

## APERTURE THEORY IN KOREAN CODA NEUTRALIZATION

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### 1 Introduction

One of the most controversial problems in Korean consonantal phonology is Coda Neutralization (henceforth CN). The three-way contrast of obstruents—plain, tense, and aspirated—is neutralized to a homorganic plain stop in coda position, as seen in (1a). Also, the syllable final affricates and continuants are neutralized into plain stops, as seen in (1b) and (1c), respectively. Relevant data are drawn from Lee (1992).

#### (1) a Neutralization of stops

<i>ɪp</i>	→	<i>ɪp</i>	'mouth'
<i>p'op'</i>	→	<i>p'op</i>	'to elect'
<i>ap<sup>h</sup></i>	→	<i>ap</i>	'front'
<i>p'ɔt</i>	→	<i>p'ɔt</i>	'to expand'
<i>ka<sup>h</sup></i>	→	<i>ka</i>	'to be alike'
<i>ka<sup>t</sup></i>	→	<i>ka<sup>t</sup></i>	'end'
<i>kuk</i>	→	<i>kuk</i>	'soup'
<i>pok'</i>	→	<i>pok</i>	'to fry'
<i>puðk<sup>h</sup></i>	→	<i>puðk</i>	'kitchen'


#### b Neutralization of affricates

<i>na<sup>c</sup></i>	→	<i>na<sup>t</sup></i>	'day'
<i>na<sup>c</sup>h</i>	→	<i>na<sup>t</sup></i>	'face'

#### c Neutralization of fricatives

<i>ka<sup>s</sup></i>	→	<i>ka<sup>t</sup></i>	'a kind of plant'
<i>cap-as'(-ta)</i>	→	<i>capat(-ta)</i>	'to catch (past)'
<i>no<sup>h</sup></i>	→	<i>no<sup>t</sup></i>	'to let go of'

The specific neutralizations are shown in (2).

(2) a	<i>/p/, /p', /p<sup>h</sup>/</i>	→	[p]
b	<i>/t/, /t', /t<sup>h</sup>/</i>		[t]
	<i>/s/, /s'/</i>		
	<i>/ç/, /ç', /ç<sup>h</sup>/</i>		
	<i>/h/</i>		
c	<i>/k/, /k', /k<sup>h</sup>/</i>	→	[k]

Similar patterns are found in Thai (Lombardi 1991). In Thai, the obstruents that can appear in coda position are plain stops. However, unlike Korean there exists the only two-way contrast in obstruent consonants: plain and aspirated. Besides Thai, in Klamath, voiced, voiceless, and glottalized obstruents are neutralized into voiceless stops when preceding another stop (Clements 1985). However, few languages probably show such a full range of neutralization as Korean. This is extremely complicated to analyze in a uniform way; none of the previous researchers have provided a single rule that could cover the full range of Korean CN data, shown in (1). However, following Aperture Theory developed by Sterade (1992, 1993), I will provide a simple rule to account for CN in Korean—delinking an open aperture node,  $A_f$  or  $A_{max}$ . The more interesting argument proposed in this study is that CN does not apply only to obstruents, but also to

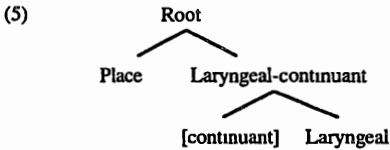


Even though this proposal accounts for the problems raised by Chung (1980), it fails to explain why only obstruents, not sonorant consonants, undergo CN. Moreover, Kim (1987) excludes the case in which the syllable final /h/ is realized as [t] *noh* → *not* 'to let go of'.

Later, Lee (1992) proposes that CN should be treated as the rule that delinks the laryngeal features [+spread glottis] and [+constricted glottis], and the manner feature [+continuant]. In her proposal, she discusses the neutralization of the syllable final /h/ in such a way that since the delinking of [+spread glottis] results in no features under the Root Node, the most unspecified consonant /t/ is realized as the surface form. However, Lee (1992) does not mention why palatals become coronals, because changing palatals to coronals results from delinking [-anterior], as discussed in Kim (1987).

Cho (1990), following Sohn (1987), has proposed that CN is a single rule that delinks three separate features: the laryngeal feature nodes, [+continuant] and [-anterior].<sup>2</sup> However, both proposals of Sohn (1987) and Cho (1990), cannot explain why these three separate features, but not other features, are delinked. In other words, they fail to account for whether there is any common property that these three features share.

Most of studies on Korean CN deal with the issue of delinking with at least two separate operations on the feature geometric tree, one of which deletes the laryngeal features and the other of which deletes the feature [continuant]. In favor of a single rule for Korean CN, Kim (1990) groups together the laryngeal features [spread glottis] and [constricted glottis] along with [continuant] under the Laryngeal-continuant Node. This is shown in (5).



Given (5), he claims that Korean CN is the rule of delinking the Laryngeal-continuant Node. Even though this approach seems to account for Korean CN with a single rule, it has a shortcoming in dealing with the feature [continuant]. The issue of the location [continuant] in the feature geometric tree has been controversial in the phonological literature. In Korean, there does not appear to be other motivation to assume that [continuant] should be grouped with other laryngeal features.

