At which processing level does extrinsic speaker information influence vowel perception?

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Introduction

- Listeners categorize sounds from an [i] to [e] continuum (a first formant (F1) vowel contrast) relative to a specific speaker’s F1 range

- If this normalization is an early process, speaker context should influence not only categorization but also auditory discrimination, and effects should be detected early in the EEG record

- If compensation occurs later, context should influence categorization but not discrimination, and effects should appear later in the EEG record

Experiment 1: Categorization

- Participants categorized stimuli on a 10-step [i] to [e] continuum. These vowels were spliced onto [papu] with high or low F1. Stimuli were thus short enough to be used in auditory discrimination

- Categorization of the [i] - [e] continuum depends on the F1 range in the subsequent [papu]

Experiment 2: Discrimination

- In a 4I-oddity task participants heard stimuli of the type standard-standard-deviant-standard and judged the deviant’s position (2nd vs. 3rd)

  - Standard: a word with an ambiguous first vowel
  - Deviant: either one of the endpoint-vowel words ([i]papu or [e]papu).

- Speaker context not only causes a shift in category boundaries, it can also make a more audible stimulus change become less audible, and vice versa

- Listeners were thus unable to access unnormalized auditory space

- This suggests that vowel normalization takes place at an early processing level

Experiment 3: EEG recordings

- In an oddball task, participants were asked to press a button when they heard a deviant

- Same standard and deviants as Experiment 2

- Analyzed time domains:

  - Oddball
    - Vowel:
      - Larger amplitudes on the P3 (p = 0.023) and on the N2 (at posterior sites, p = 0.036)
      - Earlier peaks in the N1 time domain: p = 0.044

Conclusion

Vowel normalization is the result of an early compensation mechanism that operates at an auditory processing level