

KOREAN AFFRICATES AND CONSONANT-TONE INTERACTION*

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1 Introduction

Korean has a three-way laryngeal contrast (lax, aspirated, and tense (Kim, 1965)) in obstruents which interacts with tone on a following vowel (Silva, 2006, Wright, 2007). While stops and affricates display the full three-way contrast, fricatives do not: The lax fricative is absent in Korean as shown in (1). While this division between fricatives versus non-fricatives with respect to consonant-tone interaction might be explained by appealing to the feature [continuant], we argue that [continuant] is irrelevant for this interaction. Only laryngeal features interact with tone in Korean, as seen cross-linguistically (Lee, 2008).

(1)	<i>affricates</i>	<i>stops</i>	<i>fricatives</i>	
a. <i>lax</i>	[ʧam] 'sleep'	[tal] 'moon'	N/A	L
b. <i>tense</i>	[ʧ*am] 'a moment'	[t*al] 'daughter'	[s*ada] 'to be cheap'	H
c. <i>aspirated</i>	[ʧ ^h am] 'very'	[t ^h al] 'mask'	[sada] 'to buy'	H

Note: The place of articulation of affricates is represented following Kim (1999).

Affricates have characteristics of both stops and fricatives. This ambivalence is accounted for in several different theoretical proposals. Jakobson et al. (1952) posited that affricates are [-

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continuant, +strident]. Sagey (1986) and Lombardi (1990) claimed that [continuant] can be doubly specified for both values on a single affricate. Lombardi further claimed that [continuant] features are unordered in the phonological representation of affricates, while Sagey ordered the feature values.

This paper shows that the absence of lax fricatives in Korean has an independent explanation: a constraint banning lax fricatives appealing to [+continuant] as the relevant feature. Affricates must not be [+continuant] then, since lax affricates are present in Korean. Further, the independence of consonant-tone interaction from the inventory restriction on lax fricatives, implies that an analysis of consonant-tone interaction in Korean need not refer to continuancy, but only to laryngeal features. An experiment is outlined that shows that affricates behave like stops with respect to consonant-tone interaction, supporting the phonological analysis proposed for affricates. Finally, an Optimality-Theoretic account of consonant-tone interaction cross-linguistically (Lee, 2008) is shown to cover Korean.

2 An Experiment

In the past, the three-way laryngeal contrast in Korean was described as a three-way contrast in voice-onset-time (VOT). However, recent studies have shown that Korean is undergoing a change where this VOT contrast between aspirated and lax obstruents is neutralizing (Silva, 2006, Wright, 2007). Even so, the three-way laryngeal contrast is maintained by Korean speakers. It has been suggested that the introduction of a tonal contrast has replaced the VOT contrast between aspirated and lax obstruents. The following experiment measures VOT and F0 following obstruents, including affricates, to supplement the results of Silva, who looked at stops only.

2.1 Method

Two female native speakers of Seoul Korean were recorded at the Phonetics and Field Research Laboratory (PFRL) of Rutgers University. The participants' voices were recorded using a Marantz PMD 671 solid-state recorder, while wearing a Shure WD-10 headworn microphone. The sampling rate was 44,100 Hz. They read from powerpoint slides that automatically advanced every five seconds. There were fifty-five sentences, including some distractors. These were repeated four times and presented in random order. The target words began with stops and affricates varying in terms of place of articulation and manner of articulation. Distractor stimuli with bilabial and alveolar nasal onsets were also included. The first vowel in the target words varied between [i] or [a]. All possible combinations of vowel quality and onset type were included.

(2) Carrier Phrase

이건 ___ 이라고 하지요.
"This is called ___."

The sound files were manually segmented in Praat (Boersma and Weenink, 2007) using visual and audio cues. An automated script computed F0 at the onset of the vowel.

2.2 Results

The results show that lax affricates have lower pitch on following vowels. Tense and aspirated affricates have higher pitch on following vowels. Table 1 shows the mean F0 measurements at the onset of a vowel following an affricate. This three-way difference in F0 is the same pattern as seen in Korean stops as shown in figure 1. An ANOVA was performed with F0 as the dependent variable and laryngeal manner and oral manner (stop vs. affricate) as the independent variables. Separate ANOVA's were performed for each of the two speakers. For speaker 201, affricates and stops were found to have different effects on F0 ($F=8.43; p<0.01$); however for speaker 202, no such effect was seen ($F=0.33; p=n.s.$), meaning affricates and stops had no difference in their effect on F0. Figure 1 below shows mean F0 measurements for speaker 201. The difference in the effect is restricted to tense stops and affricates: Tense affricates correlate with higher F0 than tense stops. However, this is a secondary effect among tense stops and affricates and so we do not discuss it further. The primary effect remains: Tense stops and affricates correlate with lower F0 than aspirated stops and affricates for both speakers ($F=123.37; p<0.01$).

