A Constraint-Based Approach to Korean Loanwords*

Hideyuki Hirano

This paper presents an analysis of Korean loanwords within the framework of Optimality Theory. It argues that the constraints FAITHFULNESS and MARGIN-R, which condition the preservation of original input forms, play a crucial role in loanword phonology, and that they interact with other constraints describing the unmarked characteristics of the basic syllable structure. It also argues that a system of both dominant constraints and ranked, violable constraints selects forms. This research strongly suggests that a ranking of constraints, BR, M-R≫FAITHFULNESS≫PARSE≫ALIGN-R≫FILL≫ONS≫-COD exists in Korean loanword phonology. Moreover, it is demonstrated that two possible actual forms are characterized by the ranking differences between violable constraints, and that overparsing is a reliable strategy for rescuing unsyllabifiable segments. This analysis shows how Optimality Theory works in loanword phonology.

0. Introduction

Yip (1990, 1993) notes that loanwords are words that move from a language with one set of well-formedness conditions to a language with a different set, with the result that adjustments must be made. Since the speaker is trying to adopt the word as close to its original form as possible,

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featural changes, epenthesis and deletion will occur only in a quite restricted way. This paper will examine Korean loanwords borrowed from English from this point of view. Korean has a simpler syllable structure than English, so most loanwords require adjustment to conform to Korean syllable structure constraints.

Optimality Theory (Prince and Smolensky (1993) and McCarthy and Prince 1993a) claims that an interaction of a set of ranked, violable, universal constraints explanis the data, rendering rules unnecessary. Prince and Smolensky (1993) argue that even when a representation cannot satisfy all constraints, the language treats the representation as more well-formed than another representation which violates more highly ranked constraints. They also argue that there are no rules at all involved and that relative ranked constraints alone can explain the data. I will analyse Korean loanwords, in particular the adoption of consonants, by assuming the framework of Optimality Theory can account for these facts clearly.

All of the data comes from Y-S Pae (1976) and Yasuda and Son (1983), though they have been checked with my informants and available dictionaries.[1]

In section 1 I will give some theoretical assumptions and sketch the discussion. In section 2, conditions on syllable structure and phonotactic conditions are discussed and the relative ranking of basic syllable constraints is stated. Section 3 summarizes the data and discusses the way in which Korean adopts English loanwords. In section 4 I rank the remaining constraints and attempt to construct a constraint-based analysis of output forms within Optimality Theory.

1. Theoretical Assumptions

In his discussion of Cantonese loanword phonology, Silverman (1992)

[1] One reviewer correctly points out that the same English loanword may show different characteristics depending on whether they came into Korean directly or indirectly via Japanese. In addition, they may be differently pronounced depending on whether or not the speaker has studied English. I tried to exclude loanwords which may have come into Korean from Japanese for the purpose of my discussion. I expect that generation differences and Japanese influences should be reflected in judgments of the violation of constraints if the differences crucially influence the nature of Korean syllable structures.

argues that there are two steps in the adoption of a loanword: the Perceptional Level and the Operative Level. The output of the Perceptual Level as the input to the Operative Level, which Silverman calls the phonology proper. Following Silverman (1992), the English 'band' [bænd] is perceived as [pan], and this is, in turn, the input to the phonology.

When a language adopts loanwords into its vocabulary, it attempts to bring those words into conformity with its phonology. The attempt may be incomplete, for example, Japanese has many words which feel foreign, such as [di]suko, there[f]on, [ti]ketto, and so on. Korean too accepts unassimilated loanwords, but we will concentrate on the cases which have been properly assimilated. It is assumed that the shapes of loanwords reflect the speakers' knowledge of their language, while the general properties of the language itself regulates the treatment of their structure.

This paper will concentrate on the phonological level and argue that it consists of a set of ranked constraints, all of which are either universal and motivated in Korean. Before going to a discussion of the Korean data, I would like to introduce some theoretical assumptions.

The analysis presented here is constructed within the framework of Optimality Theory as laid out in the work of Prince and Smolensky (1993) and McCarty and Prince (1993a). They assert that there are no phonological rules. Instead, a system of relatively ranked constraints checks all possible output representations for a given input, and assigns degrees of well-formedness to them. The optimal output is then chosen from among the candidates. There are two groups of constraints: highly ranked or inviolable constraints which must be satisfied, and lower ranked or violable constraints which are to be satisfied if possible, but need not be satisfied if a dominant constraint is violated. Schematically, the grammar is like this:

(1) An Optimality-Based Grammar (McCarthy and Prince 1993b)
Gen ($input_i$) = {$cand_1$, $cand_2$……}
Eval ({$cand_1$, $cand_2$……)} → $cand_k$ (the output, given $input_i$)

Gen produces an infinite set of possible output forms for any given input. Eval is a procedure for selecting the optimal output form given a set of output forms and the system of ranked constraints. Universal Grammar specifies the set of constraints Con out of which grammars are constructed. Each language imposes a ranking on the entire universal constraint set

Con.

The function Gen is extremely powerful. It must be constrained by certain principles. McCarthy and Prince (1993b) assumes three principles underlie the theory of Gen.

(2) a. Freedom of Analysis: Any amount of structure may be posited.
b. Containment: No elements may be literally removed from the input form. Every candidate form thus contains the input as an identifiable sub-part.
c. Consistency of Exponence: No change in the exponence of a phonologically specified morpheme is permitted.

Consistency of Exponence requires that epenthetic elements posited by Gen have no morphological status, even when they lie within or between strings with morphemic identity. Containment requires that the underlying representation must be present in any licit candidate.

Prince and Smolensky (1993) outlines Basic Syllable Theory within the Optimality-theoretical approach, arguing that Universal Grammar provides a set of violable constraints on syllable structure and individual grammars fix the relative ranking of these constraints. Their Basic Syllable structure constraints[2] can account for the syllabification of Korean loanwords. Among the Basic constraints proposed by Prince and Smolensky (1993) are Onset and No-Coda which describe the nature of syllable structure (Itô 1986, 1989, 1990, Prince 1985). Following Itô's onset principle, a constraint Onset is formulated as in (3a). A constraint No-Coda is stated as in (3b).

In Korean loanword phonology there is evidence to suggest that it is preferable to avoid a degenerate syllable. For example, 'target' is adopted as /tha:get/ rater than as /tha:getɯ/. Moreover, Korean permits syllables closed by consonants. However, in Optimality Theory the presence of closed syllables in output forms of the language merely indicates that No-Coda is dominated, hence violated. In Korean No-Coda is dominated by PARSE and FILL in (4). We assume, therefore, these two constraints as follows:

[2] See Prince and Smolensky (1993). They lay out their Syllable Theory in chapter 6 and discuss the Lardil syllabification in chapter 7.

