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AN ANALYSIS OF ENGLISH LOANWORDS IN KOREAN

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This paper investigates sound substitutions that occur in English loanwords in Korean within the theory of Natural Phonology (NP). In NP, phonological phenomena are accounted for in terms of two types of phonological processes: fortition and lenition. The crucial part of the present analysis can be found in how an insertion phenomenon is viewed compared to other theories. Specifically, vowel insertion is seen as resulting from maintaining a certain length of moras under Broselow and Park's (1995) mora conservation law. However, Broselow and Park's analysis turns out to be limited because of counterexamples that violate the law of moras. Vowel insertion is hard to see as a result of certain universal principles; rather it can be seen as occurring from an interaction of a set of natural phonological processes.

1. INTRODUCTION. This paper examines English borrowings in Korean. Generally, sounds in the donor language are likely to be replaced by similar sounds in the borrowing language. They are also subject to phonotactic modification in order to be acceptable in the borrowing language. Through this modification, phonological processes are found based on sound substitutions. These processes are accounted for within the theory of Natural Phonology (NP) (Donegan and Stampe 1979; Ohso 1973; Major 1987). This theory will be discussed below.

The data were collected from *Oeraeo Sajon* 1987, a contemporary dictionary. Old dictionaries often contain "Japanese-like" forms or alphabetically written forms. Such forms are likely to be different from the way Korean speakers actually perceive and produce English borrowings. Current dictionaries like *Oeraeo Sajon* are modified to eliminate such problems. As another source of data, some English words are drawn from Nam and Southard 1994, which includes over 200 English loanwords in the appendix.

This paper consists of three further sections. Section Two is concerned with the principles of Natural Phonology. Particularly, it focuses on the principles relevant to the analysis of borrowings. Section Three describes the phonemes of English and those of Korean, and it also discusses the phonetic properties of phonemes that are missed in the phoneme charts. Section Four, the main part of the paper, presents phonological processes that govern the Korean perception and production of English words. These processes are viewed from the framework of Natural Phonology.

2. PRINCIPLES OF NATURAL PHONOLOGY. One goal of phonological theories is to provide a proper explanation for sound substitutions in borrowings. In this paper, the theory adopted is Natural Phonology.

The theory of NP has been discussed in various studies. Various phonological phenomena are considered to be results of natural processes (Donegan and Stampe 1979). For instance, Ohso (1973) analyzed English borrowings in Japanese within the framework of NP. Further, Major (1987) examined the theory of NP in its application to second-language learners, as well as other phonological phenomena.

As for borrowings, I summarize two basic principles of NP (following Ohso 1973). First, NP claims that fortition processes apply to underlying forms. These processes constrain the phoneme inventory of a borrowing language. As foreign segments are borrowed, they become underlying forms. But some forms are inadmissible. If a borrowing language does not allow a form, it means that the form violates processes that have been retained in the borrowing language. Such forms have to be revised according to these processes. Then, once they are admissible, that is the way hearers perceive the foreign segments. Accordingly, such processes are supposed to appear if necessary, even if they are not found in the alternations of the native phonology.

Thus, the hearers of a borrowing language perceive only forms to which these processes have already applied. This is why these processes are not noticed by the hearers. As such, phonological processes apply before the underlying forms are admissible. In this way, NP differs from other phonological theories.

The second principle is based on lenition processes that affect the lexicon of a borrowing language in production. In NP, these processes are supposed to apply to foreign segments in reverse in perception.

For instance, Japanese vowel insertion (Ohso 1973) was explained in terms of the second principle. The inserted vowel was considered as resulting from the reverse application of vowel deletion. In Japanese, vowel devoicing occurs in fast speech or casual speech, and vowel deletion optionally occurs, as

well. Such processes provide for reversals of vowel deletion. Since Japanese speakers devoice or delete a vowel, they undo this process as hearers when they hear foreign consonant clusters or word-final consonants. Accordingly, the vowel that Japanese speakers hear in English words is one resulting from a restoration process. From now on, English borrowings will be discussed with reference to these principles.

3. PHONEMES IN ENGLISH AND KOREAN.

3.1 CONSONANTS.

3.1.1 ENGLISH CONSONANTS. Table 1 shows English consonant phonemes.

	Labial	Labio-dental	Inter-dental	Alveolar	Palatal	velar
-voi stop	p				tʃ	k
+voi stop	b				dʒ	g
-voi fricative		f	θ		ʃ	h
+voi fricative		v	ð		ʒ	
Nasal	m			n		ŋ
Liquid				l	r	
Glide	w					j

TABLE 1. English consonant inventory

English phonemes are drawn from Wells 1982, who classified them into those of American English and those of British English. But for consonants, there is little difference between the two. One important feature in English is [voice]. English obstruents contrast by [voice] in six places of articulation. English voiceless stops become aspirated in stressed syllables except when preceded by *s*. The feature [aspiration] affects non-native speakers' perception of English voiceless stops.

