

# Place of Articulation and Lingual Coarticulation of Korean Coronal Obstruents:

## An Electropalatographic Study

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### Place of Articulation of Korean Affricates

- **Phonological patterning**
  - Affricates (/c cʰ c'/) pattern as “palatal” or “post-alveolar”.
  - I.e., they interact with high front vocoids: ‘j’-dropping, blocking of umlaut across affricates, affrication of coronal stops before i/
- **Articulatory studies**
  - Affricates are produced at the “(denti-)alveolar” place.
  - Static palatography, fMRI, EPG.
  - Skaličková 1960, Shin 1997, Anderson et al. 2003, Kim 2001, 2004
  - Most examined the closure portion only and/or were limited in vowel context or were based on a single speaker, etc.

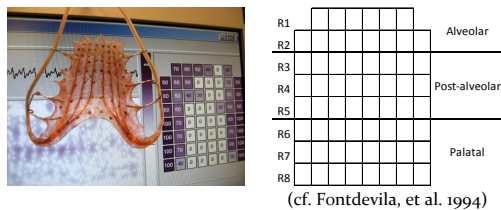
### Goals

- To examine the constriction location at both **closure** and **release** portion of the affricates in comparison with coronal stops and fricatives.
- To examine the degree of secondary palatal articulation of coronal obstruents.

### Method

- **Participants**
  - 1 male (M1) and 2 female (F1, F2) speakers of Seoul Korean.
- **Materials**
  - A combination of real and nonsense words, maCV:
    - C = affricate /c cʰ c'/, stop /t tʰ t'/, fricative /s, s'/
    - V = /a ʌ u i/ (non-palatal) and /i/ (palatal).
  - Produced in a carrier phrase “이제 \_\_\_-라고 말해요.”
  - 3 repetitions \* 4 rounds = 12 tokens per item.
- **Instrumentation**
  - A WinEPG system (Wrench et al. 2002) with EPG data sampled at 100 Hz, acoustics at 22,050 Hz.
  - Custom-made artificial palates with 62 electrodes (Fig. 1).
- **Data analysis**
  - Contact indices taken at:
    - maximum contact during closure (based on articulation)
    - midpoint of frication interval (based on acoustics).

Fig. 1. A sample EPG palate and phonetic zoning



(cf. Fontdevila, et al. 1994)

### Primary Constriction (non-palatal V only)

- **Contact Anteriority**
  - Most tokens of affricates show “alveolar” contact.
  - All tokens of stops/fricatives are “alveolar” or “dental”.

Table 1. Percentage of tokens with front-most row of maximum contact at R1-2 (alveolar) vs. R3-5 (post-alveolar)

		Closure			Frication		
		F1	F2	M1	F1	F2	M1
Affricates	alv.	100.0%	100.0%	100.0%	64.3%	98.6%	100.0%
	p.a.				35.7%	1.4%	
Stops/ Fricatives	alv.	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
	p.a.						

- **Contact Posteriority** (Fontdevila, et al. 1994)
  - CP<sub>a5</sub>: Weighted sums of activated electrodes in the anterior 5 rows with more weight given to the posterior rows.

$$CP_{a5} = [\log((t^*(R1/6) + 9*(R2/8) + 81*(R3/8) + 729*(R4/8) + 6561*(R5/8)) + 1)] / [\log(7381 + 1)]$$

- Overall, the constriction extends further to the posterior rows for affricates than for stops or fricatives, to a different extent depending on context and speaker.

Fig. 2. Mean CP<sub>a5</sub> of closure and frication

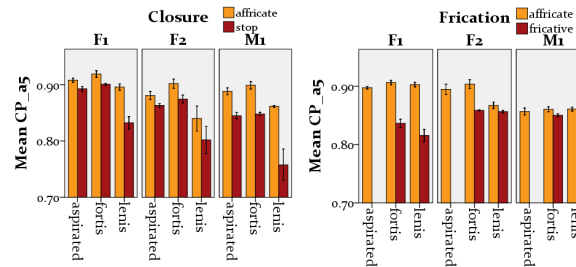


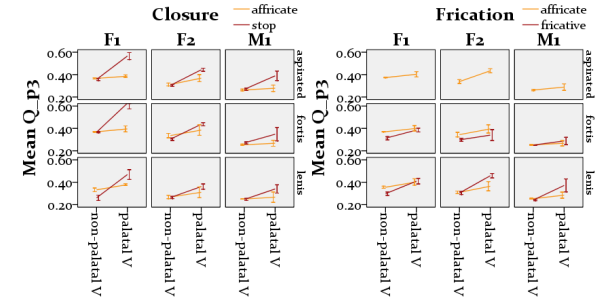
Fig. 3. Mean linguopalatal contact for representative contexts/speakers (average of 12 tokens)

	Closure		Frication	
Affricates are similar to stops/fricatives	F1 [mac'u] vs. [mat'u]	F2 [macu] vs. [masu]	F1 [mac'u] vs. [mat'u]	F2 [macu] vs. [masu]
Affricates are more posterior than stops/fricatives	M1 [mac'u] vs. [mat'u]	F1 [macu] vs. [masu]		

### Secondary Articulation: palatalization

- **Quotient of Palatal Contact**
  - Q<sub>p3</sub>: Sums of activated electrodes in the posterior 3 rows.
    - $Q_{p3} = (R6 + R7 + R8) / 24$
  - Affricates show no more palatal contact than stops/fricatives.
- **Lingual Coarticulation**
  - Palatal contact during the consonant constriction is higher before a palatal vowel than for all consonants.
  - Affricates are more resistant to coarticulation (flat line) than stops/fricatives (steep line).

Fig. 4. Mean Q<sub>p3</sub> of closure and frication



### Summary

- **Primary Constriction**
  - Affricates consistently show “alveolar” constriction, for all 3 speakers during closure, and for 2 speakers during frication.
  - On average, affricates show more post-alveolar contact than stops/fricatives.
- **Secondary Articulation: Palatalization**
  - Affricates show no more palatal contact than stops/fricatives.
  - Affricates are more resistant to palatal coarticulation than stops/fricatives.
- **Implications**
  - Although Korean affricates are not true post-alveolars or palatals in their primary constriction (cf. Anderson et al. 2003, Kim 2001, 2004, among others), they pattern like post-alveolars and palatals in that they are more resistant to lingual coarticulation (cf. Recasens 1999).

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