

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 c^h 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/j
- 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.

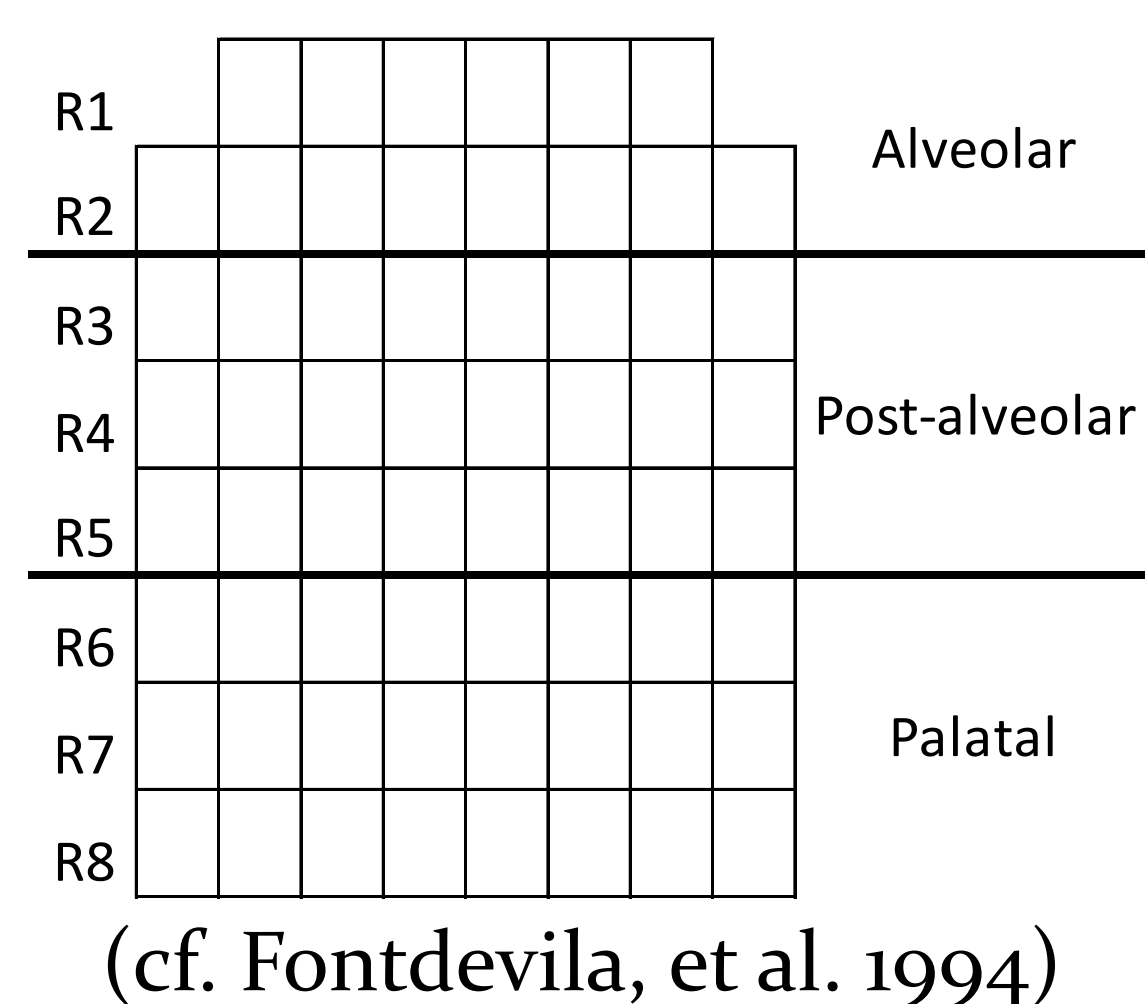
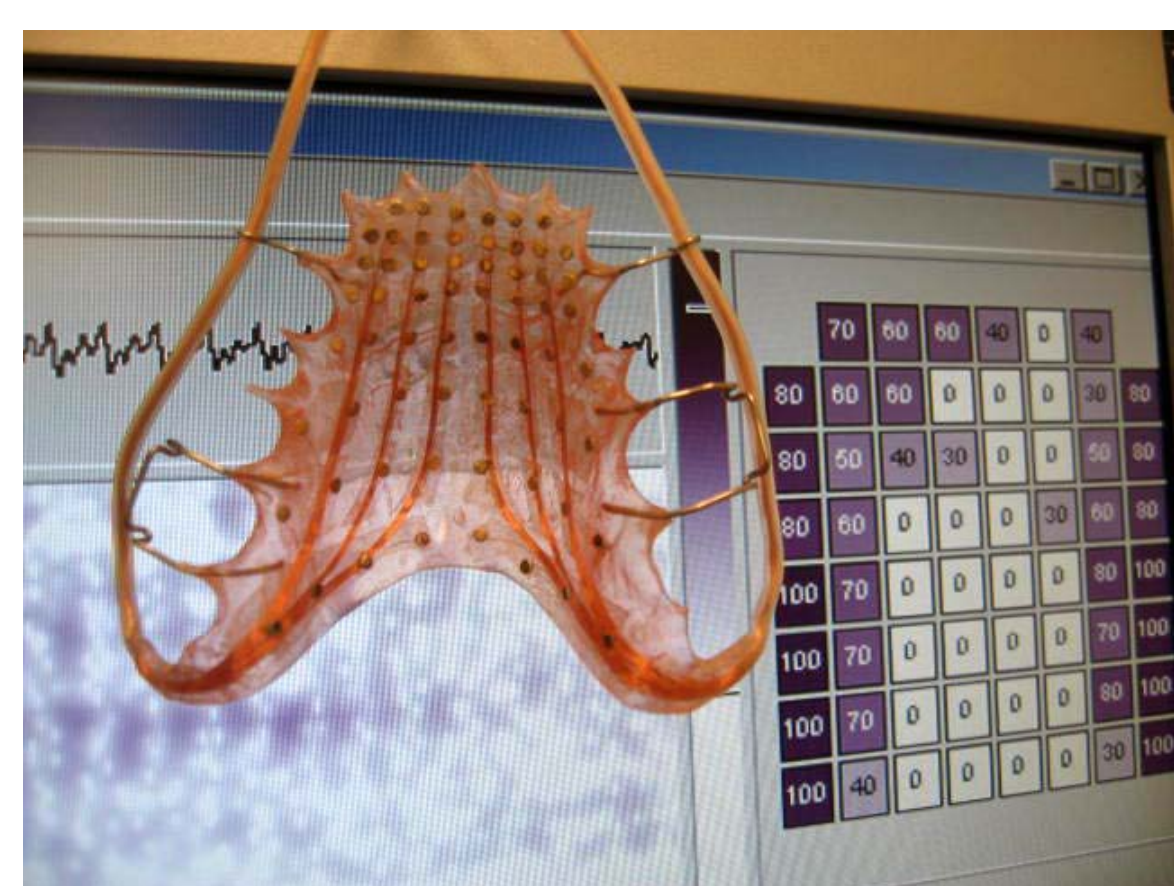
Goals