3.1.2 KOREAN CONSONANTS. Table 2 shows Korean consonant phonemes. They are drawn from Cho 1967.

	Labial	Alveolar	Palatal	Velar
-voi stop	p	t	tʃ	k
Aspir stop	p ^h	t ^h	tʃ ^h	k ^h
Laryngeal stop	p'	t'	tʃ'	k'
-voi fric		s [s ^h]		
Laryngeal fric		s'		
Nasal		n		
Liquid		l		
glide	w		j	

TABLE 2. Korean consonant inventory

Three phonological features in consonants are noticeable—[voice], [spread glottis], and [constricted glottis] (Stevens and Keyser 1989). All obstruents are voiceless in the phoneme chart. However, unaspirated voiceless stops become voiced between vowels. This process also applies to affricates. Kagaya (1974) provided acoustic evidence for this process.

Phonetic features are often missed in phonological analysis. The [aspiration] of Korean /s/ was not often mentioned in the literature, including Cho's analysis, until Kagaya (1974) pointed it out. Even after this study, phonologists did not mention this feature. However, phonological evidence as well as acoustic evidence supports this fact. Korean unaspirated voiceless obstruents are subject to voicing between vowels but Korean /s/ is not. This is the second reason /s/ is thought to belong to the aspirated sounds.

3.2 VOWELS.

3.2.1 ENGLISH VOWELS. Table 3 shows English vowel phonemes (Donegan (1985)).

	+palatal	-palatal	-palatal	
	-labial	-labial	-labial	+labial
	+tense	-tense	-tense	-tense
	+tense	-tense	-tense	+tense
High	iː	ɪ		ʊ
Mid	eɪ	ɛ	ʌ	oʊ
Low	æ		ɑ	ɒ

(plus other diphthongs like aɪ, aʊ, and, oɪ)

TABLE 3. English vowel inventory

In the phoneme charts of English and Korean, vowels are characterized by features like vowel height, palatality (frontness), labiality (roundness), and tenseness. These features are based on Donegan (1985). Although the first three features are shared both in English and Korean, tenseness applies only to English. This feature does not play a role in Korean, while English vowels are divided into tense and lax vowels. The definition of tenseness slightly differs among phonologists. I follow the definition of Donegan 1985: tense vowels have a relatively high degree of palatality or labiality. From this point of view, /æ/ is included as a tense vowel. With a tense/lax distinction, only three degrees of vowel height are needed.

3.2.2 KOREAN VOWELS. Table 4 shows Korean vowel phonemes. These vowels are presented as in Cho 1967.

	+palatal		-palatal	
	-lab	+lab	-lab	+lab
high	i	ɻ ~ ɰi	u	ʊ
mid	e	ø ~ ɰe	ɣ	ø
low	(æ)		ɑ	

TABLE 4. Korean vowel inventory

Cho's analysis is modified here in a few respects. First, three palatal vowels, /i, e, æ/, contrasted in Cho's analysis. His analysis does not include the results of recent phonetic or phonological research. Instead, it seems to be influenced by the orthographic representation because Korean /e/ contrasts with /æ/ in spellings such as <key> 'crab' and <kæy> 'dog'. The present paper does not distinguish orthographic <e> from <æ>; Korean /e/ is used for both.

Similarly, Korean long vowels are excluded from the phoneme chart. Cho included long vowels as phonemes. However, vowel length is disappearing and is not distinctive in the standard dialects in Korean. Broselow and Park (1995:159) also pointed out this prosodic process with reference to other studies (Magen and Blumstein 1991; Moon 1981).

On the other hand, two palatal labial vowels, /ɻ/ and /ø/, are maintained in Cho's analysis. These vowels were considered as diphthongs like /ɰi/ or /ɰe/ (Ahn 1985; Martin 1957). The Korean orthography also represents them by means of two letters, just like other diphthongs. But these vowels are treated as monophthongs in this paper: /ɰi/ was replaced by /ɻ/, and /ɰe/ by /ø/. Although Korean /ɻ, ø/ are diphthongized in some environments, these vowels are sometimes monophthongs.

4. ANALYSIS OF LOANWORDS

4.1 PALATALIZATION. Since English [ʃ] is not a phoneme in Korean, we might assume that Koreans are unable to produce this segment. As expected, depalatalization applies in Korean to limit the phoneme inventory. But Koreans distinguish English [s] from English [ʃ] by the following vowels. They hear [ʃ] as /sɪ/ or /si/. In addition, two other processes, palatalization and glide deletion, occur in words containing English [ʃ]. Each will be discussed below.

- (1) Depalatalization: $\int \rightarrow s$
 Palatalization: $s \rightarrow \int / _ i, \underset{\sim}{i}$
 Glide deletion: $\underset{\sim}{i} \rightarrow \phi / [+palatal] _$

(2) English (Eng.) phonetic	Korean (Kor.) phonetic	phonemic	Gloss
[k ^h ændɪʃən]	[k ^h ʌntɪʃʌn]	/k ^h ʌndɪʃʌn/	‘condition’
[fæʃən]	[p ^h eʃən]	/p ^h ɛʃən/	‘fashion’
[ɪʃu]	[iʃu]	/ɪʃiu/	‘issue’
[ʃædəʊ]	[ʃedou]	/ʃiɛtəʊ/	‘shadow’
[ʃu:tɪŋ]	[ʃut ^h iŋ]	/ʃiut ^h iŋ/	‘shooting’
[ʃɑ:pɪŋ]	[ʃop ^h iŋ]	/ʃiɔp ^h iŋ/	‘shopping’
[ʃɔ:t]	[ʃot ^h u]	/ʃiɔt ^h u/	‘short’

In Korean, /s/ becomes [ʃ] before a high vowel or glide. Thus, English [si] as in *sea* is produced as [ʃi] by Koreans. Since Korean [ʃ] is the result of palatalization, it should appear only before a high palatal vowel, because [ʃ] is only derived from /s/ in this environment. However, palatalization is found in words containing a non-high non-palatal vowel. For instance, English [ʃæ] as in *shadow* is produced as [ʃe] by Koreans. Even though the word *shadow* does not have a high palatal vowel, Korean /s/ becomes palatalized once the English low vowel [æ] is replaced by the Korean mid vowel [e].

