Edge-Integrity and the Syllable Structure in Korean

Eungyeong KANG
Cornell University
Dept. of Linguistics, Morrill Hall,
Ithaca, NY 14853, USA
ek33@cornell.edu

Abstract

The so-called overapplication of Coda Neutralization in Korean, the occurrence of a neutralized consonant in a non-neutralizing environment, is often considered as evidence for serial derivation. In this paper I propose that the neutralization effect at surface is not a result of a phonological process at an intermediate level in serial derivation, but due to a constraint requiring the integrity of the morphological constituent: EDGE-INTEGRITY. It is argued that this is not reducible to an alignment constraint, but a genuine faithfulness constraint on the edge of a morphological constituent. The putative opacity related with the coda neutralization is shown to be an epiphenomenon arising from the ambisyllabic representation of a consonant at a morphological juncture, satisfying both EDGE-INTEGRITY and syllabic conditions. Consonant Copy in the Jeju dialect provides further evidence for EDGE-INTEGRITY, the only difference being that the conflict between syllabic conditions and EDGE-INTEGRITY is resolved by insertion of a copied consonant.

1 Introduction

Syllable structure is regulated by several different constraints. One of them is a purely prosodic requirement, and the asymmetry between onsets and codas in the syllable is well known in that respect: syllables require onsets while they permit codas at most (Itô 1986, 1989, McCarthy and Prince 1993a, Blevins 1995 and references therein). All else being equal, the best syllable structure for a given sequence /V_1CV_2/, is (1a) with the intervocalic consonant in the onset of σ_2.

(1) /V_1CV_2/

a. σ_1 σ_2 — V_1. C V_2 — [C as an onset]

b. σ_1 σ_2 — V_1C. V_2 — [C as a coda]

c. σ_1 σ_2 — V_1. C.V_2 — [C as an onset and a coda]

Another constraint regulating syllable structure is the integrity of morphological structure: given a morphologically complex sequence /V_1C+V_2/, where + is a morphological boundary, the structure in (1b) is chosen over the one in (1a): prosodic structure respects morphological structure. Everything else being equal, no evaluation yields (1c) as optimal. If syllable structure conditions dominate the morphological integrity, (1a) is optimal structure. If the ranking is reversed such that the morphological structure takes a priority over the syllable well-formedness conditions, (1b) is optimal. The representation itself is more complex than the other two, too.

However, (1c) satisfies both sets of constraints to a certain degree: the intervocalic consonant serves as an onset of σ_2: (1c) fares better than (1b) with regard to ONSET requirement. It also respects morphological structure and its integrity by being linked with the morpheme with which it is affiliated: the structure (1c) satisfies morphological integrity better than (1a) in this sense.

In this paper I present a case study in which the ambisyllabic structure in (1c) is forcefully chosen at the cost of simple representation to satisfy both sets of requirements: the so-called overapplication of Coda Neutralization in Korean. I will show that the conflicting constraints on syllable structure from prosody and morphology are resolved by finding a compromise. In the optimality theoretic

analysis, it will be shown that the ambisyllabic structure in (1c) also provides us with a means to avoid the problem of phonological opacity, which arises from the interaction of phonological processes and the so-called resyllabification. I will propose a constraint, EDGE-INTEGRITY as a critical constraint regulating morphological requirements of integrity at the edges of morphological constituents. Its crucial role will be further supported by the analysis of Consonant Copy in the Jeju dialect in Korean.

2 Overapplication of Coda Neutralization in Korean and EDGE-INTEGRITY

This section analyses the overapplication of Coda Neutralization in Korean as empirical evidence for the edge-integrity of morphological units. In 2.1 Coda Neutralization is illustrated, and a primary optimality theoretic analysis is presented. In 2.2, the overapplication of Coda Neutralization is presented and the putative opacity problem in optimality theory is raised. In 2.3, EDGE-INTEGRITY is proposed as a crucial morphology-prosody interface constraint motivating the ambisyllabic structure in (1c), and an analysis of the overapplication problem as a result of a constraint interaction is presented.

2.1 Coda Neutralization

As a general background of Korean phonology, consonant and vowel inventories are illustrated in (2) and (3). Plosives show three-way contrast of laryngeal features: aspirated, tense, and plain. The coronal fricative /s/ shows two-way phonation contrast: plain vs. tense. The only liquid /l/ shows an allophonic variation, such that it is realized as lateral [l] in the coda position and [r] everywhere else.

