from a graduate student’s computer. Eye movements were recorded while subjects answered true/false questions about the crimes on a computer. Guilty participants took more time to read questions, spent more time rereading questions, and showed greater pupil dilations than did innocent subjects. Guilty participants who stole money from a secretary’s purse spent more time reading questions about the crime involving the credit card information. Guilty participants who stole the credit card information spent more time on questions about the theft of the money. Pupil diameter for guilty participants was largest when reading questions about the crime they did commit. A two-process hypothesis is proposed to account for these seemingly contradictory findings.

EYE MOVEMENTS, ATTENTION, AND THE CEREBELLUM IN AUTISM
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Descriptors: autism, eye tracking, attention

While the specific cause of autism is still unknown, there has been a substantial amount of research documenting cerebellar dysfunction in individuals with autism. The goal of this study is to examine eye movements, visual attention, and fine motor movements in a wide range of children with autism spectrum disorders. Children with autism, developmental delay or typical development received MRIs at 3–4 years of age. The same children returned for behavioral testing at 10 to 12 years of age. These behavioral tests included measures of visual motor adaptation, visual attention, visuomotor precision, fine manual motor movements, saccades and smooth pursuit eye movements, known to involve the cerebellar system. We also examined correlations between measures of eye movement, standardized behavior measures, as well as autism symptoms to assess the relation between cerebellar functioning and behavioral symptoms in autism. At 3 to 4 years of age, the children with autism had significantly smaller vermal volumes I-V and VI-VII then children with typical development but larger vermal volumes than children with developmental delay. At 9 to 12 years of age, the children with autism performed abnormally on tests of visual adaptation and visual attention. Preliminary analyses suggest that children with autism had both qualitative and quantitative abnormalities in the pattern of performance on tasks that involved coordination of visual and motor systems.

Funding Source: National Alliance for Autism Research, National Institutes of Health NICHD & NIDCD.

PERCEPTION OF MOONEY FACES BY TEENS WITH AND WITHOUT AUTISM
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Descriptors: autism, face processing, development

The primary goal of this work was to explore face perception in teenagers with and without an autism spectrum disorder (ASD). Individuals with ASD show slowed processing of faces compared to objects and compared to controls at the N170 (e.g., McPartland et al., 2004; Webb et al., in press). These tasks involved passive viewing of face and object stimuli. To investigate face perception during directed attention, teens between 12 and 16 years of age viewed upright and inverted Mooney Stimuli and were asked to make a judgment as to whether the image could be perceived as a face or was not a face. High density ERPs were collected during the task. Teens with ASD met the criteria for ASD based on standard research assessment tools (n = 28); teens with typical development were matched on age, gender and global IQ (n = 27). Both groups were more likely to report an upright Mooney face as a face (M = 77 ASD, 83 Control) than to report an inverted Mooney face as a face (M = 57 ASD, 51 Control). Subjects were faster to identify a stimulus as a “face” than having “no face”, regardless of whether or not the stimulus was upright or inverted. Preliminary ERP results suggest that there were general differences in the amplitude of the P1 and N170 between individuals with autism and controls, similar to prior reports of face processing alterations. However, there were few ERP differences between response to upright Mooney faces perceived as faces vs. inverted Mooney faces perceived as faces or not as faces. This pattern of results differs from that seen in adult controls (Jemel et al., 2005).

Funding Source: Cure Autism Now.

THE SHORT-TERM EFFECT OF ANTIPSYCHOTIC MEDICATION ON ATTENTIONAL FUNCTIONING IN SCHIZOPHRENIA
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Descriptors: schizophrenia, startle response, attention

