Phonological Constraints and Korean Loanword Phonology

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Keywords: constraint rankings, Optimality, Loanword,
Harmonious structure, Faithfulness

0. INTRODUCTION

Yip (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 have to be made to meet conditions. Since the speaker is trying to adopt the word as close to its original form as possible, minimal featural changes, epenthesis and deletion will occur only in a quite restricted way. This paper will examine loanwords borrowed from English into Korean from this point of view. Korean has a simpler syllable structure than English, and most loanwords require adjustment to conform to Korean syllable structure constraints. We will argue that no rule at all are involved and that the relative ranked constraints can explain the data. We will work within Optimality Theory presented by Prince and Smolensky (1992). They propose that representations change only if the change creates more harmonious structures. This approach is generally well-known as Harmonic Phonology (Goldsmith (1990, 1992) and Paradis (1988)). Prince and Smolensky argue that when a representation cannot satisfy all the constraints the language treats the representation as more well-formed than another which

violates more highly ranked constraints. I will work out this approach of Optimality Theory to Korean loanwords, in particular the adoption of consonants.

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

1.0 Syllable Theory

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

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, or motivated in Korean. In loanword phonology it is epenthesis which is only used to rescue unsyllabifiable segments, such as final /s/, and we also see segments which are only allowed in loanwords.

Our analysis is constructed within the framework of Optimality Theory as laid out in the work of Prince and Smolensky (1992). They assert that there are no phonological rules. Instead, a set of relatively ranked constraints checks all possible output representations for a given input, and assigns degrees of well-formedness to them; the optimal member is chosen from among the representations as

the optimal output. There are two groups of constraints: highly ranked or inviolable constraints are ones must be satisfied, and lower ranked or violable constraints is satisfied if possible, but need not be satisfied if a dominant constraint is violated.

Prince and Smolensky (1992) outlines the Basic Syllable Theory within the Optimality-theoretical approach, and they argue that Universal Grammar provides a set of violable constraints on syllable structure and individual grammars fix relative ranking of these constraints. Their Basic Syllable structure constraints[1] can be fundamentally applied to the syllabification of Korean loanwords. Among the Basic constraints proposed by Prince and Smolensky (1992), are Onset and -Coda constraints which describe the universally unmarked nature of the structures. In Korean loanword phonology there is evidence to suggest that it is preferable to avoid a degenerate syllable even if it can be rescued by epenthesis. It is suggested that instead of the constraint -Coda, the marked constraint Coda should be incorporated into a set of the constraints that will be proposed here. Now we may state two constraints as follows:

(1) a. ONS (ONSET CONSTRAINT)
Syllables must have onsets

b. COD (CODA CONSTRAINT)
Syllables must have a coda

The other basic constraints are those that constrain the relation between structure and input.

(2) a. PARSE
Underlying segments must be parsed into syllable structure

b. FILL
Syllable positions must be filled with underlying segment

These basic constraints are relatively ranked in Korean. Korean also has other language particular constraints,

including ONSET-CONDITION, CODA-CONDITION, FAITHFULNESS and so on. These constraints will be discussed in detail in the following section. Some of them will be fixed in superordinate position. This means that the violation of such constraints is fatal. If two input forms violate the same constraint, the violations are canceled and the better form is the one with no lesser violation or the lower ranked lesser violation.

The output of the loanword phonology must meet well-formedness conditions of Korean syllables which consists of a set of dominant constraints. 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 FAITHFULNESS is proposed as a constraint. This FAITHFULNESS is different from Yip's FAITHFULNESS in that this constraint is narrowly defined (Yip 1993:275).

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

FAITHFULNESS prohibits both deletion and epenthesis. Overparsing exerts the process of epenthesis in order to salvage unsyllabified segments. The ranking of the constraints accounts for the output forms in the loanword phonology.

A constraint Maximal Syllable (MAXSYLL) is proposed which describes the largest possible prosodic syllable structure in Korean. Hirano (1994) has argued that the maximal syllable structure in Korean is a bimoraic nucleus plus a sonorant consonant. He have also argued that the preferable word structure is bi-syllabic (See Hirano 1994). A constraint Minimal Word (MINWD) on word structure is formualted as (4b).

(4) a. MAXSYLL: $[\mu\mu C]_{\sigma}$ (R, SON)　　b. MINWD: $[\sigma\sigma]_{PW}$

Where PW stands for Prosodic Word.

The constraint MAXSYLL requires that a nucleus, vowel + /r/, and diphthongs be long and that long, open syllables do not become closed, unless a syllable-final consonant is specified for the Sonorant node. The MAXSYLL is enforced by Weight-by-Position (Hayes 1989, Archangeli 1991). The conspiracy of the two constraints, MINWD and FAITHFULNESS, may account for possible variants in the output. We will defer the relative ranking of these constraints to section 4.

The universal constraint on syllable structure proposed by Prince and McCarthy (1986) and Prince and Smolensky (1992) must be taken into consideration. This constraint is called Foot Binarity (FTBIN) and it states that feet are binary at some level of analysis (μ, σ). The Prosodic Word must contain at least one foot. A foot consists of two morae or more. From this general characteristic of feet it is claimed that lexical words are minimally bimoraic. In Korean preferable syllable structure is bimoraic; hence the constraint FTBIN is also applicable to Korean syllable structure and may be undominated. We notice that FTBIN properly include the constraint MINWD in (4), as seen from the definition. However, MINWD should be preserved in the loanword phonology.

All of the constraints may 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. The ranking of this subset of the constraints is consistent with the native phonology. Thus this demonstrates that loanwords are

subject to native constraints.

