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Internship proposal

Auditory-somatosensory interaction in event-related potentials in stuttering participants

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Background: While speech is auditory in nature, somatosensory inputs can also provide a basis for precise control of speech movements. In addition, because speech production requires precise coordination of multiple articulators, auditory-somatosensory interaction can play an important role in speech processing. For fluent production of speech sounds, phrase and sentences, multiple types of somatosensory input together with auditory input can be thus processed and coordinated precisely in time. This fluency of speaking lacks in the persons who stutter (PWS). The disfluency in PWS is considered to be caused by multifactorial pathways (Smith and Weber, 2017). Since changing temporal coordination between auditory and somatosensory inputs using delayed auditory feedback technique can reduce disfluency in PWS (Kalinowski and Stuart, 1996), lack of fluent sensory processing and coordination can be hypothesized as one of the factors for disfluency of speaking. Investigating sensory dysfunction in PWS will thus help to understand human sensory processing including auditory-somatosensory interaction mechanism.

Purpose: The current project aims to examine **auditory-somatosensory interaction processing in PWS in event-related potentials (ERPs).** In the previous study, auditory-somatosensory interaction in ERPs was modulated depending on temporal relationship between these two sensory stimulations in English speakers (Ito et al., 2014). In this internship, we will try to reproduce a similar temporal modulation of ERPs during auditory-somatosensory interaction in fluent French native speakers. This is a first step toward establishing a proper experimental procedure to investigate auditory-somatosensory interaction in PWS.

Method: Event-related potentials (ERPs) in response to paired and separated auditory-somatosensory stimulations will be recorded. Auditory stimulation will be used a midway sound between /e/ and /u/. Robotic device (Geomagic: Phantom 1.0 as shown in Fig. 1) was used to produce somatosensory stimulation as shown in Figure 1. Different from the figure, the robot will pull the facial skin in backward direction by modifying a configuration of support arms. The obtained ERP's will be analyzed using EEGLAB on MATLAB.

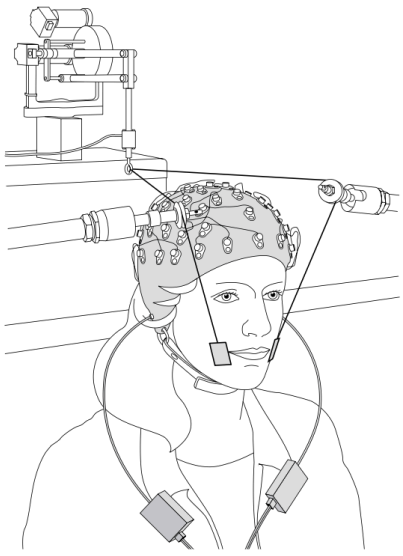

Figure 1

Outputs: The findings will help not only to better understand speech function in people who stutter, but also to elucidate the relationship between speech production and perception more generally. Through this internship, the student will gain a theoretical understanding of human cognitive function in speech processing and learn how to address these questions by applying an original and sophisticated technique based on a robotic system in combination with electroencephalography (EEG). The student will also learn to use various software for controlling the actuator, running the experiments, and analyzing the results using statistical tools.

Ito T, Gracco VL, Ostry DJ (2014) Temporal factors affecting somatosensory-auditory interactions in speech processing. Frontiers in psychology 5:1198.

Kalinowski J, Stuart A (1996) Stuttering amelioration at various auditory feedback delays and speech rates. Eur J Disord Commun 31:259–269.

Smith A, Weber C (2017) How Stuttering Develops: The Multifactorial Dynamic Pathways Theory. J Speech Lang Hear Res 60:2483–2505.