The prepulse inhibition (PPI) of the startle reflex is a measure of sensorimotor gating, which is consistently observed when a sensory stimulus shortly precedes the startle eliciting stimulus. Recent studies revealed that patients with schizophrenia exhibit PPI deficits, while the beneficial effect of antipsychotic drugs on PPI deficits are still under debate. The present study was aimed at elucidating the effect of antipsychotic medication on PPI and further attentional functioning in patients with schizophrenia. 33 schizophrenia patients (12 females) and 37 healthy controls (21 females) were enrolled in the ongoing study. The patients were included during the first two days of their inpatient treatment. The assessment of attentional functioning included an acoustic PPI paradigm and several tests of selective attention as well. These assessments were repeated every two weeks during the inpatient treatment. Thus far 15 patients and 21 controls completed the study. Preliminary analyses revealed that patients exhibited subtle PPI deficits, which improved across the inpatient treatment resulting in comparable amounts of PPI in patients and controls during the final assessment. Deficits in selective attentional functioning observed in schizophrenia patients improved as well, but were still present in the final assessment. PPI performance was unrelated.
to the severity of the psychopathological symptoms but, interestingly, appeared to be less impaired in first-episode patients.

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STATISTICAL PROCESSING OF FACIAL ELECTROMYOGRAPHY (EMG) SIGNALS IN EMOTIONAL FILM SCENES

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Descriptors: emotion, EMG, statistical parameters

To improve human-computer interaction, computers need to recognize and respond properly to their users' emotional state. As a first step to such systems, we investigated how emotional experiences are expressed in various statistical parameters of facial EMG signals. 22 Subjects were presented with 8 emotional film fragments while a TMS Portilab system was used to measure the activity of frontalis above the left eye (EMG1), right corrugator supercilii (EMG2), and left zygomaticus major (EMG3). Additionally, subjects rated the intensity of both their positive and negative feelings for each film. Based on average positive and negative ratings, films were classified into 4 emotion categories (with 2 films each): Mixed, Neutral, Positive, and Negative. From each EMG signal, 6 statistical parameters were derived: mean, absolute deviation, standard deviation, variance, skewness and kurtosis. For each of the resulting 18 parameters, a REMANOVA was conducted, with the 4 emotions and 2 films as within-subject factors. The effect of emotion was significant for EMG2 skewness (F(3,18) = 3.500, p = 0.037), EMG3 mean (F(3,18) = 9.711, p = 0.001), EMG3 absolute deviation (F(3,18) = 8.369, p < 0.001), EMG3 standard deviation (F(3,18) = 5.837, p = 0.006) and EMG3 variance (F(3,18) = 4.064, p = 0.023). Thus, only few of the EMG parameters reached significance, possibly because—mimicking a potential human-computer situation—we did not correct our data for baseline values and averaged over a period as long as 120s. Nevertheless, the EMG3 signal remains promising in its differentiation among emotion categories.

NONCONSCIOUS COMPETITION PRIMING MODULATES FACIAL REACTIONS TO AVATAR EMOTIONAL FACES

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Descriptors: facial expression, EMG, subliminal

To investigate whether a subliminally primed competition goal influences facial reactions to facial emotional displays, 49 participants were either subliminally competition primed or neutrally primed. In the priming procedure words (e.g. rival, opponent for competition condition; street, background for neutral condition) were presented paralelly for 90 milliseconds and immediately covered by a letter string. The priming itself was covered as reaction time task. Thereafter, participants viewed computer generated avatar faces with happy, neutral and sad expressions while M. Corrugator supercilii and M. Zygomaticus major reactions were recorded electromyographically. Whereas congruent facial muscular reactions to both happy and sad expressions were expected for the neutrally primed condition, subliminal competition priming was expected to reduce these reactions. As expected, results revealed congruent M. Corrugator supercilii and M. Zygomaticus major reactions to happy and sad faces in the neutrally primed group. Furthermore, subliminal competition priming enhanced M. Corrugator supercilii activity after an initial relaxation while viewing the happy faces. In addition, competition primed participants showed a trend to react with M. Zygomaticus major activity to sad faces. An impression formation task revealed counter empathic effects and therefore confirmed successful competition priming. Overall, results indicate that nonconscious processes influence nonverbal behavior and social perception.

