CNV Potentials During Overt and Covert Hand Movements
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Purpose: The purpose of this study was to investigate the contingent negative variation (CNV), which is a slow negative wave deflection of an electroencephalogram, relative to overt and covert hand movements. The results of the CNV were analyzed to predict the occurrence of overt and imagined hand movements to be used for a motor imagery brain-computer interface.

Methods: Six healthy individuals and one individual with advanced amyotrophic lateral sclerosis (ALS) participated in the study. Participants were seated in a sound proof booth in front of a computer screen that displayed the targets. The visual AAC type display had five icons that included row scanning, which highlighted the target for 1.5 seconds, and an auditory prompt “click” sound. When the desired target was highlighted, participants were asked to perform overt right or left hand movements in the first condition, and overt or covert right hand movements in the second condition. Targets were randomized. To perform covert movements, participants were asked to perform kinesthetic, or first person, motor imagery, as opposed to third person.

Results: For the six healthy individuals, a significant CNV was present during the performance of overt and covert hand movements as opposed to when the hands were at rest. For the individual with ALS, there was a large amount of variation. There were significant differences in negativity (pfdr<.1) for overt and covert (pfdr<.05). False discovery rate (fdr) corrected t-test p values were used for analysis of the data.

Conclusions: Results show that recreating an AAC icon selection, a reliable CNV can be recorded from both healthy participants and from an individual with ALS after performing overt and covert movements. This information is useful for individuals that can no longer reliably control their motor or vocal motor movements to operate an AAC device. The CNV might also be helpful towards simplifying BCI control.