(Diachronic Change in) Perception of Korean Sibilants

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Background: Korean Sibilants

	Fortis	Aspirated	Lenis
Affricate	/cc/ (ㅉ)	/ch/ (ㅊ)	/c/ (ㅈ)
Fricative	/ss/ (ㅆ)	/s/ (ㅅ)	

Laryngeal contrast (also present in stops):
- f0 (Lenis < Fortis < Aspirated, dialectal/age variation)
- Aspiration (Fortis < Lenis < Aspirated)
- Voice quality (Fortis = creakier, Lenis/Asp. = breathier)

Affricates contrast with **fricatives** in place (Kang et al. 2014, Kong et al. 2014, but see Kim 2001) and manner (Pyo et al. 1999).

/s/ has an **ambiguous laryngeal status**, showing properties of both Lenis and Aspirated consonants (Iverson 1983, Kang 2000, Chang 2013).
- Patterns phonologically with Lenis
- Has high f0 like Aspirated

Both consonantal and vocalic information play a role in **/s/** vs**. /ss/** perception (Yoon 1999, Chang 2013, Goun and Lee 2014).

Listeners can use some consonantal cues to distinguish **/c/** from **/s/** (duration and rise time, Park et al. 1998).

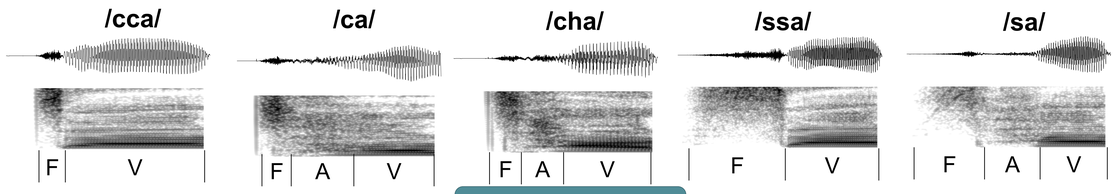
Affricates and fricatives differ in **place**, **manner**, and **laryngeal** characteristics, but it is not known how listeners weight these factors.

Research Goals

1. Map perception of Korean sibilants in an acoustic space encompassing all categories.
2. Investigate interplay of laryngeal, manner, and place cues to sibilant identity.
3. Examine how listeners perceive "ambilaryngeal" /s/ in the context of all sibilants.
4. Test whether younger listeners rely on f0 more heavily than older listeners.

Methods

Stimuli: Baseline natural productions of all sibilants followed by /a/:



Manipulations

C-Affil (x5): Consonant (Fric+Asp) spliced from natural productions

V-Affil (x5): Vowel spliced from natural productions

f0 (x3): Manipulated (105, 137, 170 Hz at vowel onset)

FricDur (x3): Manipulated Frication duration (25, 75, 155 ms)

AspDur (x3): Manipulated from **nonfortis** baseline Cs (0, 45, 90 ms)

Procedure:
- Forced choice task on the 495 target syllables embedded in a Korean carrier phrase.
- Listeners chose between 5 sibilants and "other"

Participants:
- 9 Older listeners (mean age 61, range 52-70)
- 16 Younger listeners (mean age 27, range 20-47)
- Grew up in Seoul region; some Younger listeners currently reside in Toronto (n=9)

Discussion

- All manipulated parameters influenced categorization of each sibilant (except Aspiration duration for /c/)
- Global vowel (VAffil) and consonant (CAffil) spectral cues overall most important to categorization
  - *Specific* vowel and consonantal information played a very small but significant role (e.g. /s/ vs. /ss/ baseline)

Primacy of f0 in /c/ classification
- CART results: f0 alone separates /c/ from other sibilants.
- Regression results: f0 *more* important for classifying /c/ than other sibilants, and other cues *less* important.
- f0 (a laryngeal cue) trumps place and manner cues for /c/.
- Primacy of laryngeal cues in sibilant classification may relate to regularization of loanword adaptation of English /z/ (cf. Kang 2009).

/s/ perception
- Higher f0 is a weak predictor of /s/ classification compared to the other sibilants.
- f0 not crucial for /s/ classification; spectral information in vowel and consonant are primary, with frication duration playing a supporting role.

