

## Features or gestures in speech production and perception?: The case of Korean

The present study is to evaluate whether features or gestures play a role in speech production and perception. For this purpose, we consider recent MRI, external photoglottography, aerodynamic and acoustic studies on Korean stops and Korean perception of Japanese sounds, arguing for features as the linguistic representation of speech sounds.

First, recent MRI studies (Kim et al. 2005, 2010) have revealed that a linguopalatal/lip contact is sustained longer in aspirated and fortis than in lenis stops with the larynx moving higher in the former and that the glottis opens the widest in aspirated, the narrowest in fortis and in between in lenis word-initially and narrower in fortis and lenis than in aspirated stops word-medially. The laryngeal-oral coordination would pose a problem in a gesture-based model because there is no gesture for laryngeal height and because there would be no way of synchronizing the phase of the gesture for laryngeal height, if any, with that for the primary articulator such as *Lips*, *Tongue Tip* or *Tongue Body*. In addition, if the three degrees of glottal opening of word-initial Korean consonants (Figure 1) were articulatorily specified in terms of the gesture *Glottis*, the natural class of lenis and fortis plosives to the exclusion of aspirated ones in (1) cannot be accounted for. If we use the features [ $\pm$ s.g.] for glottal opening and [ $\pm$ tense] for the tensing of both the primary articulator (i.e., lips, tongue blade or dorsum) and the vocal folds, as in (2), the sound pattern is easily characterized, as follows: lenis and fortis consonants which are [-s.g.] pattern together to the exclusion of aspirated ones ([+s.g.]), and the lenis ones which are [-tense] change into the fortis ([+tense]) in word-initial position.

Second, two recent perception studies reveal that it is not gestures but phonological categories such as features and prosody as well that play a role in perceiving speech. In one experiment where 80 native speakers of Seoul Korean participated (Kim 2017), the Japanese geminates [p:, t:, k:] were mostly perceived as either the coda /s/ and a fortis onset or a fortis onset with no coda (e.g. [sap:oro] ‘Sapporo’ as /sa(s).p’o.lo/). If gestures are the primitive objects of speech perception, the primary articulator gestures are expected to be perceived as the double of the gestures for the Japanese geminates. But this cannot explain why either the coda /s/ or no coda with a fortis onset plosive is perceived. In the other perception experiment (Kim 2019), another eighty young Seoul Korean subjects mostly categorized word-initial Japanese voiced plosives as lenis with the significant effect of L and voiceless ones as aspirated with the significant H tonal effect, whereas they perceived word-medial Japanese voiced plosives as lenis and voiceless ones as either aspirated or fortis with no H/L effect, when the Japanese plosives are followed by a H or L vowel across the contexts. If gestures were perceived, neither the tonal effect only in word-initial position nor their perception of word-medial voiceless ones as either aspirated or fortis would be expected at all. In a feature system where segments and prosody are hierarchically organized with the latter above the former, we suggest that the geminates are parsed as a coda and an onset lenis plosive with the coda as /t/ by default; the coda is then lexically stored as /s/ due to the Korean lexical restriction; after the coda neutralization of /s/ into /t/, the /t/ is often deleted on the surface; and the onset lenis changes to its fortis counterpart by virtue of the phonological process of Post-obstruent Tensing. The tonal effect on their perception of word-initial Japanese plosives is made by Korean Accentual Phrase-initial boundary tones (e.g. Jun 1993), and the oral closure of word-medial Japanese plosives is parsed to a cue for the feature [ $\pm$ tense] (2b), such that a long closure is parsed for [+tense] (i.e. aspirated or fortis) and a short one for [-tense] (i.e. lenis).

To conclude, features are preferred as the linguistic representation of speech sounds, and the interaction of features with prosody in perception also favors a feature-based model in Korean.

(1) Word-initial lenis stops in (a) non-intensified expressions and fortis ones in (b) intensified expression in native Korean words.

a.		b.			
	pɛ.k'i.ta		p'ɛ.k'i.ta		*p <sup>h</sup> ɛ.k'i.ta
	taŋ.ki.ta		t'ʌŋ.ki.ta		*t <sup>h</sup> ʌŋ.ki.ta
	tsa.sik		ts'a.sik		*ts <sup>h</sup> a.sik
	ka.si		k'a.si		*k <sup>h</sup> a.si
					'to copy'
					'to pull'
					'chap'
					'thorn'

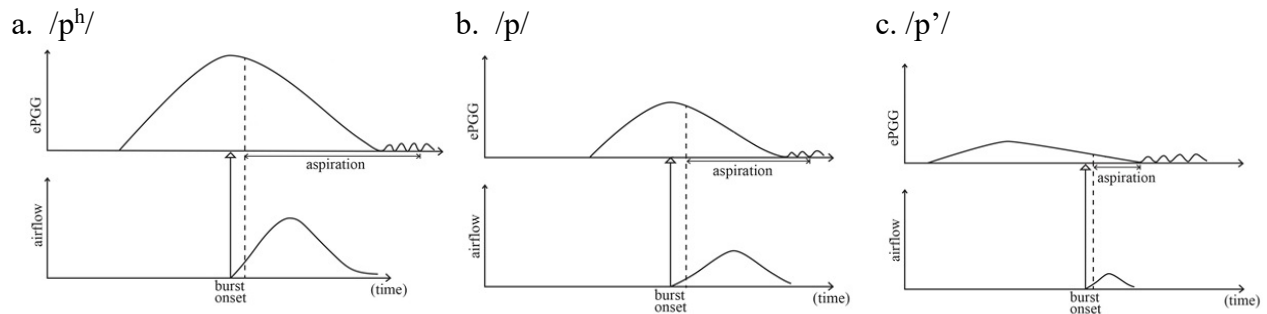


Figure 1. The relative timing among a glottal opening peak, consonant release onset and an airflow peak in the production of the word-initial plosives /p<sup>h</sup>, p, p'/ by one male subject. The onset of aspiration is marked by a dotted line (Kim et al. 2018).

(2) The laryngeal specification of the three-way phonation contrast in Korean stops (Kim et al. 2005, 2010, 2018; H. Kim 2003, 2005)

	/p, t, ts, k/	/p <sup>h</sup> , t <sup>h</sup> , ts <sup>h</sup> , k <sup>h</sup> /	/p', t', ts', k'/
a. [s.g.]	-	+	-
b. [tense]	-	+	+

Selected references

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