(2) Korean Consonant Inventory

		labial	alveolar	palatal	velar	glottal
		dental				
plosives	plain	p	t	c	k	
	tense	p'	t'	c'	k'	
	aspirated	p^h	t^h	c^h	k^h	
fricatives	plain		s			h
	tense		s'			
nasal		m	n		ŋ	
liquid		l(r)				
glide		w		j		

(3) Korean Vowel Inventory

	Front		Back	
	unrounded	rounded	unrounded	rounded
high	i	(y)	ɨ	u
mid	e	(ø)	ə	o
low	ɛ		a	

The maximal syllable is (C)(G)V(C), where G stands for a glide /y/ or /w/. While all the consonants are allowed in the onset,[1] only /p, t, k, m, n, ŋ, l/ are allowed in the coda. What is responsible for this restricted distribution of consonants in the coda position is a feature changing process, Coda

[1] Interestingly, there are restrictions on the word initial consonant in Korean: there is no word that begins with [ŋ]. [l] is not allowed word initially and alternates with [n]. The sequences of [ni] and [ny] are not allowed initially such that they alternate with [i] and [y] respectively. Since they cannot be reduced as syllable initial conditions, and do not have any bearings in the proposed analysis, I will leave the issue here.

Neutralization, as in (5) following Sohn (1995). Simply put, obstruents lose their laryngeal feature contrast, and continuants /s, ss, c, c^h, h/ lose their continuancy and become the coronal [t] in the coda position.

(5) Coda Neutralization (Sohn 1995: 165)

p, p^h, (p')	→ [p]
t, t^h, (t'), s, s', c, c^h, (c'), h	→ [t][2]
k, k^h, k'	→ [k]

when unreleased[3] (i.e., in the environment of __C, #, +,
where # is a word boundary and + is a compound boundary)

The evidence for neutralization is found from the realization of stem final consonants in (6). When a stem is followed by a consonant initial suffix, the stem final consonant is realized as neutralized in the coda and loses its continuant and laryngeal feature, as in (6a) and (6c). When the stem final consonant is followed by a vowel initial suffix, it is realized as it is in the onset of the following syllable without any featural change, as in (6b) and (6d).

(6)	a.	/nas-to/	nat.t'o[4]	'sickle-and'
	b.	/nas-i/	nasi	'sickle-Nominative'
	c.	/əp^h-ta/	əpt'a	'to turn over-Declarative'
	d.	/əp^h-ə/ .	əp^{h}ə, *əbə	'to turn over-Infinitive'

This process is readily analyzed in Optimality Theory as an interaction of a markedness constraint regulating coda consonants, CODA CONDITION and a faithfulness constraint militating against featural change between an input and an output segments, IDENT-IO(F) (McCarthy and Prince 1995).

(7) CODA CONDITION (CODACOND henceforth)

a. *[+spread glottis]]$_\sigma$, *[+constricted glottis]]$_\sigma$
b. *[+continuant]]$_\sigma$
c. *[-anterior]]$_\sigma$ [5]

CODACOND requires that features such as [+spread glottis], [+constricted glottis], [+continuant] and [-anterior] should not appear in the coda position. If any of the features appear in the coda position, it

---

[2] The neutralization of coronal stops, affricates, and fricatives /s, h/ into [t] is exemplifies as follows:

[nat]	/nat/	'cereal grains'
	/nat^h/	'piece, unit'
	/nas/	'sickle'
	/nac/	'daytime; to be low'
	/nac^h/	'face'
	/nah-/	'to give a birth to'

[3] Consonants in Korean are realized as unreleased in the coda position. See Kim-Reneau 1974 for a functional analysis of coda neutralization.

[4] The realization of a tense consonant following the stem final coda consonant in (6a) and (6c) is due to an independent process, Post Obstruent Tensing, which makes an obstruent following another obstruent tense. When the two consonants are identical as in (6a), they are optionally simplified into a single tense consonant. Thus [tt'] in [natt'o] is optionally realized as a [t'].

[5] I assume that palatal consonants are distinct from coronal consonants by an additional [-anterior] feature, following Clements and Hume (1995).

will incur a violation marker. On the other hand, IDENT-IO(F)[6] is a constraint regulating featural identity between an input and an output: it requires that if an input is specified for a certain feature [F], then its output segment should have an identical feature specification.

The interaction of the constraints is illustrated in tableau (8) and (9). In tableau (8), the candidate (8b) loses to the candidate (8a), due to the fatal violation of IDENT-IO[+CONT]. The constraint CODACOND guarantees that featural change, if any, occurs only when the consonant is in the coda position. Everything else being equal, it is better to be faithful to the input. Tableau (9) shows the role of CODACOND, which crucially dominates IDENT-IO(F): when an offensive consonant [s] appears in the coda, featural change is forced, and (9b) is chosen as a winner. Since (9a) loses to (9b), the violation of CODACOND is fatal, yielding us the constraint hierarchy in (10), in which CODACOND dominates IDENT-IO(F).