(Lack of) age-related differences
- Considerable variability in use of f0 (vs. other parameters).
- No differences found between younger and older listeners.
- Preliminary analyses: individual use of f0 in sibilant perception correlated with use of f0 in stop perception.

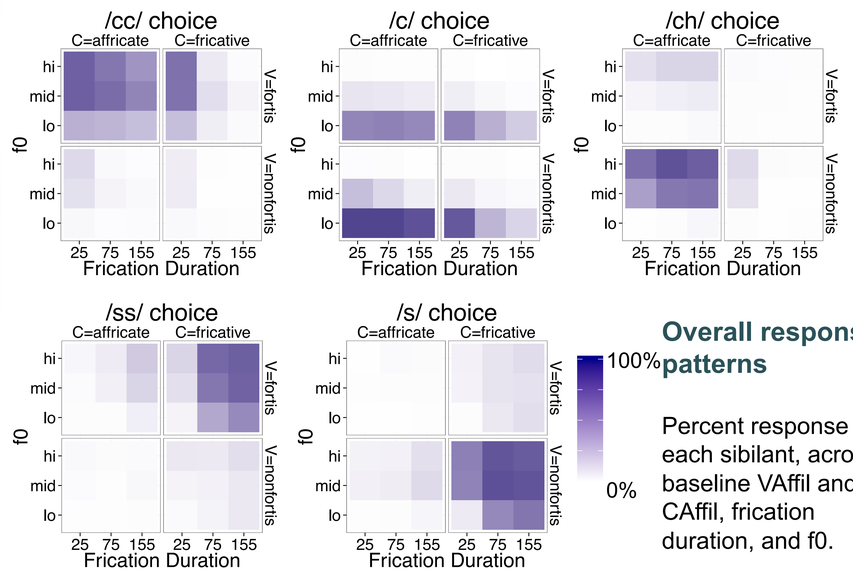
All analyses collapse CAffil and VAffil into two categories:
- VAffil = Fortis (/cca, ssa/) vs. Nonfortis (/ca, cha,sa/)
- CAffil = Fricative (/sa, ssa/) vs. Affricate (/ca, cha, cca/)

Classification and Regression Tree (CART) analysis

f0 = Lo				c (67%)
f0 = Mid/Hi	VAffil= For	CAffil= Affricate		cc (73%)
		CAffil= Fricative	FricDur = Short	cc (72%)
			FricDur = Mid/Long	ss (78%)
	VAffil= NonFor	CAffil= Affricate		ch (70%)
		CAffil= Fricative		s (78%)

Results show the division of acoustic correlates that best predicts response category. Percentage accuracy of these correlates in predicting listener response are also given.

Results

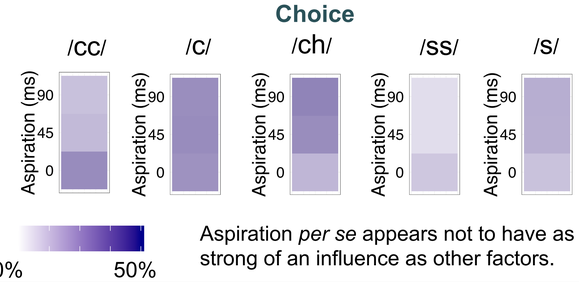


Overall response patterns

Percent response for each sibilant, across baseline VAffil and CAffil, frication duration, and f0.

Effect of Aspiration

Percentage response for each sibilant on subset of stimuli for which aspiration was manipulated, across different AspDurs (CAffil = /ca, cha, sa/)



Aspiration *per se* appears not to have as strong of an influence as other factors.

Beta-coefficients from univariate mixed-effects logistic regression analysis. All are significant at $p < .0001$ unless otherwise noted.

	/cc/	/c/	/ch/	/ss/	/s/
f0	0.46	-3.31	1.22	0.43	0.34
FricDur	-0.63	-0.34	0.09	0.72	0.42
AspDur	-0.59	*n.s.*	0.35	-0.41	0.17
VQual	-2.95	0.76	2.55	-2.08	2.80
CPlace	-1.04	-1.00	-2.98	2.29	2.97

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