		Initial F0	standard error
a. lax	[tsa]	193.2 Hz	9.0
b. tense	[ts [*] a]	297.3 Hz	15.4
c. aspirated	[ts ^h a]	337.1 Hz	14.2

Table 1. F0 measurements at the onset of a vowel following affricates

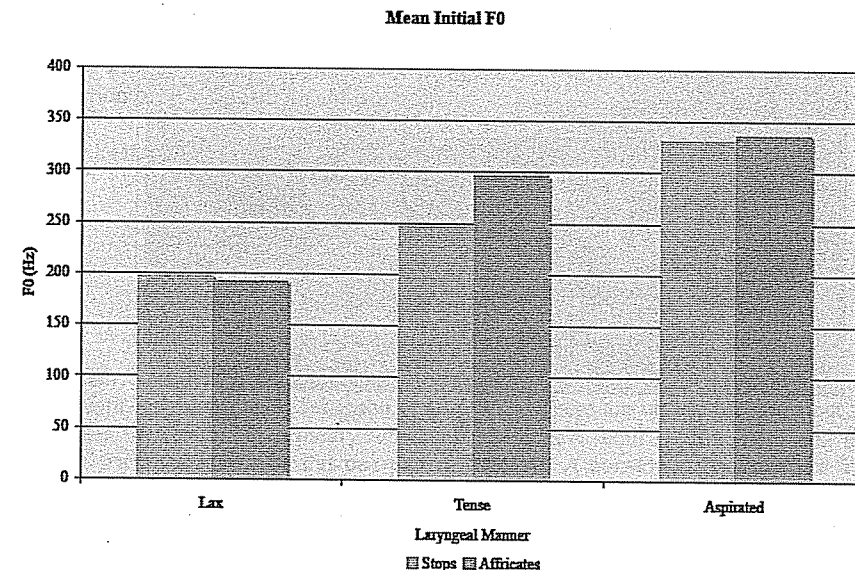


Figure 1. Initial F0 for stops and affricates (speaker 201)

Though controversial, we interpret this result as the emergence of tone in Korean, as suggested by Silva (2006). The traditional three-way contrast between the stops was attributed to differences in voice-onset time (VOT) (Kim, 1965 among others). However, Silva (2006) showed that in younger generations of Seoul Korean speakers, the extent of the VOT contrast between aspirated and lax stops is lessened. Figure 2 shows that this neutralization of VOT contrast holds for our speaker 201. For each of the three stops and the affricate, clearly the tense sounds have lower VOT than do lax and aspirated sounds. Laryngeal manner has a significant effect on VOT ($F=372.97; p<0.01$). On the other hand, aspirated stops have only slightly higher VOT than do lax stops, whereas lax affricates have slightly higher VOT than do tense affricates. Statistically, these slight differences in VOT between lax and aspirated articulations are insignificant: An ANOVA performed on a subset of the data that included all lax and aspirated (but not tense) stops, showed there is no difference in VOT between lax and aspirated stops ($F=1.70; p=n.s.$). However, it was discovered that affricates and stops have different effects on VOT ($F=72.10; p<0.01$). In summary, tense stops and affricates have lower VOT compared to their lax and aspirated counterparts.

Articulatorily, affricates consist of a stop closure followed by fricative release. This stop closure works in concert with laryngeal activity, and so segments with [-continuant] are better anchors for tone than [+continuant] segments (cf. Steriade, 1994). Affricates and stops share the feature [-continuant]. (cf. affricates and fricatives share the feature [+continuant])

