Introduction

L2 speech has typically been considered more variable in its phonetic realization than L1 speech (e.g., Flege, Takagi, & Mann 1985; d’Ydewalle, Baese-Berk, & Idsardi 1989).

In learning a new phonetic category, a speaker may have:

- Uncertainty in the targets
- Uncertainty in the implementation

Previous research has found constraints on permissible variation between speech sounds within a natural class in L1 speech.

Talker mean VOTs of /p/ and /t/ strongly covary with one another in L1 American English, indicating systematic relationships of VOT within the natural class (Chodroff & Wilson 2017).

VOT covariation has also been observed across over 100 languages, but in L1 speech only (Chodroff, Golder, & Wilson under review).

Given the increased uncertainty in L2 representations, it seems plausible that these structured relations in VOT may break down in L2 speech.

Do L2 English speakers maintain structured relations in VOT among the voiceless stop consonants?

Does VOT covariation arise from the use of L1 phonetic targets or from a parallel shift in phonetic targets?

L2 English VOT Covariation

Do L2 English speakers maintain structured relations in VOT among the voiceless stop consonants?

Methods

Employed English read speech from L1 and L2 speakers

Forced phonetic alignment using FAVE

Represented L1 I Number of speakers I Presence of aspiration in L1

<table>
<thead>
<tr>
<th>Country</th>
<th>Number of speakers</th>
<th>Presence of aspiration</th>
</tr>
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<tbody>
<tr>
<td>Chinese</td>
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<tr>
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<td>✓</td>
</tr>
<tr>
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<td>✓</td>
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<tr>
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</tr>
<tr>
<td>Gujarani</td>
<td>1</td>
<td>✓</td>
</tr>
</tbody>
</table>

Table 1: Comparison of L1 and L2 English VOT Covariation

Results

Strong covariation of VOT (ms) among voiceless stops in L2 English

Summary and implications

Strong linear relationships between VOT means of /p/ and /t/ in L2 English

Some representation of natural class in L2 grammar: phonetic targets underlying VOT for /p/ and /t/ shift in parallel (rarely the case that an individual acquires a more English-like VOT for /i/ but not for /p/ and /t/)

Need to further investigate cases when shifts are not entirely parallel (e.g., Spanish /p/)

What gives rise to covariation?

Structure in the output indicates structure in the input

Mapping from phonological feature value to corresponding set of phonetic targets may be uniform for all segments with that feature value

Phonetic targets underlying VOT may be articulatory in nature

Covariation arises from the use of L1 phonetic targets or from a parallel shift in phonetic targets

Discussion

The phonetic targets underlying VOT for /p/ and /t/ may differ from the L1 to L2 grammar, but the relationship among those segments is approximately the same