REDUCED PPI DURING STRESS IN PTSD

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Descriptors: prepulse inhibition, anxiety disorders, stress

Although reduced PPI has been found in Vietnam veterans with PTSD under both baseline and stressor conditions (Grillon et al., 1996; Grillon et al., 1998), recent research has failed to find reduced PPI in non-combat PTSD subjects under baseline conditions (Lipschitz at al., 2005). This research assessed PPI at 3 lead intervals in 9 subjects with non-combat PTSD and 11 low-trauma control subjects during baseline and stressor conditions (oral mental arithmetic). In a repeated measures ANOVA with independent variables of condition, lead interval and group, a 3-way interaction qualified main effects of condition (stress reduced PPI) and lead interval (greatest PPI reduction at 120 ms). The interaction revealed that PPI did not differ between groups during baseline, but during stress, subjects with PTSD showed reduced PPI compared to controls at a 120 ms lead interval, but not at 60 ms or 240 ms lead intervals. During stress, the 120 ms lead interval PPI correlated with a subset of PTSD symptoms (avoidance-numbing), showing reduced PPI with increasing symptoms. Both total PTSD symptoms and a second subscale, re-experiencing symptoms, also were elevated with reduced PPI and also only at 120 ms lead intervals and only during stress. These preliminary results suggest that for non-combat PTSD, baseline PPI does not differ from controls but that during stress PPI may be reduced at specific lead intervals. Future research can assess if specific symptoms such as numbing and re-experiencing are associated with reduced PPI in subclinical populations as well as in PTSD.

THE NEUROANATOMICAL BASIS OF TEMPERAMENT IN EARLY ADOLESCENTS

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Descriptors: temperament, adolescence, MRI

We investigated the relationship between four core temperament dimensions evident during early adolescence (Effortful Control, Negative Affectivity, Affiliation, and Surgency), and brain structure in a sample of 155 12 to 13 year olds. Participants were selected from a larger sample (n = 2500) that completed the Early Adolescent Temperament Questionnaire (Revised). MRIs were performed on a 3T scanner using a 3D volumetric sequence and images were transferred to an SGI/Linux workstation where morphometric analyses were performed. Key regions of interest (ROI), including limbic and paralimbic areas of the ventral, rostral, and dorsal anterior cingulate cortex (ACC), amygdala, hippocampus, and orbitofrontal cortex (OFC), were manually defined and quantified. Analyses examined the relationship between each temperament dimension and ROI volumes, controlling for whole brain volume, gender, and handedness. Effortful Control (a dimension describing the capacity to plan, focus and shift attention, and suppress inappropriate responses) was associated with larger volumes of the left amygdala and hippocampus, left dorsal paralimbic ACC and left and right OFC. Negative Affectivity (frustration to goal-blocking) was associated with smaller volume of the left dorsal paralimbic ACC. Affiliation (the desire for warmth and closeness with others) was associated with smaller whole brain and left ventral limbic ACC volumes, and larger right rostral limbic ACC. The present findings suggest that temperament dimensions in healthy early adolescents can be linked to neural substrates.

QUALITATIVE DIFFERENCES IN N400 BETWEEN HIGH-CLOZE IDIOMS AND LITERAL SENTENCES

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Descriptors: language, N400, ERP

Few studies have examined idiom processing electrophysiologically, though many studies have made use of highly familiar idioms as a means of manipulating...
Cloze probability. As well, idioms presented in previous studies have been mostly uncontrolled on dimensions of idiomaticity shown to be important in the psycholinguistic literature (syntactic complexity, length, literal plausibility, semantic decomposability). Thus, it is unclear whether event related potentials (ERPs), such as N400, respond to idioms solely because of their high Cloze probability, or because of a unique process specific to idiom comprehension. In this study, 23 participants read 120 “verb-the-noun” idioms (She kicked the bucket), 120 literal sentences matched to the idioms on Cloze probability, length, and frequency of the sentence-final word (She wore the skirt), and 120 anomalous sentences matched on length and frequency of the sentence-final word (He read the fun). High Cloze idioms elicited a more positive-going N400 than matched literal sentences. This idiom-related enhancement of the N400 was most prominent over frontal sensors. In contrast, low Cloze idioms did not differ in N400 amplitude from matched literal sentences. These results are consistent with the view that early retrieval of idiomatic meanings, which likely occurs prior to the sentence-final word for high Cloze idioms, reduces the N400 observed at the sentence-final word. Subsidiary analyses will investigate whether the N400 effect for high Cloze idioms extends to idioms that differ in literal plausibility or semantic decomposability.