2.0 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 will be formulated.

2.1 Phonemes of Korean

We will start with a brief discussion of Korean phonemes and phonotactic rules. The consonant inventory of Korean is shown in (5):

(5)[2]

p	t	s	c	c^w	k	k^w	h	h^w
p'	t'		c'		k'			
pp	tt	ss	cc		kk			
m	n				ng		r(l)	
		y			w			

As is shown in (5), there are no voiced stops in Korean. The syllable in Korean is maximally CVC. There are no complex codas. The three consonant plus glide clusters /k^w, c^w, h^w/ should be treated as a single consonant, but the other consonant plus coronal glide clusters are analysed as branching onsets. 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. A liquid /l/ and a velar nasal cannot occur in onset position. /r/ occurs between vowels and serves as an onset. Thus /r/ is complementarily distributed with /l/. Neither /r/ nor /l/ can occur at the beginning of a word in native phonology.[3] Glides and /h/ are possible onsets. All acceptable onsets except the branching ones are

listed in (6):

(6) p p' pp m t t' tt n s ss c c' cc k k' kk w y h r
c^w k^w h^w

Some stops and sonorants are permissible as a coda. Acceptable codas are listed in (7):

(7) p m t ng n l k

(7) shows that the unaspirated, non-tensed or plain stops, nasals and the liquid /l/ may close syllables in Korean. Stops are unreleased in coda position. The liquid can be realized only before other consonants and as a geminate.

The Korean vowel phonemes is given in (8):

(8)[4]

i	ï		u
e			o
æ		ô	
	a		

Diphthongs /ui/ and /oi/ are often realized as /ü/ and /ö/ respectively. The vowels contrast lexically in length in several pairs of words, but their length is phonemically insignificant in most Korean lexical items. In the Seoul dialect, word accent play no role and is not relevant to this paper.

When a language adopts loanwords into its vocabulary, it attempts to bring those words into conformity with the phonology of the language. The attempt may be incomplete, for example, Japanese has many words which produce a feeling of foreignness, such as [di]suko, tere[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, and general properties of the language itself regulate the

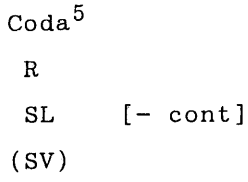
treatment of their structure.

2.2 Conditions

The segments which are licensed as codas or onsets were listed in the previous section. On the basis of our discussion, constraints concerning segments are formulated, which are called CODA-CONDITION (COD-CON) and ONSET-CONDITION (ONS-CON), and a constraint Free-R is proposed which requires that /r/ of the input be not parsed in Coda position.

As we have seen in (7), the segments which can stand in Coda position must have the following segment structure.

(9) COD-CON:



COD-CON requires that voiceless plain stops, nasals and the liquid can become codas. COD-CON is a dominant and inviolable constraint and must be highly ranked. COD-CON has the serious consequence in the loanword phonology that unlicensed salient segments in codas must be parsed and that the resulting degenerate syllables must be saved by epenthesis.

Korean restricts the set of possible complex onsets. If we assume that /ky/, /kw/, etc., are palatal-velar and labial-velar, respectively, we can simply state ONS-CON as the prohibition of a complex onset, *COMPLEX ONSET. However, as discussed in 2.1, it is obvious that unsurfaced consonant plus glide clusters exclusively consist of the combination of a consonant plus a velar glide. Thus we can formulate a condition in (10a) which accounts for all possible complex onsets consisting of a consonant plus a

coronal glide. We conclude that these clusters are complex onsets. There is another onset constraint which prohibit the occurrence of the liquid /l/ preceded by a vowel as an onset. We formulate ONS-CON as follows:

(10) ONS-CON: *Onset　　*Onset

C　C [-con]　　V　C　V

Cor　　/l/

ONS-CON does not allow branching onsets which consist of two obstruents. ONS-CON is also a superordinate constraint and thus inviolable.

The third constraint restricts possible nuclei. In Korean nuclei are vocalic. We state the constraint simply in formal form below:

(11) NUCLEUS (NUC): Nuclei are always vocalic. Empty nuclei must not have obstruent codas.

This constraint rejects the occurrence of [+son] consonants nuclei and degenerate syllables closed by obstruents. NUC is dominant and inviolable. We have formulated three superordinate constraints. We cannot rank these three constraints and therefore they are not crucially dominated in the ranking. All the superordinate constraints including FTBIN, which was discussed in section 1 are listed in (12).

(12) Undominated Constraints
ONS-COD, COD-CON, NUC, FTBIN

/r/ in syllable-final position of the original forms is deleted in Korean loanwords. This /r/ is unparsed and violates PARSE and FAITHFULNESS. Since this non-parsing violate two constraints, it will be avoided unless there is

another, higher-ranked constraint that compels it. We formulate the relevant condition so as to require that the syllable-final /r/ not be parsed.

(13) FREE-R
Syllable-final /r/ must not be parsed

There are forms that violate MINWD if they satisfy FREE-R. In this case empty elements must be added. FREE-R cannot be dominated by other violable constraints.

2.3 Ranking of the Constraints

We will start with the ranking of the four constraints ONS, COD, FILL and PARSE. Following Prince and Smolensky (1992), we state the ranking which is valid for Korean loanword phonology.