(8) /nas-i/ 'sickle-Nom' → [nasi]

	/nas-i/	CODACOND	IDENT-IO[+CONT]
a. ☞	na.si		
b.	na.ti		*!

(9) /nas-to/ 'sickle-and' → [nat.t'o]

	/nas-to/		
a.	nas.to	*!	
b. ☞	nat.t'o		

(10) CODACOND >> IDENT-IO(F)

2.2 Coda Neutralization and the Problem of Phonological Opacity

Although Coda Neutralization does not have any exceptions, its generalization is not always surface-apparent. There are cases where we see an unexpected effect of neutralization, as shown in (11).[7] Notice that the word final consonants, represented in bold, are realized as voiced preceding a vowel initial word. Considering that only plain obstruents, excluding aspirated and tense consonants, undergo voicing in an intervocalic position, as in (12), the voicing of word final consonants in (11) shows that they are neutralized.

(11) Overapplication of Coda Neutralization across words

a. /mulɨ**p**^{h} alɛ/	mulɨ**b**alɛ	'knee-under (in the care of)'
b. /puə**k**^{h} ap^{h}/	puə**g**ap.	'kitchen front (in front of the kitchen)'
c. /ci**p**^{h} i-ko/	ci**b**igo	'carrying straw on the head'
d. /ko**c**^{h} əti is'-ə/	ko**d**ətiis'ə	'where is the flower?'

(12) Intervocalic Voicing

a. /apəci/	a**b**ədʒi	'father'
b. /ci**p**^{h}jo/	ci**p**^{h}jo, *cibjo	'guide'
c. /yɛ**p**'ɨ-ta/	yɛ**p**'ɨ-ta, *yɛbɨ-ta	'pretty-Declarative'

[6] I use IDENT-IO(F) as a general cover term for IDENT-IO[+constricted glottis], IDENT-IO[+spread glottis], IDENT-IO[+continuant], and IDENT-IO[-anterior], since their relative ranking is not crucial in the proposed analysis.

[7] (11a-b) are compounds, (11c) is a verb phrase, and (11c) is a full sentence.

An unexpected neutralized consonant in the onset of the following morpheme initial vowel is also observed from prefixed forms as in (13). Again neutralization is evident from the voicing of the prefix final consonant between vowels.

(13) Coda Neutralization between [Prefix-Stem]

a.	/hot^h-ipul/	hodipul, *hot^{h}ipul	'thin comforter (sheet)'
b.	/has-os/	hadot, *hasot	'warm-clothes'
c.	/nuc-oɬi-ta/	nudorɬita. *nucorɬita	'late blooming'

We have two independent problems at hand. First, we should account for the fact the prefixes and independent words pattern together, excluding suffixes, as is shown by the contrast between (6) on the one hand and (11) and (13) on the other. Second, we have an effect of Coda Neutralization, but do not have an environment for the process, neither in the input, nor at surface. Notice that stem or prefix final consonants are not in the coda position but in the onset position at surface. In this sense, Coda Neutralization is over-applied.[8]

The first problem is readily accounted for by assuming a prosodic analysis (cf. Kang 1992, Han 1994). The fact that prefixes and words pattern together with respect to a syllable structure sensitive process such as Coda Neutralization is nicely captured if we assume the prosodic word structure given in (14): suffixes form a prosodic word with its stem, while prefixes form their own prosodic word just like stems.

(14)

	Morphological structure	Prosodic structure
a.	[[Stem] Suffix]	$(\text{Stem-Suffix})_{\text{PrWd}}$
b.	[Prefix [Stem]]	$(\text{Prefix})_{\text{PrWd}}$ $(\text{Stem})_{\text{PrWd}}$
c.	[[Stem][Stem]]	$(\text{Stem})_{\text{PrWd}}$ $(\text{Stem})_{\text{PrWd}}$

In Optimality Theory, a family of alignment constraints regulates the mapping between the morphological and prosodic categories. Following the spirit of McCarthy and Prince (1993b) and Selkirk (1995), I propose that the following alignment constraints regulate the prosodic structure in Korean. STEML and STEMR require that the edges of a stem coincide with those of a prosodic word at both edges. NONREC-PRWD bans a recursive prosodic structure.

(15) Prosodic Constraints in Korean

a. STEML: Align(Stem, Left; PrWd, Left)
b. STEMR: Align(Stem, Right; PrWd, Right)
(Stem = a lexical category, i.e. Noun, Verb, Adjective, Adverb)
c. NONREC-PRWD: No PrWd dominates a PrWd.