THE PERSISTENCE OF A STATE REGULATION DEFICIT IN ADULT ADHD: AN EVENT-RELATED POTENTIAL STUDY

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Descriptors: ADHD, erp, state regulation

It is estimated that up to 50 percent of children with ADHD continue to manifest symptoms in adulthood. A major theoretical account of ADHD concerns the state regulation hypothesis which postulates that poor task performance of children with ADHD is related to poor energetic state control. The current study was the first to investigate whether such a deficit persists in adult ADHD. Nineteen male adults diagnosed with ADHD and 19 control male subjects took part in the study. Event-related potentials (ERPs) were recorded during administration of a Go/No-Go task that incorporated the stroopressor presentation rate of stimuli. It was found that males with ADHD responded slower than control males only in the slow condition, accompanied by a missing increase in the parietal P3 amplitude, which may indicate that they did not allocate enough effort in order to adjust their under-activated state during the slow condition. No group differences were found with respect to the response inhibition measures (errors of commission, No-Go N2, and the N2 effect).

In conclusion, results of the current study suggest that state regulation problems persist in males with ADHD, whereas no support was found for a deficit in response inhibition in males with ADHD. Further studies are needed to evaluate whether state regulation problems also persist in female adults with ADHD.

This study was supported by grants from the Ghent University Research Fund.

VOLUNTARY AND IN VOLUNTARY ATTENTION TO FACIAL STIMULI IN SOCIAL ANXIETY

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Descriptors: emotion, attention, eye movements

Cognitive theories of anxiety propose that phobics involuntarily allocate their attention to threatening stimuli, and consequently show difficulties in voluntarily suppressing this reflexive capture of attention. Attentional deployment was investigated by means of a video-based eye-tracking system while high and low socially anxious and controls viewed pairs of facial expressions (happy, angry, fearful, sad, or neutral) in free viewing conditions (1st task) or while performing an antisaccade task with facial expressions (2nd task). The frequency of the first fixation and the time course of fixations were analyzed in the former, the error rate and saccade latencies in the latter task. In the free viewing paradigm, high socially anxious initially directed their gaze more often at happy faces compared to controls, whereas no differences were found for low socially anxious. Interestingly, the controls showed an attentional bias for angry faces. Thus, high socially anxious seem to avoid angry facial expressions, whereas normal controls initially more often direct their attention to angry faces. No differences were found between groups in the time course of fixations. Regarding the antisaccade task, groups did not differ in performance of prosaccades, whereas performance of high socially anxious in the antisaccade task was worst. Thus, high socially anxious showed more problems in voluntarily draw their attention away from facial stimuli regardless of emotional content. This is in line with the assumption that faces are especially meaningful for socially anxious people.

DON'T YOU DARE TO STARE! AN ERP ANALYSIS OF PERCEIVED GAZE DIRECTION AND FACIAL EXPRESSION IN SOCIAL ANXIETY

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Descriptors: ERP, facial expression, gaze

In social communication, gaze direction is supposed to influence how efficiently facial expressions of emotions are processed by perceivers. In social anxiety, angry facial expressions are probably the strongest phobic stimuli, and directed gaze might above all boost the facilitated processing of facial threat. Twenty-eight persons who were subdivided in high vs. low socially anxious by means of a questionnaire on social anxiety were investigated. Pictures of angry, friendly and neutral faces with directed and averted gaze were presented for 1 s each while continuous EEG was recorded. The face-specific N170, the EPN and the late positive potential (LPP) were analyzed. Overall, angry facial expressions elicited an augmented EPN compared to neutral faces, whereas friendly faces did not. High socially anxious people tended to show enhanced N170 amplitudes to all facial expressions, but no effects of emotion or gaze direction were found in this component. However, LPPs differed as a function of emotional content and, interestingly, were enlarged in high socially anxious. Additionally, high socially anxious tended to show largest LPPs to directed faces. A significant interaction of emotion and gaze direction was found in subjective ratings of emotional valence as well as effects of gaze on arousal ratings. Thus, whereas emotional content of facial expressions is analyzed within a blink of an eye, gaze direction seems to play its role at later stages of stimulus processing. As enlarged N170 amplitudes may indicate, faces per se are more meaningful for socially anxious.

