An Optimality-Theoretic Approach to Korean and English Consonant Cluster Simplification

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Kim, Won-Bo. 1998. An Optimality-Theoretic Approach to Korean and English Consonant Cluster Simplification. *Studies in Phonetics Phonology and Morphology* 4, 109-124. The purpose of this paper is to show how consonant cluster simplification of both standard Korean and Kyengsang dialect as well as of English can be explained in a unified manner under Optimality Theory. To do so, we propose a new constraint, Spontaneous Voice Constraint, which uses manner feature of articulation, and attempt to account for consonant cluster simplification of Korean and English with the newly proposed constraint plus several other existing constraints under Optimality Theory.**(Cheju National University)**

Keywords: consonant cluster, simplification, optimality theory, spontaneous voice constraint, consonant place constraint

1. Introduction

Many researchers have tried to account for consonant cluster simplification phenomena in syllable-final positions in both Korean and English. However, there have been few satisfactory explanations of either of them because Korean shows different realizations of consonant cluster simplification in some clusters according to dialects and English seemingly reveals its inconsistent realizations in various words.

Let us consider the following Korean consonant cluster simplification in both standard Korean and Kyengsang dialect.

(1) standard Korean		(2) Kyengsang dialect	
(a)	(b)	(a)	(b)
p(s)	n(c)	p(s)	l(k)

k(s)	l(t^h)	k(s)	l(p)
(l)k	l(h)	(l)m	l(p^h)
(l)p	n(h)		n(c)
(l)p^h			l(t^h)
(l)m			l(h)
			n(h)

The consonant in parentheses is to be deleted in phonetic realizations. Standard Korean and Kyengsang dialect show particularly different phonetic realizations of the clusters /-lk/, /-lp/ and /-lp^h/.

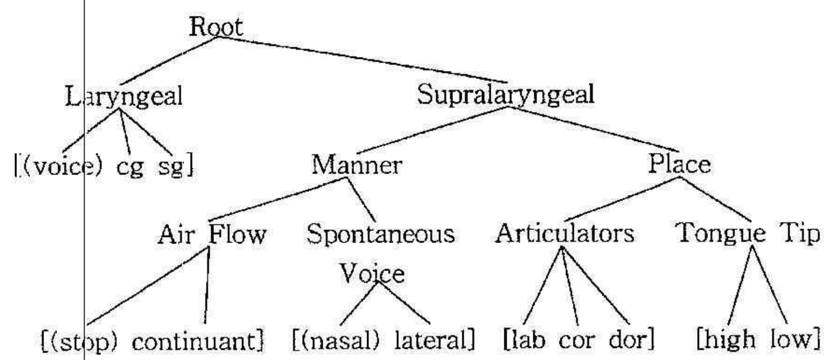
Most researchers have approached such phenomena in terms of the asymmetry of coronal sounds versus labial and velar sounds. In other words, they have tried to account for consonant cluster simplification (henceforth, CCS) in Korean in relation to the asymmetry between place features of articulation. Both (1a) and (2a) are naturally accounted for by assuming the deletion of unmarked coronal consonants on the basis of the asymmetry of unmarked coronal consonants versus marked labial and velar consonants. With such an asymmetry between place features, however, they could account for neither (1b) nor (2b) naturally and satisfactorily, so they have either introduced unnatural and arbitrary ways to explain them or given up explaining them altogether.

In previous research, place features of articulation on the basis of feature geometry and its underspecification have mainly been used in explaining Korean CCS. This paper aims to account for which consonant of the two consonants should be deleted in phonetic representations by using the method of feature geometry and its underspecification plus the hierarchical relations among constraints based on Optimality Theory (henceforth, OT). Therefore, in this paper both Korean and English consonant cluster simplification will be accounted for by using ranked constraints concerning place and manner features under OT.

