Speaker Variability in Cue Weighting for Laryngeal Contrasts: the Relationship to Sound Change

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4th Workshop on Sound Change
Apr 19 - 22, 2017, Edinburgh, Scotland

BACKGROUND

- **Seoul Korean**: Sound change in progress (Bang et al., under review):
  - F0 is replacing the role of VOT in producing aspirated/lfax stop contrasts (e.g. /p/) vs (/p/).
  - “Trade-off” between the use of VOT and F0 across words, vowel contexts, and individuals.
- **Other languages**: ΔVOT/ΔF0 covariation observed across individuals
  - English (Shultz et al., 2013): negative
  - English, Khmer, Thai, and Vietnamese (Korby, 2016): negative
  - limited to the languages with long-lag VOT stop category
  - English (Clayards, 2017): positive
- **Limitations**:
  - Inconsistent results possibly due to the small # of data
  - How are cues used across words and contexts?

QUESTIONS

- **What is the relationship between synchronic covariation in VOT/F0, and diachronic sound change?**
  - Q: What is VOT/F0 covariation in signaling contrasts across word frequencies, vowel contexts, and individuals?
  - Languages undergoing change (Korean) versus not (German/English): “trade-off” as a precondition to change?

DATA

- **Read speech corpora**
  - Language: Korean, English, German
  - Corpus: NIKL (IKL, 2005), WPC (Morgan et al., 2005), PhoNetDat (Draxler, 1995)
  - # of speakers: 118, 126, 118
  - # of words: 60, 76, 79
  - # of tokens: 5559, 4208, 2660

- **F0 values converted into semitones**
- **VOT measured using AutoVOT (Keshet et al., 2014)**

HEIGHT

<table>
<thead>
<tr>
<th>Language</th>
<th>Korean</th>
<th>English</th>
<th>German</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOT contrast</td>
<td>[-high] &gt; [+high]</td>
<td>[-high] &gt; [+high]</td>
<td>[-high] ? [+high]</td>
</tr>
<tr>
<td>p = 0.022</td>
<td>p = 0.019</td>
<td>p = 0.39</td>
<td></td>
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- **Korean**: Trade-off between VOT & F0 contrasts
  - Total cue informativity constant across vowel contexts
- **German & English**: No trade-off
  - Less informativity in [-high] contexts

WORD FREQUENCY

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</thead>
<tbody>
<tr>
<td>VOT contrast</td>
<td>High &gt; Low (weak)</td>
<td>High &gt; Low (weak)</td>
<td>High ? Low</td>
</tr>
<tr>
<td>p = 0.09</td>
<td>p = 0.09</td>
<td>p = 0.07</td>
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<tbody>
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<td>High &gt; Low (weak)</td>
<td>High &gt; Low (weak)</td>
<td>High &gt; Low</td>
</tr>
<tr>
<td>p = 0.01</td>
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<td>p = 0.01</td>
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- **Stop in low frequency words behave similarly to those in high vowel contexts.**

CUE COVARIATION ACROSS SPEAKERS

- **Cohen’s D**:
  - Kor. raw: r = 0.5, p < .001
  - Eng. raw: r = 0.24, p = 0.006
  - Ger. raw: r = 0.03, p = 0.7

- **LDA weights**:
  - Between the weights of VOT and F0 across speakers in all languages (Exception: D values in German)
  - Greater speaker variability in VOT than F0 (also for all speakers, F0 weights are positive)
  - English and German: Greater speaker variability in VOT than F0 (also for all speakers, VOT weights are positive)

DISCUSSION

- **The use of F0 and VOT are negatively correlated across speakers in all languages.**
  - Change seems to be progressing by strengthening the existing correlations.
  - Correlations across words and contexts exist only in Seoul Korean.
  - In Seoul Korean, change is more advanced in the conditions where total cue informativity (VOT + F0) is smaller in other languages.
  - VOT/F0 covariation across speakers may be an origin of sound change due to speakers’ use of efficiently integrated voicing cues.