

Internship proposal

Auditory perceptual training paired with somatosensory inputs can determine speech motor learning

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Description of the Project:

Speech learning and acquisition can be achieved by repetitive exposure of appropriate sensory stimulation. In case of speech perception, auditory stimulation can be a predominant role in this exposure. In case of speech production, orofacial somatosensory inputs also involved in learning together with auditory inputs. Recent study demonstrated that the somatosensory inputs during speech motor learning also modified representation of speech perception (Ohashi and Ito, 2019). Considering the contribution of orofacial somatosensory inputs in the processing of speech sound (Ito et al., 2009), somatosensory inputs can play an important role in speech learning for both production and perception. The current project tries to illuminate further a predominant role of somatosensory inputs in the establishment or reorganization of the auditory-somatosensory representation through learning. We will specifically examine **whether the perception training with paired auditory-somatosensory stimulation can determine the amplitude of speech motor adaptation.**

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.

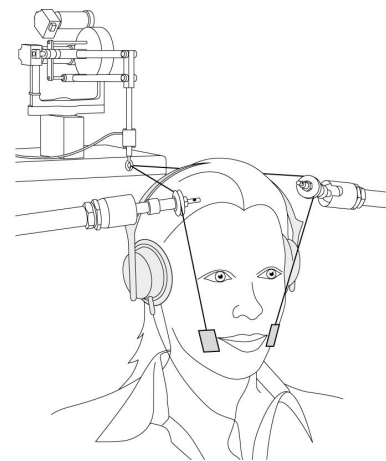


Figure 1

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:

- 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, Tiede M, Ostry DJ (2009) Somatosensory function in speech perception. *Proc Natl Acad Sci U S A* 106:1245–1248.
- Ohashi H, Ito T (2019) Recalibration of auditory perception of speech due to orofacial somatosensory inputs during speech motor adaptation. *J Neurophysiol* 122:2076–2084.