In borrowings, the difference between English [s] and [ʃ] is not perceived, although English [ʃ] is a possible sound in Korean. The palatality of [ʃ] is perceived by Koreans as a result of the interpretation of [ʃ] as /s/ accompanying a palatal glide. So, a palatal glide is or seems to be “inserted” before the vowel which follows English [ʃ]. Because of this “inserted” glide, palatalization seems to occur in any environment.

The view of NP on inserted segments was mentioned briefly in Section 2. Speakers of a borrowing language “hear” a segment that is not actually produced in the source language. Thus, the segment seems to be “inserted.” However, NP does not regard the “insertion” as a process. In NP, the inserted segment in perception is considered as resulting from undoing the process that deletes a segment in production. For example, English speakers hear a nasal segment when they hear a French nasalized vowel (p.c. P. Donegan). If we analyze the nasal “insertion” from the view of NP, the nasal segment is “inserted” as a result of undoing nasal deletion, which occurs in the English phonology. Since English speakers drop a nasal segment after a nasalized vowel, they hear the nasal segment (after a nasalized vowel) as a result of nasal restoration.

For the same reason, glide insertion is excluded from (1) because it is not a process. Instead, it is drawn from the reversal in perception of glide deletion, which applies in Korean.

In the Korean phonetic representation, the palatal glide which is “restored” does not appear. The glide is subject to deletion after a palatalized segment. Here, Korean /s/ becomes palatalized, and then the glide is deleted in the context of [ʃ]. Glide deletion is a process which governs Korean production as well as Korean perception.

Supposing that glide restoration has to do with the feature of palatality, it has to apply to other English palatal obstruents [ʒ, tʃ, dʒ] as well. But a glide is not “inserted” because the glide is not deleted either. English [ʒ, tʃ, dʒ] are perceived as the Korean palatal affricates. Thus, glide restoration occurs only in the context of English [ʃ], because a glide is not needed to account for palatality in the affricates.

- (3) Affrication.

Eng. phonetic	Kor. phonetic	phonemic	Gloss
[tʃeri]	[tʃ ^h eri]	/tʃ ^h eri/	‘cherry’
[dʒɛli]	[tʃɛlli]	/tʃɛlli/	‘jelly’
[dʒɔɪnt]	[tʃɔɪnt ^h u]	/tʃɔɪnt ^h u/	‘joint’
[dʒus]	[tʃusɯ]	/tʃusɯ/	‘juice’
[lɛʒə]	[ledʒʌ]	/letʃʌ/	‘leisure’

Most vowels are accompanied by a high palatal glide if English [ʃ] is perceived by Koreans. But the palatal glide is not inserted before [i]; [i] is already a palatal vowel.

(4) Eng.	Kor.		Gloss
phonetic	phonetic	phonemic	
[məʃɪn]	[mʏʃɪn]	/mʏsɪn/	‘machine’

The palatal vowel [ɪ] as in *ship* is sometimes replaced by the Korean palatal labial [ʏ]. The lip rounding of English initial [ʃ] is perceived by Koreans. Perhaps the rounding of English [ʃ] is more salient in word-initial than in medial position. This phonetic feature of English [ʃ] can explain why medial [ʃ] as in *machin* is not replaced by the labial vowel.

(5) [ʃɪp]	[ʃʏɪp ~ ʃʏp]	/sʏp/	‘ship’
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Palatalization before [ʏ] argues for Cho’s analysis (1967) of Korean vowels. Cho described two Korean vowels as monophthongs, [ʏ] and [ø], which are otherwise treated as diphthongs, /ʏi/ and /ʏe/. In the Korean orthography, these vowels are also treated as diphthongs. If [ʏ] were treated as a diphthong like /ʏi/, palatalization would be hard to explain because /ʏi/ has a non-palatal glide. Since palatalization occurs, this vowel is presumably a monophthong.

With respect to the Korean perception of English [s] and [ʃ], there is more evidence that these segments are underlyingly distinguished according to their following vowels. In the example above, English [ʃ] is perceived as Korean /s/ followed by a palatal glide. In reverse, Koreans assume that English [s] is not followed by a high palatal. For this distinction, when English [s] is followed by a non-palatal glide and a high palatal vowel, we might expect English [swi-] or [swɪ-] sequences to be replaced by Korean /sʏ-/ sequences, since Korean /ʏ/ is sometimes diphthongized to [ʏi], which is close to an English [wi] sequence. But this is not the case. A vowel /u/ is perceived as occurring between English [s] and the glide [w].

