Increased electrical activity in the brain is linked to increased difficulty in the eye movement task

Authors: K.S. Hemington and J.N. Reynolds

Background
Brain activity can be recorded using a technique called electroencephalography (EEG). EEG measures differences in electrical activity between the neurons that make up the brain. This activity is detected using small sensors called electrodes (see the picture below).

In the past, many electrodes were placed all over the scalp in order to get a measure of total brain activity. Recently, researchers have collected information about brain activity using a single electrode placed at the F3 location \(^1\) (red box in Figure 1), corresponding to a particular region of the frontal cortex. Activity in the F3 area can detect changes in brain function, such as increased activity when tasks become harder.

Figure 1. Adapted from: DaSilva, A. F., Volz, M. S., Bikson, M., Fregni, F. Electrode Positioning and Montage in Transcranial Direct Current Stimulation. J. Vis. Exp. (51), (2011).

Research Question

- As eye movement tasks become more difficult, can associated changes in brain activity be measured using a single-electrode EEG?

What did we do?

- Healthy young adults were asked to perform a working memory eye movement task with increasing difficulty while electrical activity was measured at a location within the frontal cortex called FP1 (Green circle in Figure 1).

What did we find?

- Changes in electrical activity were found and were linked to increased task difficulty. The more difficult tasks, or those that needed more attention to complete them, included keeping eyes open (compared to closed, or no eye movement), and memory-related tasks.

Why is this important?

- People with frontal lobe brain damage have difficulty with working memory eye movement tasks and the results from this study show that changes in brain activity are associated with increasing task difficulty.

- Using single-sensor EEG to measure brain activity has several advantages over other methods. These include comfort and portability; it will be easier to test brain function in children who have trouble sitting still and who do not live near a testing centre.