In the following discussion, the notations given in (14) are used to simplify representations. Each of the notations means as follows:

(14) 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) ['] 'a node Nuc is empty'
5) ! 'the violation of the constraint is fatal'
6) % 'the candidate is the optimal output'
7) A >> B 'A is more highly ranked than B'

Korean allows onsetless syllables. Prince and Smolensky (1992) analyze a single vowel /V/ to determine which of the constraints ONS, PARSE and FILL is lowest in the constraint ranking of a given language. Among three possible analyses that they propose Korean must choose .V. as the best analysis of /V/. The analysis .V. is the optimal parse of /V/ in a language that does not require onsets. Prince and Smolensky's tableau (1992:90) is as follows:

(15)

/V/	FILL	PARSE	ONS
.V.			*
<V>		*!	
.[]V.	*!		

The violation of PARSE eliminates the analysis <V> and the

analysis .[]V. is ruled out by the violation of FILL. The violations of the two constraints are fatal because the analysis .V. satisfies both constraints.

The analysis <V> vacuously 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. The analysis .V. receives the highest value in Korean. The constraint ONS is the lowest-ranked in this language. 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/. There are three possible parses in this case, too. If .CVC. is the optimal output, we have the following tableau:

(16)

/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[']. must involve open syllables if they are chosen. If the .CV<C>. is the best parse, the final consonant is not parsed and thus must be deleted. If the .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 ONS is the lowest, either. In the loanword phonology unsyllabifiable consonants are realized as epenthesized degenerate syllables. For this reason it is assumed as the first approximation that the constraint ONS is dominant over COD in the loanword phonology. Thus Korean has the following ranking of the four constraints:

(17) FILL, PARSE >> ONS >> COD

The relative ranking of other violable constraints should be determined by examining the loanwords. We will demonstrate how Korean adopts unacceptable syllable structure in English loanwords.

3.0 Data

In this section we will present the data and show what strategies 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 the input.

3.1 Unacceptable Segments

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

(18) a.	feet	p'iit'ï		vest	pesït'ï
	fancy	p'ænssi		virus	pairôsï
b.	check	c'ek'ï		jump	côмp'u
	short	syoot'ï		side	ssaitï
	size	ssaijï		socket	soket'ï

The labio-dental fricatives /f/ and /v/ become /p'/ and /p/ respectively. The fricatives /s/ and /s/ are adopted as /ss/ or /s/ and /sy/, respectively. Affricates are accepted as /c'/ and voiced fricatives are adopted as /c/.

Next consider voiced and voiceless stops. The voiced stops are taken up as plain stops or tensed stops, but they may surface as voiced ones intervocalically. The voiceless ones are adopted as aspirates. Some examples are listed as follows:

(19)

pen	p'en	body	podi
time	t'aim	dice	taisï
code	k'odï	girdle	kôdïl
goal	kkol	guard	kkadï or kadï

The voiced stops are treated as tensed consonants in the word-initial position in some cases, since they are pronounced without aspirate.[6] Inter-dental consonants come into Korean as coronal stops, depending on their voicity. The voiced obstruents in the coda position are adopted as plain stops which then are voiced between a vowel and an epenthetic vowel. In the case of voiceless stops, whether they can become codas seems to depend on the length of the preceding vowels. This problem will be discussed in detail later.

Lastly we will give a word to liquids. It is important to note that liquids are allowed word-initially in the loanword phonology. In the onset position /l/ occurs if the input is /l/, and /r/ is adopted if the input is /r/. In the coda position only /l/ is realized. The following examples show that this is the case.

(20)

rope	roop'u	royal	royal
merit	merit'ï	alarm	allaam
lining	laining	four	p'oô

Whether the loanwords are adopted from British English or from American English, /r/ in the coda position is ignored and does not have a phonetic realization.

Here it is necessary to briefly discuss the gemination of liquids. In loanword phonology there are no other geminate consonants. The data are listed in (21), with the epenthetic vowels underlined.

(21)

a.	dollar	ttalla	helicopter	hellik'opt'ô
	slang	sï̲llæng	block	pu̲llok
b.	paraffin	p'arap'in	siren	ssairen
	thrill	t'ï̲ril	spring	sï̲p'u̲ring

This contrast of /r/ with /l/ in medial position results from a native phonotactic condition in Korean. The contrast is preserved in the initial position in the loanword phonology, but it is canceled in the coda position, since Korean cannot have /r/ as a coda, as shown in (20). /l/ is realized in final position and before a consonant, i.e., in the coda position, and in other positions it surfaces as /r/. In the native vocabulary the /l/ is derived from /r/ by rules, since they occur in mutually exclusive environments. The Korean loanword phonology relies on the gemination of a liquid to make an environment in which a liquid occurs before a consonant, so single liquids between vowels are adopted as geminates.

There is a condition in native Korean that prevents fricatives and the voiced stops of English loanwords from becoming codas. This phonotactic condition forces any final obstruents to change into the corresponding unreleased stops, or implosives. The application of this condition to loanwords would have the effect of radically eroding the articulatory and acoustic properties of loanwords. It is noteworthy that the loanword phonology thus prohibits the rule from applying to loanwords so as to maintain their close acoustic approximation of the inputs.

Korean uses a strategy like the following to conform loanwords to native phonological constraints. The phonetic shapes of the final obstruents are preserved through epenthesizing vowels to creating new open syllables. This is demonstrated by the fact that epenthesis does not occur if the input is not affected by native phonotactic conditions.

3.2 Acceptable syllable structures

If the English input can be arranged into CV or CVC

syllables, it is syllabifiable in Korean. In words with these syllables there are no initial or final consonant clusters, and no medial clusters longer than CC. Generally the consonants that can become codas are nasals and liquids, but we note that stops can optionally become codas under certain conditions which will be discussed later.