THE SPR SOFTWARE REPOSITORY: A COLLECTION OF PSYCHOPHYSIOLOGICAL DATA ANALYSIS PROGRAMS

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Descriptors: ANS, EEG, functional neuroimaging

Analysis of psychophysiological data increasingly necessitates advanced software and algorithms. A number of researchers have developed specialized analysis programs they are willing to share with the community. The SPR software repository attempts to collect these resources on a web page, and portray and distribute them to advance psychophysiological research. Submissions so far include: ANSLAB, for analyzing peripheral physiological channels (e.g. ECG, EDA, tonic and reflexive startle EMG, pulse plethysmography, arterial pressure, respiration pattern, capnography, accelerometry); EMEGS, for analyzing high-density event-related EEG/MEG, correcting for eye movement and calculating, for example, ERPs, evoked frequency response, source localization, 3-D data projection, and trial-based statistics; PSPHA, for analyzing peripheral physiological channels (e.g. ECG, EDA, tonic and reflexive startle EMG, pulse plethysmography, respiration pattern); Simple EDA/EMG, for analyzing EDA and EMG; EELAB, for analyzing high-density event-related EEG/MEG, correcting for eye movement and calculating ERPs and trial-based statistics; SP, for analyzing fMRI, PET, SPECT, EEG and MEG; and FieldTrip, a collection of command-line functions for analyzing EEG/MEG. Except for PSPHA, all programs are written in MATLAB and disclose the analysis methods implemented. For experienced us-
Affective modulation of somatosensory-evoked blink elicited by noxious sural nerve stimulation

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Descriptors: nociception, emotion, motivation

Numerous studies have shown that affective valence modulates eyeblinks resulting from intense, abrupt, noxious stimuli. Extending this work, we have demonstrated that somatic (noceptive flexion reflex), autonomic (skin conductance response, heart rate acceleration), and subjective (pain ratings) reactions resulting from noxious electric sural nerve stimulation are modulated in parallel by affective valence. The present study examined whether eyeblink reflexes resulting from sural nerve stimulation show the same pattern of modulation. IAPS pictures (attack, neutral, erotica) were presented in random order, during which noxious stimuli were randomly delivered (balanced across picture valence). Eyeblink magnitude was quantified from the orbicularis oculi muscle electromyogram (EMG) by subtracting the average 60 ms prestimulus EMG activity from the peak rectified and integrated (10 ms time constant) activity with onset occurring 60 – 200 ms poststimulation (to account for time needed for transmission from sural nerve to supraspinal centers). As expected, the main effect of picture valence was significant (p < .05), with larger blinks during pictures of attack and smaller blinks during erotica. The valence linear trend explained 62% of the variance in blink magnitude. These data suggest that emotion does modulate somatosensory-evoked eyeblinks.

This work was supported in part by a Faculty Development Summer Fellowship from The University of Tulsa.

Affective modulation of the post-auricular reflex in schizophrenia patients

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Descriptors: postauricular reflex, emotion, schizophrenia

The nature and extent of affective disturbances in schizophrenia have not been well defined. One viable method for delineating emotional processes involves measuring affective modulation of the startle eye blink in response to emotion-laden pictures. We applied this paradigm to another reflex that is evoked by a startle probe, the post-auricular reflex (PAR). Benning et al. (2004) found that among healthy male subjects, pleasant images potentiated PAR and unpleasant images inhibited PAR relative to neutral images. The current investigation sought to extend these findings by examining affective modulation of PAR in schizophrenia patients. PAR was recorded from 31 schizophrenia patients and 24 healthy comparison subjects. Subjects were instructed to view a series of images differing in valence and arousal while listening to startle probes. Results suggest that healthy male comparison subjects potentiated PAR to pleasant relative to unpleasant images and healthy female comparison subjects potentiated PAR to unpleasant relative to pleasant images. Consequently, comparisons between schizophrenia patients and healthy comparison subjects were analyzed separately by gender. PAR obtained from male and female schizophrenia patients did not differ significantly from that of healthy male and female comparison subjects, respectively. Because of the possibility that group and gender differences in self-reported arousal levels may be exerting a moderating effect, additional analyses are underway.