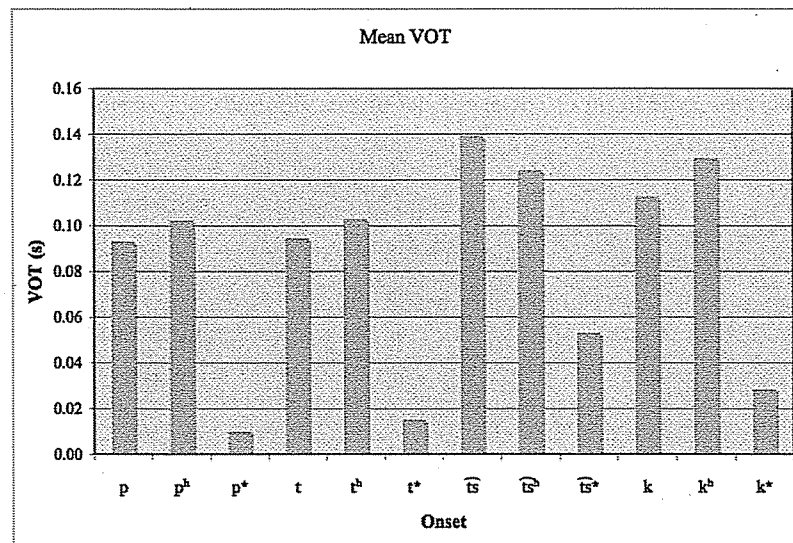


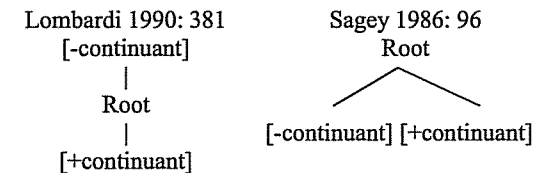
Figure 2. Voice-onset-time (VOT) of Korean obstruents (speaker 201)

3 Implications for phonological features of affricates

Based on our findings, stops and affricates have the same effect on tone in Korean: Aspirated stops and affricates and lax stops respectively allow high and low tone following them. Fricatives, on the other hand, do not allow low tone following them.

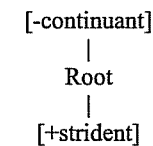
Sagey (1986) treats affricates as an ordered pair of [-continuant] and [+continuant] features. This ordering implies that phonological processes that are sensitive to [continuant] would treat affricates as [-continuant] in a preceding environment, but as [+continuant] in a following environment. Lombardi (1990), on the other hand, treated affricates as an unordered pair of [continuant] features. Unordered [continuant] specifications would imply that either value, [+continuant] or [-continuant], could potentially interact with following or preceding environments.

(3) Featural representation of affricates



A third possible view of affricates treats them as strident stops, [-continuant, +strident] (Jakobson et al., 1952: 24). This third representation of affricates would allow [-continuant] to interact with tone, like Lombardi's account. Only Sagey's account would be problematic for an interaction between [-continuant] and tone.

(4) Featural representation of affricates by Jakobson et al. (1952)



When considering facts of Korean phonology, affricates can only be represented as [-continuant, +strident] as in Jakobson et al. (1952). There are no lax fricatives but there are lax affricates in Korean. In a theory where affricates have both [-continuant] and [+continuant] values, fricatives and affricates can pattern together. A constraint that bans lax fricatives (*[-sonorant, +continuant, -constricted glottis, -spread glottis]), would also necessarily ban lax affricates. Therefore, in Korean, where lax fricatives are absent, one would expect that lax affricates should also be absent. However, this is not the case and so affricates cannot bear a [+continuant] value.

One possible explanation is that in fact, this gap is only apparent, and that lax and aspirated fricatives are both present but do not contrast on the surface. Since fricatives are always produced with spread glottis, it might not be possible to maintain such a contrast. In this case, lax

fricatives should act like other lax obstruents phonologically and should be voiced intervocally. This pattern is attested, in fact, in Burmese (Okell, 1969, Green, 2005, Lee, 2009). However, this is not the case in Korean, implying that affricates are not [+continuant], but only [-continuant]¹ as suggested by Jakobson et al. (1952).

Furthermore, affricates' influence on the pitch of the following vowel comes *only* from the laryngeal feature associated with obstruents. Since stridency distinguishes stops from affricates and fricatives, it is not relevant because consonant-tone interaction groups stops and affricates together as a class. The continuant specification for stops and affricates is also irrelevant for consonant-tone interaction. Lax fricatives are absent due to a phonotactic constraint banning them, rather than any constraint involving consonant-tone interaction. Therefore, a constraint banning lax obstruents preceding H tone need not even refer to fricatives at all. It can apply freely to all obstruents, and in fact if Korean had lax fricatives, we would expect them to be banned with H tone.

We have shown that consonant-tone interaction in Korean concerns laryngeal features only following cross-linguistic observations (Peng, 1992, Bradshaw, 1999, Lee, 2008, Tang, 2008 among others).

4 An OT analysis

In this section, an analysis of affricate-tone interaction in Korean is proposed using Optimality Theory (Prince and Smolensky, 1993/2004). Lee (2008) formalizes the difference of tone associated with consonants and tone associated with vowels since the former involves a direct association of tone, which is only restricted by markedness constraints. This is enforced in the way constraints are defined, as below.

(5) Constraints

- a. MORA→T
Assign a violation mark to moras not linked to a tone.
- b. ROOTNODE→T
Assign a violation mark to root nodes (including non-moraic consonants) not linked to a tone.
- c. * [+SPREADGLOTTIS]/L
Assign a violation mark if [+s.g.] segments are directly associated with L tone.
- d. IDENT-T
Corresponding segments associated to a mora have identical values for the tonal feature T_F.

This version of IDENT-T is more restricted than the previously proposed IDENT-T constraint (Yip, 2002), in that it is only violated by tone associated with moraic segments. There is no faithfulness constraint that preserves the association between non-moraic segments and tone. Thus, tone can never be contrastive on non-moraic segments.

