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

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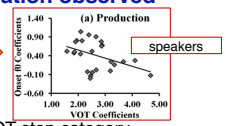
BACKGROUND

- **Seoul Korean**: Sound change in progress (Bang et al., under review):
  - **F0 is replacing the role of VOT** in producing aspirated/lax stop contrasts (e.g. /pʰ/ 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 (Kirby, 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?

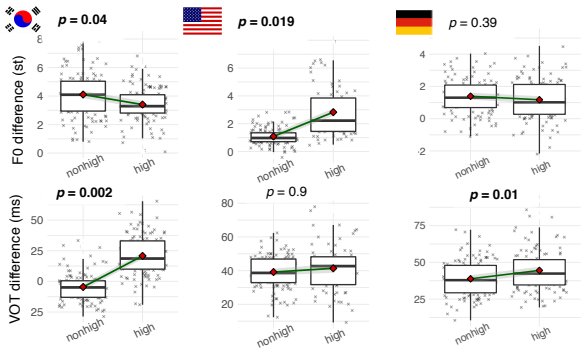
DATA

- Read speech corpora

Language	Korean	English	German
Corpus	NIKL (NIKL, 2005)	WPC G3 (Morgan et al., 2005)	PhonDat (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)

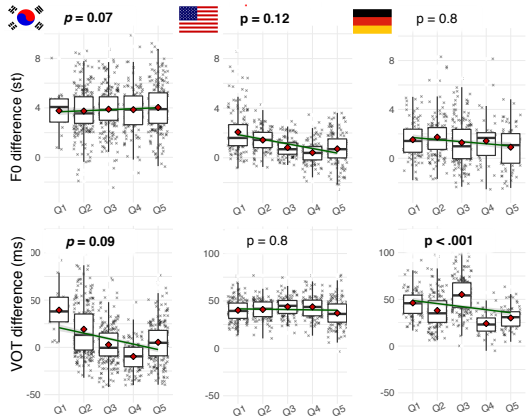
HEIGHT



Language	Korean	English	German
F0 contrast	**[-high]** > [+high]	[-high] < **[+high]**	[-high] **?** [+high]
VOT contrast	[-high] < **[+high]**	[-high] **?** [+high]	[-high] < **[+high]**

- **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

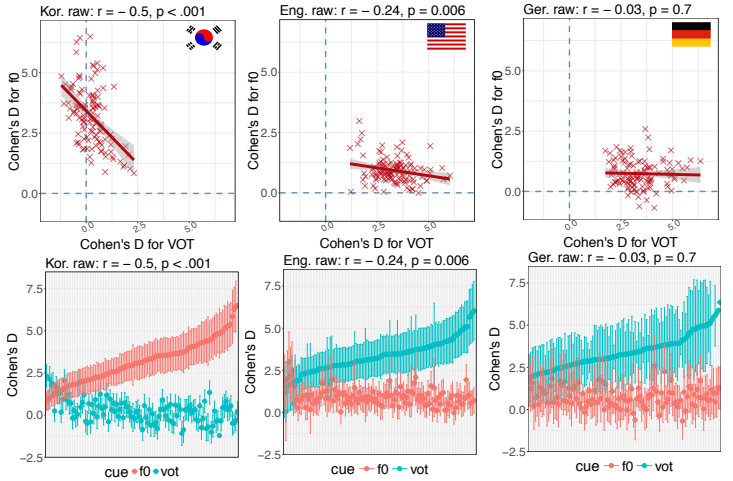


Language	Korean	English	German
F0 contrast	**High** > Low (weak)	High > **Low** (weak)	High ? Low
VOT contrast	High < **Low** (weak)	High **?** Low	High < **Low**

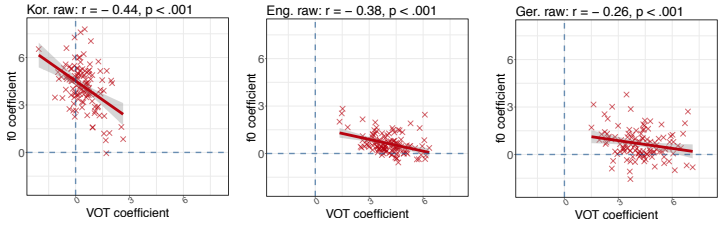
- Stops in **low** frequency words behave similarly to those in **high** vowel contexts.

CUE COVARIATION ACROSS SPEAKERS

- **Cohen's D:**



- **LDA weights:**



- **Negative correlation** between the weights of VOT and F0 across speakers **in all languages** (Exception: *D'* values in German)
  - ✓ **A stronger correlation in the language undergoing change**
- **Korean**: Greater speaker variability in F0 than VOT (also for almost 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.

Bang, H.-Y., Sonderegger, M., Kang, Y., Clayards, M., & Yoon, T.-J. (2015). The effect of word frequency on the timecourse of tonogenesis in Seoul Korean. Proceedings of the 18th ICPHS, Glasgow, Scotland, UK. / Draxler, C. (1995). Introduction to the Verbmobil-PhonDat Database of Spoken German, PrologApplications Conference PAP 95, Paris. / Kang, Y. (2014). Voice Onset Time merger and development of tonal contrast in Seoul Korean stops:A corpus study. J Phon, 45, 76–90. / Keshet, J., Sonderegger, M., & Knowles, T. (2014). AutoVOT: A tool for automatic measurement of voice onset time using discriminative structured prediction [Computer program]. Version 0.91. https://github.com/mlml/autovot. / Kirby, J. P. (2016). Cross-linguistic variability in cue weighting of consonant voicing. Oral presentation at the Workshop on Higher-order structure in speech variability, The 15th Conference on LabPhon, Cornell University, Ithaca, USA, Jul 13-17. / Shultz, A. A., Francis, A. L., & Llanos, F. (2012). Differential cue weighting in perception and production of consonant voicing. JASA, 132(2), EL95– E101.