2. Feature Geometry and Consonant Representations

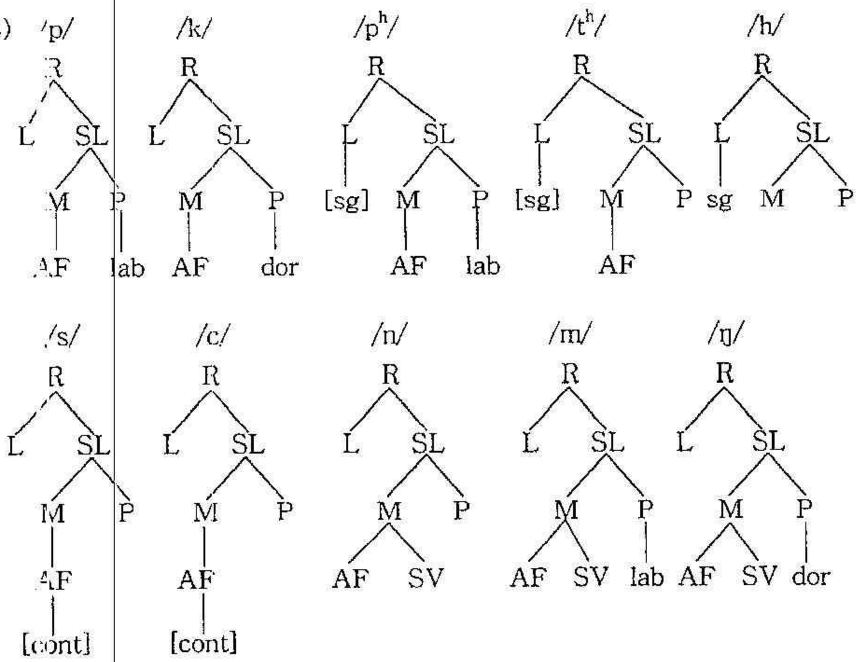
The hierarchical organization of features that I assume here is based on the geometries of Sagey (1986), McCarthy (1988), Avery & Rice (1989), and Rice (1993). The particular hierarchical representation of a segment structure is given in (3).

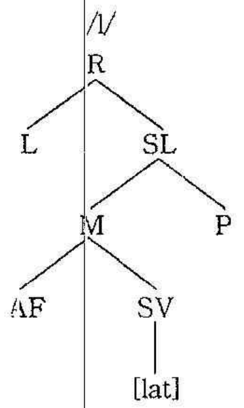
(3)



Let us define the segments necessary for accounting for CCS by using both feature geometry given in (3) and its underspecification.

(4)





Consonants representations in (4) on the basis of feature geometry and its underspecification will be used for explaining CCS of both Korean and English.

3. Optimality Theory and Consonant Cluster Simplification

OT is a model of constraints and their interactions. Hierarchical rank among constraints is important when explaining phonological phenomena under OT. Constraints and their hierarchy in OT enable us to select an optimal output form through the evaluation of an array of candidate outputs. In this paper I explore in some detail how naturally both Korean and English CCS is explained by using segment representations as shown in (4) and constraint interactions based on optimality-theoretic analysis

3.1 Korean Consonant Cluster Simplification

In Korean one of the two consonant clusters in syllable-final position has to be deleted. This phenomenon is called Korean Consonant Cluster Simplification. Standard Korean and Kyengsang dialect show different realizations of CCS in some clusters as shown below:

(5) Examples of CCS in both standard Korean and Kyengsang dialect

(a) phonological representations (b) phonetic representations

		standard Korean	Kyengsang dialect
ps:	/kaps/ 'price'	p: [kap]	p: [kap]
ks:	/nəks/ 'spirit'	k: [nək]	k: [nək]
lm:	/cəlm-/ 'be young'	m: [cəm]	m: [cəm]
nc:	/anc-/ 'sit'	n: [an]	n: [an]
lt^h:	/$halt^h$-/ 'lick'	l: [hal]	l: [hal]
lh:	/t'ulh-/ 'pierce'	l: [t'ul]	l: [t'ul]
nh:	/manh-/ 'be plentiful'	n: [man]	n: [man]
lk:	/ilk-/ 'read'	k: [ik]	l: [il]
lp:	/palp-/ 'step'	p: [pap]	l: [pal]
lp^h:	/ilp^h-/ 'recite'	p: [ɨp]	l: [ɨl]

First of all, we will have to employ a universal constraint called No Complex Coda introduced by Prince & Smolensky (1993: 87) to account for the fact that Korean does not phonetically allow consonant sequences in the coda position of a syllable as shown in (5).