¹ Affricates may be [+continuant] in addition to [-continuant] in other languages. Mielke (2005) shows that liquids and nasals can pattern with sonorants or with obstruents on a language-by-language basis. The same might hold of affricates patterning with fricatives or not on a language-by-language basis (although they should always potentially pattern with stops). This is a topic for future research.

The OT analysis should capture the following descriptive generalizations. Tense and aspirated affricates do not occur with L tone (1b, c), implying that an underlying sequence of tense or aspirated affricates followed by L tone must map to some other surface form. This requirement is accommodated by changing underlying L to H tone on the surface. Similarly, lax affricates do not occur with H tone on the surface (1a). This requirement is accommodated by changing H to L tone (see Lee and Perkins (2008) for an analysis where consonant-tone interaction in lax obstruents is accounted for).

Tableau (6) shows that sequences of tense affricates and underlying L tone vowels do not surface faithfully. As mentioned, underlying L tone changes to surface H tone. Candidate (6b) fatally violates ROOTNODE→T because the tense affricate is not linked to a tone on the surface. Candidate (6c) fatally violates * [+c.g.]/L because the tense affricate is linked to a L tone on the surface. Candidate (6a) satisfies both of the aforementioned constraints, while violating IDENT-T. Since IDENT-T is ranked lower than ROOTNODE→T and * [+c.g.]/L, candidate (6a) is optimal.

(6)

	L /ts* a/	ROOTNODE→T	* [+c.g.]/L	IDENT-T
a.	H ^ [ts* a]			*
b.	L [ts* a]	W *		L
c.	L ^ [ts* a]		W *	L

The same holds for aspirated affricates as shown in tableau (7) below. Sequences of aspirated affricates and underlying L tone vowels do not surface faithfully. Underlying L tone changes to surface H tone. Candidate (7b) fatally violates ROOTNODE→T because the aspirated affricate is not linked to a tone on the surface. Candidate (7c) fatally violates *[+s.g.]/L because the aspirated affricate is linked to a L tone on the surface. Candidate (7a) satisfies both of the aforementioned constraints, while violating IDENT-T. Since IDENT-T is ranked lower than ROOTNODE→T and *[+s.g.]/L, candidate (7a) is optimal.

(7)

	L /ts ^h a/	ROOTNODE→T	*[+s.g.]/L	IDENT-T
a.	H ^ [ts ^h a]			*
b.	L [ts ^h a]	W *		L
c.	L ^ [ts ^h a]		W *	L

Markedness constraints on consonant-tone interaction outrank the tonal faithfulness constraint (IDENT-T). Under this ranking, the change of tone is allowed to satisfy the markedness requirements. In this analysis, consonant-tone interaction results from constraint interaction, and not from representational requirements (i.e. Bradshaw (1999) among others).

5 Conclusion

Consonant-tone interaction in Korean involves only laryngeal features on consonants, as is observed cross-linguistically. The seemingly relevant continuancy feature proves to be a separate issue. A constraint that bans lax fricatives can only account for the presence of lax affricates in Korean, if the former are [+continuant] and the latter are not. This suggests that Jakobson et al. (1952) were correct in positing that affricates are strident stops.

A phonetic experiment was conducted to measure VOT and F0 following obstruents, including affricates. The results showed that VOT is neutralized between lax and aspirated stops and affricates and that an F0 difference does exist. We have proposed an OT analysis of consonant-tone interaction for Korean affricates based on Lee (2008).

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A COMPARATIVE SYNTAX OF ELLIPSIS IN JAPANESE AND KOREAN*

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1 Introduction

Japanese and Korean are known to be very similar in syntax. The task of Japanese-Korean comparative syntax is then to shed light on the nature of general principles based on their common properties and to investigate micro-parameters that explain their differences. This paper examines ellipsis in the two languages, focusing on argument ellipsis, "sluicing," and N'-ellipsis. We argue that the relevant phenomena provide evidence for the LF copying analysis of ellipsis over the PF deletion analysis. We also show that N'-ellipsis obtains in Japanese but not in Korean and attribute this difference to a micro-parameter in the genitive marker insertion rule.

It has been known since Kim 1999 and Oku 1998 that argument-ellipsis applies in the same way in Japanese and Korean. Examples from the two languages are shown in (1)-(2).

- (1) a. John-wa [CP [NP zibun-no teian]-ga saiyoosareru-to] omotteiru (J)
J-top self-gen proposal-nom be.adopted-comp think
'John thinks that his proposal will be adopted.'
- b. Mary-mo [CP ___ saiyoosareru-to] omotteiru
M-also be.adopted-comp think
'Mary also thinks that her proposal will be adopted.'

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