We begin our discussion about the syllabification of monosyllabic and bisyllabic words. We can easily find relevant examples, some of which are listed in (22):

(22)	a.	car	k'aa	hĭp	hip
		game	kkeim	mile	mail
		zone	con	team	t'im
	b.	jumper	cômp'ô	napkin	næpk'in
		target	t'aaget	time	t'aim
		siren	ssairen	volume	pollyum
		total	t'ot'al	dining	taining

The English words listed in (22) all are syllabifiable in Korean. Stops, nasals and liquids can become codas. As discussed in section 3.1, some segments must undergo slight changes in their segment structures to conform with Korean phonemic inventory, but these words can be arranged into CV(C) syllables in accordance with native syllabification. The examples in (22b) 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.

Voiceless stops seems to be syllabifiable segments, since Korean can have unreleased stops in coda position. We can find some examples, as listed in (23a) and some forms are adopted as bi-syllabic words, as shown in (23b,c).

(23)	a.	gap	kkæp	cap	k'ap
		kick	k'ik	neck	nek
	b.	knot	not'ï	hip	hip'u
		let	let'ï	gut	kat'ï

c. night nait'ï foot p'uut'ï

The forms with closed syllables have short vowels. However, we find that many forms, which fall into this category, come into Korean as words with two open syllables. The adopted forms with occlusive codas may result from the preference of the forms at the perceptual level over those at the operative level, according to Silverman (1992). In (23b) the voiceless stops are assigned to degenerate syllables (syllables lacking syllable nuclei). This means that a stops is treated as an unsyllabifiable segment. We assume that stops are not permissible codas in the stage of syllabification and are optionally resyllabified as a coda under certain conditions.

3.3 Unacceptable syllable structures

In this section we will discuss how unsyllabifiable clusters and segments are adopted. Korean has to take up unsyllabifiable consonant clusters and segments and cannot have consonant clusters in coda and onset position. Fricatives and affricates cannot occur as codas.

3.3.1 Codas

It is impossible for fricatives and affricates to become codas and no consonant clusters may occur in coda position. We will start our discussion with fricatives and affricates. Consider the following examples. In all the examples which follow the epenthetic vowel is underlined.

(24) a.	bus	ppôsï		gas	kkasï
	both	posï		dance	ttænsï
	nurse	nôsï		push	p'usï
b.	match	mæc'i		change	c'einji
	pose	p'oji		montage	mont'aji

The English forms in (24) have fricatives or affricates in the word-final position. These obstruents can become onsets, but they cannot be in coda position. They are assigned to degenerate syllables which then undergo epenthesis. The epenthesis gives nuclei to the degenerate syllables. This is the only way that Korean adopts word-final coronal obstruents. The same procedure applies to any syllable-final fricatives and affricates, as is shown in (25).

(25) basket pasïk'et instant insït'ant'ï
chestnut c'esïnat cosmos k'osïmosï

We shall assume the prosodic theory of Ito (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 /ï/, although there is some harmony with palatals and labials: for example, tape /t'eip'u/, switch /suwic'i/, and so on.

It is important to note that Korean has no voiced stops nor labio-dentals /f/ and /v/. Thus these segments cannot occur in coda position. As might be expected, they are treated as unlicensed consonants. Again the epenthetic vowel /ï/ incorporates the unlicensed consonants as onsets into its own syllable to make new syllables as follows:

(26) rod rodï code k'odï
robe robu dog tôgï
chief c'ip'u dive taibu

The unlicensed consonants cannot be syllabified as codas. Syllabification must assign degenerate syllables to them as onsets and to be realized as such, the unlicensed codas have to acquire epenthetic nuclei.

3.3.2 Initial clusters

Korean has no branching initial clusters other than the consonant plus coronal glide clusters. The most consistent strategy used for adopting unsyllabifiable segments is epenthesis and it is by this strategy that unacceptable initial clusters are taken up. In Korean unsyllabifiable consonants are never deleted in any context. Epenthesis is found without exception in all unlicensed initial consonant clusters, as shown in (27).

(27)

scandal	sɨk'ændal	stress	sɨt'ɨresɨ
snow	sɨno	spike	sɨp'aikɨ
star	sɨt'a	smog	sɨmogɨ

The same strategy of syllabification as that of (27) is applied to the other initial consonant clusters. Obstruent-liquid clusters are split into two syllables by epenthetic vowels. Coronal obstruent-velar glide clusters are adopted by assigning degenerate syllables to the coronal obstruents and then the degenerate syllables which are then epenthesized in the loanword phonology. The data in (28) shows how those clusters are adopted.

(28)

a.	tweed	t'ɨwedɨ	sweater	sɨwet'ô
b.	bridge	purijɨ	plan	p'ullæn
	dress	tɨresɨ	slice	sɨllaisɨ

The intervocalic liquid must be implemented as a geminate, which is dominated by both the onset node and its preceding coda.

3.3.3 Final clusters

Final clusters are dealt with systematically, 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 the syllable with a short vowel, and the vowel /ï/ is epenthesized after the other consonants. The relevant examples are listed in (29).

(29)

tank	t'ængk'ï	sect	ssekt'ï
volvox	polboksï	fault	p'olt'ï
lamp	lamp'u	sense	sensï
next	neksït'ï		

Note that the final /k/ functions as a coda. This suggests that stops are allowed to be codas in this environment. The gemination of liquid is not necessary if the liquid occurs before a consonant. In some examples, syllabification creates one syllable closed by sonorants and in other examples the one or two final stops create separate open syllables by epenthesis, since a degenerate syllable is built over each final consonant.

