

Justification for Eligibility of Proposed Research

The primary purpose of this research is to explore the neural processes involved in music perception and imagination in order to develop a music-based brain-computer interface (BCI). This BCI will be able to detect the contents of a participant's imagination using only the recorded electroencephalography (EEG) signal. Such a BCI would allow patients that are unable to communicate behaviourally (minimally conscious, locked-in etc.) to communicate by modulating their brain states. I will also be exploring neural processes responsible for perception and imagination of music. BCIs often require extensive training time for a patient to learn to control it. This can lead to patient fatigue. To reduce training time and fatigue, I will use the information collected during passive music perception to inform the BCI algorithm that decodes the music imagination data, as listening is unlikely to be as tiring as other training paradigms.

This BCI will rely on EEG recorded in healthy participants who will be tested on paradigms that manipulate music perception and imagination. Through careful manipulation of audio characteristics such as rhythm, affect, and instrumentation, I will determine what aspects of music are the most salient and reliably identifiable from EEG data alone.

I will have the benefit of conducting this research at the University of Western Ontario under the supervision of Dr. Adrian M. Owen (NSERC Canada Excellence Research Chair) and Dr. Jessica A. Grahm (NSERC Discovery Grant holder) at the Brain and Mind Institute. The Brain and Mind Institute is one of Canada's leading centres for brain research and this offers the ideal environment for research collaboration. The institute provides me with access to multiple EEG systems (e.g. BioSemi, EGI, GTEC). Access to these systems allows me to use the most appropriate technology for my experimental paradigms and will have a positive impact on my research success. Having the opportunity to pursue my research at the University of Western Ontario will allow me to work with the guidance of leaders in the field with an infrastructure to support my research.

My research aligns closely with NSERC's goal to advance research in a valuable new area of study. This research explores a fundamental process in humans that will ultimately lead to the development of a medical device to be used by patients with motor deficits that affect their communication abilities. The research will be conducted on healthy human participants and will allow us to learn about the neural processes involved in music perception and imagination. Given the field of my research, my proposed location of tenure, and the contributions to be made by my findings, my application is most appropriately reviewed by the Natural Sciences and Engineering Research Council of Canada.