GTitle: EEG Studies of Simple Problem Solving

Author: Matthew Copello

Faculty Advisor: Jessica Turner, Matthew Turner

Keywords: EEG, arithmetic, alpha, asymmetry

Introduction

In this study, a wireless 14-electrode electroencephalogram (EEG) created by EMOTIV is being used to measure a lateralized change in alpha power across the cortex. This change, called alpha asymmetry, is measured in an arithmetic problem-solving task. This study is a replication study of Earle (1984) who observed a change in alpha asymmetry when presenting participants with arithmetic problems increasing in difficulty. Earle showed that difficult arithmetic problems elicited an increase in left hemispheric activation when compared to easy problems (Earle, 1984).

Methods

Twenty Georgia State University undergraduate students were recruited through SONA. The task was broken into 3 blocks of arithmetic problems consisting of 1 x 1, 2 x 1 and 3 x 1 digits. Participants had 2 minutes per block to solve these problems in their heads, then input answers into a keyboard. Reported data was collected from homologous electrode pairs above the temporal and parietal lobes during problem solving. Alpha asymmetry was computed by the log of the alpha scores on the right side minus the log of the alpha scores on the left.

Results

Data from 14 participants (9 female, 5 male) with a mean age of 19 has been analyzed using a related group ANOVA. Based on average latency across all solutions, problems in the 3 x 1 block took 25 s whereas those in the 1x1 block required 4 s, an increase of 167%. Currently, there is no relationship between the difficulty of the multiplication problems and lateral hemispheric alpha power. Data collection is still underway for this study.

Conclusion

The goal of this study is to replicate findings from Earle's paper while adding a few elements. These elements include the utilization of a wireless EEG, and an additional homologous electrode pair above the temporal lobe. We will examine the differences between our analysis methods and Earle's to identify possible causes for the failure to replicate.