Perceptual Adaptation to Foreign-Accented Speech Reshapes the Internal Structure of Phonetic Categories

Xin Xie[1], Rachel Theodore[2], Emily Myers[1,2]
[1]Department of Psychology; [2]Department of Speech, Language, and Hearing Sciences, University of Connecticut

UCONN UNIVERSITY OF CONNECTICUT

Language and Brain Lab

INTRODUCTION

Perceptual Learning of Accented Speech

- Native listeners robustly adapt to *talker-specific* speech variation in foreign-accented speech (intelligibility studies [1-2], and studies of phonetic adjustment [3-5]).

Remaining Questions about Talker-Specific Adaptation

- Measures have focused on phonetic boundary shifts [3-4].

Is there a reorganization of internal category structure beyond the boundary region?

- Rich internal structure: typicality of speech instances affects speech perception and word recognition in a gradient manner [6].
- The representation of phonetic structure is malleable [7].
- Listeners track talker-specific phonetic detail [8].

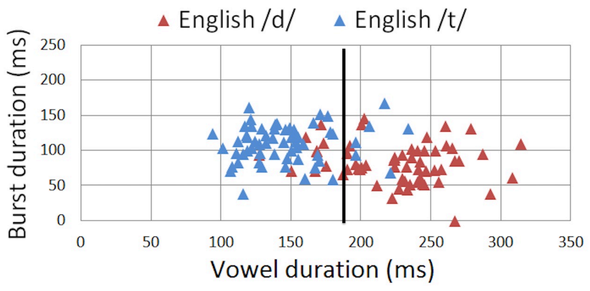
How does accent adaptation attenuate lexical competition?

- Adaptation to foreign-accented speech increases lexical activation of intended words [5].
- It is unknown whether adaptation alleviates competition between phonetically-similar words [9].

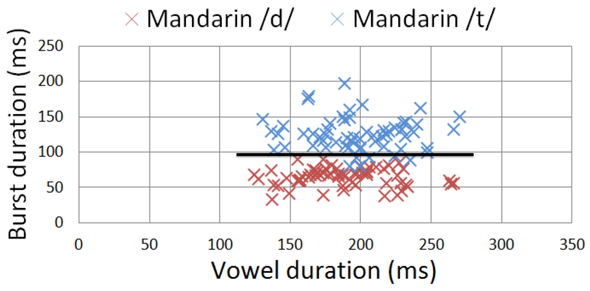
PRODUCTION DATA

Mandarin-accented word-final /d/s are acoustically similar to English /t/s and often cause perceptual confusion.

***Native-*American English**



***Mandarin-*Accented English**



*** Minimal pairs of /d/-final and /t/-final words produced by a male native-English speaker vs. a native-Mandarin speaker**

METHOD

Each experiment has an exposure phase and a test phase.

EXPOSURE PHASE: ***Auditory lexical decision task***

Participants were assigned into one of the two conditions.

- Experimental condition: 30 /d/-final words (e.g., overload)
- Control condition: 30 replacement words (e.g., animal)
- n = 24 each condition in each experiment

TEST PHASE

EXPERIMENT 1: ***Cross-modal priming***

	Visual target type	
Prime Type	**/d/-final**	**/t/-final**
Related priming	seed → SEED	seed → SEAT
Unrelated priming	milk → SEED	milk → SEAT

EXPERIMENT 2: ***2AFC category identification task***

- Does the word end in /d/ or /t/?
- e.g. "seed" or "seat"?

EXPERIMENT 3: ***Goodness rating task***

- How good is the sound as an exemplar of /d/ (or /t/) on a 1-7 scale ?

DISCUSSION

More than a boundary shift: the internal phonetic structure is reshaped following talker-specific adaptation.

- Ambiguous tokens were incorporated into a recalibrated category [3-5] .
- Unambiguous tokens were perceived as better exemplars of the intended category.

Adaptation to foreign accents is harder than adaptation to native variants: no decrease in lexical activation for phonological competitors (e.g., "seat" for the intended word "seed").

- In contrast with perceptual adaptation to native-accented speech[5].

