Session 2I

Multimodal Explorations of Neurological Disorders

Session Moderator: Gwenn Garden, Neurology
MGH 271
3:30 PM to 5:15 PM
* Note: Titles in order of presentation.

Effects of Delayed Feedback on Auditory-Motor Adaptation in Speech Production

Maria Gabriel Merakov, Senior, Speech and Hearing Sci (Com Disorders)
UW Honors Program
Lisa C, Fifth Year, Speech & Hearing Sciences
Mentor: Ludo Max, Speech & Hearing Sciences
Mentor: Robert Hermosillo, Speech and Hearing Sciences

Auditory-motor adaptation is a form of sensorimotor learning in which human subjects gradually (i.e., over several trials) adjust the movements of their speech articulators when experiencing experimentally manipulated auditory feedback. For example, it is well documented that subjects lower their formant frequencies (i.e., acoustic output resonant frequencies that are determined by the articulators' positions) in response to a real-time upward shift of these formants in the perceived auditory feedback. Our long-term goal of translating such auditory-motor learning protocols into clinical applications for individuals with speech disorders requires an understanding of the central nervous system's tolerance for feedback delays. Indeed, one potential problem for efficient sensorimotor learning arises when movement-related feedback is delayed: perceiving the consequences of one's own actions with a delay results in this sensory information being processed similar to externally-generated, rather than self-generated, sensory input. In the present study, we follow up on recent work in which we found that auditory-motor learning in speech is completely abolished with feedback delays of 100 ms or more. Here, we tested whether shorter delays also have a negative impact on speech auditory-motor learning. Twelve adult subjects read out loud monosyllabic words while a digital vocal processor applied a 2.5 semitones upward shift to all formants in the auditory feedback signal that was presented through insert earphones. In separate conditions, this feedback was delayed by 0, 33, 66, or 100 ms. Measurements of the subjects' extent of auditory-motor learning across all conditions will be presented and interpreted in the context of current models of sensorimotor learning.

Session 2I

Multimodal Explorations of Neurological Disorders

Session Moderator: Gwenn Garden, Neurology
MGH 271
3:30 PM to 5:15 PM
* Note: Titles in order of presentation.

Exploring EEG-Neurofeedback as a Novel Tool in the Treatment of Stuttering

Tsz Ling (Serena) Leung, Senior, Speech and Hearing Sci (Com Disorders)
Mary Gates Scholar, UW Honors Program
Kwang S (Kwang) Kim, Graduate, Speech & Hearing Sciences
Mary Gates Scholar, Undergraduate Research Conference Travel Awardee, Washington Research Foundation Fellow
Mentor: Ludo Max, Speech & Hearing Sciences

Although efficacious treatment options are available for children who stutter, currently existing treatments for adults who stutter are generally ineffective and time-consuming with relapse rates as high as 50-70%. Thus, there is an urgent need for innovative stuttering treatment approaches that are both effective and efficient. Here, we explore the use of neurofeedback training as a novel tool in reducing stuttering frequency. Neurofeedback is a type of biofeedback that enables individuals to self-regulate particular aspects of brain activity (e.g., slow cortical potentials or activity in specific frequency bands) through real-time visual feedback. Neurofeedback protocols targeting various activation patterns have already been tested extensively for the clinical management of disorders such as epilepsy, ADHD, and Tourette's syndrome. In the present preliminary study, we examined whether or not the direct regulation of a brain wave called the mu rhythm (8-13 Hz) shows promise for reducing the primary symptoms of stuttering. Three adults who stutter completed 12 sessions of neurofeedback training over a 6-week period. Brain activity was recorded with an electroencephalography (EEG) system and, after on-line filtering, these data were used to provide visual feedback about activity in the mu frequency band. Participants played a video game in which the goal was to change the color of a balloon by increasing or decreasing their mu rhythm activity. Reading and conversational speech samples were audio- and video-recorded before and after each training session for the offline calculation of stuttering frequency. Data collection has been completed and analysis of each participant's stuttering frequency within and across sessions is ongoing. Results will provide initial data regarding the potential use of EEG-based neurofeedback as a new clinical tool in the treatment of stuttering.