

Internship proposal

On-line speech motor control in response to dynamic modulation of background noise

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Background:

In our daily life, reaching the arm to an object or some other movement has to be made in unstable environment, for example, taking a cup on a train. We can compensate such environmental unstableness when we make a motor plan. Recent study showed that sudden change of background visual field during arm reaching movement changes trajectory of the arm as a compensation of visual field change (Saijo et al., 2005), suggesting that our movement is also controlled and compensated in on-line manner against such dynamical change of external environment during movement. In case of speech, the produced sound is also controlled depending on the external environment for better communication, such as Lombard effect, which is to increase speech volume unconsciously in noisy environment (Luo et al., 2018). Similar to arm reaching, we may also monitor dynamical change of external environment in real-time during speaking, and may reflect such sudden change of external environment into our speech production in real-time manner. The current project will **examine whether the dynamical change of background sound can affect to the production of speech sound.**

Method:

- 1) Real time sound modulation system with MATLAB (The MathWorks Inc) is used to change the background sound in synchronized with speech production.
- 2) We will carry out speech recording with this real-time sound modulation.
- 3) The recorded speech sound will be analyzed using Linear Predictive Coding method to extract formant frequencies in MATLAB or Praat.
- 4) The extracted formant frequency will be statistically evaluated using R software.

Outputs:

The results will shed very interesting light on the cognitive processing, specifically quick compensatory mechanism, 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:

Luo J, Hage SR, Moss CF (2018) The Lombard Effect: From Acoustics to Neural Mechanisms. Trends Neurosci 41:938–949.

Saijo N, Murakami I, Nishida S, Gomi H (2005) Large-Field Visual Motion Directly Induces an Involuntary Rapid Manual Following Response. J Neurosci 25:4941–4951.