Speakers of tonal and non-tonal Korean dialects use different cue weightings in the perception of the three-way laryngeal stop contrast

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**Background**
- Hindi p p̚
- Korean fortis lenis aspirated
- [ul] pul p̚ul

- *káci* Seoul
- *káci* Seoul
- *VOT*
- *important*
- *Despite*

- *Lexical pitch accent contrast in Kyungsang Korean*

- Seoul: kádi ‘branch’
- Kyungsang: káci (HH) ‘branch’
- ‘type’
- ‘eggplant’
- *Kyungsang does as VOT increases*

- *Acoustic findings*: Seoul and Kyungsang use acoustic cues differently for the 3-way contrast: Seoul uses both F0 and VOT, but Kyungsang primarily uses VOT (Lee and Jongman, 2012)

- *But, VOT has a stronger effect for Kyungsang Korean than Seoul* (Classification accuracy: Seoul 72%, KS 83%)

**Results 1: Heat plots**
- **Non-tonal Seoul**
- **Tonal Kyungsang**

- Short VOT triggers Fortis responses
- Long VOT triggers Aspirated; Low F0 triggers Lenis; High F0 triggers Aspirated & Fortis

- A phonetic trade-off between VOT and F0 at ambiguous VOTs for Fortis-Lenis and for Lenis-Aspirated distinctions

- Dialectal difference in the trading relation between VOT and F0

- VOT longer than 82ms is a more reliable cue for Kyungsang than Seoul for the Lenis-Aspirated percept

- Low F0 plays a role restricted to ambiguous VOTs between Lenis-Aspirated for Kyungsang; For Seoul, low F0 triggers Lenis across almost all VOTs

**Results 2: Logistic Regression**

- Analyzed participants’ choice proportions using binary logistic regression (e.g., Lenis vs. Non-Lenis (fortis, aspirated))

- Repeated three times, using Fortis, Lenis, or Aspirated response as the outcome variable

- **Seoul model/data**
  - Low F0 (99Hz)
  - Mid F0 (149Hz)
  - High F0 (209Hz)

- **Kyungsang model/data**
  - Short VOT (10ms)
  - Mid VOT (70ms)
  - Long VOT (142ms)

- **Lenis**
  - Quadratic effect of VOT; Negative effect of F0; VOT*F0-the effect of F0 is boosted as VOT increases
  - Greater effect of VOT in Kyungsang than Seoul: Kyungsang uses VOT more than Seoul regardless of change in F0
  - VOT curve is steeper for Kyungsang than for Seoul
  - Greater effect of VOT*F0 in Seoul than Kyungsang: Seoul uses F0 more than Kyungsang does as VOT increases

- **Aspirated**

- Positive effect of VOT; Positive effect of F0; VOT and F0 interact with each other

- No inter-dialectal differences interacting with VOT and F0

- Greater intercept for Kyungsang than Seoul: Earlier perceptual boundaries of VOT and F0 for Kyungsang than Seoul

- Kyungsang listeners hear aspirated stops at shorter VOTs and lower F0s compared to Seoul

- Seoul listeners need longer VOTs and higher F0s to perceive Aspirated

**Discussion & Conclusion**
- Seoul and Kyungsang use VOT and F0 cues differently, particularly for the lenis and aspirated stops
- While Seoul relies primarily on F0 for Lenis and on VOT & F0 for Aspirated, F0 plays a less important role in modulating both Lenis and Aspirated for Kyungsang than for Seoul

- What causes the inter-dialect difference in the identification of the voiceless stops?
  1. Different tonal systems between Seoul and Kyungsang Korean
  2. Loss of VOT distinction between Lenis and Aspirated stops in Seoul Korean (Silva 2006)

- The presence of lexical tone in Kyungsang weakens the F0 cue to the laryngeal distinction; the on-going diachronic change in Seoul Korean weakens the VOT cue

- Despite the weakened cue in each dialect, the three-way laryngeal contrast is maintained by strengthening the other cue for each dialect

- Although the difference in phonology between the two dialects influences the way that phonemes are perceived, the phonetic trade-off among acoustic cues enables each dialect to maintain the phonemic distinction in its own way

- **Kyungsang**

- **Seoul**

- **VOT is boosted as F0 increases**

- **No dialect difference in fortis judgment**