Tableau (16) shows that the suffix is inside the prosodic word headed by the preceding stem. With NONREC-PRWD dominating STEMR, (16a) is chosen as optimal, yielding the desired structure (15a). Note that STEML does not play a role in the evaluation of (16a) and (16b).

(16) Prosodic evaluation of [Stem-Suffix]: /nas-i/ → (.na.si.)[9] 'sickle-Nominative'

	/ nas - i/	NONREC-PRWD	STEMR
a. ☞	(.na.si.)		
b.	((.nat.).i.)	*!	

[8] This kind of unexpected non-surface apparent effect of a phonological process has been observed in reduplication originally, and has been called "overapplication" (McCarthy and Price 1993a, 1995).

[9] . stands for syllable boundary. ( ) represent the left and the right edge of a prosodic words respectively.

In prefixed forms, STEML plays a crucial role as is shown in (17). While the candidate (17a) satisfies both constraints, the candidate (17b) fatally violates STEML, by incorporating the prefix in the same prosodic word with the stem. The difference between suffixes and prefixes comes from the fact that only prefixes are regulated by higher-ranked STEML. The candidate (17c) fatally violates NONRECPRWD. The constraint hierarchy for the prosodic constraints is given in (18).

(17) Prosodic evaluation of [Prefix-Stem]: / nɨc cam / → .nɨc.cam. 'sleeping late'

/nɨc- cam/	STEML	NONRECPRWD
a. ☞ (.nɨt.) (.cam.)		
b. (.nɨc.cam.)	*!	
c. (.nɨt.(.cam.))		*!

(18) NONRECPRWD, STEML >> STEMR

As for the problem of overapplication of Coda Neutralization, this would crucially call for the so-called serial syllabification or "resyllabification" in a derivational phonology as follows.

(19) Coda Neutralization: C→ ℂ / ___]$_\sigma$

(20) a. /VC + V/ Underlying Representation

b. [redacted] Syllabification, Coda Neutralization

c. V.ℂV Resyllabification

Suppose that we have a Coda Neutralization rule as in (19). Given a form as in (20a), syllabification applies within a word in (20b), putting the word final consonant in the coda position, and the Coda Neutralization rule applies. At the next stage in (20c), resyllabification applies and the neutralized ℂ is realized in the onset of the following vowel. Notice that the derivation is **opaque** (Kiparsky 1971): at surface, a neutralized segment appears in an environment that does not trigger neutralization. In a derivational model, the opacity comes from the intermediate stage of derivation, which is (20b).

The phonological opacity poses a serious problem in any non-derivation theory of phonology, including optimality theory. Considering that Optimality theory is a model subscribing to a parallel, non-derivational evaluation of constraints, there is no way to refer to the intermediate representation like (20b), in which the consonant in question appears in the coda position. To accommodate this problem, there have been several proposals in Optimality Theory, ranging from a proposal for a serial evaluation of constraints based on levels or derivational stages, local conjunction of constraints, to Sympathy analysis (Itô and Mester 1997, McCarthy 1998).

2.3 EDGE-INTEGRITY and the Overapplication of Coda Neutralization

The right conceptualisation of the overapplication of Coda Neutralization is that it comes from an interaction of two orthogonal constraints: one is a strong requirement from the morphological component to keep the morphological integrity of a morphological unit as transparently as possible in prosodic structure. The other is syllable well-formedness constraints. In a sequence/VC+V/, a morpheme dominating the C claims the consonant's morphological affiliation by keeping it at the edge of a prosodic unit. On the other hand, a strong prosodic condition, ONSET obscures this by relocating it in the onset of another morphological unit. The overapplication is a compromise to satisfy both requirements.

The problem is that we do not have a way to satisfy these double requirements with the constraints proposed so far. Tableau (21) shows the problem clearly. If ONSET dominates STEML/R, the candidate (a) is the winner. If STEML dominates ONSET, (b) is optimal. Considering that the candidates (c-d) violate IDENT-IO additionally, no ranking will choose either of them as a winner. There is nothing forcing the overapplication effect.

It is clear from (21) that the requirement of morphological integrity cannot be reduced to alignment constraints. I propose that this is performed by a faithfulness constraint, EDGE-INTEGRITY, which requires a morphological unit preserve its edge segments in their underlying positions, by keeping them at the edge of a corresponding prosodic structure. The definition is given in (22).

(21) /os an/ → odan 'clothes-inside (inside of clothes)'

/os an/	ONSET	STEML	STEMR	IDENT-IO
a.☞ (.ot.) (.an.)	*			*
b.☞ (.o.)(.san)		*	*	
c. (o.(d.)an)		*	*	*!
d. (.o.)(.dan.)		*	*	*!