(3) a. ONS (ONSET CONSTRAINT)
Syllables must have onsets
b. -CODA (NO-CODA CONSTRAINT)
Syllables must be open

The other basic constraints are those that describe the relation between structure and input:

(4) a. PARSE
Underlying segments must be parsed into syllable strucuture
b. FILL
Syllable positions must be filled with underlying segments

These basic violable constraints are relatively ranked in Korean. Next I will introduce a constraint FAITHFULNESS which plays an important role in evaluating a set of output forms in loanword phonology.

It is desirable for the output of loanword phonology to have similar sound shapes to the original input forms. To indicate and exclude candidates which are not faithful to the original sound shapes I propose a constraint FAITHFULNESS. This FAITHFULNESS is different from Yip's FAITHFULNESS in that this constraint is more loosely defined (Yip 1993: 275).

(5) FAITHFULNESS
Adopt a segment that is as close as possible to the input

Prince and Smolensky (1993) call FAITHFULNESS a package of structural constraints including PARSE AND FILL. Loanword phonology requires that PARSE and FILL in (4) be separated out from FAITHFULNESS for the same reasons presented by Yip (1993). FAITHFULNESS prohibits both deletion and epenthesis. Overparsing initiates the process of epenthesis in order to salvage unsyllabified segments as in 'thrill' [sɯril], while underparsing deletes segments. FAITHFULNESS tries to detect unparsed segments and empty nodes, but epenthesis take place, since FAITHFULNESS must be violated for 'thrill'.

FAITHFULNESS seems to describe a wide variety of segmental phenomena beyond PARSE and FILL violations. Languages including Korean should not accept unlimited featural changes between inputs and possible candidates. This is because a violation of FAITHFULNESS is more serious than a violation of FILL or PARSE. Thus the ranking of the constraints

accounts for the output forms in loanword phonology.

Finally one of the alignment constraints must be incorporated into the ranking scheme. The ALIGN-R constraint is proposed by McCarthy and Prince (1993b). This constraint are defined in (6).

(6) ALIGN-R (A-R): Align (Stem, R, σ, R)

This constraint requires the right edge of all the stems coincide with the right edge of some syllables. Vowel epenthesis in morpheme-final position violates the constraint ALIGN-R.

All of the constraints considered above play an important role in native Korean phonology as well as in Korean loanword phonology. In most cases the interaction of the constraints in the loanword phonology can also account for the optimal representations in the native phonology. In other words, the ranking of this subset of the constraints is consistent with the native phonology. Thus, this demonstrates that loanwords are subject to native constraints.

2. Syllable Structure and Conditions

In this section the phonemes of Korean and permissible codas and onsets are summarized. Phonotactic conditions in Korean are also discussed. Then, in 2. 2, constraints that describe the language-specific nature of syllable structure are formulated.

2.1. Phonemes of Korean

We will start with a brief discussion of Korean phonemes and phonotacitc rules. The consonant inventory of Korean is shown in (7), which is adopted from Kang (1992) with a few slight changes:

(7)[3]	p	t	s	c	k	h	
	ph	th		ch	kh		
	p′	t′	s′	c′	k′		
	m	n			ng		l(r)
			y		w		

[3] In this paper we use some phonemic symbobls which are different from those of international Phonetic Association. The symbols like /p′ / indicate glottal stops, which are called tense consonants. /ph, th/ etc. indicate aspirate stops and the affricate [tʃ] is indicated by /c/. /ng/ indicates the velar nasal /ŋ/.

As is shown in (7), there are no voiced stops in Korean. The maximal syllable in Korean is CVC. There are no complex codas. Following the theories of prosodic and moraic phonolgy, (Itô 1989, 1990 and Hayes 1989), we assume that consonant plus glide clusters are analyzed as branching onsets in Korean. Some of these clusters are excluded by the Obligatory Contour Principle proposed by McCarthy (1986) which prohibits two adjacent occurrence of the same feature or segment. The liquid /l/ and the velar nasal /ŋ/ cannot occur in onset position. /l/ phonetically realizes as [r] between vowels. /l/. Neither /r/ nor /l/ can occur at the beginning of words of Korean origin and Sino-Korean words, owing to morphologically conditioned constraints.[4] However, English loanwords do not obey these native constraints (Pae 1976). All acceptable onsets, except the branching ones (Kang S-K 1992), are listed in (8):

(8) p ph p′ m t th t′ n s s′ c ch c′ k kh k′ w y h l(r)

Some stops and sonorants are permissible as codas. Acceptable codas are listed in (9):

(9) p m t ng n l k

(9) shows that the unaspirated and non-tense phonemes that is the plain stops, the nasals and the liquid /1/ may close syllables in Korean. Stops are unreleased in coda position. The liquid /r/ is realized between vowels.

We assume, along with Kang (1992), that the Korean vowel phonemes are as given in (10):

(10)[5]

i			ɯ	u
	e			o
		æ	ə	
			a	

[4] There are two morphologically conditioned rules in the traditional sense which apply to the initial consonants of a word. One rule applies to the coronal nasal and the liquid, deleting them before the coronal glide /y/ if they occur in word-initial position. The other changes a word-initial liquid into a coronal nasal before back vowels.

[5] In this paper I use the following symbols for vowels:
/æ/ : a front unrounded low vowel
/ə/ : a back unrounded mid vowel
/ɯ/ : a back unrounded high vowel

The diphthongs /ui/ and /oi/ are often realized as /ü/ and /ö/ respectively. Vowels contrast lexically in length in several pairs of words, but their length is phonemically insignificant in most Korean lexical items in the traditional sense (Lee 1984). In the Seoul dialect, word accent plays no role. However, length and accent in English words are relevant at the operative and perceptual levels, respectively, in loanword phonology.

2.2. Conditions

The segments which are licensed as codas or onsets were listed in the previous section. On the basis of the discussion above, I propose constraints concerning segments, which I call CODA-CONDITION (CON-COND) and ONSET-CONDITION (ONS-COND), and a constraint Margin-R which requires that /r/ of the input not be parsed as a coda.

As we have seen in (9), the segments which can stand in Coda position are the plain stops, nasals and /l/. Following the models of feature geometry proposed by Avery and Rice (1989) and developed by Rice (1993), CODA-CONDITION is formulated as follows:

(11) COD-COND:

COD-COND in (11) states that only the voiceless plain stops, nasals and the liquid /l/ may become codas. COD-COND is a dominant constraint. COD-COND has the important consequence in the loanword phonology that unlicensed salient segments in coda position must be parsed and that the resulting degenerate syllables must be saved by epenthesis.