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 the left of the possible coda as seen in (30a). However, if the first member of the cluster is not a possible coda and the second consonant is an obstruent, double epenthesis occurs. This is the case if the first consonant is a fricative or a affricate, and the second obstruent cannot be licensed as a coda. Degenerate syllables are assigned to the first segment of the cluster, as well as to the second member. Thus epenthesis creates two open syllables instead of one closed syllable, as shown in (30b).

(30)

a.	prism	p'urijïm	council	k'aunsïl
	Nelson	nelssïn	film	p'illïm
b.	post	p'osït'ï	mosque	mosïk'ï

4.0 Constraint Interaction

In the previous section we have shown that unaccept-

able segments in the input must undergo featural changes and degenerate syllables are rescued by epenthesis. Both strategies are used to adopt the perceived input as closely as possible and to create well-formed output forms which obey Korean phonotactic conditions.

In Optimality Theory (Prince and Smolensky 1992), languages seek for the most harmonic, well-formed structures. There are no phonological rules. Instead, constraint interaction in a given language automatically decides the optimal member of a set of candidates. Dominant constraints are the ones that must be satisfied. The lower ranked constraints are violable. The number of the violations is not relevant to the choice of the optimal output, but a violation of a highly ranked-constraint is fatal.

Tentatively we propose that Korean loanword phonology has the following set of ranked constraints in the loanword phonology.

(31) Superordinate: COD-CON, ONS-CON, NUC, FREE-R, FTBIN >> MAXSYLL >> FAITHFULNESS >> MINWD >> PARSE >> FILL >> ONS >> COD

This ranking of the constraints will be discussed in detail in the next section. The optimal candidate is the one the 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.

(32)

/gas/	DOMINANT	FAITHFULNESS	PARSE	FILL
% ka.s[‘]		*		*
.kas.	*COD-CON!			
ka.<s>	*FTBIN!	(*)	(*)	

/kas[]/ is the optimal output and the empty nuclear

node surfaces as the epenthetic vowel [ï], in [kasï]. Both /ka<s>/ and /kas[]/ violate FAITHFULNESS, but the candidate /ka<s>/ is rule out because it violates FTBIN, and is thus worse than /kas[]/, which violates the constraints FAITHFULNESS and FILL.

4.1 FREE-R

As discussed in the previous section, the syllable-final /r/ in English loanwords is not perceived and never surfaces in Korean. However, we cannot suppose that the /r/ is simply deleted, as the vowel before the syllable-final /r/, which constitutes the Rhyme, undergoes compensatory lengthening and functions as a long vowel. In view of this dominant characteristic of the constraint, FREE-R should not be dominated in the ranking.

To show how FREE-R interacts with other constraints to establish Optimality, we examine the following relevant forms:

(33)　short　syootï　　car　k'aa　　target　t'aaget

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 unparsed /r/ in nucleus. The simultaneous truncation/augmentation analysis is plausible because the first heavy syllables of the form /target/ must remain open. Consider the following constraint tableaux:

(34)

/short/	DOMINANT	MAXSYLL	FAITHFUL	MINWD	FILL
% .syo[]<r>.t'[].			*		**
.syor.t'[].	*FR-R!		(*)		(*)
.syo[]<r>t.		*!			(*)

/car/

% .k'a[]<r>.				*	
.k'ar.	*FR-R!			(*)	
.k'a.<r>	*FTBIN!	(*)	(*)	(*)	

/target/

% .t'a[]<r>.get.					*
.t'a[]<r>.ge.t'[]			*!		(**)
.t'ar.get.	*FR-R!				
.t'a<r>g.et.	*COD-CON!	(*)	(*)		
.t'a<r>.get.			*!*		

In (34) we give a constraint tableau that illustrates some possible output candidates for each of three forms in (33). Our tentative ranking serves to distinguish between the optimal parse and the other candidates. This ranking asserts that it is better to augment the nuclei, violating FILL, than to simply truncate the /r/.

When the output satisfies FREE-R and MAXSYLL, as in /.syo[]<r>.t'[]/, Optimality is readily established. In the first example, the FILL is marked twice in the optimal parse, once from overparsing t and once from augmentation. The optimal forms for 'car' and 'short' violate FAITHFULNESS. The constraint MAXSYLL interacts with FAITHFULNESS in the first example. A syllable with bimoraic nuclei cannot be closed by stops in /.syo[]<r>t./ because long syllables must remain open, and a monosyllabic monomoriac output are possibly produced in the second example. The former violates MAXSYLL and the latter is eliminated by FTBIN. This MAXSYLL violation may be fatal and the optimal parse must satisfy MAXSYLL. Consequently MAXSYLL must be dominant over FAITHFULNESS.

In the last example, the optimal form has the violation mark *COD. In this bi-syllabic form, the constraint FAITHFULNESS comes into play when the final consonant is overparsed or underparsed. The underparsed form /t'a<r>.get/ has two marks *FAITHFULNESS and the overparsed output /t'a[]<r>.ge.t'[]/ also has a mark *FAITHFUL-

NESS. These two candidates are eliminated because this violation is fatal.

The tableaux in (34) show that the constraints FAITHFULNESS, MINWD and FILL are violable while the constraints FREE-R and MAXSYLL both play a decisive role. We claim that the language particular idiosyncratic FREE-R is undominated. The relative ranking of FAITHFULNESS and MINWD has no effect on the outcome.