Sponsored videogames need not be physiologically arousing or pleasant in order to be effective: A preliminary study of advergames

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Descriptors: emotion, advertising, video games

We explored how advergames (sponsored videogames) with brand-relevant themes affect arousal, valence, and attitude towards the brand in a 2 (Theme: Relevant/Irrelevant) x 2 (Game) mixed-design experiment. Theme was a between-subjects factor and referred to whether or not the theme of the game had any connection with the product or service being advertised. Game was a within-subjects factor and referred to the two games that participants (N = 35) played depending on random assignment to Theme. Participants completed a pretest assessing their attitudes towards several brands, then played two games sponsored by a particular brand for five minutes each. We measured skin conductance and zygomatic electromyography during gameplay as physiological indicators of arousal and pleasantness, respectively. Participants rated each game as they completed it, then took a posttest so that we could assess changes in attitude towards the brand attributable to the gaming experience. Results showed that subjective ratings of each game were the best predictors of positive change in attitude toward the brand. Neither skin conductance nor zygomatic activity during gameplay significantly contributed to changes in attitude toward the brand. Game ratings accounted for more of the change in attitude towards the brand in the Relevant condition. This indicates that participants attributed more of their game enjoyment to the brand sponsor when there was a thematic link between the brand and the game, even though Relevant games were no more arousing or enjoyable than Irrelevant games.

“Turning” pages online fails to elicit cardiac orienting even when a new advertisement appears on the page

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Descriptors: orienting, online news, advertising

We explored whether advertisements that change from page to page would elicit cardiac orienting and lead to better recognition of specific copy points in online news readers. Participants (N = 35) in a 2 (Ad Type: Dynamic/Static) x 2 (Trial) within-subjects experiment read a series of four multi-page online news stories while we collected heart rate as an indicator of cardiac orienting. Each story was three pages long. A multi-page advertisement appeared in the same position on each page of the story. Ad Type referred to whether or not the advertisement design and copy changed from page to page, even though the product advertised was the same throughout the story. Dynamic ads changed from page to page, while Static ads remained the same throughout each page of the story. Contrary to our predictions, dynamic ads failed to elicit cardiac orienting, yet yielded identical recognition of specific copy points. These results suggest that when people are engaged in a cognitively demanding task (reading news), a new advertisement does not represent enough of a meaningful change in the sensory environment to elicit cardiac orienting. Recognition for specific copy points was similar for Dynamic and Static ads, indicating that when people are involved in a cognitively demanding task, additional exposures of a message do not lead to better recognition. These results are further discussed in terms of assumptions about orienting, cognitive effort, and recognition in the context of online news and advertising effects.

This research was supported by a grant from the Center for the Digital Globe (CDG), University of Missouri-Columbia.
COGNITIVE EFFORT, AROUSAL, AND RECOGNITION IN READING ONLINE NEWS AS A FUNCTION OF THE NUMBER OF AVAILABLE OPTIONS

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Descriptors: attention, recognition, new media

Does the cognitive processing of online news vary as a function of the number of choices from which a particular story was chosen? We explored this question through a 2 (Available Choice: Limited/Extensive) x 3 (Story) within-subjects experiment (N = 40). Participants chose 3 news stories each from websites containing 5 (Limited) and 15 (Extensive) choices. Stories were pre-tested for arousal to avoid a possible confound with attention. Heart rate and skin conductance were recorded while participants chose and read each story. After reading all stories and taking part in a lengthy distractor task, participants took part in a forced-choice recognition test. Participants showed significantly better recognition for details of stories chosen from extensive options, although there were no significant differences in both heart rate and skin conductance during reading. Results are discussed with regard to theories of motivated attention and cognitive effort.

