

Exploring the neural correlates of speech adaptation using repetitive transcranial magnetic stimulation

Eng, E.,^{1,2} Shidfar, D.,^{1,3} Wheatley, K.,^{1,4} Beal, D.^{1,4}
¹Bloorview Research Institute, ²McMaster University, ³Queens University, ⁴University of Toronto

Background

- Speech adaptation is a process that uses auditory feedback to detect errors and modify future speech productions
- Existing studies suggest that the left ventral premotor cortex (LvPMC) plays an important role in speech adaptation [1,2]

Objective

To demonstrate a causal relationship between the LvPMC and speech adaptation.

Methods

Protocol

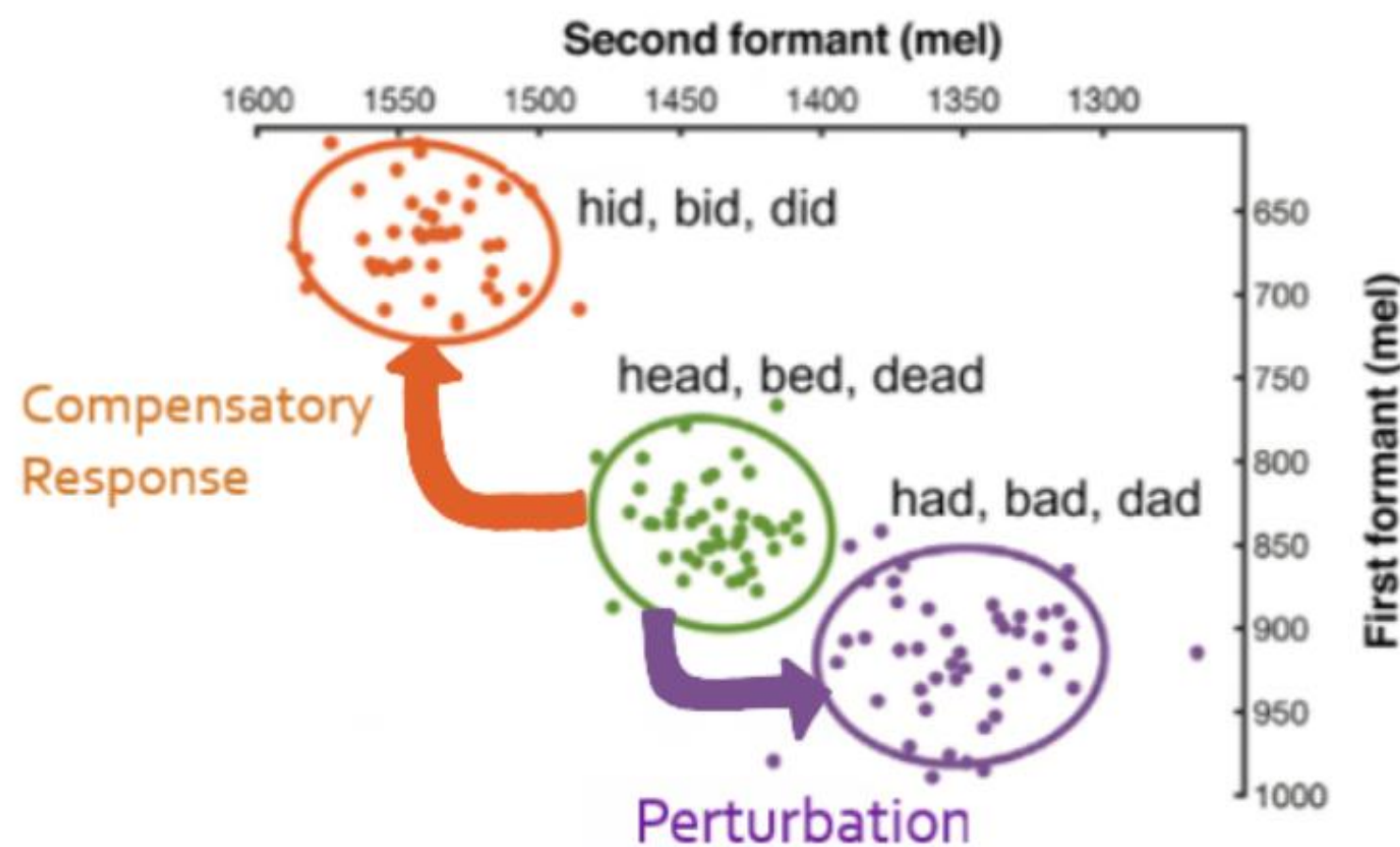
Participants will receive facilitatory, inhibitory, or sham repetitive transcranial magnetic stimulation (rTMS) over the LvPMC prior to an auditory perturbation task.