(22) EDGE-INTEGRITY(MCAT, PCAT)
A segment at the edge of a morphological constituent should be at the edge of a prosodic constituent, where edges can be left, right, or both.

EDGE-INTEGRITY is a constraint regulating segments at the edges. This captures the robust generalization that the segments at the edges of a morphological unit are protected: they are immune to phonological processes, such as epenthesis (Kang to appear). EDGE-INTEGRITY allows us to capture this by imposing a more strict faithfulness requirement on the segments at the edges.

The constraint evaluates a segment and its affiliation: it is violated if an initial or final segment of a MCat is not affiliated with a corresponding PCat's edge. Thus, the configuration in (23a) violates EDGE-INTEGRITY on two counts, since the morpheme final segment C is not affiliated with $PCat_1$ and V_2, the initial segment of $Mcat_2$, is not in the initial position of $PCat_2$. The structure in (23b) does not violate EDGE-INTEGRITY at all, while (24c) violates EDGE-INTEGRITY on one count due to V2. Crucially, however, the ambisyllabic representation in (23c) fares better than (23a) with regard to EDGE-INTEGRITY, since the final C of $MCat_1$ is linked to the PCat1 at the right edge, although the linking is not exclusive.

(23) $/V_1C+V_2/$ (+ stands for a morphological boundary)

a. $PCat_1$ $PCat_2$ b. $PCat_1$ $PCat_2$ c. $PCat_1$ $PCat_2$

| /\	| \ |	| \ / |
V_1 C V_2	V_1 C V_2	V_1 C V_2
| / |	| / |	| / |
$MCat_1$ $MCat_2$	$MCat_1$ $MCat_2$	$MCat_1$ $MCat_2$

One thing worth to point out is that the ambisyllabic structure in (23c)[10] is morphologically driven, under the pressure of EDGE-INTEGRITY: ambisyllabic structure is available only when a given form is morphologically complex.

EDGE-INTEGRITY is different from alignment constraints. Its role is clear once we consider the overapplication of Coda Neutralization case in tableau (25). I propose EDGE-INTEGRITY for Korean in (24), which requires that both edge segments of a morphological word should be affiliated with the edges of a prosodic word.

---

[10] I assume that geminates are distinct from ambisyllabic consonants in that they are two root nodes sharing the same features, as follows. For the two root theory of length, see Selkirk (1990).

Ambisyllabic consonants

σ_1 σ_2
| \ / |
V C V
|
[αF]

Geminates

σ_1 σ_2
| \ / |
V CC V
\ /
[αF]

(24) EDGE-INTEGRITY(MWORD, PRWD)
Segments at the edges of a morphological word should be at the edge of a prosodic word at both edges.

(25) /os an/ → .o.d.an. 'clothes inside (inside of the clothes)'

/os an/	ONSET	STEML	EDGE-INTEGRITY	STEMR	IDENT-IO	NO CODA
a. PrWd PrWd | | σ σ |\ |\ [od] [a n][11]	*!					
b. PrWd PrWd | | σ σ | / |\ [o s][a n]		*	*!*			
c. ☞ PrWd PrWd | | σ σ |\ / |\ [o d][a n]		*	*			
d. PrWd PrWd | | σ σ | / |\ [o d][a n]		*	*!*			

The tableau (25) shows that a syllable well-formedness constraint ONSET dominates the prosodic constraints.[12] The candidate (25a) loses due to the fatal violation of this constraint. The candidates (25b), (25c), and (25d) are on tie with regard to ONSET, STEML, and STEMR. However (25c), with ambisyllabic structure fares better with regard to EDGE-INTEGRITY than the other two, in that the stem final consonant [t] is affiliated with its original morpheme final position. The violation of EDGE-INTEGRITY is fatal for the candidates (25b) and (25c).

Notice that all three candidates (25b,c,d) violate the alignment constraints, STEML and STEMR. The alignment constraints require crisp alignment between morphological and prosodic units. If there is a disruption of crisp alignment, it counts as a violation. Crucially, the double linking of the ambisyllabic consonant in (25c) disrupts relevant prosodic edges and constitutes a violation of any relevant alignment constraint. On the other hand, it does not violate EDGE-INTEGRITY, at least at the right edge. As long as the consonant is affiliated with the morphological constituent through prosodic structure, it satisfies EDGE-INTEGRITY. Being a faithfulness constraint on the edge segments, it does not care about crisp or exclusive linking. The crucial difference of EDGE-INTEGRITY vs. STEML/R towards the ambisyllabic structure comes from that of a faithfulness constraint vs. an alignment constraint.