(6)[1] No Complex Coda (henceforth, NCC)

No more than one consonant may associate to the coda.

The NCC has the effect of preventing two or more consonants from appearing in the coda position, and so may account for the phenomena in (5).

Next, such phenomena as shown in (5) have been dealt with in terms of the asymmetry of coronal consonants versus labial and velar consonants on the basis of markedness of consonant places. Following such a traditional view of markedness of consonant places, we introduce Consonant Place Constraint as follows.

(7) Consonant Place Constraint(henceforth, CPC)

Either labial or dorsal consonant should be parsed in a coda position.

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[1] Prince & Smolensky (1993: 87) defines this constraint as follows;
*Complex: No more than one C or V may associate to any syllable position node

This constraint is similar to *PL/Lab >> *PL/Cor claimed by Prince & Smolensky (1993: 181) on the basis of the fact that labial consonants are more marked than coronal consonants. Similarly, Kenstowicz (1994: 18-20) also claims that more marked consonants should be parsed in the place of articulation.

In addition, there should be another constraint since CPC in itself is not sufficient to account for CCS. Another constraint is related to the manner of articulation. We assume the following Spontaneous Voice Constraint as a constraint on the manner of articulation to explain CCS.

(8) Spontaneous Voice Constraint (henceforth, SVC)
A consonant with Spontaneous Voice node should be parsed in the coda position.

As can be seen in (3) and (4), a consonant with SV node is both a liquid and a nasal, while a consonant without SV node is an obstruent. SVC implies that when there are clusters of either liquid or nasal + obstruent, either the liquid or the nasal should be parsed in the coda position. This is equivalent to the claim that the more sonorant consonant is preferred in the coda position in view of Sonority Hierarchy. Furthermore, a high-ranked consonant in the Sonority Hierarchy is more salient and perceptible than a low-ranked consonant. Therefore, it is valid for us to assume SVC in consideration of Sonority Hierarchy and Perceptibility Principle, a universal principle, which requires that speech be perceptible. SVC is similar to Salience Hierarchy claimed by Lee (1996: 167), which says that physiologically and acoustically, the more complex segments are more salient.

We can understand why two such constraints are needed to account for CCS in the coda position when we pay attention to the special status a coda has in a syllable. The coda has a dual character in a syllable: it is willing to retain its status by reinforcing its position and having more consonantal character, while it is continuously influenced by and assimilated to a preceding vowel, a nucleus of a syllable, losing consonantal character, and finally heads for the most unmarked syllable structure of CV. CPC is needed to account for the former trait of the coda, while SVC is needed for the latter trait of the coda.

Because of this dual character of coda, either CPC expressing consonantal character or SVC expressing vocalic character can be ranked higher than the other under OT according to whether a language (or a dialect) prefers a consonantal or a vocalic trait in the coda position. Therefore, there is no problem in assuming inverse hierarchies between two constraints according to languages and dialects and in this way we can easily account for different consonant realizations in CCS of both standard Korean and Kyengsang dialect as shown in (5).

In addition, three-way contrasted obstruents in phonological representations (lax/aspirated/tense) are neutralized into their homorganic lax stops in coda positions. Consider the following examples:

(9) Coda Neutralization Phenomena

/ip+to/	→	[ipt'o] 'mouth also'
/ip^h+to/	→	[ipt'o] 'leaf also'
/pak+to/	→	[pakt'o] 'gourd also'
/pak'+to/	→	[pakt'o] 'outside also'

We see that only lax stops can be realized phonetically in coda positions and so only [p, t, k, m, n, ŋ, l] out of the 19 consonants appear in the coda on account of such coda neutralizations as in (9). We need the following Coda Neutralization Constraint to prevent both aspirated and tense stops from appearing in phonetic representations.