Auditory Perturbation

- Participants will read the words “bed” “head” and “dead” presented on a screen over many trials
- Participants’ auditory feedback will be altered in real time by shifting F1 and F2 formants

Typical adaptation response= compensatory shift in opposite direction to the perturbation [3]



Vowel F1/F2 Chart [3]

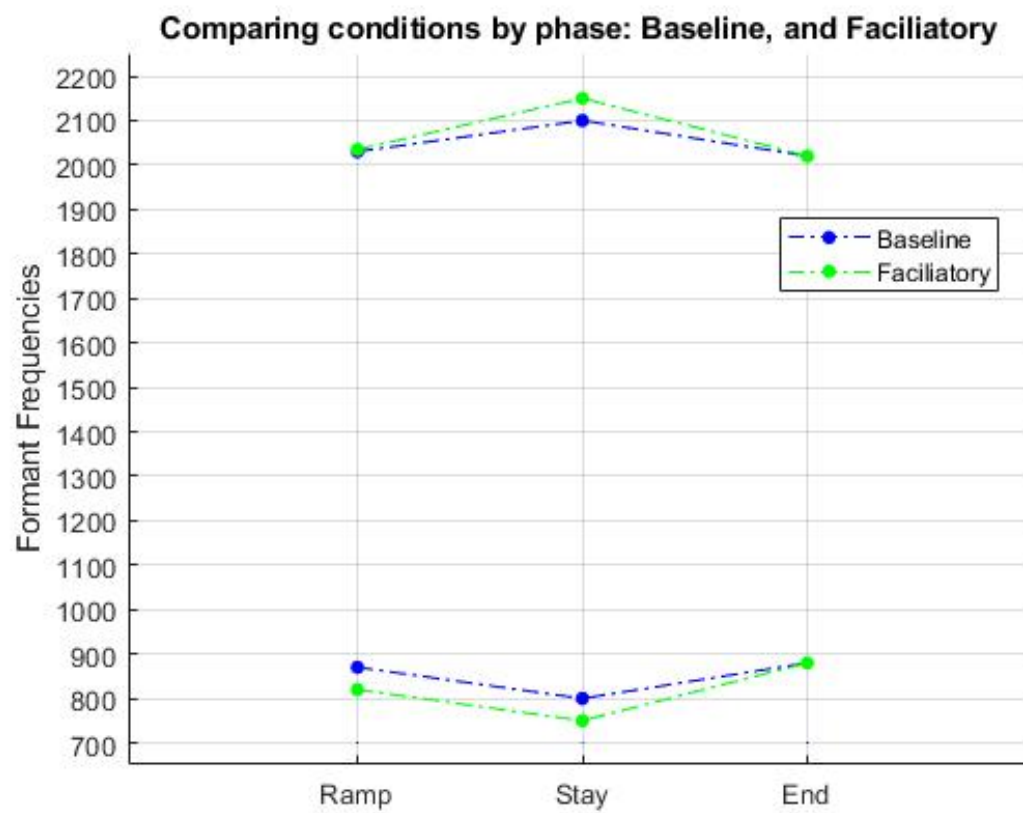
Noninvasive brain stimulation over the left ventral premotor cortex may influence speech adaptation



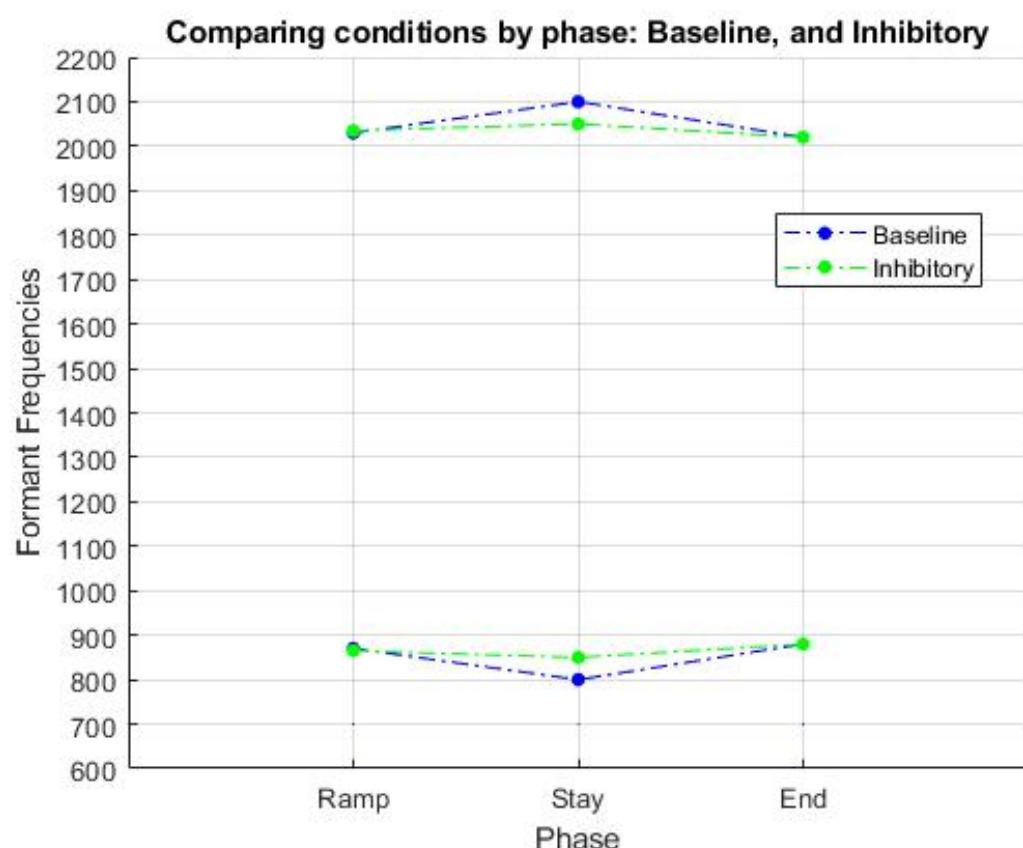
Holland Bloorview
Kids Rehabilitation Hospital