To sum up, I have shown that overapplication of Coda Neutralization in Korean is well accounted for in an optimality theoretic framework without recourse to neither any serial derivation nor any

[11] [and] represent morphological word boundaries.
[12] Since epenthesis of a consonant is not an option to satisfy ONSET, I assume that DEP-IO is undominated in this case.

special mechanisms such as Sympathy, using a richer representation. Crucially this non-derivational evaluation is possible with the ambisyllabic representation, which is driven by strong double requirements, EDGE-INTEGRITY and ONSET. Ambisyllabic consonants are linked in a coda position and thus regulated by undominated CODACOND, being realized as neutralized at surface. The representation makes all the relevant information transparent and available at surface. The so-called phonological opacity in this case is nothing but a surface effect of the proposed representation, which satisfies both syllable well-formedness constraints and EDGE-INTEGRITY, a morphology-phonology interface requirement to mark morphological constituency as prosodically transparent as possible.

3 Consonant Copy in the Jeju dialect in Korean

The constraint EDGE-INTEGRITY is not an arbitrary constraint proposed only to account for overapplication of Coda Neutralization in Korean. The effect of the strong requirement to mark a morphological constituency transparently in prosodic structure is also evidenced from other processes. In this section I present the Consonant Copy in the Jeju dialect in Korean, as another piece of empirical evidence for the crucial role of EDGE-INTEGRITY.

3.1 Data

The Jeju dialect in Korean shows a peculiar phonological process, the Consonant Copy, by which a morpheme/word final consonant is optionally copied and doubled when preceding a vowel initial word. The Consonant Copy applies between prefix-stem in (26), across words in compounds as in (27) and in phrases as in (28). All the examples are drawn from Jeong (1997).

(26) Consonant Copy between Prefix-Stem[13]

a. /hot^h ipul/	hot.**t'**i.pul~hon.**n**i.pul[14]	'thin comforter'
b. /hot^h os/	hot.**t'**ot	'thin clothes'
c. /c^{h}əs atəl/	c^{h}ət.**t'**a.təl	'the first son'

(27) Consonant Copy in Compounds

a. /cicip ai/ female child	ci.cip.**p'**a.i	'girl'
b. /kacuk os/ leather clothes	ka.cuk.**k'**ot.	'leather clothes'
c. /pitan os/ silk clothes	pi.tan.**n**ot.	'silk clothes'
d. /mul ankjəŋ/ water glasses	mul.**l**an.kjəŋ	'goggles'
e. /sul wesaŋ/ liquor not-paying	sul.**l**we.saŋ	

(28) Consonant Copy across words in Phrases

a. /nun ətuk-ən/ eye dark-Inf	nun.**n**ə.tu.kən	'the eyesight is not good'

[13] Copied consonants are in bold. The fact that copied obstruents are tense is due to the tensification of an obstruent following another obstruent.

[14] The variation is due to another phonological process: n-Epenthesis, by which an [n] is inserted preceding a high vocoid [i/y] after a consonant final word (Han 1994, Sohn 1995, Hong 1997). This process occurs in other dialects of Korean in general. Jeong (1997) points out that consonant copy is more often observed in a younger generation and is a renovation in that sense.

b. /tap answer	al-an/ know-Inf	tap.**p'**a.ran	'knowing the answer'
c. /c^{h}ɛksaŋ desk	u-e/ top-Loc	c^{h}ɛk.s'aŋ.**ŋ**u.e	'on top of the desk'
d. /mas taste	ɨs-ən/ not-exist-Inf	mat.**t'**ɨ.sən	'(sth) not tasting food'

Several properties emerge readily. First, there is no restriction on the quality of the copied consonant or the following vowel: it applies as long as the prosodic environment is met. Second, it is evident from the examples in (26)-(28) that the consonant copy applies at the prosodic word juncture: the prosodic word final consonant is copied in the initial position of the following prosodic word. This is further supported by the fact that it does not apply between a stem and a suffix.

(29) No Consonant Copy between Stem-Suffix

a. /kacuk-i/	ka.cu.gi, *ka.cuk.k'i	'leather-Nominative'
b. /mək-ən/	mə.gən, *mək.k'ən	'eat-and'
c. /c^{h}ɛk-i-uk'wa/	c^{h}ɛ.gi.u.k'wa	'book-Copula-Question'

Third, the Consonant Copy is observed only when the first word ends with a consonant and the second word begins with a vowel.[15] Recall that the environment of Consonant Copy overlaps with that of overapplication of coda Neutralization. The copying of neutralized segments [t] instead of [s] in (26c) and (28d) shows that the consonants in the coda position are copied.

