An Acoustic Study of Real and Imagined Foreigner-Directed Speech

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Introduction

Speakers accommodate the communicative needs of their listeners.

- Speech is louder and slower in noisy environments than in quiet ones.
- Speech to hearing-impaired listeners is slower and less reduced (e.g., fewer reduced vowels) than normal conversational speech.

Foreigner-directed speech (FDS) is often cited as a similar accommodative speech style. It has characteristic syntactic and lexical properties (simplification).

⇨The *acoustic* properties of FDS are surprisingly understudied.

What *is* known about FDS is mostly from experimental data that is
- *not* specifically foreigner-directed
- spoken to an *imagined* interlocutor

e.g., "Read ***as if*** speaking to a listener with a hearing loss ***or*** from a different language background."

Current Study

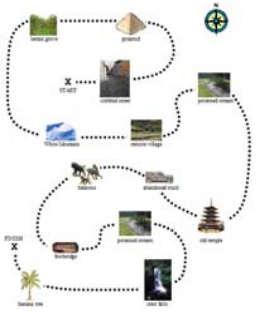
- Are there acoustic properties that characterize FDS and differentiate it from speech directed to a native speaker?
- Are these properties comparable to those found in other types of listener-directed speech?
- Is the speech elicited in an authentic foreigner-directed speech task the same as speech elicited in hypothetical situations?

The answers to these questions will help to better situate FDS in the broader context of clear speech.

Experimental Design

Methods
- 10 native speakers of American English (7M, 3F)
- Post-test measured exposure to non-native English
- 2 confederates (1 F American English, 1 F Mandarin)

Materials
- 1 pair of modified maps (q3ec6g and q3ec6f) from HCRC Map Task Corpus
- Maps contained same landmarks for participant and confederate
- Interaction focused on direction of the path
- 4 maps with distinct paths used in study



Procedure
Participants described route indicated on map under 4 conditions:

- Imagined foreigner
- Imagined native speaker
- Real confederate foreigner
- Real confederate native speaker

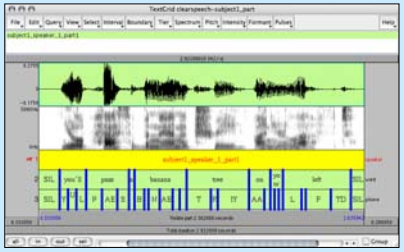
Order of conditions varied across participants

Method of Analysis

Data preparation
- The audio signal ***segmented*** into breath groups (1 to 20 words)
- Orthographically ***transcribed*** (Transcriber)
- Forced word and phone ***alignments*** using Sonic

Result: 64 minutes of speech, 3315 breath groups, 13,901 words, and 43,751 phones

Measures
- Rate of speech
- Vowel Duration
- Vowel Dispersion: F1 and F2

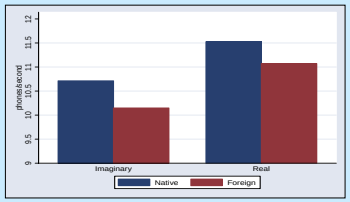


Results: Rate of Speech

Experiment 1: Two-Factor RM ANOVA
Factors: Listener Language (native vs. foreign) and Task Authenticity (real vs. imaginary)
Dependent Variables: number of phones/sec (PPS) and the number of words/sec (WPS)

- Significant main effect of Listener Language for PPS (F[1,9]=7.399, p<.05)
- Significant main effect of Task Authenticity for WPS (F[1,9]=6.483, p<.05)

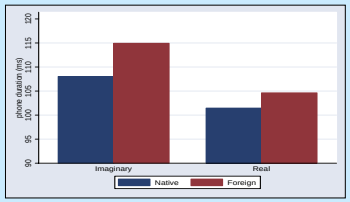
Speakers talk slower to foreigner and imaginary listeners.



Experiment 2: Two-Factor RM ANOVA
Factors: Same as experiment 1
Dependent variables: phone duration and word duration

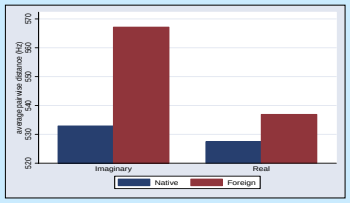
- Significant main effect of Listener Language for phone duration (F[1,9]=10.505, p<.05)
- Significant main effect of Task Authenticity for word duration (F[1,9]=6.861, p<.05)

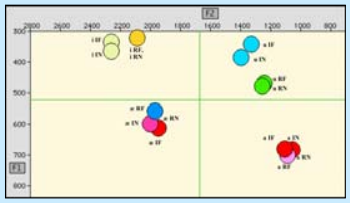
Phone duration and word duration are significantly longer when speakers interact with foreigners and imaginary listeners.



Results: Vowel Space

- Vowels: target words, stressed syllables
- **Dependent variables:** vowel triangle area, average pair-wise distance, & point vowel distances (i-u, i-a, & a-u)
- **Factors:** Listener Language (native vs. foreign) and Task Authenticity (real vs. imaginary)
- No significant differences
- Non-significant trend for **more expanded vowel space in Foreigner-Directed Speech**



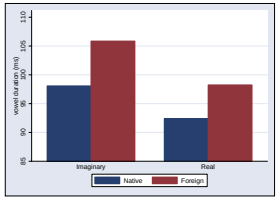


Results: Vowel Duration

Two-Factor RM ANOVA
Dependent variable: Mean vowel duration (stressed vowels in target words)
Factors: Listener Language (native vs. foreign) and Task Authenticity (real vs. imaginary)

Significant main effect of Listener Language (F[1,9]=5.834, p<.05)

Longer vowels (M=102.1) when talking to foreigners than to native speakers (M=95.2)



Discussion

- slower rate of speech (PPS, WPS)
- longer vowel duration

i. in speech to foreigners
ii. to hypothetical / imagined listeners

Speakers adjust conversational tempo according to the communicative demands of their listeners.

⇨ FDS is indeed acoustically distinct from standard native-directed speech.

Adjustments in FDS are consistent with those seen in other listener-directed speech styles:

signal was "clearer" in speech to listeners who might have extra processing difficulties (in this case, due to limited language experience).

⇨ Listener-directed speech has different properties in the absence of a real listener.

- Interpersonal interactions seem to speed up speech events.
- The authenticity of the experimental task is important in the elicitation of FDS (and presumably other listener-directed styles as well).

Future Directions

⇨ We predict that further analysis will reveal other acoustic characteristics of FDS (shared with other listener-directed speech styles).

- e.g., higher mean f0 and/or greater f0 range
- e.g., less phonological reduction (fewer deleted segments, unreleased stops, etc.)
- e.g., spectral hyperarticulation

Many of the target words in the maps in this study had vowel-adjacent liquids, which strongly affect vowel quality. In a replication of the study with targets chosen to minimize coarticulatory effects on the vowels, we predict spectral hyperarticulation will be brought out.

⇨We suggest that methodologies for future studies of clear or listener-directed speech should involve more communicatively authentic elicitation tasks.

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