(10) Coda Neutralization Constraint (henceforth, CNC)
Both aspirated and tense stops in coda position should be neutralized into their homorganic lax stops.

Let us explain CCS in standard Korean on the basis of OT. We propose the following constraint hierarchy for CCS of standard Korean.

(11) NCC >> CPC >> SVC >> CNC

With the ranking in (11), let us consider the following tableaux in (12), (13), (14) and (15).

(12)

ks/ps	NCC	CPC	SVC
a. ks/ps	*!		
☞b. k(s)/p(s)			
c. (k)s/(p)s		*!	

In (12) candidate (a) violates the highest constraint NCC, which is fatal. Candidate (c) violates the intermediate constraint CPC. Thus candidate (b) is chosen as the optimal output, with the result that labial and velar consonants are selected over coronal consonants. The lowest constraint SVC does not apply here because neither k nor s has the Spontaneous Node, which is the vital factor to decide whether or not the constraint applies.

(13)[2]

lp/lk/lm	NCC	CPC	SVC
a. lp/lk/lm	*!		
b. l(p)/l(k)/l(m)		*!	
☞c. (l)p/(l)k/(l)m			(*)

In (13) candidate (a) does not show any change, thus violating the highest constraint NCC and candidate (b) violates the intermediate constraint CPC at the cost of having lateral consonants. Thus, candidate (c) is selected as the optimal output form. In (12) and (13) CNC is not motivated to be applied.

[2] The asterisk(*) in (13) is in parentheses to indicate that both the elements of the candidate (c) violate the SVC with the exception of *(l)m*.

(14)

lp^h	NCC	CPC	SVC	CNC
a. lp^h	*!			*
b. $l(p^h)$		*!		
c. $(l)p^h$			*	*!
☞ d. $(l)p$			*	

Candidate (a) showing no change violates the highest constraint NCC and candidate (b) violates the high-ranked constraint CPC. When candidates (c) and (d) are compared, both of them violate the same SVC. But candidate (d) is chosen as the optimal output in that it violates fewer constraints than candidate (c), since candidate (c) violates CNC in addition to SVC while candidate (d) violates only SVC. The $/p^h/$ will be phonetically realized as [p] on account of the constraint CNC.

(15)

$nc/nh/lh/lt^h$	NCC	CPC	SVC	CNC
a. $nc/nh/lh/lt^h$	*!			(*)
☞b. $n(c)/n(h)/l(h)/l(t^h)$				
c. $(n)c/(n)h/(l)h/(l)t^h$			*!	(*)

In (15) candidate (b) is selected as the optimal output since it does not violate any constraint. Candidate (a) violates the highest constraint NCC, which is fatal and candidate (c) violates the low-ranked constraint SVC, which is fatal. Here CPC is not motivated to be applied because there is no either labial or dorsal consonant among candidates.

Therefore, CCS in standard Korean can be accounted for easily and naturally under optimality-theoretic analysis of constraints and constraint interactions. Next, let us consider how CCS in Kyengsang dialect can be accounted for in the same way as above.

We propose the following constraint hierarchy to account for CCS in Kyengsang dialect, in which the two constraints of CPC and SVC are ranked inversely, compared with those in standard Korean.

(16) NCC >> SVC >> CPC >>CNC

With the ranking in (16), let us consider the following tableaux in (17), (18), (19), and (20).

(17)

$lp/lk/lp^h$	NCC	SVC	CPC
a. $lp/lk/lp^h$	*!		
☞b $l(p)/l(k)/l(p^h)$			*
c. $(l)p/(l)k/(l)p^h$		*!	

In (17) candidate (a) violates the highest constraint NCC, which is fatal. Candidate (c) also violates the intermediate constraint SVC and therefore is not suitable as the optimal output form. The optimal form (b) violates only the lowest constraint CPC.

