

# Neural mechanisms of sensorimotor integration in speech perception



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## Introduction

- We perceive speech sounds in distinct perceptual categories despite variability in physical stimuli
- Identical stimuli can be perceived differently depending on listening conditions and context

### Active role of sensorimotor system in perception

- Engaging the articulators skews perception<sup>1,2</sup>
- Motor-related brain rhythms altered before, during, and after listening<sup>3</sup>
- Motor cortex issues predictive signals via beta-band oscillations<sup>4</sup>

### We predict that sensorimotor perturbation will:

- Influence perception of vowels
- Alter oscillatory signals in sensorimotor regions

## Method

### Participants

2 healthy young adult participants, 1 fluent French speaker (Pilot 2)

### Stimuli

9 synthetic speech stimuli (200ms) generated along acoustic continuum from /u/ (as in shoe, who) to /œ/ (as in bird, heard)



### Materials

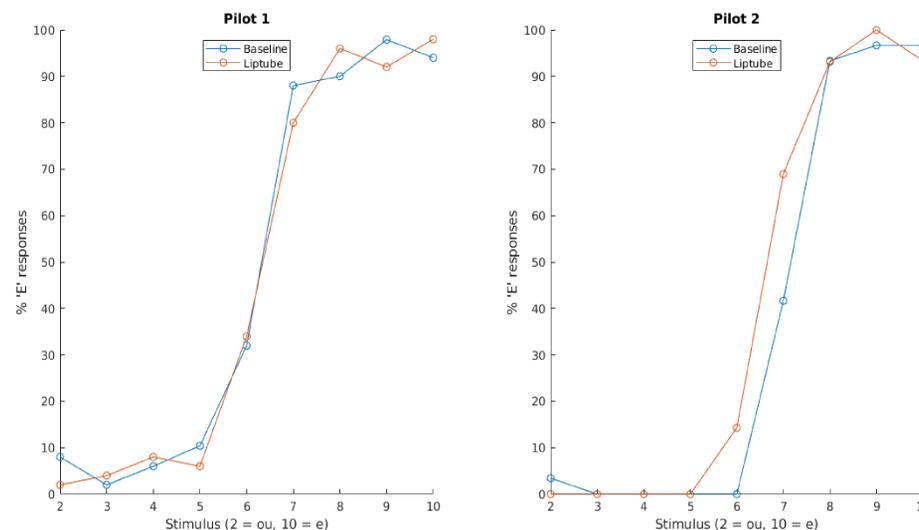
- Small plastic tube (“liptube”) of 2.5 cm diameter held between the lips
- Prevents rounding necessary to produce /u/
- Known to bias vowel perception<sup>5</sup>

### Procedure

- Participants seated in magnetoencephalography (MEG) apparatus while brain activity recorded
- Classified sounds as either /u/ or /œ/
- 450 trials per session
- Trials: 1000-2000ms duration
- Task performed both with and without liptube

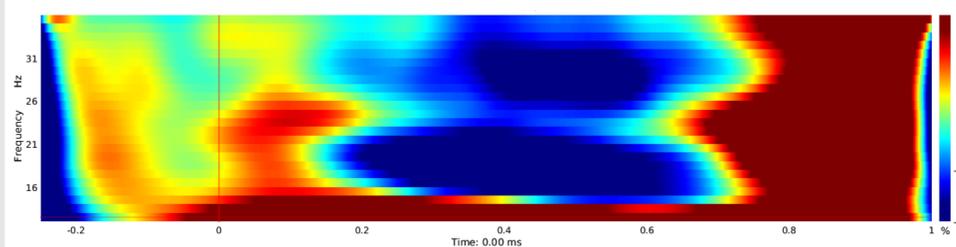
## Results

### Behavioural results

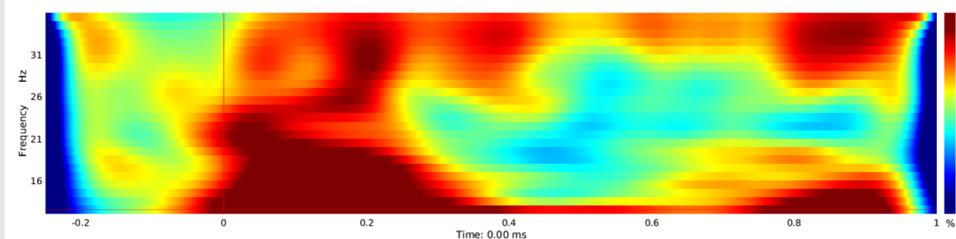


### Event-related spectral perturbation Left motor cortex: 12-35Hz

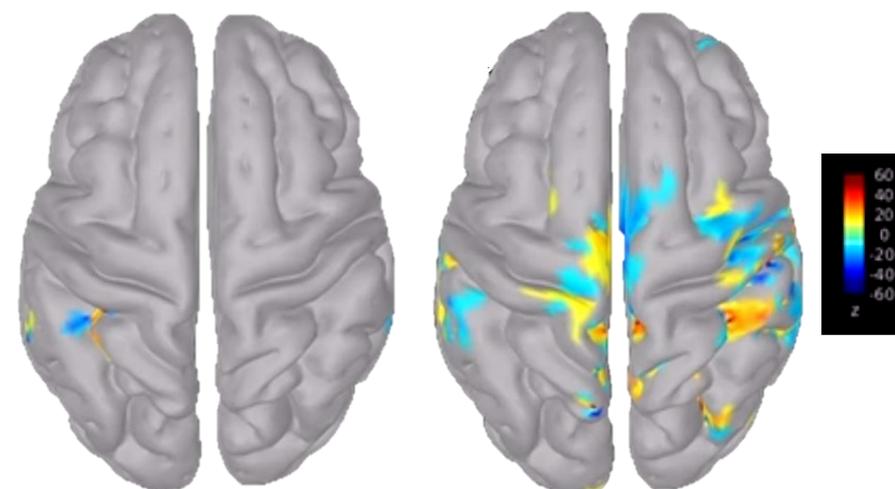
Pilot 1



Pilot 2



### Differential beta-band (12-35Hz) activity 300ms after stimulus onset



## Discussion

Liptube had different perceptual effect on clear vs ambiguous stimuli

- Effect more pronounced at perceptual boundary between phonemes
- Sensorimotor system may be more involved in speech perception during difficult listening conditions<sup>3</sup>, i.e. phonemic ambiguity

Beta-band activity: early synchronization and late desynchronization at motor cortex

- Indicative of predictive coding<sup>6</sup>
- Could reflect motor system signalling contextual information towards auditory cortex to help categorize sound

### Current Directions

- Increasing sample size
- Closer investigation of effect on clear vs. ambiguous stimuli
- Investigating time course of functional connectivity between auditory-sensorimotor regions during task

## References

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