In addition, there is another coda constraint in the loanword phonology

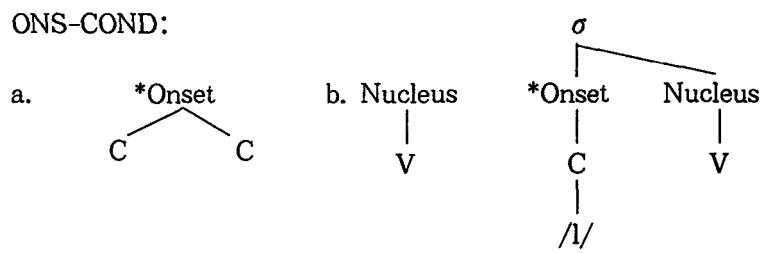
[6] The following abbreviation are used: L=Laryngeal, SL=Supralaryngeal, PL=Place, SV=Spontaneous Voice, N=Nasal, C=Coronal, D=Dorsal, La=Lateral, [son]=sonorant, [con]=consonant, [cont]=[continuant] and R=Root. Rice (1993) provides support for the SV node by discussing the existence of two different processes of voicing assimilation which involove the spreading of the SV node and that of the Voice node, respectively.

that empty and heavy nuclei must not have obstruent codas, as in 'strike' */.sɯt.rai.khɯ./ and 'night' */.nait./, but that empty and heavy nuclei can have sonornat consonant codas. This means that degenerate and heavy syllables must be closed by nasals or /l/. This CODA-CONDITION is formulated as in (12):

(12) COD-COND:
Obstruents must not close degenerate and heavy syllables.

Korean restricts its set of possible complex onsets. Since Korean prohibits a sequence of two true consonants from occurring as an onset, we can formulate the condition in (13a) which excludes all complex (i.e., branching) onsets consisting of a sequence of true consonants. There is another onset constraint given in (13b) which prohibits the occurrence of the liquid /l/ as an onset when preceded by a vowel. Let us formulate ONS-COND as follows:

(13) ONS-COND:



a. Two true consonants clusters must not be in onset position.
b. Intervocalic /l/ must not be an onset.

ONS-COND in (13a) states that consonant plus glide clusters are acceptable onsets in Korean (Kang S-K 1992) and ONS-COND in (13b) forced /l/ to be realized as a geminate intervocalically. ONS-COND is also a superordinate constraint and thus inviolable.

The third constraint restricts possible nuclei. In Korean all nuclei are vocalic. We state the constraint formally below:

(14) a. NUCLEUS (NUC): Nuclei are always vocalic.
b. BRANCHING (BR): Complex nuclei must be parsed into a single σ.

This constraint prevents the occurrence of [+son] consonants as nuclei. NUC is also a dominant constraint. The domain of BRANCHING is a sub-

set of the domain of FAITHFULNESS. We have formulated three inviolable constraints. All of the dominant constraints which were discussed in section 1, are listed in (15).

(15) Superordinate Constraints
ONS-COND, COD-COND, NUC

/r/ in syllable-final position of the original forms is not always deleted in Korean loanwords. The syllable-final /r/ is underparsed, if it occurs in a word-final unstressed syllable, for example, 'cutter' [khəthə]. In other environments, the syllable final /r/ is also underparsed, for example, 'carpet' [khaphit] and 'port' [photɯ]. Failure to parse this /r/ violates PARSE and FAITHFULNESS. Since this underparsing violates two constraints, it will be avoided unless there is some other constraint that compels it. We formulate the relevant constraint so as to require that /r/ not be parsed as a margin in both a stressed syllable and a word-internal coda position. Owing to this parsing of the /r/, these syllables may be perceived as a long vowel in some cases.

(16) *MARGIN-R (M-R)
Syllable-final /r/ must not be parsed as a margin.

It is important to note that the constraint M-R is not violated by forms in which a word-final /r/ of a stressless syllable in the original English does not surface phonetically in the Korean loanword. This is because the word-final /r/ in these forms is unsalient at the perceptual level and cannot be parsed at the operative level, as in, 'burner [pənə]. This lack of saliency depends on the stresslessness of the final syllables in these words. In other words, the word-final /r/ in stressless syllables does not exist at the operative level. Thus the syllablefinal /r/ in underlying representation must be parsed as a nucleus. The domain of Margin-R is a subset of the domain of the FAITHFULNESS constraint. According to Pânini's Theorem on Constraint-ranking (Prince and Smolensky 1993), the violable constraints MARGIN-R and BRANCHING are ranked over FAITHFULNESS, since the former is more specific than the latter.

2.3. Ranking of the Constraints

We will start with the ranking of the five constraints ALIGN-R, ONS,

-COD, FILL and PARSE. Following Prince and Smolensky (1993), let us state the valid ranking for Korean loanword phonology.

In the following discussion, the notation given in (17) is used to simplify representations.

(17) 1) .X. 'the string is a syllable'
2) ⟨X⟩ 'the element X has no mother; is free'
3) [ ] 'a node Ons, Nuc, or Cod is empty'
4) ! 'the violation of the constraint is fatal'
5) % 'the candidate is the optimal output'
6) A ≫ B 'A is more highly ranked than B'

First, I would like to fix the ranking of three basic syllable constraints for Korean. Prince and Smolensky (1993) analyze syllables consisting of a single vowel /V/ to determine which of the constraints ONS, PARSE and FILL is lowest in the constraint ranking of a given language. Korean allows onsetless syllables. Therefore among the three possible rankings that they propose Korean must choose a ranking in which an ONS violation is not fatal. This means that .V. is chosen according to the ranking of the three constraints as the best analysis of /V/ in Korean, as seen in (18). The analysis .V. is the optimal parse of /V/ in a language that does not require onsets. Prince and Smolensky's tableau (1993: 90) is as follows:

(18)

/V/	FILL	PARSE	ONS
.V.			*
⟨V⟩		*!	
.[ ]V.	*!		

The analysis ⟨V⟩ is eliminated by the violation of PARSE and the analysis .[ ]V. is ruled out by the violation of FILL. The violation of the two constraints is fatal because the analysis .V. satisfies both constraints.

The analysis ⟨V⟩ trivially meets ONS, generating no syllable. The analysis .[ ]V. creates a syllable with an empty onset node, leading to epenthesis. If .V. is the best analysis, it is because ONS is the lowest of the three constraints. We cannot decide the relative ranking of the constraints PARSE and FILL from these analyses.

We consider the input /CVC/ in order to determine the relative ranking of -COD, FILL and PARSE. The analysis of /CVC/ exactly corresponds to

the /V/. When /CVC/ is parsed, we have three possible candidates in this case, too. Codas are optional in a language if -COD is dominated by PARSE and FILL. If .CVC. is the optimal output, we have the following tableau in (19a):

(19) a.

/CVC/	FILL	PARSE	-COD
.CVC.			*!
.CV⟨C⟩		*!	
.CV.C[ ]	*!		

Since Korean allows codas, .CVC. is the best analysis. The analyses .CV⟨C⟩. and .CV.C[ ]. are chosen in languages that require open syllables. If .CV⟨C⟩. is the best parse, PARSE is the lowest, then the final consonant is not parsed and thus must be deleted. If .CV.C[ ]. wins, FILL is the lowest and the empty nuclei are filled by epenthesis.

Without any further information, we cannot decide the relative ranking of FILL and PARSE, nor that of -COD and the other constraints. In (20) three possible parsings are shown.

(20)

	PARSE	FILL	-COD
.CV.CVC.			*!
.CV.CV.C[ ]		*!	
.CV.CV⟨C⟩	*!		