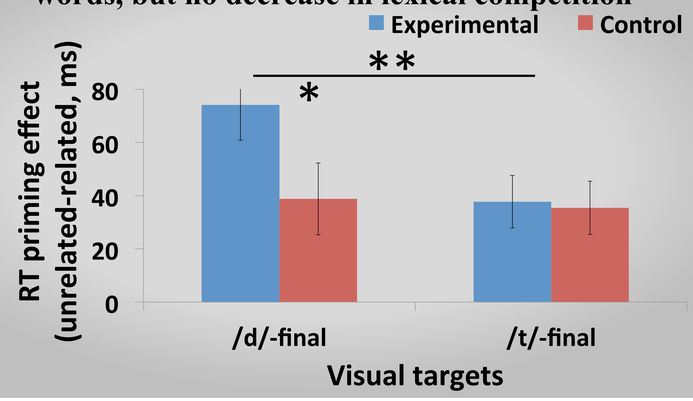
Adaptation occurs at the sub-phonemic level: re-weighting of acoustic cues.

- Experimental group relied on the burst cue to a greater extent than control group did.

Future directions: to what extent the observed adjustment in the phonetic structure and cue-weighting strategy are context-specific?

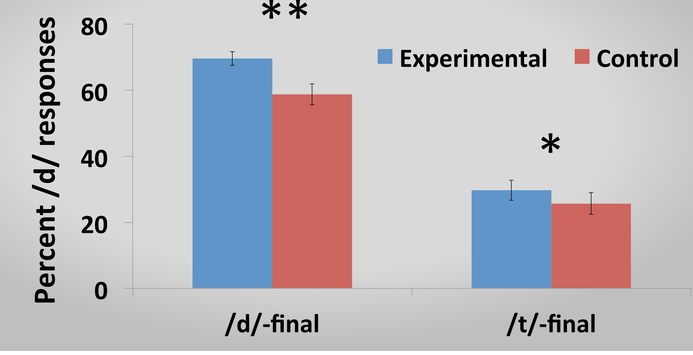
RESULTS: EXP 1

Incomplete adaptation: increase in priming for /d/ words, but no decrease in lexical competition



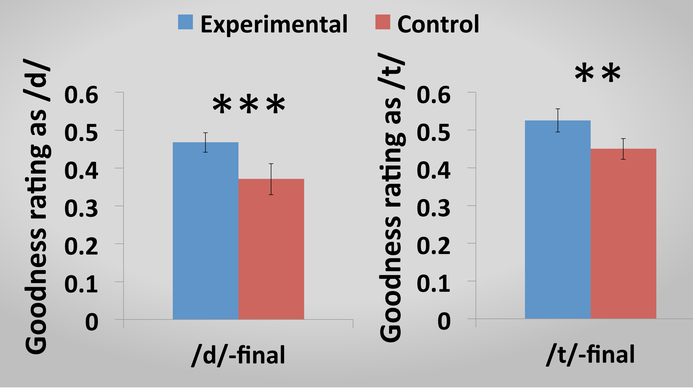
RESULTS: EXP 2

Shift of phonetic category boundary: increase in /d/ responses



RESULTS: EXP 3

Reorganization of internal structure: increase in perceived goodness



1. Bradlow, A. R., & Bent, T. (2008). Perceptual adaptation to non-native speech. *Co*gnition, *106*, 707-729.
2. Wade, T., Jongman, A., & Sereno, J. (2007). Effects of acoustic variability in the perceptual learning of non-native-accented speech sounds. *Phonetica, 64,* 122-14
3. Kraljic, T., & Samuel, A. G. (2005). Perceptual learning for speech: Is there a return to normal? *Cognitive Psychology, 51*, 141–178.
4. Norris, D., McQueen, J. M., & Cutler, A. (2003). Perceptual learning in speech. *Cognitive Psychology, 47*, 204–238.
5. McQueen, J. M., Cutler, A., & Norris, D. (2006). Phonological Abstraction in the Mental Lexicon. *Cognitive Science, 3*0, 1113-1126.
6. Andruski, J. E., Blumstein, S. E., & Burton, M. (1994). The effect of subphonetic differences on lexical access. *Cognition, 52*, 163-187.
7. Theodore, R. M., & Miller, J. L. (2010). Characteristics of listener sensitivity to talker-specific phonetic detail. *JASA, 128*, 2090-2099.
8. Theodore, R. M., Myers, E. B., & Lomibao, J. A. (2015). Talker-specific influences on phonetic category structure. *JASA, 138*, 1068–1078.
9. Eisner, F., Melinger, A., & Weber, A. (2013). Constraints on the transfer of perceptual learning in accented speech. *Frontiers in Psychology,* 4,148.

ACKNOWLEDGEMENTS: This work was supported by NIH NIDCD R03 DC009495 (Myers, PI) and by a Doctoral Dissertation Fellowship awarded to Xin Xie.