4.2 Other Constraint Interaction

In section 2.3 and 4.0 we examined interaction among some constraints, determining a set of relative domination relations. In this section we will determine whether our hierarchy of constraints in (31) can account for the Korean facts in Korean loanword phonology. We will consider the loanwords and check that the Korean parse is optimal as determined by the ranking of the constraints. The hierarchy of the constraints will be modified if necessary. To verify that constraint rankings create the correct output, it is necessary to show that all unchosen output candidates are all worse than the optimal form.

4.2.1 Unacceptable Segments

First we consider the input which includes the unacceptable segments. Korean must adopt these English segments by u sing Korean phonemes that are different from but closest to the English ones, and thus most of English segments may change featurally. These regularly and superficially affect the segment structures. We assume that these feature changes do not violate FAITHFULNESS while deletion and epenthesis do. The examples in section 3 are stated again for convenience.

(35) fancy p'ænssi virus pairôsï jump côмp'u
girdle kôdïl guard kaadï

Some of the examples in (35) are treated in the following tableaux:

(36)

/fancy/	DOM	MAX	FAITH	MIN	PAR	FILL
1 .p'æn.ssi.			?			
2 %.p'æn.si.						
3 .p'æns.i.	*COD-CON!					
/jump/						
4 %.côm.p'[].			*			*
5 .cômp.	*COD-CON!			(*)		
6 .cô.m[].p'[].			**!			**
7 .côm.<p>			*	*!	(*)	
/girdle/						
8 %.kô[]<r>.d[]l.			*			*
9 .kô[]<r>dl.	*COD-CON!					
10 .kô[]<r>.d[].l[].			**!			(**)
11 .kô[]<r>d.l[]	*COD-CON!	*!	(*)			(*)

/virus/	DOM	MAX	FAITH	MIN	PAR	FILL
12 .pai.rôs.	*COD-CON!					
13 %.pai.rô.s[].			*			*
14 .pair.ôs.	*FR-R!					

In the examples in (36) the constraint COD-CON comes into play and as shown by the mark *COD-CON, it rules out some candidates. In the first example, the forms (36.1) and (36.2) lead us to the question of how to determine the most harmonic parse. Though it is not shown in the tableau in (36), the two competitors violate the lower ranked constraint COD, but this mark is irrelevant and canceled by convention. Since there is no crucial mark which shows the one to be less harmonic than the other, the hierarchy of the constraints is not sufficient to decide which of the candidates is optimal. Perhaps it is that the syllable theory analysis cannot apply because occasional feature changes are be relevant in this case. Even if the con-

straint interaction cannot account for the optimal form in 'fancy', this does not affect the validity of Optimality Theoretic approach. We give a question mark to /p'ænssi/(36.1) to show /p'ænsi/ to be optimal. It seems reasonable to suppose that in the cases like this the establishment of optimality simply depends on the speakers.[7]

The next three examples are easily explained. The violation of FAITHFULNESS corresponds to the violations of FILL and PARSE. In the second example in (36), 'jump', the optimal parse has the marks, *FAITHFULNESS and *FILL. The form (36.6) has two overparsed segments and fatally violates FAITHFULNESS twice. The constraint interaction plays out in 'jump'. Both the candidate (36.7) and the optimal form violate FAITHFULNESS. To avoid the higher mark *MINWD, the final segment would have to be parsed. If the constraint MINWD is dominant over FAITHFULNESS, the analysis gives the incorrect prediction that the candidate /jum.<p>/(36.7) is optimal. We conclude that we can establish the ranking in (31).

As mentioned above in the discussion of (34.6), the one mark *FAITHFULNESS could be canceled, if is still left in (36.10). Thus the form (36.8) is optimal. In the last example, two candidates violate the undominated constraints and are thus eliminated. Only the optimal parse, /pairôs/, survives.

4.2.2 Gemination and Monosyllabic Words

In this section we will discuss geminated loanwords and try to explain, using constraint interaction, why some monosyllabic bimoraic forms have the corresponding bisyllabic variants.

We take some examples from our data that have shown in

section 3.

(37)a.

helicopter	hellik'opt'ô	block	pullok
volvox	polboksi	fault	p'olt'ï
prism	p'urijïm	film	p'illïm

These examples include unsyllabifiable segments. The discussion of these segment clusters will not be presented here, as it is not relevant to the matter at hand. Consider the following constraint tableaux in (38). From now on we will omit any irrelevant violations of lower ranked constraints.

(38)

/block/	DOM	MAX	FAITH	MIN	PAR	FILL
1 .p<l>ok.			*		*!	
2 .plo.k'[].	*ONS-CON!					
3 .p[].lok.	*ONS-CON!					
4 %.p[]l.lok.			*			*
5 .p[]l.lo.k'[].			**!			

/volvoks/	DOM	MAX	FAITH	MIN	PAR	FILL
6 .pol.po.k'[].s[]			**!			**
7 %.pol.pok.s[]			*			*
8 .po.l[].pok.s[]	*ONS-CON!					
9 .pol.poks.	*COD-CON!					