(6) Vowel restoration			
Eng.	Kor.		Gloss
phonetic	phonetic	phonemic	
[swɪtʃ]	[suwʏiitʃ ^{hi}]	/suwʏtʃ ^{hi} /	‘switch’
[swetə]	[suwʏit ^{hʏ}]	/suwʏt ^{hʏ} /	‘sweater’
[swɪt]	[suwʏt ^{hʊ}]	/suwʏt ^{hʊ} /	‘sweet’

Other English sequences do not have an inserted vowel because English [wi] sequence is replaced by Korean /ʏ/. English /kw-/ sequences are presented below.

(7) Eng.	Kor.		Gloss
phonetic	phonetic	phonemic	
[kwɪk]	[k ^h ʏik]~[k ^h ʏk]	/k ^h ʏk/	‘quick’
[kwɪz]	[k ^h ʏidʒʊ]~[k ^h ʏidʒʊ]	/k ^h ʏdʒʊ/	‘quiz’

English consonant clusters which contain [Cwi-] sequences are limited because only a few consonants like [s] or [k] occur in these sequences. Thus, the initial consonant above is limited to English /k/.

4.2 ASPIRATION. English voiceless stops are replaced by Korean aspirated stops.

(8) Eng.		Kor.		Gloss
phonetic	phonemic	phonetic	phonemic	
[p ^h ɪpəl]	/pɪpəl/	[p ^h ɪp ^h ʊl]	/p ^h ɪp ^h ʊl/	‘people’
[mɪrəɪ]	/mɪtəɪ/	[mɪt ^{hʏ}]	/mɪt ^{hʏ} /	‘meter’
[t ^h ɪkɪt]	/tɪkɪt/	[t ^h ɪk ^h et]	/t ^h ɪk ^h et/	‘ticket’
[spɪd]	/spɪd/	[suw ^h ɪdʊ]	/suw ^h ɪtʊ/	‘speed’
[stæk]	/stæk/	[suw ^h ak]	/suw ^h ak/	‘stock’

This process is related to the actual pronunciation of English voiceless stops. As discussed in §2, English voiceless stops become aspirated word-initially or initially in a stressed syllable.

Major and Kim (1996) overlooked this process in Korean. Their analysis is originally based on the comparison of the phonemes of two languages. Within such a contrastive analysis, this process is difficult to note. Thus, they predicted that Koreans do not distinguish a voicing contrast, so English voiceless stops

are replaced by Korean unaspirated voiceless stops. In addition, English voiced stops are also predicted to be replaced by the same Korean stops. However, the data show that Koreans perceive the feature [aspiration] of English stops, and neutralization does not occur.

If substitutions of initial English voiceless stops are accounted for by the feature [aspiration], how are English unaspirated stops perceived by Koreans? For instance, the medial English /p/ as in *people* is phonetically unaspirated [p]. It is predicted that a Korean speaker will hear English [p] as Korean /p/ because they are phonetically closer. The data indicate that these stops are still perceived as aspirates. English unaspirated [p] cannot be perceived as Korean /p/, because Korean unaspirated voiceless stops are voiced between vowels. If a Korean speaker perceived /p/ for English [p], it would be voiced: Eng. [p^hip^ol] → * Kor. /p^hipwul/ → Kor. [p^hibwul]. Accordingly, a Korean speaker would intend /p^h/ and assume that the English speaker intends /p^h/, because the /p^h/ remains [-voice]: Eng. [p^hipəl] → Kor. /p^hip^hwul/ → Kor. [p^hip^hwul].

4.3 DEVOICING. In Korean, all obstruents are voiceless; devoicing applies to the phoneme inventory. So English voiced stops are perceived as voiceless as a result of devoicing. In addition to this process, voicing creates some [+voice] stops between vowels. Accordingly, the voiced stops in Korean are the result of voicing.

(9) a. Devoicing

Eng. phonetic	Kor. phonetic	phonemic	Gloss
[bɛlt]	[pɛlt ^h w]	/pɛlt ^h w/	‘belt’
[dæns]	[tɛnsu]	/tɛnsu/	‘dance’
[gɛɪm]	[keim]	/keim/	‘game’

b. Voicing

[badi]	[padi]	/pati/	‘body’
[gɔɹld]	[kɔɹldw]	/kɔɹldw/	‘gold’
[labi]	[labi]	/lapi/	‘lobby’

Koreans do not distinguish voiceless stops from voiced ones. This fact is drawn from naive phonology. Although some voiced obstruents appear in the Korean phonology, these obstruents are perceived as voiceless phonemically. For this reason, English /b/ in *body* is pronounced as [p] in Korean, while English /b/ as in *lobby* is Korean [b]. Despite this voicing contrast, Koreans do not perceive a difference between these two stops.

Two processes, devoicing and voicing seem to be related in a reverse way. One process is in Korean production, and the other is in perception. This interpretation could be right in some contexts. However, devoicing in perception does not simply occur as the reversal of voicing. Devoicing is a more general process which applies to all Korean stops regardless of their contexts while voicing is context-sensitive.

4.4 ASSIBILATION. English [θ] is not a possible phoneme in Korean. Other non-sibilant fricatives are subject to stopping. But [θ] undergoes assibilation. This process constrains the Korean phoneme inventory by eliminating phonemes like [θ] or [ð].