3.2 CONSONANT COPY AS INSERTION: EDGE-INTEGRITY and STEMR

Consonant Copy occurs in the exactly same environment as overapplication of Coda Neutralization: ...C)$_{\text{Prwd}}$ $_{\text{PrWd}}$(V.... The only difference is that the vowel initial morpheme satisfies its ONSET requirement with a copied consonant, instead of ambisyllabic representation of the intervocalic consonant. I propose that Consonant Copy is insertion of a root node to the onset of the prosodic word initial vowel with additional featural copy from the preceding consonant at the prosodic word juncture.

(30) $_{\text{PrWd}}$(...VC)(ℂV...)$_{\text{PrWd}}$ [in which ℂ represents a copied root]
\ /
[F]

Now the question is what forces the insertion of the final consonant in this environment. I propose that it is EDGE-INTEGRITY, the same constraint that chose ambisyllabic representation in the same environment as (30) in the previous section. Recall that Consonant Copy is optional on a par with ambisyllabic structure in the same environment. What makes the Jeju dialect peculiar is that DEP-IO is sufficiently low ranking as to allow insertion of a consonant as an option under the pressure of ONSET and EDGE-INTEGRITY. The evaluation of /kacuk os/ → [ka.cuk.**k'**ot.] 'leather clothes' is as follows. Note that DEP-IO is ranked lower than prosodic constraints and EDGE-INTEGRITY.

The candidates (31a) and (31b) are on tie with regard to ONSET. Both of them violate STEML and EDGE-INTEGRITY due to the disruption of the left edge of /os/ 'clothes' to satisfy a higher-ranking constraint ONSET. The decision goes down to STEMR. Recall that STEMR is an alignment constraint

[15] Nothing is inserted to break vowel hiatus in Korean in general. This suggests that the relevant constraint in this case forcing the doubling of a consonant is SYLLABLE CONTACT CONDITION (SYLLCON), which requires that sonority should be falling across syllable boundaries. Thus the syllable contact of ...C]$_{\sigma}$ $_{\sigma}$[V..., ...Obst]$_{\sigma}$ $_{\sigma}$[Sonorant..., and ...Consonant]$_{\sigma}$ $_{\sigma}$[Glide... will violate SYLLCON, while ...V]$_{\sigma}$ $_{\sigma}$[V... does not. It has been shown that this plays a role in consonant assimilation and *n*- Epenthesis in Korean (Hong 1997, Davis and Shin 1999). I use ONSET for the expository convenience, however this will be replaced with SYLLCON eventually.

which requires crisp alignment between prosodic and morphological constituent. The ambisyllabic representation in (31a) fatally violates STEMR due to the double linking. The candidate (31b) is chosen as optimal output by satisfying it. Since DEP-IO is ranked sufficiently low, it is better to insert a consonant and satisfy a crisp alignment constraint. If DEP-IO were ranked higher than prosodic constraints, the ambisyllabic representation would be chosen as the optimal output. The candidate (31c) loses trivially due to the fatal violation of ONSET.

(31) /kacuk os/→ [ka.cuk.k'ot.] , *[ka.cu.k.ot] 'leather clothes'

/kacuk os/	ONSET	STEML	EDGE-INTEGRITY	STEMR	DEP-IO
a. PrWd PrWd / \ | σ σ σ /| /|\ / | \ [k a. c u k][o t]		*	*	*!	
b.☞ PrWd PrWd / \ | σ σ σ /| /|\ /|\ [k a c u k]k'[o t]		*	*		
c. PrWd PrWd / \ | σ σ σ /| /|\ |\ [k a c u k][o t]	*!				

What is important in this evaluation is the crucial role of the crisp alignment constraints, in particular the one at the right edge of a prosodic word: STEMR. Often the right edge of a morphological unit is disrupted due to a purely phonological requirement, ONSET. When this is satisfied by a copied segment, the crisp alignment requirement at the right edge emerges.

4 Conclusion

In this paper, I have shown that the so-called overapplication of Coda Neutralization and the Consonant Copy in the Jeju dialect in Korean are motivated by a morphology-prosody requirement to keep the integrity of morphological structure, EDGE-INTEGRITY as well as syllabic well-formedness constraints. Especially I showed that ambisyllabic representation is forcefully chosen as a compromise at the cost of a simple structure when both sets of constraints are sufficiently high ranked. I proposed that this is a case of morphologically driven ambisyllabicity. The putative problem of phonological opacity involved with Coda Neutralization was analysed as a surface effect coming from the interaction of the general edge-marking requirement and ONSET, without recourse to any special mechanism or derivation, using the ambisyllabic structure. Consonant Copy in Jeju dialect is presented as further supporting evidence for EDGE-INTEGRITY. The analysis of the consonant copy further shows that the relevance of crisp alignment requirements independent from EDGE-INTEGRITY. In particular the role of the right edge of a morphological constituent and its corresponding prosodic constituent is shown to be critical.