Korean loanword phonology says that .CV.CVC. is the best candidate if the final C can become a coda, as in 'target' [tha:get]. In the loanword phonology unsyllabifiable consonants are realized as epenthesized degenerate syllables and thus they are never deleted by Stray Erasure (Steriade 1982, Itô 1989, Wilkinson 1988). For this reason, it is assumed as a first approximation, that the constraint ONS is dominant over -COD in the loanword phonology.

Finally, we must decide the relative ranking of FILL, PARSE and ALIGN-R. In Korean vowel epenthesis is obligatory even in morpheme-final position to avoid the violation of the dominant constraint COD-COND. ALIGN-R must be ranked below PARSE. Since the actual form obeys ALIGN-R at the expense of an a FILL violation, the constraints are ranked ALIGN-R≫FILL, as in, 'film' [phillm]. We can say that Korean has the following ranking of the five constraints:

(21) PARSE ≫ ALIGN-R ≫ FILL ≫ ONS ≫ -COD

The relative ranking of other violable constraints should be determined by examining the loanwords. I will demonstrate in the following section how Korean treats with the unacceptable syllable structure in English loanwords.

3. Data

In this section we will present the data and discuss the strategies that are used to handle English loanwords. In Korean the two strategies are featural change and epenthesis. We rarely find the deletion of segments in the adoption of input.

3.1. Unacceptable Segments

In this section we will take a look at how unacceptable segments are adopted. We will start by discussing fricatives and affricates. Consider the following examples.

(22)	a.	vest	pesɯthɯ	feet	phi(:)thɯ
		virus	pairəsɯ	filter	philthə
	b.	check	chekhɯ	jump	cəmphɯ
		short	syothɯ or syot	side	s'aidɯ
		zero	cero	socket	sokhethɯ or sokhet
		third	tə(:)dɯ	lights	laithɯ

For most young speakers the labio-dental fricatives /f/ and /v/ become /ph/ and /p/ respectively. However, /f/ is adopted as /h/ by the older generation.[7] The fricatives /s/ and /š/ are adopted as /s'/ or /s/ and /sy/, respectively. The affricate /c/ is accepted as /ch/; /ts/ is accepted as /th/; and voiced coronal fricatives and /j/ are adopted as /c/. The inter-dental consonant /θ/ appears in Korean as the coronal stop /t/.

Next consider voiced and voiceless stops. English voiced stops are taken up as plain stops or tense stops, but the plain stops surface as voiced stops intervocalically. English voiceless stops are adopted as aspirates. Some examples are as follows:

[7] This was pointed out to me by an anonymous reviewer.

(23)	pen	phen	body	podi
	time	thaim	hose	hosɯ
	girdle	kə(:)dɯl	goal	k′ol or kol
	guard	k′a(:)d or ka(:)d[8]		

The voiced stops are treated as tense consonants in the word-initial position in some cases, especially by the older generation. I do not know all the reasons for this alteration, but one is that they are pronounced without aspiration.[9] The voiced obstruents in the coda position are adopted as plain stops in the onset position which then are voiced between the nuclear vowel and an epenthetic vowel.

Lastly, we will give a word to liquids. It is important to note that liquids are allowed word-initially in the case of the adoption of English loanwords. Following the FAITHFULNESS constraint, the English word-initial /l/ and /r/ surface in Korean as /l/ or /r/, respectvely. English syllable-final /l/ before onsets is adopted as /l/ and /l/ between vowels is adopted as /ll/ in Korean. The following examples show that this is the case.

(24)	rope	ro(:)phɯ	royal	royal
	merit	merithɯ	alarm	alla(:)m
	lighter	laithə	report	rephothɯ

Whether the loanwords are adopted from British English or from American English, /r/ in the coda position is adopted in the same way. /r/ in the coda position must obey the constraint *M-R.

Here it is necessary to briefly discuss the gemination of the liquid /l/. In loanword phonology, there are no other geminate consonants. The data are listed in (25), with epenthetic vowels underlined.

(25) a.	dollar	t′alla	slang	sɯllæng
	block	pullok or purok		
	helicopter	hellikhopthə or herikhopthə		

[8] In the dictionary Sae Urimal Kheun Sajeon edited by Sin and Sin (1975), all English initial /g/'s are adopted as /k/.

[9] The tense consonants which correspond to voiced stops are not pronounced as a true tense consonants by most speakers who have some konwledge of English, but older speakers may still pronounce them as tense consonants. I am informed that speakers in some region give a preference to the tense consonants.

b. paraffin	pharaphin	siren	s′airen
thrill	sɯril	spring	sɯphuring

The adoption of the intervocalic /l/ as /ll/ results from a native phonotactic condition in Korean. The liquid /r/ is always preserved in onset position in loanword phonology. In 'block' and 'helicopter' /l/ can also be adopted as /r/. This adaptation of /l/ to /r/ will be discussed in section 4. 3.

There is a condition in native Korean phonology that prevents the fricatives and voiced stops of English loanwords from becoming codas. This coda condition forces any final obstruents to change into the corresponding unreleased stops. The application of this condition to loanwords would have the effect of radically eroding their articulatory and acoustic properties. It is noteworthy that the loanword phonology thus avoid fatal violation of COD-COND at the cost of violating FILL so as to maintain their closer acoustic approximation to the input forms.

3.2 Acceptable Syllable Structures

If the English input can be arranged into CV or CVC syllables, it is syllabifiable as in Korean. In words with these acceptable syllables there are no initial or final consonant clusters, and no medial clusters longer than CC.

We begin our discussion about the syllabification of monosyllabic and bisyllabic words. We can easily find relevant examples, some of which are listed in (26):

(26) a.	car	kha(:)	tip	thip
	game	keim	mile	mail
	team	thi:m		
b.	pump	phəmphɯ	napkin	næpkhin
	target	tha:get	time	thaim
	siren	s′airen	volume	pollyum
	total	thothal	shopping	syophing

The English words listed in (26) all are syllabifiable as is in Korean. The stops, nasals and liquids occurring in coda position can become codas. As discussed in section 3. 1, some segments must undergo slight changes in their segment structures to conform with Korean phonemic inventoty, but these words can be arranged into CV(C) syllables in accordance with native syllabification. The examples in (26b) show medial clusters which are made up of permissible coda-onset sequences. They also demonstrate that a

single intervocalic liquid in coda position must be geminated by inserting another liquid in onset position.

It seems that original syllable-final voiceless stops can be incorporated as codas in the Korean syllables. They should be analyzed as syllabifiable segments, since Korean can have unreleased stops in coda position. However, the matter is not so simple. There are counterexamples, as listed in (27). In these examples, syllable-final voiceless stops are adopted as codas or onsets of degenerate syllables (syllables lacking syllable nuclei) in some forms.

