Background

Previous research has identified a coronal-to-dorsal ‘perceptual assimilation’ in which English listeners identify Modern Hebrew word-initial /tl/ and /dl/ as beginning with /k/ and /g/, respectively (Hallé & Best 2007). Reported findings indicate that /tl/ is misperceived more often than /dl/—a surprising asymmetry on phonological grounds—and acoustic-phonetic factors that modulate misperception rates across stimulus types and tokens have not been identified.

Cross-language perceptual assimilation in general can be attributed to both phonological constraints and processes (e.g., Berent et al. 1997) and acoustic-phonetic (auditory) similarity to native categories (e.g., Escudero et al. 2012).

- Phonetic constraints of English support perceptual repair of /tl/ and /dl/, but do not account for different rates of perceptual assimilation across types and tokens.
- Can acoustic-phonetic properties known to be relevant to place perception account for detailed patterns of perceptual assimilation?

Objectives

- Replicate Hallé & Best study with original stimuli and novel stimuli from a different MH talker
- Determine the role of acoustic-phonetics in coronal-to-dorsal perceptual assimilation

Identification Results: Stimulus Set 1

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>Overall accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>/tl/</td>
<td>45.5%</td>
</tr>
<tr>
<td>/dl/</td>
<td>97.7%</td>
</tr>
</tbody>
</table>

Analyzed with mixed-effects logistic regression, predicting place perception accuracy of the pre-/tl/ token.

- Coronal-to-dorsal perceptual assimilation (place = -4.45, p < .001)
- Replication of /dl/>/tl/ asymmetry (place × voice = -0.88, p < .05)

Identification Results: Stimulus Set 2

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>Overall accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>/tl/</td>
<td>67.6%</td>
</tr>
<tr>
<td>/dl/</td>
<td>84.5%</td>
</tr>
</tbody>
</table>

*primarily voicing errors

Acoustic Analysis

- Measures to predict rate of coronal response

<table>
<thead>
<tr>
<th>Measure</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean frequency</td>
<td>Spectral moments (Forrest et al. 1988) from a smoothed spectrum (Hanson &amp; Stevens 2003; Fleming 2007) of initial ~10ms burst onset</td>
</tr>
<tr>
<td>Burst duration</td>
<td>Burst onset to onset of voicing (periodicity)</td>
</tr>
<tr>
<td>Relative amplitude</td>
<td>Max amp of initial 10ms of burst – max amp vowel</td>
</tr>
<tr>
<td>F3–F2</td>
<td>Measured at approximant onset</td>
</tr>
</tbody>
</table>

Acoustic Model of Coronal Perception

Stimulus Set 1

- Significant factors: mean frequency = 2.39, s.d. = -1.22, skew = -0.86, kurtosis = 1.79
  - vcl/vot = -1.63, vcd/vot = -2.22, F3–F2 = 1.10 (p < .001)
  - r = .88 across stimuli

Stimulus Set 2

- Significant factors: mean frequency = 2.83, s.d. = -1.15, kurtosis = 0.72
  - vcl/vot = -1.18, F3–F2 = 0.41 (p < .001)
  - r = .93 across stimuli

Discussion

Perception

- English listeners’ perception of MH /tl/-/dl/ clusters is highly talker- and stimulus-dependent
  - Misperception rates vary from 0% to 100% for /tl/ stimuli
  - /tl/ vs. /dl/ asymmetry is not consistent across talkers
- Main sources of variation in perception, including voiceless vs. voiced asymmetries, are acoustic-phonetic properties

Acoustic Model

- Acoustic-phonetic factors known to cue stop consonant place of articulation can model the rate of coronal identification
  - Directions of acoustic effects are expected from the general theory of place perception, for example:
    - Higher mean burst frequency → more coronal responses
    - More ‘peaked’ spectral distributions → more coronal responses
- Longer burst duration → fewer coronal responses

Future Directions

- Can perceptual models trained on English stop acoustics predict cross-language perception patterns?
- How much do phonotactic constraints contribute to the perception of illegal consonant clusters?
- Talker adaptation and learning effects? (but no evidence so far for adaptation over the course of an experiment)