Somatosensory inputs in auditory perceptual training changes speech motor learning

Supervisors: Takayuki Ito, David J. Ostry
Contact: Takayuki Ito, takayuki.ito@grenoble-inp.gipsa-lab.fr
Location: GIPSA-lab / Université Grenoble Alpes

Description of the Project:

Somatosensory inputs play a role not only in speech production, but also speech perception. The identification of speech sounds is altered when the facial skin was stretched by robotic device in a manner that subjects experience during speech production (Ito et al., 2009). Given that orofacial somatosensory inputs provide articulatory information associated with speech production (Johansson et al., 1988), this somatosensory effects on speech perception may arise as a result of the involvement of speech production system in speech perception. Since repetitive exposure of somatosensory stimulation in speech perception changes speech perception (Ito and Ogane, 2022) and speech production (Ashokumar et al., 2022), the somatosensory system can contribute to establishing or reorganizing the representation of speech perception through learning. This project aims at testing this prediction further, by examining **whether the perception training with paired auditory-somatosensory stimulation changes speech motor learning**.

Method:

1) A perception training concerning the speech sound identification and speech motor adaptation test will be carried out in order.
2) Somatosensory stimulation associated with facial skin stretch will be applied during perceptual training.
3) Speech motor adaptation test will be carried out using altered auditory feedback system, Audapter, (Cai et al., 2011).
4) The stimulation device and stimulus sound presentation are controlled with Matlab and Psychophysics toolbox.
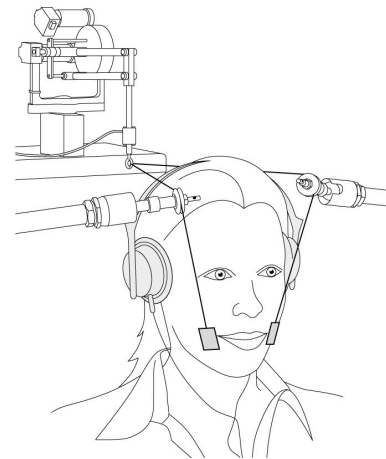5) The participant's responses will be analyzed using Matlab and R for statistical analysis.

Figure 1

Outputs:

The results will shed very interesting light on the cognitive processing, specifically adaptation mechanism concerning speech perception, in the human brain. The student will learn an original and sophisticated technique associated with the use of the real-time sound modulation. The internship will combine psychophysical experiments and use of various software for driving the experiment and analyzing the results with

statistical tools. This experiment, if successful, could drive towards further studies and possible developments for speech processing and speech learning.

References:

Ashokumar M, Schwartz jean-luc, Ito T (2022) Orofacial somatosensory inputs in speech perceptual training modulate speech production. In, pp 784–787.

Cai S, Ghosh SS, Guenther FH, Perkell JS (2011) Focal manipulations of formant trajectories reveal a role of auditory feedback in the online control of both within-syllable and between-syllable speech timing. J Neurosci 31:16483–16490.

Ito T, Ogane R (2022) Repetitive Exposure to Orofacial Somatosensory Inputs in Speech Perceptual Training Modulates Vowel Categorization in Speech Perception. Front Psychol 13:839087.

Ito T, Tiede M, Ostry DJ (2009) Somatosensory function in speech perception. Proc Natl Acad Sci U S A 106:1245–1248.

Johansson RS, Trulsson M, Olsson KÂ, Abbs JH (1988) Mechanoreceptive afferent activity in the infraorbital nerve in man during speech and chewing movements. Exp Brain Res 72:209–214.