

# Perceptual learning in vowel systems

Chelsea Sanker

Yale University

Phonetics and Phonology in Europe, 21-23 June 2021

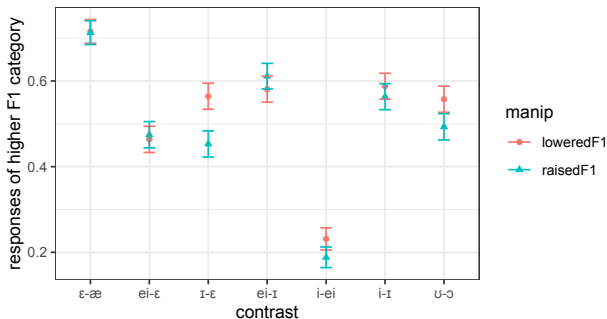
## Generalizations in perceptual learning

- ▶ In perceptual learning, shifted category boundaries can be extended to sounds that were not part of the exposure (e.g. Kraljic & Samuel 2006)
- ▶ Prior work has demonstrated generalization across vowels (e.g. Ladefoged & Broadbent 1957; Maye, Aslin, & Tanenhaus 2008, Mitterer 2006; Chládková, Podlipský & Chionidou 2017)
- ▶ What drives generalizations? Best tested with a single exposure vowel quality and several testing vowels
- ▶ **This study:** Two perception experiments tested how exposure to shifted F1 or F2 in a single vowel quality influences other vowels – *perceptual shifts generalize to vowels sharing phonological features in the domain of manipulation.*

# Task design

- ▶ Participants (128 English speakers) heard a word and identified it as one of two orthographic response options
- ▶ Two phases:
  1. **Exposure:** Consonant decisions between response options with the same vowel (e.g. *ship-chip*), formant manipulation as described below
  2. **Testing:** Vowel decisions (e.g. *pit-pet*) to test category boundaries, using vowels manipulated on a continuum.
- ▶ Study 1: Training stimuli had /ɪ/. The manipulation was raised/lowered F1 (half of participants in each condition)
- ▶ Study 2: Training stimuli had /u/. The manipulation was raised/lowered F2 (half of participants in each condition)

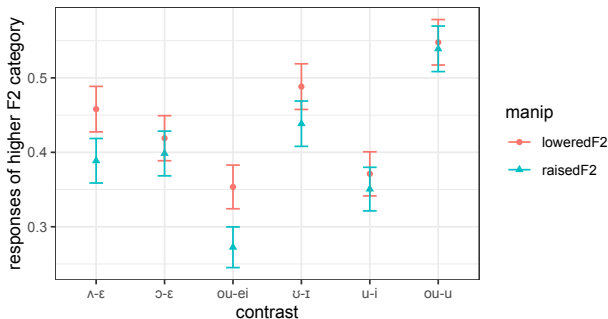
# Study 1



Proportion of responses of the vowel with the higher F1, by manipulation and contrast. Significant effect of manipulation on:

- ▶ /i-ε/ decisions ( $\beta = -0.73$ ,  $t = -4.3$ ,  $p < 0.001$ )
- ▶ /u-ɔ/ decisions ( $\beta = -0.41$ ,  $t = -2.5$ ,  $p = 0.014$ )
- ▶ /i-ei/ decisions ( $\beta = -0.35$ ,  $t = -2.0$ ,  $p = 0.05$ )

## Study 2



Proportion of responses of the vowel with the higher F2, by manipulation and contrast. Significant effect of manipulation on:

- ▶ /ou-ei/ decisions ( $\beta = -0.51$ ,  $t = -3.2$ ,  $p = 0.0015$ )
- ▶ /Λ-ε/ decisions ( $\beta = -0.41$ ,  $t = -2.6$ ,  $p = 0.01$ )
- ▶ /ʊ-ɪ/ decisions ( $\beta = -0.32$ ,  $t = -2.6$ ,  $p = 0.01$ )

# Conclusions

Perceptual learning generalizes based on shared phonological features in the domain of manipulation:

- ▶ Altered F1 in /ɪ/ training shifts the high vs. mid boundary
- ▶ Altered F2 in /u/ training shifts the front vs. back boundary

# References

Chládková, K., Podlipský V.J., & Chionidou, A. 2017. Perceptual adaptation of vowels generalizes across the phonology and does not require local context. *Journal of Experimental Psychology: Human Perception and Performance* 43(2), 414–427.

Kraljic, T., & Samuel, A. 2006. Perceptual learning for speech: Is there a return to normal? *Cognitive Psychology* 51(2), 141–178.

Ladefoged, P., & Broadbent, D.E. 1957. Information conveyed by vowels. *Journal of the Acoustical Society of America* 29(1), 98–104.

Maye, J., Aslin, R. N., & Tanenhaus, M. K. 2008. The weckud wetch of the wast: Lexical adaptation to a novel accent. *Cognitive Science* 32(3), 543–562.

Mitterer, H. 2006. Is vowel normalization independent of lexical processing? *Phonetica* 63(4), 209–229.