AN INVESTIGATION OF THE TIMECOURSE OF SENTENTIAL CONTEXT USE BY THE CEREBRAL HEMISPHERES

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Descriptors: sentence processing, N400, hemispheric asymmetries

Prior work (Federmeier & Kutas, 1999) pointed to the possibility that each of the cerebral hemispheres is biased toward distinct modes of sentence processing. In particular, it was suggested that the left hemisphere is biased toward top-down, predictive processing whereas the right hemisphere is biased toward bottom-up integration of stimuli with the preceding context. Still unclear is whether such biases reflect qualitatively different underlying processing mechanisms in the two hemispheres or differences in the timecourse with which similar underlying mechanisms unfold. To examine this question, expected sentence endings, incongruous endings from the expected semantic category, and incongruous endings from a different semantic category were presented in the left and right visual fields while event-related potentials were recorded, as in Federmeier & Kutas (1999). The stimulus onset asynchrony (SOA) between the final word of the sentence context (presented centrally) and the sentence-final critical word (presented laterally) was varied. The pattern of N400 responses observed for each visual field varies with SOA and suggests that the right hemisphere may be able to appreciate featural match between an incongruous word and its same-category expected counterpart if given sufficient processing time (albeit unrealistically long for normal language processing). This suggests that the patterns produced by the two hemispheres may appear more similar to each other if observed on different time scales.

ESTIMATING RSA FROM THE MATTRESS-RECORDED KINETOCARDIOGRAM

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Descriptors: respiratory sinus arrhythmia, actigraphy, sleep

We describe a method for extracting respiratory sinus arrhythmia (RSA) from the kinetocardiogram (KCG) recorded from accelerometers embedded in a mattress topper. The method assumes only that a stereotyped signal occur at a frequency compatible with heart rate. Validation has been performed via simultaneous recording of ECG. Data derived from 25 consecutive subjects providing KCG and ECG during apexia screening studies performed in our laboratory. Subjects were men and women, aged 24 – 55. Sleep quality was variable. ECG data were analyzed in five-minute epochs, KCG data in one-minute epochs. For both, each artifact-free epoch yielded a mean IBI and an estimate of the magnitude of the respiratory sinus arrhythmia (RSA) calculated using conventional frequency-domain methods. Divergently sensitive to body movement, position, and adiposity, KCG- and ECG-based estimates of IBI and RSA were necessarily derived from different sections and percentages of the night. Nevertheless, all-night estimates of IBI and RSA from KCG and ECG were highly correlated (r>0.90). A bias toward lower IBI and higher RSA estimates deriving from KCG was compatible with the likelihood that movement-free epochs were preferentially associated with lowered arousal and/or sleep. In summary, accelerometer-based mattress actigraphy represents an adaptable, zero-burden method of obtaining precise long-term trends in heart rate and effects on the N170 amplitude. However, group differences in amplitudes or latencies of the N1, P1, and P200 components were not observed. Multiple dipole source analysis of ERPs using BESA (MEGIS Software GmbH) localized sources in the occipito-temporal and frontal cortices. Compared with normal controls, source activation in the region of the bilateral superior frontal gyrus was reduced or absent in autism during face processing. This result supports previous PET, fMRI, and DTI studies that have found reduced frontal activation (Hall et al. 2003), dysfunctional frontal mirror neuron system (Dapretto et al. 2006) and frontal-amygdala connections (Ogi et al. 2003), as well as disrupted frontal lobe white matter tracts (Barnea-Goraly et al. 2004) in patients with autistic disorder.

DISRUPTION OF AUDITORY AND VISUAL ATTENTION IN SCHIZOPHRENIA

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Descriptors: ERP, schizophrenia, attention

Disruption of attention is a hallmark symptom of schizophrenia, and event-related potentials have been instrumental in studying this cognitive deficit, particularly the well-described reduction of the P300 component in auditory tasks. Some studies have found sparing of the P300 in visual attention, despite reduction of an earlier attention-sensitive N2 or related component (e.g. N2b), suggesting that auditory attention may be differentially disrupted in schizophrenia and that the N2b may be a more sensitive index of attention disruption. The current study compared visual and auditory attention using both unimodal and bimodal stimulus presentation in the same participants to examine the impact of schizophrenia on attention at both the early N2b and later P300 stages. Twelve patients with schizophrenia and twelve control participants were compared using unimodal auditory and visual oddball tasks as well as attend auditory and attend visual audio-visual bimodal presentation tasks. Both N2b and P300 showed attention effects, being larger to targets than non-targets in all tasks. The N2b was reduced in the patient group in all tasks except the bimodal attend visual task, while the P300 was spared in the patients in all tasks. Early auditory and visual attention, as indexed by the N2b, are impaired in patients with schizophrenia, with auditory attention more susceptible to disruption, even when later attention, indexed by the P300, is intact. This P300 sparing may be due to effortful compensation by the patients for earlier attention deficits.