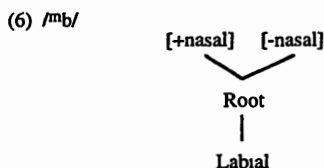
Due to the fact that none of the previous studies can provide any uniform solution of Korean CN, in the next section I will discuss in more detail this issue in the framework of Aperture Theory and Underspecification. I contend that Korean CN can be best interpreted as delinking any open aperture node of a coda consonant no matter whether they are obstruents or sonorants.

### 3 Aperture Theory

Since the previous studies fail to take Korean CN into account in a uniform way and also fail to include all data with respect to CN, I will propose a new version of this phenomenon, following Steriade (1992, 1993), with the assumption that Korean syllable coda consonants are never released. This assumption is also discussed by Kim-Renaud (1986), Cho (1990), and Iverson & Sohn (1994).

With the development of segment structure, revealed by Anderson (1976), it has been widely accepted that there are some segments which internally have two values for a feature, such

segments are called contour segments. The following figure shows the internal representation of the prenasal /<sup>m</sup>b/ that must be phonologically analyzed as being a monosegment, as in Sagey (1986)



This illustrates that /<sup>m</sup>b/ is a monosegment which is linked to a single root node, however, it is a contour since it contains two sequenced values for the feature [nasal]. Further, Steriade (1992), following Anderson (1976), uses the term "aperture nodes"-- $A_0$  (full closure),  $A_f$  (intermediate aperture), and  $A_{max}$  (maximal aperture)--to explain the integrity of contour segments. Based on Steriade (1992), I assume that segments may comprise more than one of the intrasegmental values which she calls aperture positions. These aperture positions are demonstrated with various primitive degrees of constriction within the vocal tract. The definitions are based on Steriade (1992, 1993)

(7) Aperture position Types

- $A_0$  = closure (i.e., zero aperture)  
 $A_{max}$  = maximal aperture  
 $A_f$  = intermediate aperture generating turbulent airflow

Given these definitions, the representations of released stops, affricates, approximants, and fricatives are obtained in (8a-d), respectively

- (8) a Released stops  $A_0A_{max}$   
 b Affricates  $A_0A_f$   
 c Approximants  $A_{max}$   
 d Fricatives  $A_f$

In Steriade's proposal, contour segments include released stops, aspirated stops, glottalized stops, and affricates. Plain released stops are defined as a stop phase-- $A_0$ --followed by abrupt maximal release-- $A_{max}$ . In the case of affricates, they are analyzed as a noncontinuant node  $A_0$  followed by fricative release  $A_f$ . Aspirated and glottalized consonants are represented as the sequence of  $A_0$  followed by  $A_{max}$  associated to [spread glottis] and [constricted glottis], respectively. Given this assumption, the representations for plain released stops, affricates, aspirated stops, and glottalized stops are illustrated in (9a), (9b), (9c), and (9d), respectively.<sup>3</sup>

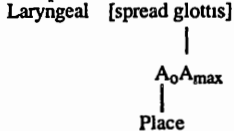
## (9) a Plain released stops



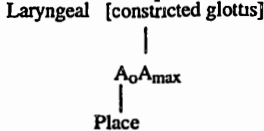
## b Affricates



## c Aspirated stops



## d Glottalized stops



By contrast, approximants and fricatives are regarded as having a single aperture node,  $A_{max}$  or  $A_f$ . This is illustrated in (10)

## (10) a Approximants



## b Fricatives



I have shown how segments are represented in the framework of Aperture Theory. Given these representations, in the next section I will reanalyze CN in Korean.

## 4 Proposed Analysis of Coda Neutralization

As indicated in section 1, in Korean all the syllable-coda labial obstruents are neutralized into the unreleased [p̚], all the coronals into the unreleased [t̚], regardless of anteriority and continuancy, and all the dorsals into the unreleased [k̚]. However, most Korean phonologists have ignored the fact that the sonorant consonants may not be released in syllable-coda position. Kim-Renaud (1986), Baek (1991), and Iverson & Sohn (1994) introduce the unreleased condition of sonorant consonants in coda position. In their view, the nasal /n/ is produced without release of the oral closure [n̚]. For example, as discussed in Iverson & Sohn (1994), the /n/ in the English word *can* is produced by a Korean speaker with oral contact maintained throughout with no release of the oral closure as [kæn̚]. As a consequence, Korean speakers learning English as a second language have difficulty in differentiating it from *can't* [kænt̚], since these two words emerge as homophones. Moreover, oral contact may be maintained throughout the articulation of the lateral /l/ in Korean in coda position. This is shown in (11).

## (11) Unreleased lateral in coda position

a /mal/	[mal̚]	*[mal]	'language'
b /pul/	[pul̚]	*[pul]	'fire'

Therefore, CN should be extended to obstruents as well as to sonorants.