(18)

$nc/nh/lh/lt^h$	NCC	SVC	CPC
a. $nc/nh/lh/lt^h$	*!		
☞b. $n(c)/n(h)/l(h)/l(t^h)$			
c. $(n)c/(n)h/(l)h/(l)t^h$		*!	

In (18) the optimal output form is candidate (b), which does not violate any constraint. Candidate (a) violates the highest constraint NCC and candidate (c) violates the intermediate constraint SVC.

(19)

ks/ps	NCC	SVC	CPC
a. ks/ps	*!		
☞b. k(s)/p(s)			
c. (k)s/(p)s			*!

In (19) candidate (a) violates the highest constraint NCC, which is fatal. Candidate (b) does not violate any constraint. Candidate (c) violates the lowest constraint CPC. Thus, candidate (b) is selected as the optimal output form. The constraint SVC is not motivated to be applied here as in (12).

(20)

lm	NCC	SVC	CPC
a. lm	*!		
b. l(m)			*!
☞c. (l)m			

In (20) candidate (a) is excluded since it violates the highest constraint NCC. This leaves candidates (b) and (c), both of which satisfy the high-ranked constraints of NCC and SVC. The lowest constraint CPC determines which candidate, (b) or (c), is the optimal output form. Candidate (b) violates CPC, while candidate (c) satisfies CPC. Thus candidate (c) is chosen as the optimal output form.

We have seen how different realizations of CCS in both standard Korean and Kyengsang dialect can be accounted for under optimality-theoretic analysis. We can confirm that CCS in both standard Korean and Kyengsang dialect can be easily and naturally explained in a unified way under OT.

3.2 English Consonant Cluster Simplification

English shows asymmetric phonological phenomena between stem-affixed forms and word-affixed forms in the case of CCS. Let us consider the following examples:

(21)[3]	(i) root	(ii) root + stem affixes	(iii) word + word affixes
	(a) bomb	bombard	bombing

[3] Stem affixes are added to dependent stems or roots, while word affixes only to words. According to Kiparsky(1985)'s model, the former(-al, -ous, -ity, -th, -ize and so on) belongs to level 1 and the latter(-hood, -er, -ism, -ist, -ian and so on) belongs to level 2. To be noted here is that while a stem affix is so combined with a stem or a root that it forms only one phonological word, a word affix in itself forms a phonological word even before it is combined with a word, which of course independently forms another phonological word. Therefore, in Prosodic Phonology there is only one phonological word, the application unit of phonological rules, when a stem affix is added to a root or stem, while there are two phonological words when a word affix is added to a word.

	crumb	crumble	crumby
	thumb	thimble	thumbing
(b)	long	longest	longing
	strong	strongest	strongly
(c)	damn	damnation	damning
	condemn	condemnation	condemning
	autumnal	autumnal	autumning
	hymn	hymnal	hymning
(d)	sign	signature	signing
	resign	resignation	resigning

In Lexical Phonology, which assumes that the lexicon consists of ordered strata as domains for phonological and morphological rules, the above examples, especially the difference of (ii) and (iii) showing whether or not consonant clusters exist in roots and words after word formations, were not accounted for naturally.

Here we try to account for the above examples under OT as in Korean.[4] To do so, we propose to use the same constraint hierarchy as in Kyengsang dialect.

(22) NCC >> SVC >> CPC

In addition to the constraints in (22), the following three additional constraints for syllabification are needed to explain the phonological phenomena in (21).

(23) Align-R
Right edge of every prosodic word coincides with right edge of a syllable.

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[4] These data have been dealt with under OT as in Lee(1996) and Lee(1997) and so on. Nonetheless, the reason why we deal with the same data here again is to show how they are accounted for with the same constraints as in Korean.

(24) Onset Constraint
Syllables must have the onset.

(25) Max-IO
Every segment of the input has a correspondent in the output.

Constraint (23), which is based on the assertion that the unit for English syllabification is a prosodic word, means that the rightmost edge of every phonological word must coincide with the rightmost edge of every syllable. Constraint (24) is based on the fact that every syllable must have the onset if possible. Constraint (25) means that phonological input should be the output without any deletion.