(27) a.	bag	pæk	kick	khik
	hip	hiphɯ or hip	gap	k′ æp or kæp
b.	jet	cethɯ	check	chekhɯ or chek
	net	nethɯ	knock	nokhɯ or nok
c.	night	naithɯ	type	thaiphɯ

The forms given above with closed syllables all have short vowels. However, we find that many forms falling into this category appear in Korean as words with two open syllables. The adopted forms with occlusive codas may result from the preference of forms at the perceptual level over those at the operative level, a phenomenon mentioned in Silverman (1992). In (27b) two examples have variants whose voiceless stops are assigned to degenerate syllables. This means that the stop is treated as an unsyllabifiable segment. If these bisyllabic forms are not adopted from Japanese, we can expect that they are subject to the constraint ALIGN-R. We will show that the interaction of constraints can account for the fact that stops are permissible codas in the stage of syllabification and are optionally resyllabified as onsets of degenerated syllables.

3.3. Unacceptable Syllable Structures

In this section we will discuss how unsyllabifiable clusters and segments adapted in Korean have to take up unsyllabifiable consonant clusters and segments. The adoption of fricatives and affricates as codas is shown in 3. 3. 1. True consonant clusters in onset position are treated in 3. 3. 2. and consonant clusters in coda position are discussed in 3. 3. 3.

3.3.1. Codas

Codas in Korean do not contain consonant clusters, fricatives or affri-

cates. We will start our discussion with fricatives and affricates. Consider the following examples. Here and in all examples which follow, epenthetic vowels are underlined.

(28) a.	bus	p′əs′ ɯ	gas	k′as′ ɯ
	dance	t′æns′ ɯ	push	phusi
b.	coach	khochi	change	cheinji
	page	pheiji		

The English forms in (28) have fricatives or affricates in the word-final position. These obstruents can become onsets, but they cannot occur in coda position. They are assigned to degenerate syllables which then undergo epenthesis. Overparsing is the only method in Korean for adopting fricatives and affricates as codas in word-medial position including word-final coronal fricatives and affricates, as shown in (29).

(29) a.	basket	pasɯkhet	instant	insɯthanthɯ
	cosmos	khosɯmosɯ		

I adopt the prosodic theory of Itô (1989), in which epenthesis is an intrinsic part of the process of syllabification, as suggested by the requirement that every syllable needs a nucleus for proper licensing. The usual epenthetic vowel is /ɯ/, although there is some harmony with palatals and labials: for example, tape /theiphu/, switch /sɯwichi/, and so on.

3.3.2. Initial Clusters

Korean has no initial clusters other than those consisting of a consonant plus coronal glide clusters. As with all other unsyllabifiable segments, unacceptable initial clusters are adapted in Korean through epenthesis. In Korean unsyllabifiable consonants are never deleted in this case. Epenthesis is found without exception in all unlicensed initial consonant clusters, as shown in (30).

(30)	scandal	sɯkhændal	stress	sɯthɯresɯ
	snow	sɯno	spike	sɯphaikhɯ
	smog	sɯmok		

In (30) the cotonal fricative /s/ is assigned the degenerate syllable and rescued by the epenthetic vowel /ɯ/.

The same strategy of syllabification as that seen in (30) is applied to the other initial consonant clusters. In (31b), the obstruent-liquid /l/ clusters are split into two syllables by epenthetic vowels, and the consonant plus /r/ clusters are adapted in Korean by creating the initial epenthetic syllables. The intervocalic liquid must be implemented as a geminate, which is dominated by both the onset node and its preceding coda. The data in (31) shows how these clusters are adopted.

(31) a.	switch	sɯwichi	sweater	sɯwethə
b.	bridge	puriji	plan	phullæn
	dress	tɯresɯ	slice	sɯllaisɯ

In (31a), coronal obstruent plus velar glide clusters are taken up by assigning degenerate syllables to the coronal obstruents which are then epenthesized in the loanword phonology.

3.3.3. Final Clusters

Final clusters are dealt with in one of two ways, depending on whether the first consonant of the cluster can become a coda or not. If the first consonant is a possible coda, it can close a syllable with a short vowel, and the vowel /ɯ/ is epenthesized after the other consonant. Some relevant examples are listed in (32).

(32)	tank	thængkhɯ	pickup	pikəp
	belt	pelthɯ	lamp	lamphu
	sense	sensɯ		

Note that the final /k/ functions as a coda. This suggests that stops are allowed to be codas in this environment. It is also noted that the liquid /l/ is not geminated before a consonant. In the above examples, syllabification creates the first syllable closed by a sonorant, and the one or two final stops in the second syllable create separate open syllables through epenthesis.

More specifically, if the first member of the cluster is not a possible coda, the syllabification builds either one or two degenerate syllables over the final cluster. If the second consonant is a possible coda, epenthesis inserts a vowel to its lift as seen in (33a). However, if neither the first nor the second member of the cluster is a possible coda, double epenthesis occurs, as shown in (33b).

(33) a. prism phurijɯm hurdle hədɯl
curtain khəthɯn film phillɯm
b. post phosɯthɯ text theksɯthɯ

4. Constraint Interaction

In the previous section I have shown that unacceptable segments in the input must undergo featural changes and that degenerate syllables must be rescued by epenthesis. Both strategies are used to create output forms that are both well-formed according to Korean phonotactics and as close as possible to the perceived input.

In Optimality Theory (Prince and Smolensky 1993), languages select the most harmonic well-formed structure for any given word. There are no phonological rules. Instead, the interaction of the constraints in a given language automatically chooses the optimal member from a set of candidates. There are dominant constraints which must be satisfied, and lower ranked constraints which are violable. It is not the number of the violations which is relevant to the choice of the optimal output, but rather the rank of the constraints violated.

I would like to tentatively propose that Korean loanword phonology has the following set of ranked constraints:

(34) Superordinate: COD-COND, ONS-COND, NUC ≫
M-R, BR ≫ FAITHFULNESS ≫ PARSE ≫
ALIGN-R ≫ FILL ≫ ONS ≫ -COD

This ranking of the constraints will be discussed in the following section.

The optimal candidate is the one that survives the longest, even though it may not be perfect. For example, the input 'gas' has a number of possible output forms. To assess the different candidates, we use the following tableau.

(35)

'rope'	DOM	BR	FAITH	PARSE	A-R	FILL
% .ro:.ph[ ]			*		(*)	(*)
.ro⟨o⟩.ph[ ]			*	*!		
.ro:p.	*COD-COND!					

/ro:ph[ ]/ is the optimal output and the empty nuclear node surfaces as

the epenthetic vowel [u], in [ro:phu]. Both /roph[ ]/ and the optimal output violate FAITHFULNESS, but the candidate /roph[ ]/ is ruled out because it violates the higher-ranked constraint PARSE, and is thus worse than /ro:ph[ ]/, which violates the non-dominant constraints FAITHFULNESS, A-R and FILL. /ro:p/ is eliminated by a violation of COD-COND in (12), since the final /lc/ cannot become a coda of the syllable with a nucleus consisting of a long vowel. The evaluation of failed candidates by lower-ranked constraints is irrelevant.

