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

	voiceless		
Hindi	p	p^h	

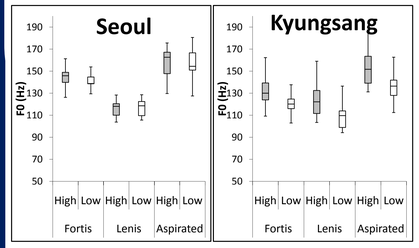
	voiceless		
	fortis	*lenis*	*aspirated*
Korean	p'	p	p^h

p'ul	*pul*	*p^hul*
'horn'	'fire'	'grass'

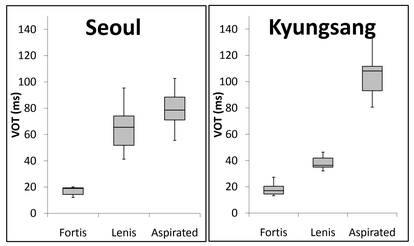
- Korean has a three-way distinction among voiceless stops at three places of articulation (bilabial, alveolar, velar) in word-initial position
- Both VOT and F0 of the following vowel are acoustic and perceptual cues to distinguish fortis from lenis from aspirated stops
- **Lexical pitch accent contrast in Kyungsang Korean**

Seoul:	kaci	'branch'	Kyungsang:	kácí (HH)	'branch'
		'type'		kácì (HL)	'type'
		'eggplant'		kàcí (LH)	'eggplant'

- **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)



- F0 is more effective for non-tonal Seoul than for Kyungsang for the three stops (Classification accuracy: Seoul 77%, KS 54%)



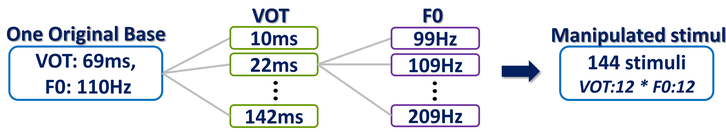
- But, VOT has a stronger effect for Kyungsang Korean than Seoul (Classification accuracy: Seoul 72%, KS 83%)

Research Questions

- Do **listeners** in the two dialects of Korean with different tone systems **perceive** the three stops differently?
  - Does the acoustic difference appear in perception?

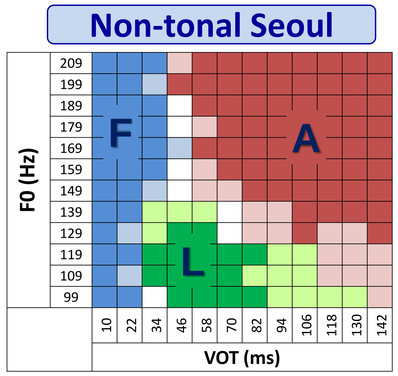
Methods

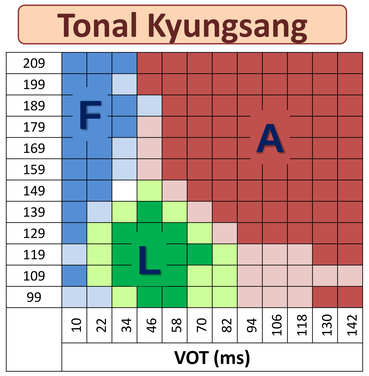
- Testing the identification of the Korean triplet *p'ul* 'horn', *pul* 'fire' and *p^hul* 'grass'
- VOT and F0 were systematically manipulated to see how listeners from the two dialects use these cues in perception
- Stimuli were manipulated from one original base token (from a male speaker) to prevent possible sources of variation
- The manipulated stimuli encompass the entire VOT and F0 range across Seoul and Kyungsang Korean (acoustic values adopted from Lee and Jongman, 2012)



- 42 listeners (21 each from Seoul and Kyungsang)

Results 1: Heat plots





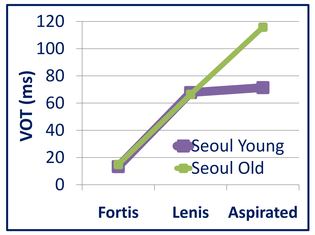
Fortis	Lenis	Aspirated	75 – 100%
Fortis	Lenis	Aspirated	50 – 74%

- 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 for 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

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)



VOT of Fortis, Lenis and Aspirated bilabial stops collected from 10 Younger (mean age = 21) and 10 Older (mean age = 66) Seoul speakers

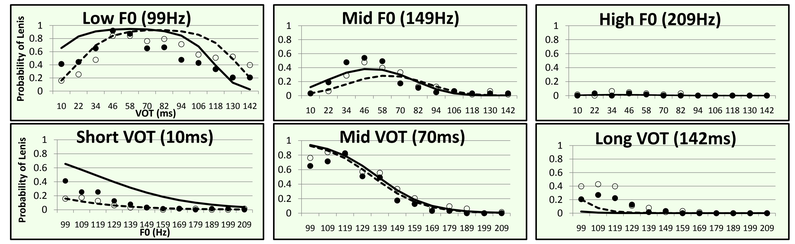
- The presence of lexical tone in Kyungsang weakens the F0 cue to the laryngeal distinction; the on-going diachronic change in Seoul Korean weakens the VOT cue
- Despite the weakened cue in each dialect, the three-way laryngeal contrast is maintained by strengthening the other cue for each dialect
- 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

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

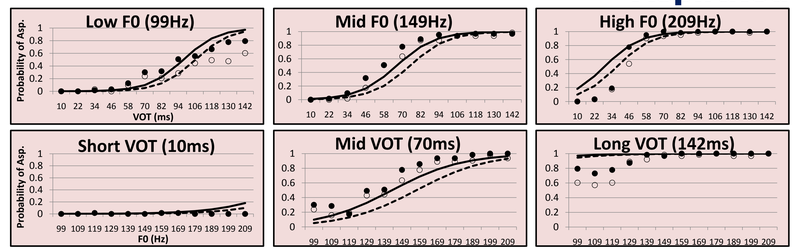
Seoul model/data — Kyungsang model/data

Lenis



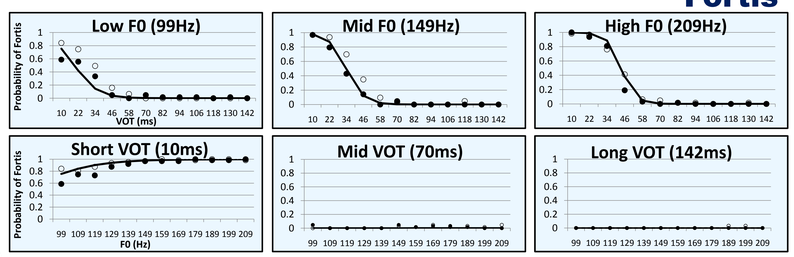
- Quadratic effect of VOT; Negative effect of F0; VOT*F0-the effect of F0 is boosted as VOT increases
- Greater effect of **VOT** in Kyungsang than Seoul: Kyungsang uses VOT more than Seoul regardless of change in F0
  - VOT curve is steeper for Kyungsang than for Seoul
- Greater effect of **VOT*F0** in Seoul than Kyungsang: Seoul uses F0 more than Kyungsang does as VOT increases
  - The effect of VOT is more easily affected by F0 for Seoul than Kyungsang
  - For Kyungsang the effect of F0 is largest when VOT is short, whereas for Seoul the effect of F0 is stable across VOTs

Aspirated



- Positive effect of VOT; Positive effect of F0; VOT and F0 interact with each other
- No inter-dialect 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

Fortis



- Negative effect of VOT; No effect of F0; The effect of VOT is boosted as F0 increases
  - No dialect difference in fortis judgment