

Production and Perception of English Word-Final Stop Consonants by Native Speakers of English and Mandarin

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Overview

- Introduce project on foreign-accented speech intelligibility
- Provide information about phase two of the project
- Discuss future directions

Non-Native Accents

- Second language learners typically produce accented speech
- Non-native accents can reduce speech intelligibility for native listeners (Derwing & Munro 1997, Munro 1998)
- *Which aspects of non-native accents are responsible for reduced intelligibility by native listeners?*

Non-Native Accents

- Anecdotal evidence suggests that non-native speakers are more intelligible to other non-native listeners than to native listeners (Weinreich 1953, Nash 1969)
 - e.g. English-accented French is more intelligible to native English listeners learning French as a second language than to native French listeners

Interlanguage Speech Intelligibility Benefit

- For non-native listeners, speech from a non-native talker is as intelligible as speech from a native talker (Bent & Bradlow 2003)
 - e.g. Native English listeners learning French as a second language are as good at comprehending English-accented French as native French speech
- *Which aspects of non-native accents are responsible for these effects?*







The Project

- **Phase One:** Acoustics of word-final stop consonant voicing contrasts in native English and ESL speech
- **Phase Two: Intelligibility of word-final stop consonant voicing contrasts in native English and ESL speech**
- **Phase Three:** Relationships among acoustic and intelligibility data

Word-Final Voicing: English

- In English, words can be distinguished on the basis of the voicing value of the final consonant sound
 - ‘bat’ and ‘bad’
 - ‘cap’ and ‘cab’
 - ‘back’ and ‘bag’

Word-Final Voicing: Mandarin

- Although Mandarin does have voicing contrasts, there is no **word-final** voicing distinction
- Native speakers of Mandarin tend to **devoice** consonants word finally in English
- Native English listeners can experience difficulty determining which word the speaker intended:
 - ‘peg’  vs. ‘peck’ 
 - ‘cub’  vs. ‘cup’ 
 - ‘cab’  vs. ‘cap’ 

Research Questions

- Does native Mandarin speakers’ difficulty producing word-final voicing contrasts reduce their intelligibility by native English listeners?
- Does this pattern of devoicing by Mandarin speakers affect intelligibility by native English and native Mandarin listeners similarly?

Hypothesis 1

- Native English listeners will be more accurate at determining the intended voicing of word-final stop consonants produced by native speakers of English than by native speakers of Mandarin

Hypothesis 2

- Native Mandarin listeners will be at least as accurate *relative to native English listeners* at determining the intended voicing of word-final stop consonants in Mandarin-accented English

Hypothesis 3

- Native Mandarin listeners will be at least as accurate at determining the intended voicing of word-final stop consonants in Mandarin-accented English *relative to native English speech*

Hypothesis 4

- Native speakers of Mandarin will show a tendency to neutralize word-final voicing contrasts in English to voiceless consonants

Study Overview

- English auditory word identification task
 - Measure of intelligibility
- Native speakers and listeners of Mandarin and English

Stimuli

- Word tokens from an existing database of native and Mandarin-accented English speech
- Three different tokens of each of eight words ('cub', 'cup', 'cab', 'cap', 'pig', 'pick', 'peg', 'peck') selected randomly from recordings of 12 speakers
 - 6 native English, 6 native Mandarin ESL speakers
 - 3 males, 3 females per group
- 288 word tokens total

Subjects

- 15 monolingual English listeners
 - No Mandarin language study
- 15 native Mandarin listeners
 - All highly fluent speakers of English

Procedures

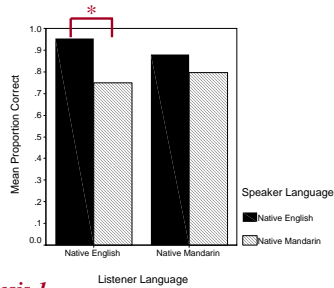
- Subjects listened to the 288 speech tokens
- Identified which word they heard in a forced-choice task
 - e.g. 'cub' or 'cup'
- Responded by pressing a button corresponding to the written word presented on computer screen
- Each token randomly presented four times, 1152 trials in the experiment
- Task duration = ~50 minutes, plus three breaks

Results

- Word identification accuracy computed as a measure of intelligibility
- Correct response = word intended by speaker
- Data submitted to ANOVA to evaluate hypotheses

Results

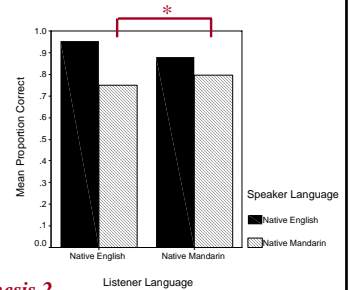
Native English listeners were significantly more accurate at identifying the voicing of final consonants in words produced by English speakers than by Mandarin speakers



→ *Support for Hypothesis 1*

Results

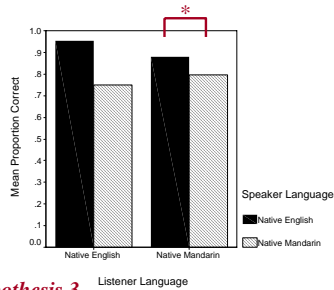
Mandarin listeners were significantly more accurate than English listeners at determining the voicing of final consonants in words produced by Mandarin speakers



→ *Support for Hypothesis 2*

Results

Native Mandarin listeners were significantly more accurate at identifying the voicing of final consonants in words produced by English speakers than by Mandarin speakers



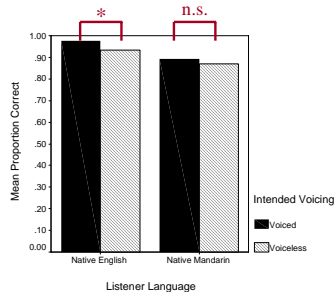
→ *No Support for Hypothesis 3*

Results

- In order to evaluate the results regarding Hypothesis 4, we need to break the data down by whether the word-final consonant was intended to be voiced or voiceless
 - Hypothesis 4: Native speakers of Mandarin will neutralize word-final voicing contrasts in English to voiceless consonants

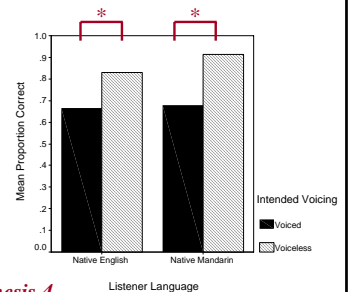
Results: English Speakers

For native English speech, English listeners exhibited significantly greater accuracy for voiced than voiceless targets; there was not a significant difference for Mandarin listeners



Results: Mandarin Speakers

But for Mandarin-accented English, both listener groups exhibited greater accuracy for voiceless than voiced targets



→ *Support for Hypothesis 4*

Conclusions

- Native English speech is more intelligible than Mandarin-accented English to native English listeners (Hypothesis 1)
- Mandarin-accented English speech is more intelligible to native Mandarin listeners than it is to native English listeners (Hypothesis 2)

Conclusions

- Native English speech is more intelligible than Mandarin-accented English to native Mandarin listeners (Hypothesis 3)
 - No support for previous interlanguage intelligibility benefit findings
- Native Mandarin speakers tend to neutralize English word-final voicing contrasts to voiceless consonants (Hypothesis 4)

Future Directions

- Phase One: Acoustics of word-final stop consonant contrasts in native English and ESL speech
- Phase Two: Intelligibility of word-final stop consonant contrasts in native English and ESL speech
- **Phase Three: Relationships among acoustic and intelligibility data**

Thank You!

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