4.1. Syllable-final /r/

As discussed in section 2.2, words with a salient (i.e., non-word-final /r/) in the original forms are adopted as forms with heavy nuclei. This phenomena was accounted for by positing the superordinate constraint MARGIN-R. The MARGIN-R analysis implies that the syllable-final /r/ be parsed as a nucleus. However, the word-final /r/ in stressless syllables is simply deleted at the perceptual level and the vowel before the word-final /r/ is realized as /ə/ in /khəthə/. In this section I will show that this analysis is indeed appropriate and establish the relative ranking of MARGIN-R.

Let us examine the following relevant forms:

(36)	short	syo(:)thu̲ or syot	car	kha(:)
	target	tha(:)get		
	cigar	siga(:)		

It is actually possible to omit the syllable-final /r/ from syllable structure in /kar/ while keeping the output bimoraic, by implanting an empty slot to replace the parsed /r/ in the nucleus. This augmentation analysis seems likely because the structure occurs independent of other stems. That this analysis is correct implies that the violation of FILL by /kha[r]/ is better than the violation of M-R incurred by /khar/. Consider the following constraint tableaux:

(37)

'short'	DOM	M-R	FAITH	PARSE	A-R	FILL
1% .syo[r].th[ ]			*		(*)	(**)
2 .syor.th[ ]		*!	(*)		(*)	
3 .syo[r]t.	COD-COND*!		*	*!		
4 .syo⟨r⟩t.						

'car'						
5% .kha[r]						*
6 .khar.		*!				
7 .kha.⟨r⟩				*!		
'target'						
8% .tha[r].get.						*
9 .tha[r].ge.th[ ]			*!			(**)
10 .thar.get.		*!				
11 .tha⟨r⟩g.et.	*COD-COND!					
12 .tha⟨r⟩.get.			*!			

(37) is constraint tableaux that illustrate some possible output candidates for each of four forms in (36). Our tentative ranking serves to distinguish between the optimal parse and the other candidates. This ranking encodes the fact that it is better to augment the nuclei, violating FILL, than to simply truncate the /r/.

When an output form satisfies M-R, as in /.syo[r].th[ ]/, optimality is relatively readily established for that output. In the first example (37.1), FILL and A-R are marked as violated in the optimal parse because of overparsing of /th[ ]/. The optimal form for 'short' also violates FAITHFULNESS. The constraint interaction between A-R and PARSE is shown in the candidates (37.1) and (37.4). A syllable with bimoraic nuclei which is closed by a stop violates a dominant constraint COD-COND as in /.syo [r]t./ because heavy syllables must not be closed by obstruents. That the form (37.4) is not the optimal form indicates that PARSE must be ranked over A-R.

A monosyllabic monomoraic output is possibly produced in the example (37.7). This form violates the constraint PARSE, and is thus ruled out, since the form (37.5) violates a lower ranked FILL only. The optimal form for 'car' includes a FILL violation which is not fatal. The optimal parse satisfies COD-COND because of its open syllable.

In the third example, the optimal form (37.8) has no violation mark. The form (37.10) and (37.11) violate M-R and the inviolable constraint COD-COND, respectively. Both the candidates (37.9) and (37.12) have the violation mark *FAITHFULNESS. These two candidates are eliminated because the optimal candidate does not violates any higher-ranked constraints.

The tableaux in (37) show that all the constraints are violable, but the

constraints M-R, FAITHFULNESS and PARSE play a decisive role in order to pick up the optimal candidates.

4.2. Unacceptable Segments

In section 2.3 and 4.1 we examined the interaction among some constraints, determining a set of relative dominance relations. In the following section we will determine whether the hierarchy of constraints in (36) can account for the facts of Korean loanword phonology. We will consider the loanwords and verify that the parses deemed optimal by this ranking of the constraints are indeed the ones used in actual speech. To verify that constraint rankings create the correct output, it is necessary to show that all failed output candidates are worse than the actual form.

First, let us consider input which includes unacceptable segments. Korean must adopt these English segments by using Korean phonemes, which are often different from the original English. The phonemes closest to the English ones are chosen but many of the English segments may change featurally. Thus, the segment structures are regularly and superficially affected. I assume that these featural changes do not violate FAITHFULNESS while deletion and epenthesis do. The examples in section 3 are stated again for convenience.

(38) homesick homsik virus pairəsɯ jump cəmphɯ
girdle kə(:)dɯl guard ka(:)dɯ

Some of the examples in (38) are treated in the following tableaux:

(39)

'homesick'	DOM	FAITH	PAR	A-R	FILL
1 .hom.s′ ik.		*!			
2% .hom.sik.					
3 .homs.ik.	*COD-COND!				
'jump'					
4% .cəm.ph[ ]		*		*	*
5 .cəmp.	*COD-COND!				
6 .cə.m[ ].ph[ ].		*		*	**!
7 .cəm.⟨p⟩		*	*!		

'girdle'					
8% .kə[r].d[ ]l.		*			**
9 .kə[r].dl[ ].	*ONS-COND!				
10 .kə[r].d[ ].l[ ].		*		*!	(***)
11 .kə[r]d.l[ ]	*COD-COND!				
'virus'					
12 .pai.rəs.	*COD-COND!				
13% .pai.rə.s[ ].			*	*	*
14 .pair.s[ ].		*!		(*)	
15 .pai[r].s[ ].			*	*	**!

In the examples in (39) the constraint COD-COND comes into play and as shown by the mark *COD-COND!, it rules out some candidates. In the first example, the form (39.2) is chosen as the most harmonic parse because the candidate (39.1) violates FAITHFULNESS, while the candidate (39.3) is ruled out by the violation of the superordinate constraint COD-COND. The two competitors (39.1) and (39.2) pose a problem. If the constraints are only allowed to look at syllable structure, there is no distinction between these two candidates. In order to complete the analysis, we must explain why the feature change in (39.1) violates FAITHFULNESS. If there are two or more possible segments chosen for a English segment, the constraint FAITHFULNESS selects a segment whose structure is minimally affected. In the case of 'homesick', /s′/ in /homs′ik/ (39.1) undergoes more featural change than /s/ in /homsik/. Thus (39.1) violates FAITHFULNESS. Given that these feature changes are permitted, we must then ask why some speakers choose /homs′ik/. The answer plausibly lies in a more extended version of FAITHFULNESS which covers conventional pronunciations or dialects.[10]

[10] English word-initial voiced obstruents are adopted either as tense obstruents or plain obstruents. In some words which were recently adopted, speakers tend to pronounce them as plain consonants, e.g. 'guard' [ka(:)d]. However, other English loanwords which are more fully absorbed into the Korean vocabulary have initial tense obstruents, such as in 'bus' [p′əsɯ]. In the case of 'bus', however, the output /pəsɯ/ may be the optimal form. We may formulate two constraints *p′/b and *p′/b as a family of the constraints FAITHFULNESS, and in young speakers *p′/b is ranked over *p/b.