/fault/	DOM	MAX	FAITH	MIN	PAR	FILL
10 .p'o.l[].t'[]	*ONS-CON!					
11 .p'ol.<t>			*		*!	
12 .p'ol.t	*NUC!					
13 %.pol.t'[]			*			*

/film/							COD
14 .p'il.m[].			*			*	*!
15 .p'i.l[]m.	*ONS-CON!						
16 %.p'il.l[]m.			*			*	

/prism/	DOM	MAX	FAITH	PAR	FILL	COD
17 .pri.s[]m.	*ONS-COD!					
18 .p[].ri.sm.	*COD-CON!					
19 %.p[].ri.s[]m.			**		**	
20 .p[].ris.m[]	*COD-CON!					
21 .p[].ri.s[].m[].			***!			*

From all the examples in (38), it cannot be denied that unsyllabifiable initial consonant clusters must be over-

parsed to avoid the fatal mark *ONS-CON, and that unsyllabifiable final consonant clusters must also overparsed in order not to violate the dominant constraint COD-CON. If one of the elements of these clusters remains unparsed, the unparsed output incurs the marks *FAITHFULNESS and *PARSE. The violation of PARSE excludes the forms less harmonic than the optimal output. This is shown by the candidates (38.1) and (38.11). If the final consonant is not overparsed like in (38.12), the output cannot survive. The output forms (38.6-8) and other examples shows that a coronal consonant /s/ in the coda must be overparsed to avoid the fatal mark *COD-CON.

We turn to the question why the gemination of the liquid /l/ is required. The constraint tableau (38.14-16) suggests that the liquid would have to be geminated to satisfy the constraint ONS-CON. 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 marked constraint COD will be replaced by -COD and /.p'i.l[]m./ would be optimal. This would be quite interesting but is not supported by the facts. The geminate form (38.16) is justified as the optimal output in the present constraint hierarchy, since it satisfies COD, while the competitor (38.14) fatally violates COD.

As we have discussed in (36), three marks *FAITHFULNESS render the form (38.21) worse than the optimal output, which only has two marks *FAITHFULNESS. It follows from this that ceteris paribus the number of the violation marks come into play in addition to the ranking of constraints. By the constraint tableau we can account for the optimal output without phonological rules. We argue that Korean loanword phonology uses overparsing to preserve salient consonants of the input as much as possible.

We proceed to a discussion of monosyllabic loanwords. There are many monosyllabic English words. If borrowed, many of them can be properly syllabified, but there are forms which must undergo epenthesis. Consider the following examples:

(39) a.	gap	kkæp		pack	p'æk
b.	knot	not'ï or not		hip	hip'u or hip
c.	night	nait'ï		foot	p'uut'ï
	time	t'aim		gawn	kaun

The examples in (39a) have stops in coda position, but the examples in (39b) show that the final consonants of the input are 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 these two variants can be produced, as seen in (39b).

There is a further point which needs to be clarified. When we examine the examples in (39c), we notice that two forms surface as by-syllabic while two other forms surface as bimoraic monosyllabic. The example (39a) is treated below in the tableau (40):

(40)	/gap/	DOM	MAX	FAITH	MIN	FILL
1	%.gæp.				*	
2	.gæ.p'[].			*!		
3	.gæ.<p>	*FTBIN!				

With monosyllabic stems the constraint MINWD comes into play, as shown in the tableau (40.1-3). Satisfying this constraint requires a second syllable to be supplied with at least one empty nucleus node. In the first example, /gap/, the optimal parse (40.1) violates MINWD. If we attempt to avoid the mark *MINWD, the output (48.3) fatally violates the higher ranked constraint FAITHFULNESS.

However, there are the adopted words which are syllabified differently such as the output /hi.p'[]/. If the output with an empty nucleus node is chosen, Optimal Theoretic analysis is sure to make a wrong prediction about the

syllabification of monosyllabic stems. It would be wrong to suppose that the output /gæ.p'[]/ is the most harmonic. We can assume that the constraint tableau gives the correct result. In view of preferable word structure and the influence of Japanese loanwords in Korean, let us then consider this problem.

Hirano (1994) has argued that Korean prefers bisyllabic prosodic word structure. Furthermore, as Yip (1993) points out, the constraint FAITHFULNESS may be the lowest ranked in the native phonology and plays little role in the constraint interaction. For this reason we can safely say that the output like (40.3) results from the speakers' attempt to avoid the mark *MINWD and survives under the very pressure of the preference of bisyllabicity in spite of the violation of FAITHFULNESS. There is another reason for accepting the bisyllabic output. Korean borrowed many loanwords including bisyllabic words from Japanese loanwords. The open syllables of these words were not resyllabified and remain open. It is important to keep in mind that the influence of the native constraint hierarchy on the loanword phonology is suggested by Optimality Theory. However, there may be still room for argument on this point.

The output forms with heavy nuclei in (39c) are treated in the following tableaux.

(41)

	/nait/	DOM	MAX	FAITH	MIN	FILL	ONS	COD
1	.na.it.		*!	*			*	
2	.nait.		*!					
3	%.nai.t'[]			*		*		**
	/taim/							
4	.ta.im.		*!	*			*	*
5	.tai.m[]			*!		*		
6	%.taim.							

The ranking of MAXSYLL and FAITHFULNESS can be shown from

the constraint tableau in (41). In the first output of the first example (41.1), we show the correct ranking of MAX-SYLL as higher than FAITHFULNESS. There are three possible parses(41.1-3) there. To avoid the worst mark *MAXSYLL the syllables must have heavy nuclei, as exemplified as in (41.2) and (41.3). We assume that syllabification as in (41.1) violates FAITHFULNESS and MAXSYLL.

In the second example, the constraint MAXSYLL requires that the output be parsed so as to create a superheavy syllable. To avoid the highest mark *MAXSYLL the final nasal would have to be parsed. The fully parsed output (41.6), therefore, is optimal. Generally speaking, unparsed candidates which violate FAITHFULNESS and PARSE are never considered as the most harmonic parse, since the mark *PARSE is worse than the mark *FILL.