(10) Assibilation: [[+continuant, -voice, +coronal, +anterior]] → [+sibilant]]

Eng. phonetic	Kor. phonetic	phonemic	Gloss
[bæθ]	[pesu]	/pesu/	‘bath’
[klɔθ]	[kulosu]	/kulosu/	‘cloth’
[θrilə]	[sullilɻ ~ tullilɻ]	/sullilɻ ~ tullilɻ/	‘thriller’

As for English [θ], if it underwent stopping, the predicted segment would be Korean /t^h/, because English voiceless fricatives are replaced by Korean aspirated stops. However, assibilation is common in the speech of English children when they learn their first language (Velleman 1988).

4.5 STOPPING. Korean does not have non-sibilant fricatives so the remaining fricatives [f, v, ð] are replaced by Korean [p^h, p, t], respectively. Since this process is not suppressed in Korean, non-sibilant fricatives are eliminated from the phoneme inventory.

(11) Stopping: [-sonorant, -sibilant] → [-continuant]

Eng.	Kor.	phonemic	Gloss
phonetic	phonetic		
[kɔfi]	[k ^h ɣp ^h i]	/k ^h ɣp ^h i/	‘coffee’
[fid]	[p ^h idɯ]	/p ^h itɯ/	‘feed’
[glʌv]	[kɯlɣbɯ]	/kɯlɣpɯ/	‘glove’
[riðm]	[lidum]	/litum/	‘rhythm’

English [f] is perceived as a stop accompanied by [aspiration] by Koreans. This substitution might have to do with the feature [friction] of fricatives. Fricatives are accompanied by some friction which, for voiceless fricatives, bears some acoustic resemblance to aspiration. This friction is interpreted as [aspiration] because Korean has aspirated segments. The two voiced non-sibilant fricatives [v, ð] also undergo stopping in addition to devoicing. Korean does not have voiced segments, so English voiced segments are subject to devoicing. [v, ð] are treated like other English voiced consonants.

4.6 AFFRICATION. English [z] is not allowed in Korean. It is replaced by the Korean unaspirated affricate /tʃ/. The reason Korean [dʒ] appears is due to voicing, which occurs between vowels.

(12) Affrication: z, ʒ → dʒ
 Devoicing: dʒ → tʃ
 Voicing: tʃ → dʒ / V _ V

(13)

Eng.	Kor.	phonemic	Gloss
phonetic	phonetic		
[mjuzɪk]	[mjʉdzɪk]	/miʉtʃɪk/	‘music’
[biznis]	[pidʒʉnisɯ]	/pitʃʉnisɯ/	‘business’
[zum]	[tʃʉm]	/tʃʉm/	‘zoom’

In the examples above, English voiced segments are replaced by Korean voiceless ones. If devoicing applied, [z] would be devoiced, too, because Korean has [s]. However, this substitution does not occur. This can be explained with reference to the principles of NP. Voicing does not occur in Korean [s]. So, English [z] cannot be perceived as Korean /s/. Korean unaspirated voiceless stops are subject to voicing between two vowels. In a reverse way, the voiced consonant [z], can be perceived as a voiceless stop by Koreans. The friction is perceived as affrication, so the stop is palatal /tʃ/.

Word-initial English [z] as in *zoom* is puzzling in this analysis. The general process that constrains the phonemes of Korean is devoicing. According to this process, English [z] should be replaced by Korean /s/ in other positions, such as word-initial. However, English [z] is replaced by Korean /tʃ/ regardless of word position.

4.7 TAPPING. Korean has one liquid /l/, and it becomes [r] in word-initial position and between two vowels. Thus, initial English liquids are replaced by Korean [r].

(14) Tapping

Eng.	Kor.	phonemic	Gloss
phonetic	phonetic		
[ræp]	[rep]	/lep/	‘rap’
[riðm]	[ridum]	/litum/	‘rhythm’
[laɪf]	[raip ^h ɯ]	/laip ^h ɯ/	‘life’
[lɔŋ]	[roŋ]	/loŋ/	‘long’

In fact, the word-initial liquid is avoided in Korean. It is only found in borrowings. The native lexicon does not contain word initial liquids due to the phonotactic distribution of the Korean liquid. This limited distribution has affected even early foreign loanwords as well as native words. As a result, early Chinese

loanwords have Korean /n/ which replaced the initial Chinese liquid. However, this constraint has become weaker. At present, Korean allows word-initial /l/ in foreign words.

4.8 GEMINATION. With respect to Korean speakers' perception and production of foreign liquids, Jakobson and Halle (1956) predicted that foreign /l/ and /r/ would be neutralized regardless of their contexts. Their analysis was based on the phoneme inventory. They compared the phonemes of Korean with those of English, and then they made a prediction. This analysis is quite similar to that of Major and Kim (1996). According to them, Korean has only one liquid, so foreign /l/ and /r/ are likely to be replaced by Korean [l] in word-final position, and they are replaced by [r] between vowels. Neutralization first seems to govern Korean speakers' perception of foreign liquids. Then neutralization interacts with tapping, which is an allophonic rule in Korean.

For example, Jakobson and Halle spell out the following Czech examples: Czech /karar/, /volal/, /oral/ and /dolar/, which presumably would be replaced by Korean [karal], [voral], [oral], and [doral]. According to them, Czech /l/ and /r/ would be perceived as /l/ by Korean speakers, so Czech liquids are replaced by Korean /l/ in word-final position. In the same way, Czech /l/ and /r/ are perceived as identical, but they are realized as [r] between vowels as a result of tapping. Their analysis seems to be oversimplified, since it does not account for what actually happens in Korean loanwords.