Let us propose the final constraint hierarchy for CCS in English including constraints (23), (24), and (25).

(26)[5] Align-R >> Onset >> NCC >>Max-IO >> SVC >>CPC

With the ranking in (26), let us consider the following tableaux in (27), (28) and (29)[6]:

(27)

damn	Align-R	Onset	NCC	Max-IO	SVC	CPC
a. damn			*!			
☞ b. dam(n)				*		
c. da(m)n				*		*!

[5] If we assume the constraint hierarchy (25), we can not explain such consonant clusters as -nd(band), -nt(tent), -ŋk(bank) appearing in English coda positions. So, we will have to introduce the additional constraint allowing such consonant clusters in English coda positions, which means that the voiceless stops articulated in the same place as the preceeding nasals are not deleted in the syllable-final sequences of nasal+stop, and situate it between Onset Constraint and NCC in constraint hierarchy in order to account for them.

[6] All the data in (21) will be accounted for in a similar way and so here we will account for only the three representative examples of *damn*, *bombard* and *bombing*. Here what we pay attention to is either roots or words preceding affixes when either roots or words are combined with affixes. So we will evaluate either the syllable-final consonant clusters of roots or words preceding affixes or the following onset with constraint hierarchy.

In (27) either (b) or (c) will be chosen as an optimal output since candidate (a) violates the fatal constraint NCC and is excluded. The lowest constraint CPC determines which candidate, (b) or (c), is the optimal output form because both of them violate the same constraint Max-IO. Thus candidate (b) is chosen as the optimal output.

(28)

	bombard	Align-R	Onset	NCC	Max-IO	SVC	CPC
☞a	bom.bard						
b	bo(m).bard				*!		
c	bomb.ard		*!	*			
d	bom(b).ard		*!		*		
e	bom.(b)ard		*!		*		
f.	bo(m)b.ard		*!		*	*	

The dot (.) indicates a syllable boundary. In (27) candidates (c), (d), (e) and (f) violate the high-ranked Onset Constraint, which is fatal. Candidate (b) violates the intermediate constraint Max-IO, while candidate (a) does not violate any constraint. Thus candidate (a) is selected as the optimal output form.

(29)

	bomb#iŋ	Align-R	Onset	NCC	Max-IO	SVC	CPC
☞a	bom(b).#iŋ		*		*		
b	bo(m)b.#iŋ		*		*	*!	
c	bomb.#iŋ		*	*!			
d	bom.b#iŋ	*!					
e	bo(m).b#iŋ	*!			*	*	
f.	bom.(b)#iŋ	*!	*		*		

The mark #, signalling a word affix, indicates a phonological word boundary which a syllable bounday should coincide with according to the constraint Align-R in (23). In (28) candidates (d), (e) and (f) violate the highest constraint Align-R, and are therefore excluded. Candidates (a), (b) and (c) violate the high-ranked Onset Constraint. Candidate (c) violates the higher intermediate constraint NCC constraint, which is fatal. Candidates (a) and (b) both violate the lower intermediate constraint Max-IO. Candidate (b) violates low-ranked constraint SVC, while candidate (a) does not violate any low-ranked constraint. Thus, candidate (a) is chosen as the optimal output form.

Thus far, we have seen how English asymmetric phonological phenomena between stem-affixed word forms and word-affixed word forms in the case of CCS can be accounted for on the basis of OT.

4. Conclusion

In this paper we show that CCS of both standard Korean and Kyengsang dialect, as well as of English, can be accounted for in a unified manner under OT. To do so, we propose two constraints: SVC, which uses manner features of articulation, and CPC, which uses place features of articulation. We demonstrate that those perplexing CCS phenomena in both Korean (including standard Korean and Kyengsang dialect) and English can be handled in a unified way by using the two main constraints of SVC and CPC, which may be ranked inversely to each other under optimality-theoretic analysis according to dialects and languages.

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