In the second example in (39), 'jump', the optimal parse (39.4) has the marks, *FAITHFULNESS, *A-R and *FILL. The form (39.6) has two overparsed segments and violates FAITHFULNESS, A-R and FILL twice. In both candidates the marks *FAITHFULNESS, *A-R and one mark *FILL are canceled by convention, and one mark *FILL left in (39.6) is a fatal violation. Thus, the optimal parse (36.4) survives. When the optimal form is compared with the output (39.7), the relevant marks are *FILL and *PARSE because of the cancellation of the mark *FAITHFULNESS. The FILL violation in the optimal form is not worse than the PARSE violation in (39.7). Thus, the candidate (39.7) is ruled out. To avoid the higher mark *PARSE, the final segment has to be parsed as an onset. If the constraint PARSE is dominant over FAITHFULNESS, the analysis gives the incorrect prediction that the candidate /cəm.⟨p⟩/ (39.7) is optimal. I conclude that it is possible to establish the ranking in (31).

As shown in (39.8-11), the form (39.9) is eliminated by the violation of top-ranked ONS-COND and the output (39.11) is ruled out by violating COD-COND. The mark *FAITHFULNESS of both (39.8) and (39.10) is canceled by convention, but an A-R violation in the candidate (39.10) is more serious than a FILL violation in the form (39.8). Thus the form (39.10) is excluded and the form (39.8) is chosen as the optimal candidate.

In the last example, the candidate (39.12) violates the superordinate constraints COD-COND. To satisfy COD-COND the fricative /s/ must be parsed as an onset. The constraint M-R is violated if the liquid /r/ is parsed as a nucleus, as in the output (39.14). Since M-R ranks higher than FAITHFULNESS, the form (39.14) is ruled out. The candidates (39.15) and (39.13) violate FAITHFULNESS, A-R and FILL. The marks *FAITHFULNESS and *A-R of these candidates are cancelled, but the form (39.15) violates FILL twice while the form (39.13) has one mark *FILL. Thus one mark *FILL of the form (39.15) is left and it is fatal. The form (39.15) is ruled out and the candidate (39.13) is chosen as the optimal output.

4.3. Gemination

In this section we will discuss loanwords containing geminated /l/.
I take some examples from the data discussed in section 3.

(40) a.

helicopter	hellikhopthə	block	pullok or purok
belt	pelthɯ	prism	phurijɯm
film	phillɯm		

These examples include unsyllabifiable segments. The discussion of these segments will not be presented here, as it is not relevant to the matter at hand.

Consider the following constraint tableaux in (41). From now on I will omit some irrelevant constraints and any irrelevant violations of lower ranked constraints.

(41)

'block'	DOM	FAITH	PAR	A-R	FILL
1 .p⟨l⟩ok.		*	*!		
2 .plo.kh[ ].	*ONS-COND!				
3 .p[ ].lok.	*ONS-COND!				
4% .p[ ]l.lok.		*			*
5 .p[ ]l.lo.kh[ ].		*		*!	
6 .p[ ].rok.		**!			
'film'					
7 .phil.m[ ].		*		*!	
8 .phi.l[ ]m.	*ONS-COND!				*
9% .phil.l[ ]m.		*			
'prism'					
10 .phri.s[ ]m.	*ONS-COND!				
11 .ph[ ].ri.sm.	*ONS-COND!				
12% .ph[ ].ri.s[ ]m.		*			**
13 .ph[ ].ris.m[ ]	*COD-COND!				
14 .ph[ ].ri.s[ ].m[ ].		*		*!	
15 .ph[ ].ri.[ ]sm	*COD-COND!				

In the examples in (41), the first member of the consonant cluster is overparsed to avoid the fatal mark *ONS-COND. If one of the elements of these clusters is underparsed, the output with unparsed segments incurs the marks *FAITHFULNESS and *PARSE. With the candidates (41.1-5), parsing the initial cluster as an onset violates ONS-COND. Parsing /l/ only as an onset in (41.3) also violates ONS-COND because the parsing creates

an intervocalic onset /l/. To avoid the violation of ONS-COND, /l/ must be parsed as a geminate which functions as an ambisyllabic segment, as in (41.4) and (41.5). The mark *FAITHFULNESS is canceled, but a violation of A-R in (41.5) is fatal. A violation of PARSE is worse than a violation of FILL. Thus, the form (41.4) is optimal, despite the violation of FILL.

It must be noted that a form /.p[ ].rok./(41.6) is also a possible candidate, as shown in section 3. According to the constraint tableau, the /.p[ ]. rok./ has the marks **FAITHFULNESS twice and *FILL while the form (41.4) violates FAITHFULNESS, FILL and -COD. In the candidate /p[ ]rok/ FAITHFULNESS is violated by the overparsed segment and /r/. Thus our analysis argues that the form (41.4) is optimal, but that the form /p[ ]rok/ sometimes survives when speakers prefer avoiding the violation of the constraints ONS-COND and -COD to violating FAITHFULNESS.

The constraint A-R plays a role in determining the optimal form in (41.7 -9). The form (41.8) is ruled out by the violation of ONS-COND. The candidate (41.7) has the marks *A-R and *FAITHFULNESS, while the output (41.9) violates FAITHFULNESS only. Thus the form (41.9) wins.

In the last example the optimal form has the mark *FAITHFULNESS and the competitor (41.14) also has the mark *FAITHFULNESS. Their marks are canceled. Since A-R is ranked higher than FILL, we can simply choose the form (41.12) as the best parse.

We return to the question of why the gemination of the liquid /l/ is required. The constraint tableau (41.7-9) suggests that the liquid would have to be geminated to satisfy the constraint ONS-COND. In the loanword phonology the liquid is allowed word-initially, but it cannot occur intervocalically. If the intervocalic single liquid /l/ is allowed to be parsed, the output fatally violates the constraint ALIGN-R.

By the constraint tableau I can account for the optimal output without phonological rules.

4.4. Monosyllabic Words

In this section I will try to explain, using constraint interaction, why some monosyllabic bimoraic forms have corresponding bisyllabic variants.

Again take some examples from the data presented in section 3, again.

There are many monosyllabic English words. If borrowed, many of them can be properly syllabified as monosyllabic words, but there are forms

which must undergo epenthesis. Consider the following examples:

(42) a.	bag	pæk	tip	thip
b.	shock	syok or syokhɯ	hip	hiphu or hip
c.	light	laithɯ	game	keim
	town	thaun		

First let us consider the examples in (42a) and (42b). The forms 'gap' and 'hip' are analysed below in the tableaux (43):

(43)

'bag'	DOM	FAITH	PARSE	A-R	-COD
1% .pæk.					(*)
2 .pæ.kh[ ].		*!		(*)	
3 .pæ.⟨k⟩		*!	(*)		
'hip'					
4% .hip.					(*)
5 .hi.ph[ ]		*!		(*)	
6 .hi.ph	*NUC!				
7 .hi.⟨p⟩		*!	(*)		

Satisfying the dominant constraint NUC requires that a second syllable with at least one empty nucleus node be supplied. The optimal parse (43.1) violates -COD. If we attempt to avoid the mark *NUC, the outputs (43.2) and (43.3) violates the higher ranked constraint FAITHFULNESS. The optimal pares survives, in spite of the violation of -COD.