Contrary to what Jakobson and Halle predicted, the contrast between English liquids is perceived when they appear in word-medial position. Even though the phoneme chart in Table 2 does not show it, Korean allows a contrast between single and geminate liquids in word-medial position. For example, *molle* 'in secret' contrasts with *mole* 'the day after tomorrow'. This contrast is found in the Korean orthography as well. The single /l/ is represented as <ㄹ>, while the geminate /ll/ is represented as <ㄹㄹ>.

This contrast of medial Korean liquids also affects the Korean perception of English liquids. Thus, medial English [l] is perceived as Korean geminate /ll/; this allows the Korean speaker to account for the presence of laterality, since Korean /ll/ remains lateral in the Korean phonetic representation. Medial English [r] is perceived as Korean /l/, which is subject to tapping. It is interesting to note that English liquids are distinguished with reference to the difference of length.

(15) a. Gemination

Eng. phonetic	Kor. phonetic	phonemic	Gloss
[kʌl̥ə]	[k ^h alla]	/k ^h alla/	'color'
[bɔ̃l̥ə]	[poill̥ɾ]	/poill̥ɾ/	'boiler'
[gæləri]	[kell̥ɾri]	/kell̥ɾli/	'gallery'
[dʒɛli]	[tʃɛlli]	/tʃɛlli/	'jelly'
b. Tapping			
[bɛəriŋ]	[pɛɾriŋ]	/pɛɾriŋ/	'bearing'
[bəri]	[pɛri]	/pɛli/	'berry'
[kæri]	[k ^h eri]	/k ^h eli/	'carry'

Given the process of tapping, Koreans might perceive foreign [r] as Korean /l/. This prediction was also suggested by Jakobson and Halle. But English [r] is not perceived as Korean /l/ in word-final position. Postvocalic English [r] is not separately perceived by Koreans; it is deleted. Final English [l] is replaced by Korean [l]; they are similar.

(16) a. Deletion

Eng. phonetic	Kor. phonetic	phonemic	Gloss
[bʌtər]	[pɾt ^h ɾ]	/pɾt ^h ɾ/	'butter'
[kʌl̥ər]	[k ^h alla]	/k ^h alla/	'color'
[pɑrk]	[p ^h akw]	/p ^h akw/	'park'

b. Lateralization

[kɒl]	[k ^h ol]	/k ^h ol/	‘call’
[pipəl]	[p ^h ip ^h ul]	/p ^h ip ^h ul/	‘people’
[taɪtəl]	[t ^h ait ^h ul]	/t ^h ait ^h ul/	‘title’

4.9 MONOPHTHONGIZATION. English high tense vowels are realized as homorganic diphthongs (i.e., containing similar elements). These diphthongs are replaced by Korean high monophthongs.

(17) Monophthongization:

Eng. phonetic	Kor. phonetic	phonemic	Gloss
[kriɪm]	[k ^h urim]	/k ^h ulim/	‘cream’
[fiɪd]	[p ^h idw]	/p ^h itw/	‘feed’
[gruɪp]	[kuurup]	/kuulup/	‘group’

If vowel length were distinctive in Korean, Koreans could distinguish between English [iɪ, uɪ] from [ɪ, ʊ] because the former are longer than the latter. Nam and Southard (1994) claimed that vowel length is distinctive in Korean. They suggested the possibility that English homorganic diphthongs are perceived as Korean long vowels. But they did not provide sufficient evidence.

It is difficult to find long vowels in borrowings, since the Korean orthography does not mark length. Thus, the orthography was cited as one factor contributing to the loss of vowel length in Korean phonology. Foreign words are usually encountered through written materials. Even though vowel length was recognized by Koreans, English vowels are subject to simplification in the orthography and even in pronunciation. Thus, there is no contrast between English long vowels and short ones. English high vowels are replaced by Korean high monophthongs regardless of the tense/lax distinction. English [iɪ] and [ɪ] are replaced by Korean /i/, and [uɪ] and [ʊ] are replaced by /u/.

4.10 SYLLABIFICATION. English non-high tense vowels are realized as diphthongs containing dissimilar elements, which are called as heterorganic diphthongs. Since the elements of these diphthongs are not similar, simplification or monophthongization does not occur. These diphthongs are replaced by Korean vowel sequences.

(18) Syllabification

Eng. phonetic	Kor. phonetic	phonemic	Gloss
[tʃeɪn]	[tʃ ^h ein]	/tʃ ^h ein/	‘chain’
[dʒɔɪnt]	[tʃɔɪnt ^h w]	/tʃɔɪnt ^h w/	‘joint’
[naɪt]	[nait ^h w]	/nait ^h w/	‘night’
[snoʊ]	[sunou]	/sunou/	‘snow’
[saʊnd]	[saundw]	/sauntw/	‘sound’
[θroʊ]	[surou]	/surou/	‘throw’
[vɪdiəʊ]	[pidio]	/pitio/	‘video’

Syllabification results in a difference in the number of syllables from English to Korean. English heterorganic diphthongs are likely to undergo syllabification, so English monosyllables are replaced by Korean disyllables, and a vowel may be inserted after English word-final obstruents. Therefore, English monosyllabic words can be replaced by Korean trisyllabic ones.

