

## Introduction

Proposed role of the sensorimotor system in guiding speech perception:

- Engaging the articulators skews perception<sup>1, 2</sup>
- Motor brain rhythms are modulated during passive listening<sup>3</sup>

How does the sensorimotor system (i.e. *speech production*) contribute to *perception*?

Approach:

- + categorical vowel perception paradigm
- + mechanical articulatory perturbation
- ⇒ behavioural & neurophysiological changes

## Methods

Participants: N = 12 fluent French speakers

Stimuli: 9-step acoustic continuum /u/ ⇒ /œ/

Materials: Small plastic tube of 2.5 cm diameter held between the lips ("liptube")

→ impairs production of rounded /u/ sound<sup>4</sup>

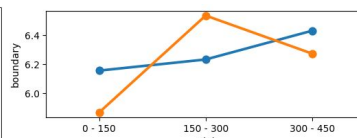
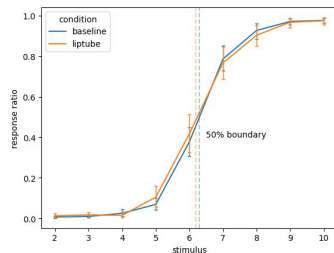
Task: Participants categorized stimuli as either /u/ or /œ/. Each stimulus was presented 50 times, totalling 450 trials per session. The task was performed at **baseline** and with the **liptube**.

EEG: Brain activity recorded via 64-channel electroencephalography (EEG). Source-level activity reconstructed with sLORETA.

## Results

**...changes perception of ambiguous vowels**  
Psychometric functions were fit to each subjects' data via logistic regression. Results demonstrate a small negative shift of slope and boundary in the liptube condition.

Compared to baseline, the liptube:

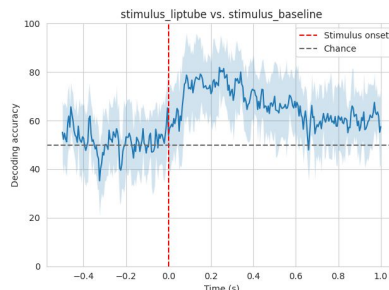


**...reorganizes perceptual categories**

The estimated boundary between phonemic categories varied more over time during the liptube condition compared to baseline.

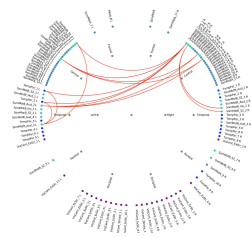
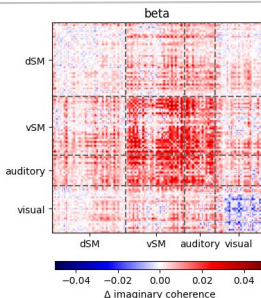
**...alters neural auditory processing**

Support vector machine (SVM) classifiers were trained on EEG data to classify the experimental condition from stimulus-evoked activity. Decoding accuracy was above chance during early to late stages of auditory speech processing and categorization.



**...increases network connectivity**

Imaginary coherence was computed between brain regions as a measure of undirected functional connectivity, and was contrasted between conditions. In the beta band (12-29Hz), connectivity increased between auditory and ventral sensorimotor regions.



## Conclusion

Perceptual shift in direction of manipulation:

- higher probability of hearing /œ/
- > ambiguous speech sounds perceived in relation to current articulatory configuration

Reorganization of perceptual categories:

- > potential adaptation to altered feedback\*

Differences in neural speech processing:

- > may contribute to stimulus categorization

Increased auditory ↔ vSM connectivity:

- sensorimotor representation of speech articulators
- > recruitment of articulatory information to resolve perceptual ambiguity
- > may reflect internal speech model dynamics

Preliminary results support an active role of the sensorimotor system in vowel perception

## References

1. Ito, T., Tiede, M., & Ostry, D. J. (2009). Somatosensory function in speech perception. PNAS.
2. Möttönen, R., & Watkins, K. E. (2009). Motor Representations of Articulators Contribute to Categorical Perception of Speech Sounds. J. Neurosci
3. Jensen, D. et al. (2014). Temporal dynamics of sensorimotor integration in speech perception and production. Frontiers in Psychology
4. Menard, L., Perrier, P., & Aubin, J. (2016). Compensation for a lip-tube perturbation in 4-year-olds. J. Acoust. Soc.