III-48

Using fNIRS to Measure Mental Workload in Naturalistic Comprehension and Composition Tasks

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Functional Near-Infrared Spectroscopy (fNIRS) is an effective brain imaging technique to estimate Mental Workload (MWL) because it is wireless, non-invasive, and possibly the most resilient to movement artefacts [1]. Although fNIRS has consistently been shown as a reliable measure of MWL in certain contexts, seemingly most often involving n-back and ATC tasks [1, 2], we remain far from measuring MWL in the real world as we do with now pervasively available physical activity trackers. If, in the future, we want to track MWL in daily life contexts like the workplace, we need to investigate whether fNIRS can reliably measure MWL in a wider scope of situations (like walking [3]). This study aimed to show that fNIRS can identify different levels of MWL in a simple reading (comprehension) and writing (composition) context, in an uncontrolled environment by imitating more naturalistic settings.

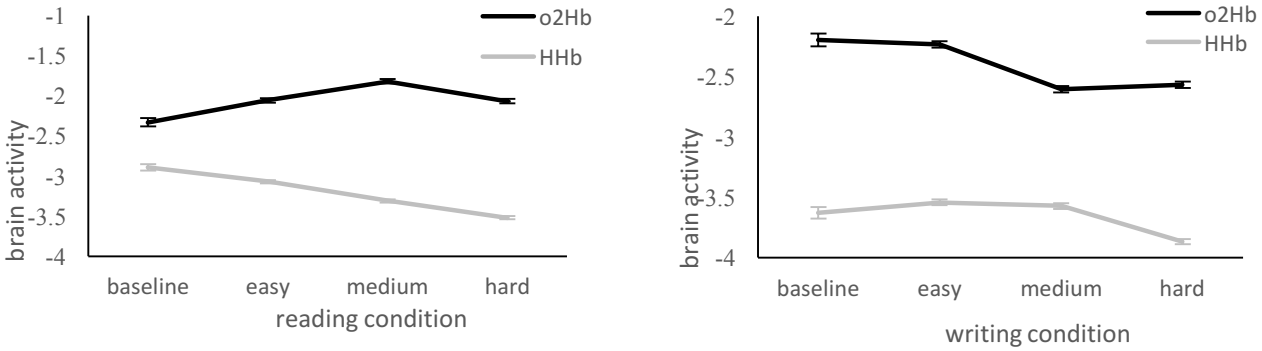

Figure 1. The relationship between reading and writing task difficulty on O2Hb and HHb levels. The error bars represent standard error of the mean (N=6).

We are mid data collection in a study where participants complete a personalized reading and writing task involving three conditions at various levels of difficulty (easy, medium and hard). The task was personalized, in that it was based on their research discipline and current work tasks. Participants sat in natural office environments, where background noise and e.g. coffee drinking was not controlled; data was collected with an Artinis Octomon. Early results indicate that fNIRS can accurately distinguish between the various levels of MWL in this context for both the reading and the writing tasks. Oxygenation levels, particularly deoxyhemoglobin (HHb), varied in accordance with task demand (Figure 1) and subjective ratings (NASA-TLX). Based on our results, future work will capture data about participants at their own desks doing their actual work, for extended periods.

References

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