4.2.3 Consonant Clusters

In this section we will briefly see how unsyllabifiable consonant clusters are adopted and syllabified. We have already discussed some of the consonant clusters in earlier parts of this paper. Consonant clusters occur in the middle of stems, stem-initially and stem-finally. Consider some typical examples, illustrated in (42).

(41)

basket	pasɨ̲k'et	scandal	sɨ̲k'ændal
stress	sɨ̲t'ɨ̲resɨ̲	sweater	sɨ̲wet'ô
next	neksɨ̲t'ɨ̲		

The examples in (42) are analyzed in the following tableaux:

(43)

	/basket/	DOM	MAX	FAITH	MIN	PAR	FILL
1	.pas.k'et.	*COD-CON!					
2	.pa.sk'et.	*ONS-CON!					
3	%.pa.s[].k'et.			*			*
4	.pa.s[].k'e.t'[]			**!			
5	.pa.s[].k'e.<p>			**!			

```
    /skandal/

6    .sk'æn.dal.   *ONS-CON!
7    .s[].k'ænd.al. *COD-CON!
8   %.s[].k'æn.dal.                *                *
9    .s[]k.æn.dal.                **!

    /stress/

10   .st[].res. *ONS-CON!, *COD-CON!
11   .s[]t.re.s[]  *NUC!
12  %.s[].t[].re.s[]              ***                *

    /sweater/       DOM    MAX   FAITH   MIN    FILL   ONS   COD

13   .swe.t'ô     *ONS-CON!
14   .s[].wet'.ô                  *             *      *!   **
15  %.s[].we.t'ô                  *             *           ***

    /nekst/

16   .nek.s[]t.     *NUC!
17   .ne.k'[].s[].t'[].          ***!           ***
18  %.nek.s[].t'[].              **             **
```

Most striking here is that any attempt to avoid the mark *FAITHFULNESS fatally violate top-ranked COD-CON or ONS-CON. The optimal output is the one with the lesser violations of FAITHFULNESS. The most interesting constraint interaction is provided by the input 'sweater'. The ranking of ONS and COD can be shown as in the constraint tableau (43.13-15). We conclude that ONS must be ranked higher than COD. If we reverse this ranking of ONS and COD, the constraint tableau clearly gives the wrong result for the output form. The complex onset /sw/ is eliminated by the violation of a inviolable constraint ONS-CON.

It is important to note that the constraints of loanword phonology also play a role in native phonology. However, in Korean, the universally unmarked constraint -COD may take the place of the marked constraint COD. The ONS-CON which rules out the intervocalic occurrence of the liquid /l/ is abandoned, and the word-initial liquids are prohibited by a native phonotactic condition.

5.0 Conclusion

We have argued that the syllabification of loanwords is subject to the phonological constraints of the host language and that ranked constraints can determine optimal parses of the input. These constraints are hierarchically arranged, and there are some top-ranked superordinate constraints. The constraint-based analysis dispenses with phonological rules. We examined the way that the ranked constraints distinguish between the most harmonic parse and other candidates for a given word. The explanation offered in this paper gives support to constraint-based syllable theory (Prince and Smolensky). It seems reasonable to conclude that the Optimality-theoretical approach contributes to the best understanding of the nature of well-structured syllables.

NOTES

* This paper is written on the basis of the earlier version presented at the 107th meeting of Linguistic Society of Japan. I was greatly stimulated by Yip's (1993) paper. I am grateful to my informant, Co Yeongho, for his patient checking of my examples. I also thank for Emily Bender for correcting my English phrasing. Of course, all errors are my own.

1. See Prince and Smolensky (1992). They lay out their Syllable Theory in chapter 6 and discuss the syllablfication of Ladil in chapter 7.

2. In this paper we use some phonemic symbols which are different from those of International Phonetic Association. The symbols like /pp/ indicate glottal stops, which are called a tense consonant. /p', t', etc./ indicate aspirate stops and the affricate [t] is shown by /c/. /ng/ indicates the velar nasal / /.

3. There are two rules which apply to initial consonants.

One rule applies to the coronal nasal and the liquid, and deletes 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.

4. In this paper we use the following symbols for vowels:

/æ/: a front unrounded low vowel

/ô/: a back rounded low vowel

/ï/: a back unrounded high vowel

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

6. The tense consonants which correspond to voiced stops are not pronounced as a true tense consonant by most of the speakers who have some knowledge of English, but older speakers may still pronounce them as a tense consnonant.

7. English word-initial voiced obstruents are adopted as tensed obstruents or plain obstruents. In some words which are recently adopted, the speakers tend to pronounce them as plain consonants, as in 'guard' [kadï]. However, other English loanwords which have already been absorbed into the Korean vocabuluary have initial tense obstruents, such as in 'bus' [ppôsï]. In the case of 'bus', the output /pôsï/ might be marked as ?FAITHFULNESS.

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音韻制約による朝鮮語外来語音韻論

[要旨]

平野　日出征

本稿は朝鮮語外来語をオプティマリティ理論の枠組みを用いて分析したものである。外来語音韻論では英語の音形にできるだけ近い音形を実現するための制約である FAITHFULNESS が重要な役割を果たすこと，またこの制約と基本的音節構造理論が規定する制約，さらに朝鮮語の韻律構造における二価性を好む傾向を記述する制約が階層的に順序付けられ，それらの相互作用によってもっとも望ましい出力形が決定できることを論じた。この分析はオプティマリティ理論の有効性と音韻規則によらない説明が支持を得られるものであることを示した。

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