EEG CORRELATES OF LEARNING TO NAVIGATE A NOVEL VIRTUAL ENVIRONMENT

Brian Veitch, *Faculty of Engineering and Applied Science*;
Sarah D. Power, *Faculty of Engineering and Applied Science & Faculty of Medicine*

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Purpose: Simulation-based training is common in safety-critical industries including aviation, military, nuclear energy, and healthcare. Currently, a trainee's proficiency in a certain skill or task is usually assessed solely based on performance measures (e.g. errors, time). However, the processing efficiency theory makes an important distinction between processing effectiveness and processing efficiency while performing a task. Although an individual may be able to perform a task effectively (i.e., achieve good performance measures) they might still require a high cognitive effort to achieve that performance. Ideally, individuals should be trained not just to perform tasks effectively, but also efficiently. They should be able to perform well without dedicating a significant amount of their available cognitive resources to the task. Therefore, performance measures alone may not be reliable indicators of task proficiency. Neural signals may provide additional information about processing efficiency in certain tasks, and could be used as a complementary objective measure of an individual's learning.

The purpose of this study is to identify features of neural signals that correlate with learning a navigation-based task, and use them to automatically classify "proficient" from "not proficient" conditions, on a single-trial basis.

Methods: Neural data, via electroencephalogram (EEG), will be collected from naïve participants as they learn to navigate an unknown spatial environment under virtual environment based simulation. Participants will complete a set of tasks that will facilitate the learning of the environment. The trials will be divided into groups representing proficiency level based on objective performance measures and subjective reports of cognitive effort. Features thought to be useful in distinguishing untrained from trained trials (e.g. those related to mental workload, task specific neural processes, processing efficiency) will be extracted from the pre-processed data signals. Features will be selected from the data to represent the physiological indicators of spatial knowledge proficiency. An optimal feature set will be used in combination with linear and non-linear classifiers to identify users' level of proficiency in the navigation task.

Results: Data collection and analysis are ongoing.

Conclusion: It is anticipated that this work could lead to the development of a complementary objective measure to assess learning in simulation-based training.