Syllabification is the most common process for English heterorganic diphthongs. But English [oʊ] sometimes undergoes monophthongization rather than syllabification. Monophthongization occurs in English words ending with a consonant (i.e., a closed syllable). In contrast, syllabification occurs in words ending with a vowel (i.e., an open syllable).

(19) a. Monophthongization: ou̘ → o / _ C#

Eng. phonetic	Kor. phonetic	phonemic	Gloss
[kou̘t]	[k ^h ot ^h u]	/k ^h ot ^h u/	‘coat’
[fo̘k]	[p ^h ok ^h u]	/p ^h ok ^h u/	‘folk’
[go̘ld]	[koldu]	/koltu/	‘gold’
[ho̘m]	[hom]	/hom/	‘home’

b. Syllabification: ou̘ → ou / _ #

[sno̘]	[sunou]	/sunou/	‘snow’
[θro̘]	[surou]	/surou/	‘throw’

There are irregular forms for some English heterorganic diphthongs. Usually, the treatment of English diphthongs depends on the following segments or the syllable structure. However, these diphthongs are monophthongized, even though a consonant does not follow.

(20) Monophthongization

Eng. phonetic	Kor. phonetic	phonemic	Gloss
[ʃou̘]	[ʃo]	/sjo/	‘show’
[vidio̘]	[pidio]	/pitio/	‘video’

4.11 VOWEL “INSERTION.” Korean does not allow released obstruents in word-final position. Due to this constraint, most English final obstruents are perceived as being followed by a vowel /u/.

(21) *u*-epenthesis

Eng. phonetic	Kor. phonetic	phonemic	Gloss
[be̘lt]	[pelt ^h u]	/pelt ^h u/	‘belt’
[bʌs]	[pɾsu]	/pɾsu/	‘bus’
[fi̘d]	[p ^h id ^h u]	/p ^h it ^h u/	‘feed’
[ge̘ɪt]	[keit ^h u]	/keit ^h u/	‘gate’
[laɪ̘f]	[laip ^h u]	/laip ^h u/	‘life’

Ohso (1973) applied the principles of NP to Japanese vowel insertion. Ohso explained this process by referring to a process that governs Japanese production. In Japanese, vowel devoicing, which is a weaker version of vowel deletion, applies in fast speech or after voiceless fricatives. The explanation in NP is that vowel insertion occurs by reversals of vowel devoicing and vowel deletion.

Korean vowel insertion can also be accounted for in this way. Vowel devoicing has been noted by Kim and Allard (1994). High vowels are likely to be devoiced in certain environments. In Korean, there are three high vowels: /i, u, ɯ/. Among them, the achromatic (i.e., non-palatal and non-labial) /u/ is selected as a restored vowel because it is the shortest and most easily deleted.

Instead of /u/, the high palatal vowel [i] is inserted after an English final palatal fricative or affricate. The palatality of such segments is perceived by Koreans, which can be accounted for by a deleted /i/. In addition, [i] is very likely to be devoiced or deleted adjacent to palatal consonants, so the restored vowel is palatal.

(22) Eng.	Kor.		Gloss
phonetic	phonetic	phonemic	
[ɪntʃ]	[ɪntʃ ^{hi}]	/ɪntʃ ^{hi} /	‘inch’
[mɛsɪdʒ]	[mɛsɪdʒi]	/mɛsɪtʃi/	‘message’
[peɪdʒ]	[peɪdʒi]	/peɪtʃi/	‘page’
[swɪtʃ]	[swɪtʃ ^{hi}]	/swɪtʃ ^{hi} /	‘switch’

4.12 UNRELEASING. Most English consonants are subject to vowels epenthesis in word-final position, but some English stops undergo unreleasing instead.

(23) Unreleasing			
Eng.	Kor.		Gloss
phonetic	phonetic	phonemic	
[bæɡ]	[pek ^ɿ]	/pek/	‘bag’
[ɡʊd]	[kut ^ɿ]	/kut/	‘good’
[tʃap]	[tʃ ^h ap ^ɿ]	/tʃ ^h ap/	‘chop’
[kʌp]	[k ^h ʌp ^ɿ]	/k ^h ʌp/	‘cup’

Unreleasing is a native phonological process resulting from the constraint on Korean word-final obstruents. In Korean, released obstruents are not allowed in word-final position. If obstruents appear in this position, they are all unreleased. Acoustic data were provided for Korean word final obstruents (Kim and Allard 1994). The results indicated that Korean obstruents are neutralized in this position. For example, labial /p, p^h, p^ʰ/ are realized as [p^ɿ]; alveolar and palato-alveolar /t, t^h, t^ʰ, s, s^ʰ, tʃ, tʃ^h, tʃ^ʰ/ are realized as [t^ɿ]; velar /k, k^h, k^ʰ/ are as [k^ɿ].

The following examples illustrate how obstruents are neutralized in Korean.

(24) word			INST.	phrase		
/nat ^h /	[nat ^ɿ]	‘piece’	[uro]/ulo/	[nat ^h uro]	/nat ^h ulo/	‘with a piece’
/nat/	[nat ^ɿ]	‘grain’	/ulo/	[naduro]	/natulo/	‘with a grain’
/nas/	[nat ^ɿ]	‘sickle’	/ulo/	[nasuro]	/nasulo/	‘with a sickle’
/natʃ ^h /	[nat ^ɿ]	‘face’	/ulo/	[natʃ ^h uro]	/natʃ ^h ulo/	‘with a face’

The feature [-release] is also found in English stops. They become unreleased when followed by another stop. They occur at word boundaries. For example, /t/ as in *cat* is realized as [t^ɿ] when *cat* is produced in *The cat pushed the vase* (Ladefoged 1993). Such unreleased stops also appear in words like *apt* [æp^ɿt] or *hotdog* [hət^ɿdɔɡ].

