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Validating methods for using noninvasive brain stimulation to influence auditory perception

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Western BrainsCAN
Transforming brain research.

Project**Summary**
KNOWLEDGE MOBILIZATION & IMPACT

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Background

Speech and music are both rhythmic in nature. When you hear them, the neural activity in your brain synchronizes with the rhythms of these sounds. This process is important - when it happens, speech comprehension is better, listening to someone in a noisy environment is more successful and moving to the beat of a musical rhythm is enhanced.

Unfortunately, this kind of synchronization is disrupted in certain disorders, such as dyslexia and Parkinson's, and in simple aging.

The Problem

'Non-invasive Brain Stimulation' (NBS) includes techniques that allow us to influence neural activity. We can use these techniques to manipulate the synchronization between the neural activity in the brain and the music or speech the individual can hear. In one technique, known as tACS or transcranial alternating current stimulation, we can apply a weak alternating current to the scalp and the neural activity will synchronize with the current.

There is little evidence that NBS affects speech synchronization and no evidence that it affects musical rhythms. We believe we can use this method to either strengthen or weaken the synchronization of neural activity, which will improve or disrupt perception. This could provide a target for therapy to improve auditory perception within disorders that normally impair it.

There is also a lack of agreement in the scientific community on how well tACS works. We also know that the precise relationship between neural activity and stimulation, whether music, speech or an alternating current, varies from person to person. Applying this technique blindly is unlikely to be successful, it has to be tailored for each individual.

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Human Cognition & Sensorimotor Core

Western Faculty, Group or Institution

Faculty of Social Science, Department of Psychology

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Aging, hearing, language & speech, music & beat perception

Related

None

The Project

We will be exploring the influence of a weak alternating current on neural activity at different frequencies to build a more complete picture of tACS. We will also incorporate EEG measurements to help us predict how the synchronization varies across individuals, to determine when to provide stimulation for each individual. Finally, we will vary the tACS stimulation and use participant behaviour as the measure to understand what stimulation timing produces the largest behavioural changes.

Together, these tests will help us 'tune' tACS for each individual, so that it strengthens the synchronization of neural activity and rhythmic sounds, whether speech or music, in situations where it is being disrupted or suppressed. This work will provide a set of best practices for tACS research going forward and sets the stage for a transformative research program.

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