- 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 c^h c'/, stop /t t^h 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



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_{a5}: Weighted sums of activated electrodes in the anterior 5 rows with more weight given to the posterior rows.

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

- **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_{a5} of closure and frication

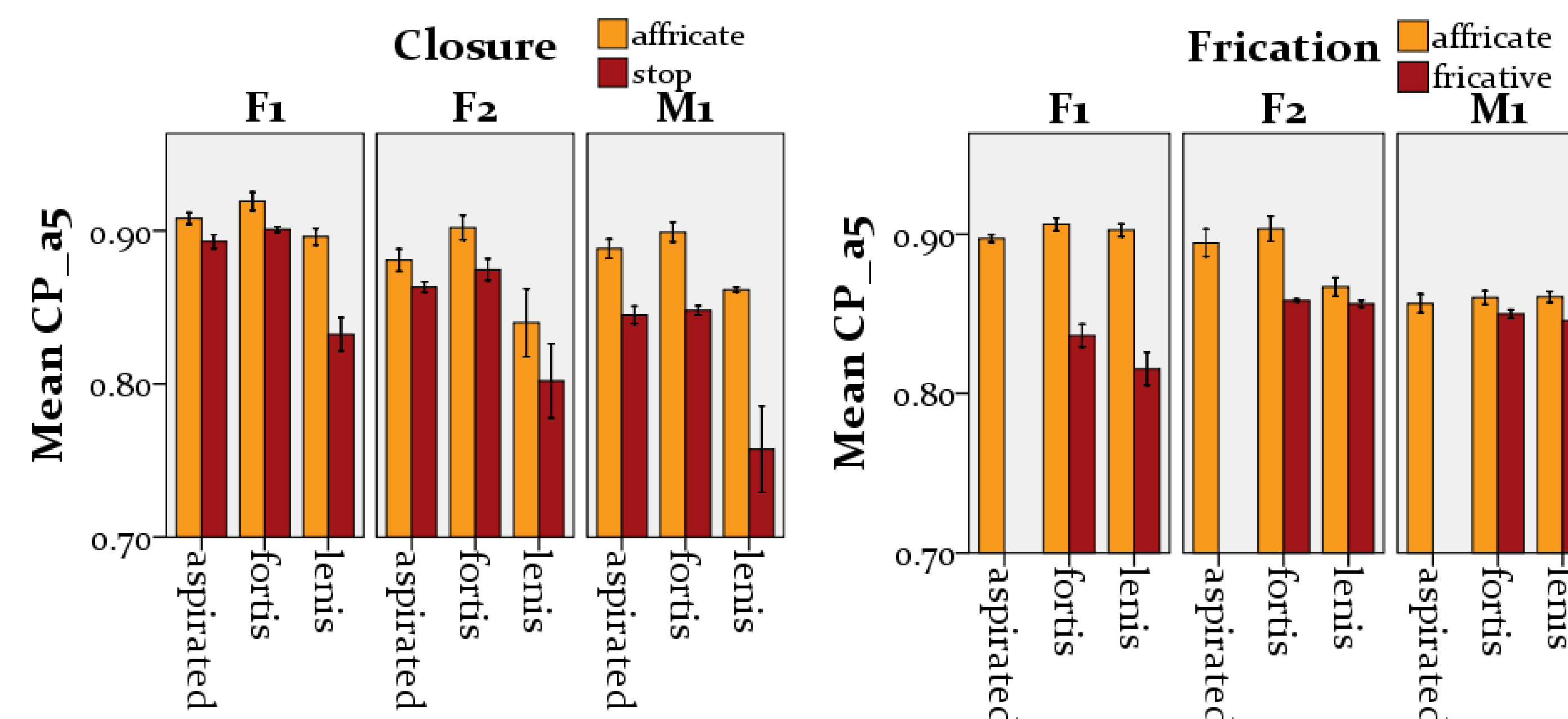


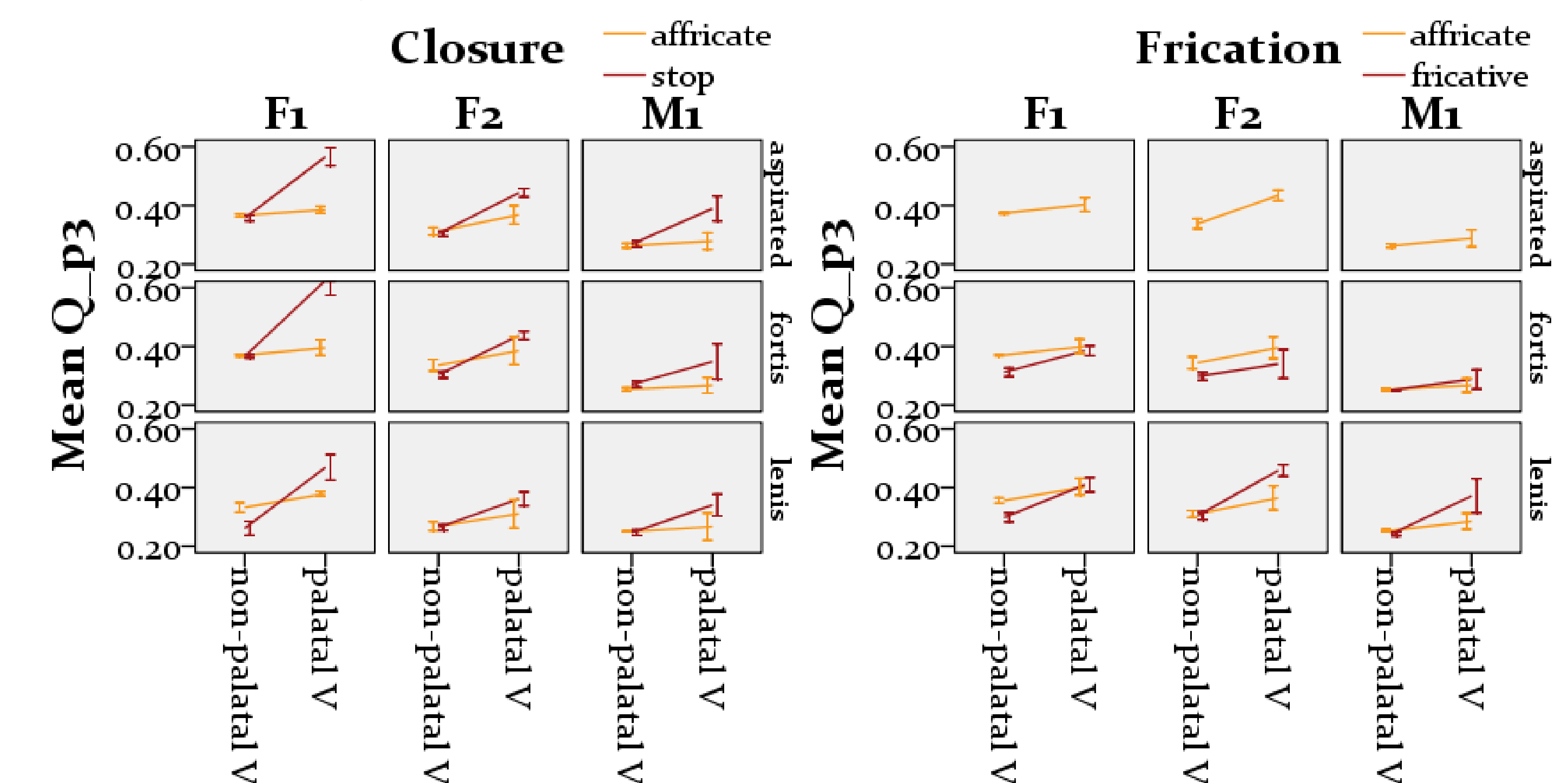
Fig. 3. Mean linguopalatal contact for representative contexts/speakers (average of 12 tokens)

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

Secondary Articulation: palatalization

- Quotient of Palatal Contact
 - Q_{p3}: 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 for all consonants.
 - **Affricates are more resistant to coarticulation** (flat line) **than stops/fricatives** (steep line).

Fig. 4. Mean Q_{p3} 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).**

Acknowledgments

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