It is not clear which words with final stops will undergo insertion and which will undergo unreleasing. Broselow and Park (1995) give an account involving the “Mora Conservation Law,” but it involves many difficulties (in providing the proper data) and there are many counterexamples. The point of their claim is that the two Korean processes, unreleasing and vowel “insertion,” occur alternatively based on the principle called the “Mora Conservation Law.” However, this principle does not account for all the examples, since there are cases where English words containing two moras are replaced by Korean three-mora words.

(25) Eng.	Kor.		Gloss
phonetic	phonetic	phonemic	
[p ^h aɪp]	[p ^h aɪpɯ]	/p ^h aɪpɯ/	‘pipe’
[leɪk]	[leɪkɯ]	/leɪkɯ/	‘lake’
[naɪt]	[naitɯ]	/naitɯ/	‘night’
[geɪt]	[keitɯ]	/keitɯ/	‘gate’

4.13. DELETION. Korean speakers are also observed to delete English word-final obstruents. This process was noted by Tarone (1987). In this pilot study, Tarone tested six speakers of three different languages: Cantonese, Korean, and Portuguese. The productions of these speakers were judged by native English speakers. Korean learners had difficulty in producing word-final consonants and thus made errors.

This may result from Korean unreleasing. Korean speakers avoid releasing final consonants. Such unreleased consonants might be perceived as “being dropped” by English speakers.

Tarone also provided another interesting kind of data for Korean interlanguage. According to this study, Korean loan phonology is not always the same as Korean interlanguage phonology. Borrowings are more likely to be affected by the orthography or by the written language, so deletion is less likely. But L2 learners are exposed to the spoken language in classroom or other situations, and deletion may occur.

For instance, Korean learners of English made more errors due to deletion than errors due to vowel epenthesis. These results are contrary to the analysis of borrowings, because vowel epenthesis was a dominant process in borrowings. Although unreleasing also occurs, this process is limited to a few English consonants. Most consonants are subject to epenthesis. However, vowel epenthesis became a minor process in Korean interlanguage phonology.

5. CONCLUSION. It is assumed that speakers of a borrowing language perceive foreign sounds in terms of the phonemes of their native language. However, it is not easy to apply this principle to actual data or languages. Questions arise concerning this principle: which phoneme is perceived as the closest sound by speakers of a borrowing language? How are substitution processes determined? Thus, within a purely contrastive analysis, fortition processes (i.e., constraining the phoneme inventory) would be predicted; for example, depalatalization, devoicing, affrication, stopping, or assibilation. However, the data are hard to account for within this analysis.

As for the Korean perception of English segments, two other studies were discussed in this paper. Major and Kim (1996) predicted that English voiceless stops would be replaced by Korean unaspirated voiceless stops, and Jakobson and Halle (1956) predicted neutralization for English liquids. Their predictions are drawn from comparing the phonemes of Korean and those of English. However, as pointed out above, such analyses based on phonemes alone do not provide an appropriate explanation for borrowings. What actually happens is different from what they predict.

For instance, English voiceless stops are not replaced by Korean unaspirated voiceless stops. Korean speakers perceive the aspiration of English voiceless stops. Such perception is not predicted just by comparing phonemes, because aspirated stops are allophonic in English. Allophones of a source language are shown to affect the speakers of a borrowing language.

Similarly, English liquids are not replaced as predicted within the phoneme-based analysis. Since Korean has only one liquid and English has two, English liquids are predicted to be neutralized. However, neutralization is limited to word-initial position.

In addition, it is difficult to explain the way English [s] and [ʃ] are replaced if we depend on the purely phoneme-based analysis. These two segments are predicted to be neutralized, because Korean has only one fricative [s]. But these two segments are not simply neutralized in Korean. Actually, they are underlyingly distinguished, because English [ʃ] is interpreted as Korean /s/ followed by a palatal glide, which is pronounced as [ʃ].

In NP, other factors are taken into consideration so that more data may be explained. For instance, NP keeps in mind the connection between a phoneme and its allophones. Allophones were also considered in the phoneme-based analysis, but this analysis does not consider the nature of allophones as arising by processes. However, in NP, processes are viewed as determining how speakers of a borrowing language hear sounds. All processes affect both production and perception. Again, the phonetic (or allophonic) qualities of the source language and the allophonic processes of the borrowing language affect the outcome.

For instance, glide or vowel “insertion” is found in Korean loan phonology. Speakers of a borrowing language hear a segment that is not originally produced in the source language. Such an inserted segment is troublesome in contrastive analysis because it is not predicted from the phoneme inventory. Phonotactic differences are not sufficient to account for this. In NP, the inserted segment is explained based on the connection between a phoneme and its allophones. Thus, “insertion” is considered as restoration, which is a reversal of a deletion. Thus, this phenomenon is not isolated from other phonological phenomena. Rather, it could be considered from a universal point of view.

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