In the proposed analysis, EDGE-INTEGRITY plays a crucial role. It is proposed as a faithful requirement on the segments at the edges of a morphological constituent. The basic intuition is that edges of a morphological constituent are prominent, and EDGE-INTEGRITY achieves this by matching them up with the edges of prosodic structure. Its role is not restricted in syllable structure but extended to epenthesis (Kang to appear). This is one of many ways of expressing the prominence of edges of morphological units in phonology: in other word, it is one facet of phonology at the service of

morphology, by preserving morphological structure and expressing it in phonology as transparently as possible.

Acknowledgements

My thanks go to Abby Cohn, John Whitman, and Draga Zec for their advice and help with the general idea and the preparation of this paper. My special gratitude goes to Professor Seong-Kyu Kim for bringing the Jeju dialect to my attention. Of course any mistakes are mine alone.

References

Blevins. J. 1995. The syllable in phonological theory. In J. A. Goldsmith (ed.). *The Handbook of Phonological Theory*: 206-244. Cambridge: Blackwell.

Cho Y. 1998. Language change as reranking of constraints. To appear in *The Preceedings of International Conference on Historical Linguistics.* University of Manchester.

Clements, G.N. and E.V.Hume. 1995. Internal Organization of speech sounds. In J. A. Goldsmith (ed.). *The Handbook of Phonological Theory*: 245-305. Cambridge: Blackwell.

Han, E. 1994. *Prosodic Structure in Compounds*. Ph.D. Dissertation. Stanford University.

Hong, S. 1997. *Prosodic domains and Ambisyllabicity in Optimality Theory*. Ph.D. Dissertation. University of Pennsylvania.

Itô, J. 1986. *Syllable Theory in Prosodic Phonology*. Ph.D. Dissertation. University of Massachusetts. Amherst

Itô, J. 1989. A prosodic theory of epenthesis. *Natural Language and Linguistic Theory* 7. 217-260.

Itô, J. and R. A. Mester. 1997. Sympathy Theory and German Truncations. In V. Migio and B. Moren (eds.) *Proceedings of the Hopkins Optimality Workshop/Maryland Mayfest 1997*. University of Maryland Working Papers in Linguistics 5.

Jeong, S. 1997. Eumso Yeonswe-wa Bi-eumumlon-jeok Gyeonggye: Jeju-do Bangeon-eul Jungshim-eulo. (Phoneme sequences and non-phonological boundaries: with special regards to the Jeju dialect). In P. Lee and C. Song. (eds.) *Umun* I. Tayhaksa. Seoul, Korea.

Kang, E. To appear. Edge-Integrity and Epenthesis. *Working Papers of the Cornell Phonetics Laboratory* No. 14. Cornell University.

Kang, O. 1992. *Korean Prosodic Phonology*. Ph. D. Dissertation. University of Washington.

Kim-Reneau, Y. 1974. *Korean Consonantal Phonology*. Ph.D. Dissertation. University of Hawaii.

Kiparsky, P. 1971. Historical linguistics. In W. Dingwall (ed.). *A Survey of Linguistic Science:*.577-642. College Park: Linguistics Program, University of Maryland.

McCarthy, J. J.1998. Sympathy and Phonological Opacity. Ms. University of Massachusetts, Amherst.

McCarthy, J.J. and A.S. Prince. 1993a. Prosodic Morphology I: Constraint Interaction and Satisfaction. Ms. University of Massachusetts, Amherst and Rutgers University.

McCarthy, J. J. and A. S. Prince. 1993b. Generalized Alignment. In. G. Booij and J.van Marle (eds.). *Yearbook of Morphology 1993:* 79-153. Dordrecht: Kluwer,

McCarthy, J. J.and A. S. Prince. 1995. Faithfulness and reduplicative identity. In Jill Beckman, Laura Walsh Dickey, and Suzanne Urbanczyk (eds.) *University of Massachusetts Occasional papers in Linguistics 18:Papers in Optimality Theory*: 249-384. University of Massachusetts, Amherst: GLSA.

Prince, A.S. and P. Smolensky. 1993. *Optimality Theory: Constraint Interaction in Generative Grammar*. Ms., Rutgers University, New Brunswick, and University of Colorado, Boulder. RuCCS-TR-2.

Selkirk, Elizabeth. 1995. The prosodic structure of function words. In Jill Beckman, Laura Walsh Dickey, and Suzanne Urbanczyk (eds.) *University of Massachusetts Occasional papers in Linguistics 18:Papers in Optimality Theory*: 439-470. University of Massachusetts, Amherst: GLSA..

Sohn, Homin.1999. *The Korean Language*. Cambridge.