The examples in (42a) have stops in coda position, but the examples in (42b) show that the final consonants of the input may alternatively be syllabified as degenerate syllables, though the input forms have the same syllable structure in both of the examples. The question which we must consider is why two variants can sometimes be produced and accepted, as seen in (42b).

Let us consider the candidates (43.4-7) in the tableau. One of the actual output forms /hi.ph[ ]/ is ruled out as a FAITHFULNESS violation, since FAITHFULNESS is ranked higher than -COD. It is apparent that Optimal Theoretic analysis is making an incorrect prediction about the syllabification of monosyllabic stems. However, it would also be inconsistent with the data to suppose that the output /pæ.kh[ ]/ is the most harmonic

parse for the form 'bag'. Before giving up on the constraint tableau for giving an incorrect result, let us consider this problem in view of preferable word structure and the influence of Japanese loanwords in Korean.

In Hirano (1994), I argued that Korean prefers bisyllabic prosodic word structure. In KBS's (1993) Korean pronunciation dictionary only 0.76% of all words cited are monosyllabic. Furthermore, as Yip (1993) points out, the constraint FAITHFULNESS plays no role in the constraint interaction in native phonology. For this reason we can safely say that outputs like (43.2) result from the speakers' attempt to produce the stable bisyllabic structure and that they survive in spite of the violation of FAITHFULNESS due to the implementation of the preferable bisyllabic structure. That is, in the adoption of some monomoraic words, FAITHFULNESS is violated under the influence of native propensity.

There is another reason for accepting the bisyllabic output. Korean borrowed many loanwords through Japaness, including bisyllabic words. In Japanese the words are adopted with open syllables. The open syllables of these words were not resyllabified and remain open. However, I do not know exactly how strong this Japanese influence is.

There is a further point which needs to be clarified. When we examine the examples in (42c), we notice that two forms surface as bisyllabic while the other two forms surface as bimoraic monosyllabic. The output forms with heavy nuclei in (42c) are analysed in the following tableaux.

(44)

'light'	DOM	BR	FAITH	A-R	FILL	ONS
1 .la.ith.	*COD-COND!					
2 .lait.	*COD-COND*!					
3% .lai.th[ ]			*	*	*	
4 .la.i.th[ ]		*!				
5 .la.it.		*!				
'game'						
6 .ke.im.		*!				
7 .kei.m[ ]			*!			
8% .keim.						
9 .ke.i.m[ ]		*!				

In the first example, the competition between the form (44.2) and the opti-

mal output (44.3) shows the correct ranking of BR as higher than FAITHFULNESS. To avoid the mark *COD-COND, the final consonant /t/ must be parsed as the onset of a degenerate syllable, as exemplified in (44.3) and (44.4). Parsing of a diphthong as two nuclei of separate syllables violates the higher-ranked constraint BR, as in (44.4) and (44.5). To avoid the violation of FAITHFULNESS the candidates (44.5) violates the constraint BR. The candidate (44.3) is chosen as the optimal output, despite the mark *FAITHFULNESS. BR requires that a diphthong as well as a long vowel be parsed as a heavy nucleus.

In the second example, the form (44.6) and (44.9) violate the constraint BR, since the diphthong is separated into two different syllables. Overporsing the final nasal incurs the cost of violating FAITHFULNESS and FILL. The candidate (44.8) is picked up as the optimal parse.

4.5. Consonant Clusters

In this section we will briefly see how unsyllabifiable consonant clusters are adopted and syllabified. In (45) are examples including stem-initial, medial, and stem-final consonant clusters.

(45)	basket	pasɯkhet	scandal	sɯkhændal
	stress	sɯthɯres	sweater	sɯwethə
	text	theksɯthɯ		

The examples in (45) are analyzed in the following tableaux:

(46)

'basket'	DOM	FAITH	PAR	A-R	FILL	ONS	-COD
1 .pas.khet.	*COD-COND!						
2 .pa.skhet.	*ONS-COND!						
3% .pa.s[ ].khet.		*			*		
4 .pa.s[ ].khe.th[ ]		*		*!			
5 .pa.s[ ].khe.⟨p⟩		*	*!				
'scandal'							
6 .skhæn.dal.	*ONS-COND!						
7 .s[ ].khænd.al.	*COD-COND!						
8% .s[ ].khæn.dal.		*			*		
9 .s[ ]k.æn.dal.		*			*	*!	

'stress'							
10 .st[ ].res.	*ONS-COND! *COD-COND!						
11 .s[ ].thr.e.s[ ]	*NUC!						
12% .s[ ].th[ ].re.s[ ]		*			*		
'sweater'							
13 .swe.thə	*ONS-COND!						
14 .s[ ].wet.		*			*		*!
15% .s[ ].we.thə		*			*		
'text'							
16 .thek.s[ ]t.	*COD-COND!						
17 .the.kh[ ].s[ ].th[ ].		*		*		***!	
18% .thek.s[ ].th[ ].		*		*		**	

Most striking here is that any attempt to avoid the mark *FAITHFULNESS fatally violates top-ranked COD-COND or ONS-COND. The optimal output (46.18) is the one with the fewest violations of FILL in the candidates (46.16-18).

In the first example, the output (46.4) violates A-R and the output (46.5) violates PARSE. The output (46.3) has the mark *FILL. The marks *FAITHFULNESS of these output forms are canceled by convention. The candidates (46.1) and (46.2) are ruled out by a violation of the highest-ranked COD-COND and ONS-COND, respectively. Since FILL is ranked lower than A-R and PARSE, the form (46.3) is optimal.

In the tableaux (46.6-9) and (46.13-15) the competitors have the marks *FAITHFULNESS and *FILL, which are canceled. The only way to avoid the fatal mark ONS is to parse the second member of the cluster as an onset in 'scandal', while /th/ must be parsed as an onset to avoid the violation of -COD. Thus the forms (46.8) and (46.15) are picked up as the optimal outputs, since they satisfy ONS.

All the candidates of the input 'stress' except the optimal form (46.12) violate the superordinate constraints. Gen cannot provide a good competitor in this case.

5. Conclusion

I have argued that the syllabification of Korean loanwords is subject to hierarchically ranked constraints of the loanword phonology of the host language and that the optimal candidate for a given input form is chosen from a set of candidate output by a system of ranked constraints. This constraint -based analysis dispenses with phonological rules. We have seen the way that the ranked constraints proposed in this analysis distinguish between the most harmonic output and other candidates for a given word in Korean loanword phonolgy. This explanation offered here gives support to constraint-based syllable theory (Prince and Smolensky 1993).

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Department of Linguistics
Tohoku University
Kawauchi Aoba-ku
Sendai, 980
JAPAN