Poster Number: 034

STROOP EFFECT DOES NOT CORRELATE WITH P300 LATENCY WITH ODDBALL (RARE) TARGET NEUTRAL AND INCONRUENT STIMULI

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Descriptors: Stroop Effect, P300 Latency

Is the locus of the Stroop effect on stimulus processing or response selection? An experiment designed to answer was Duncan Johnson & Kopell (1981). They used the ability of P300 latency to index stimulus processing speed. The Stroop effect, which they replicated, shows spoken reaction times (RTs) elevated to INCONGRUENT(I) stimuli and reduced to CONGRUENT(C) stimuli, both vs NEUTRAL(N) stimuli. They found that P300 latency did NOT change as a f(I, C, and N) and concluded that the locus of Stroop effect was in response selection. However, they used equal probability stimuli, and no target stimulus, begging the question of whether or not P300 was generated, particularly since data were presented for Pz only. Also, speech during EEG recording is a documented source of artifact. Other studies reported supportive data, though in none was there a rare target, and all used equal probability stimuli.We ran 2 groups, receiving all I or N stimuli. In each group, 1 of the 6 stimuli was designated target requiring a unique response. There were 2 blocks for both groups, one with recording during speech, and the other with recording during silent responding. For both I and N, in the silent block, Pz > Cz > Fz, F = 38, $P < .001$. There was a clear RT difference or Stroop effect for the out-loud blocks for both target and frequent stimuli; for both $t > 3.5$, $p < .002$. However in the silent block, there was no P300 latency difference between I and N for both target and frequent Stroop stimuli; for both $p > .3$. This better-designed study supports the original report with a properly identified P300.

Poster Number: 035

USING MEMORY OF TEMPORAL PATTENS TO EXECUTE ANTICIPATORY MOVEMENT: A MEG COHERENCE STUDY

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Descriptors: Timing, MEG, Cerebellum

Movements cued by isochronous stimuli shift from reacting to the first stimulus to anticipation of subsequent stimuli (movement occurs prior to stimulus presentation) after only a few cues. Anticipatory movement requires memory for and utilization of predictions for the timing of future sensory input. Cerebellum has been proposed to contribute to adaptive control of movement through a comparison of templates for future sensory input with input acquired during actual movement. We hypothesized that cortico-cerebellar networks may also utilize this predictive capacity to develop anticipatory movement. A 306-channel magnetoencephalographic (MEG) array (VectorView, located at BioMag Laboratory, HUCH) was used to characterize coherent activation of cerebellum and motor cortex during movement cued by trains of visual stimuli. Semicoherence spectra revealed dynamic changes in cortico-cerebellar networks at frequencies between 3.5 and 14 Hz during the development of anticipatory movement. The observed coherences included the 6 – 12 Hz bandwidth characteristic of climbing fiber input from inferior olivary nuclei to Purkinji cells of the cerebellar cortex. Input from inferior olivary nucleus has been proposed to represent error signals which may drive cerebellar adaptive control mechanisms and lead to remodeling of cerebellar circuits through synaptic plasticity. Our data extend previous observations of coherence networks active in cortex during perceptual integration to cortico-cerebellar coherence associated with the memory for and utilization of temporal patterns in presented stimuli. Dynamic changes in cortico-cerebellar coherence networks may provide a mechanism for the construction and utilization of short-term predictors of future sensory input.

Poster Number: 036

MEASURES AND MODELS FOR ESTIMATING AND PREDICTING COGNITIVE FATIGUE

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Descriptors: Cognitive Fatigue, EEG/ERP, Models and measures

We analyzed EEG and ERPs in a fatiguing mental task and created statistical models for single subjects. Seventeen subjects (4 F, 18 – 38 y) viewed 4-digit problems (e.g., $3+5-2+7=15$) on a computer, solved the problems, and pressed keys to respond (intertrial interval = 1 s). Subjects performed until either they felt exhausted or three hours had elapsed. Pre- and post-task measures of mood (Activation Deactivation Adjective Checklist, Visual Analogue Mood Scale) confirmed that fatigue increased and energy decreased over time. We tested response times (RT); amplitudes of ERP components N1, P2, P300, readiness potentials; and amplitudes of frontal theta and parietal alpha rhythms for change as a function of time. For subjects who completed 3 h ($n = 9$) we analyzed 12 – 15-min blocks. For subjects who completed at least 1.5 h ($n = 17$), we analyzed the first-, middle-, and last 100 error-free trials. Mean RT rose from 6.7 s to 8.5 s over time. We found no changes in the amplitudes of ERP components. In both analyses, amplitudes of frontal theta and parietal alpha rose by 30% or more over time. We used 30-channel EEG frequency spectra to model the effects of time in single subjects using a kernel partial least squares classifier. We classified 3.5-s EEG segments as being from the first 100 or the last 100 trials, using random sub-samples of each class. Test set accuracies ranged from 63.9% to 99.6% correct. Only 2 of 17 subjects had mean accuracies lower than 80%. The results suggest that EEG accurately classifies periods of cognitive fatigue in 90% of subjects.

Poster Number: 037

WHEN THE ORBICULARIS OCULI RESPONSE TO A STARTLING STIMULUS IS ZERO, THE VERTICAL EOG CAN SHOW SOMETHING HAPPENING. ZERO IS NOT NOTHING

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Descriptors: EMG/EOG, startle blink

Blink reflexes in humans are typically measured as orbicularis oculi electromyographic activity (ooEMG). When no ooEMG activity occurs in response to startle stimuli, trials are scored as zero. Gehricke, Ornitz, and Siddarth (2002) observed that when startle blinks were recorded by ooEMG and vertical electro-oculogram (vEOG), 62.5% of trials scored as zero by ooEMG showed blinks in vEOG. We examined the frequency of zero responses when blink reflexes were recorded by ooEMG and vEOG. Blinks elicited by a 50 ms 105 dB noise burst were recorded in 18 children (aged 7 – 12) and 31 adolescents (aged 16 – 17). Participants were included if they showed three or more zeros in ooEMG and stable baselines in ooEMG and vEOG. Using this criterion, 33% of children ($N = 6$) and 16% of adolescents ($N = 5$) were included. The percentage of trials in which zero ooEMGs were recorded ranged from 6.8 – 43.2%. Of these trials, the percentage showing measurable vEOGs ranged from 75 – 100%. On average, 93.1% of trials showing no ooEMG response showed blink responses (downward and upward lid movement) in vEOG. As ooEMG records orbicularis oculi contraction and vEOG records lid movement, the results suggest that in absence of orbicularis oculi contraction, the levator palpebrae can relax and tense permitting lid movement in response to startle stimuli. As an easily recorded measure, vEOG along with ooEMG provides useful information about the dynamics of blink reflexes. The results suggest a degree of independence in the orbicularis oculi and the levator palpebrae in the generation of startle blinks.