As a consequence, in this study, I propose CN as a simple rule—delinking an open aperture node,  $A_f$  or  $A_{max}$ . At first glance, though, delinking the second feature under the Aperture Node of a contour segment seems to be the right rule for CN. This is shown in (12).

- (12) Coda-neutralization in Korean  
Unreleased stops may be simply represented as closures without any open aperture nodes

This is shown in (13)

- (13) Unreleased stop  

$$\begin{array}{c} A_o \\ | \\ \text{Place} \end{array}$$

The CN process of stops, delinking  $A_{max}$ , is illustrated in (14)

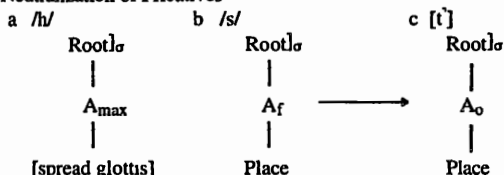
- (14) Coda Neutralization of Stops
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Here, a further explanation for the affricates is required. In Korean, there is no palatal stop comparable to a palatal affricate /c/. Therefore, delinking  $A_f$  triggers delinking the [palatal] feature attached under the Coronal Node. I assume this is a language-specific realization by means of Structure Preservation (Kiparsky 1985). This is shown in (15)

- (15) Coda Neutralization of Affricates
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However, in Korean, /s/ and /h/ which just have a single Aperture Node are also subject to CN. They are then realized as [t̚]. The representations of /s/ and /h/ are introduced within Steriade's framework, as in (16)

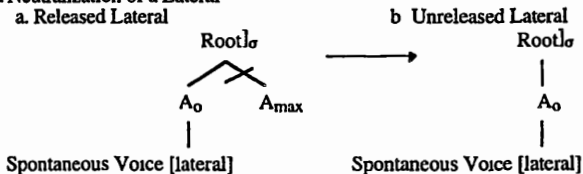
## (16) Coda Neutralization of Fricatives



Since these two are not contour segments, delinking their second feature under the Aperture Node is not possible as the expression of a single rule for CN. Therefore, I suggest a new version of CN in which any open aperture node—A<sub>f</sub> or A<sub>max</sub>—is delinked. In cases of fricatives, after delinking the open aperture node A<sub>f</sub>, they are realized as unreleased stops, represented as A<sub>o</sub> by default. They are then realized as [t'], given that this is the unmarked consonant.<sup>4</sup>

With respect to the lateral /l/, I assume that in Korean, a single feature [lateral] is linked to A<sub>o</sub> followed by A<sub>max</sub> which represents release. Then, delinking of A<sub>max</sub> automatically results in an unreleased lateral as in (17b). This is pictured in (17).

## (17) Coda Neutralization of a Lateral



As seen in (12)-(17), the CN process may be formalized as the elimination of the open Aperture release phase. This can best account for CN in the uniform way to cover all cases, obstruents as well as sonorants.

## 5 Conclusion

In this paper, I have accounted for CN in Korean in a uniform way by reference to Underspecification and Aperture Theory. I have maintained that Korean consonants, both obstruents and sonorants, are not released in coda position. In light of this, I propose that CN in Korean is best accounted for in a very simple way—delinking the open aperture release phase in coda position.

## NOTE

<sup>1</sup>Kim (1987) adopts the Feature Geometry based on Clements (1985) and Sagey (1986).

<sup>2</sup>Sohn (1987) investigates CN focusing on its complicated interaction with the other aspects of Korean consonantal phonology, such as resyllabification and Nasal Assimilation. However, here I will not consider other phonological phenomena which are not crucially relevant to the topic of this paper.

<sup>3</sup>In Steriade's (1992, 1993) framework, nasals are also treated as contour segments, docking [nasal] to both  $A_0$  and  $A_{max}$

<sup>4</sup>One piece of evidence that the unmarked consonant is the coronal in Korean is based on compounding of nouns. It is normally accepted that an empty C-slot is inserted between compounded words, and the empty C-slot is realized in various ways depending on the context. For example, the initial obstruent of the right element of a compound is tensed as in (i), and the segment /t/ or the nasal /n/ or /m/ is inserted between two elements of a compound as in (ii) and (iii), respectively (data come from Han 1992)

(i)	cam 'sleep'	+ cali 'place'	[camc'ali]	'sleeping place'
	cho 'candle'	+ pul 'light'	[chop'u l]	'candlelight'
(ii)	u 'upper'	+ os 'clothes'	[utot]	'upper clothes'
(iii)	ɪ 'teeth'	+ mom 'body'	[ɪmmom]	'gum'
	k <sup>h</sup> o 'nose'	+ nal 'line'	[k <sup>h</sup> onnal]	'nose line'

After inserting an empty C-slot between two elements of a compound, the place feature of the following consonant spreads to the empty C-slot. (In Korean, the tense consonants are regarded as a geminate.) The data (ii) show that when there is no following consonant, the empty C-slot is realized as [t], suggesting that it is the least marked consonant in Korean.

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