EVENT-RELATED POTENTIALS TO EMOTIONAL FACIAL EXPRESSIONS IN CHILDREN WITH AUTISM

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Descriptors: autism, ERP, source analysis

Face perception and recognition of emotional facial expressions are essential social skills for everyday interpersonal communication. This study used 128-channel scalp recordings of event-related potentials (ERPs) to examine the temporal and spatial aspects of visual processing of emotional facial expressions in 15 high-functioning children with autism and 15 age- and gender-matched healthy controls (14 males, aged 9 – 14 years, mean age 9 years). All subjects performed a gender discrimination task while viewing the Ekman (1988) series of faces showing happy, angry, sad, fearful, and neutral emotions. Behavioural results showed that the autism group did not differ from controls in task performance. Repeated-measures analysis of variance of ERP components revealed significant emotion
RSA. To our knowledge, such trends, particularly in RSA, have not previously been available to sleep researchers, psychophysiologists, or cardiologists. Funding for this project was provided by NIMH (R01 MH64724, J. Sheikh, PI).

THE RELATIONSHIP BETWEEN GENERATION AND INSPECTION OF MENTAL IMAGERY: AN ERP STUDY

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Descriptors: imagery, ERP, generation and inspection

We have investigated the time-course of brain activities related to visual mental imagery. In this study, the relationship between generation and inspection of mental images was examined. 5 × 5 grids were presented with a cue (lowercase letter), and an × probe mark was appeared in one cell 100 ms after the cue onset. ERPs were recorded while participants visualized the uppercase letter of the cue on the grids and decided whether or not the probe fell on the visualized letter. To investigate the generation process, the complexity, which was determined by the number of segment, was manipulated in three levels (simple (Tor L), complex (G or S), and intermediate (C or U) trials.). To assess the inspection process, the probe position was manipulated in two levels (half of the trials were early trials, in which the probe was placed on (or near) a segment drawn early in the order if the letter would be drawn on paper, and the other half were late trials.). RT for simple trials was shorter than that for complex trials in the late trials, but this effect was not observed in the early trials. In the early latency range, ERP at the occipital site was affected by both the complexity and the probe position. In the late latency range, difference between early and late trials in the complex trials was larger than that in the simple trials. These results suggest that we could generate and inspect mental images simultaneously.

FAST OPTICAL SIGNAL DETECTED IN THE PREFRONTAL LOBE WITH NEAR-INFRARED SPECTROSCOPY DURING SLEEP

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Descriptors: sleep, optical imaging, EEG

If near-infrared spectroscopy (NIRS) is to be used in clinical applications such as the localization of epileptic foci, it must be capable of recording large amplitude transients of which only a few samples are available. With this in mind, we attempted to record the NIRS correlate of delta waves during normal human sleep. The participants (N = 4) were asked to restrict their sleep time to a maximum of 6 hours the night before the experiment. One detector and four sources of 750-nm light were placed on the forehead. A second detector recorded a red light emitting diode signal to confirm EEG-NIRS synchronization. The optical raw data were sampled at 25 Hz. A high-pass filter (cutoff 0.5 Hz) eliminated slow drift and an adaptive filter removed the pulse artifact and its harmonics. The electroencephalogram (EEG) was recorded at F7, F8, C3, Oz, Fz and at the center of the forehead optical array using a bandpass of 0.1 to 100 Hz. Large-amplitude, isolated delta waves in the EEG during Stages 3 and 4 were selected offline and the corresponding optical responses were measured. Signal-averaging trials of delta waves revealed fast optical intensity changes ranging from 0.05% to 0.3% but of unstable morphology. Measuring from the positive peak of the delta wave to the nadir of the individual optical responses, we were able to statistically confirm a latency of approximately 130 to 180 ms in 75% of the channels. These data indicate that NIRS can detect fast signals associated with spontaneous EEG transients, signals that are presumably of neural rather than hemodynamic origin.