Hypothesis

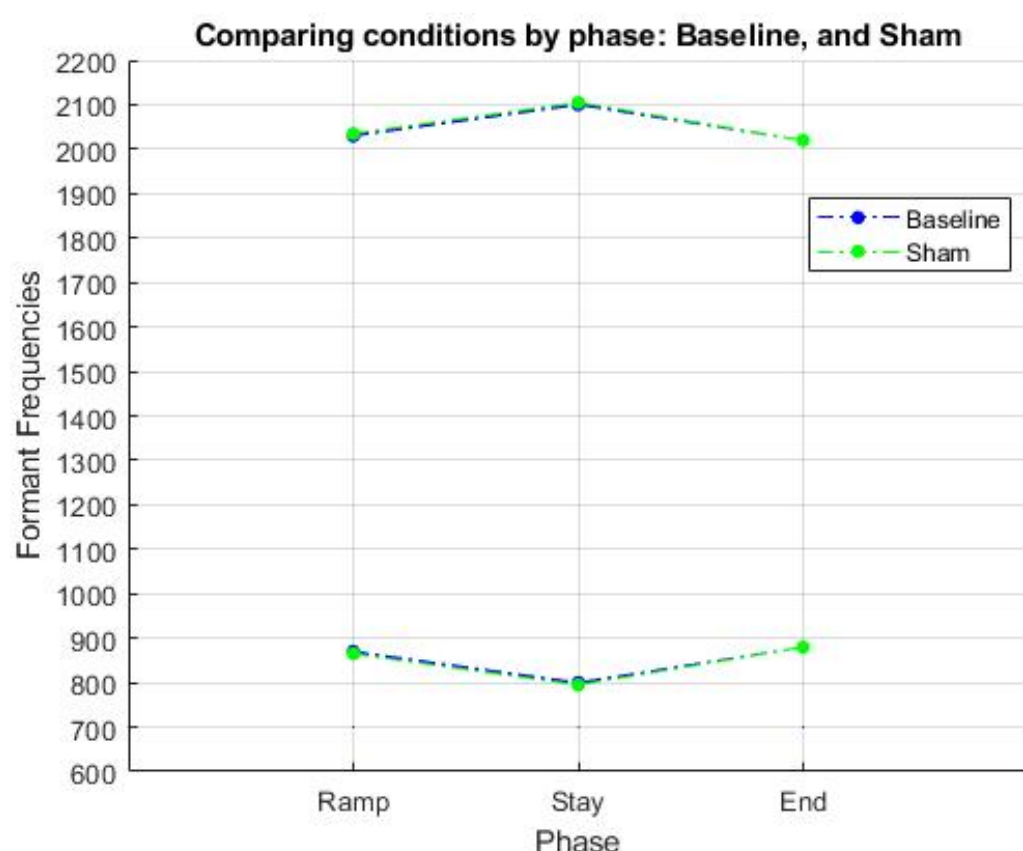
If the LvPMC is critical to speech adaptation, we expect to see...



Enhanced adaptation in facilitatory condition



Suppressed adaptation in inhibitory condition



Standard adaptation in sham condition

Next Steps

75 participants will complete the full experimental protocol.

Relevance

The results of this study will contribute to our understanding of the neural basis of speech, specifically speech motor adaptation, which is important in childhood speech acquisition.

References: [1]Scott, T. L. et al. Brain Lang 209, 104840 (2020). [2]Tang, D., McDaniel, A. & Watkins, K. E. Cortex (2021) doi:10.1016/j.cortex.2021.09.008. [3]Purcell, D. W. & Munhall, K. G. J Acoust Soc Am 119, 2288–2297 (2006).