Current Issues in Linguistic Theory

307

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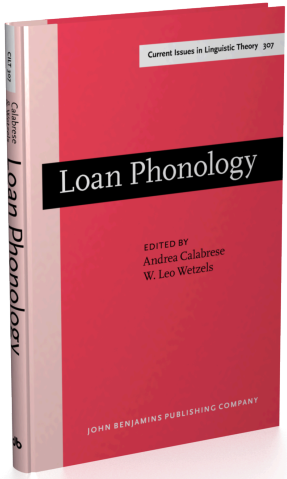
https://doi.org/10.1075/cilt.307.06kim



Pages 155–180 of
Loan Phonology
Edited by Andrea Calabrese and W. Leo Wetzels
[**Current Issues in Linguistic Theory**, 307] 2009. vii, 273 pp.

Korean adaptation of English affricates and fricatives in a feature-driven model of loanword adaptation

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The present study aims to elaborate on Kim's (2007a) feature-driven model of loanword adaptation, based on Korean adaptation of English affricates and fricatives (/f, v, θ, ð, s, z, ʃ, ʒ, tʃ, dʒ/) which the host language (L1) does not possess except /s/. We propose an L1 grammar-driven perception of L2 (source language) sounds in that a Korean speakers' perception is driven by native (L1) distinctive features and syllable structure rather than in terms of the unstructured L2 acoustical input per se or of L2 phonological categories. In addition, native structural restrictions are proposed to come into play when L2 sounds scanned by L1 grammar are lexicalized as new words in L1 lexical representations. It is also suggested that an L2 acoustic signal can be constrained by L1 distinctive features by virtue of normalization or generalization, when the L2 signal has no acoustic cues to L1 distinctive features, indicating that L1 grammar exerts a force in perception.

1. Introduction

This paper is concerned with how English affricates and fricatives are borrowed into Korean, as a follow-up study to Kim's (2007a) feature-driven model of loanword adaptation. Based on the Korean adaptation of English and French voicing contrasts in plosives, Kim (2007a) has proposed that when L1 speakers perceive an L2 acoustic signal, they parse the L2 signal for cues to the distinctive features of their own phonemes. For example, as shown in (1), the English voiceless plosives /p, t, k/ are all borrowed as aspirated /pʰ, tʰ, kʰ/, no matter where they are placed in a word (a), and the French voiceless plosives are borrowed as either aspirated /pʰ, tʰ, kʰ/ or as fortis /p', t', k'/ context-freely, as in (b).[1] As for voiced /b, d, g/ in English (2a) and French (2b), they are borrowed as the Korean voiceless lenis plosives /p, t, k/.

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1. Korean adapted forms in the present study are transcribed as lexical (underlying) representations in (4b) in a feature-driven model of loanword adaptation in (4), unless marked

(1) a. English words — Korean adapted forms

type	**t^{h}**a.i.**p^{h}ɨ**
pentium	**p^{h}**ɛn.**t^{h}**i.ʌm
computer	**k^{h}**ʌm.**p^{h}**u.**t^{h}**ʌ

b. French words — Korean adapted forms

Printemps (department store)	**p^{h}ɨ**.lɛŋ.**t^{h}**aŋ	~	**p'ɨ**.lɛŋ.**t'**aŋ
Cannes	**k^{h}**an.n**ɨ**	~	**k'**an.n**ɨ**
boutique	pu.**t^{h}**i.**k^{h}ɨ**	~	pu.**t'**i.**k'ɨ**

(2)

	English words	Korean adapted forms		French words	Korean adapted forms
a.	bag	**pæk**	b.	Bordeaux	**p**o.l**ɨ**.**t**o
	dam	**t**æm		grand	**kɨ**.laŋ
	gas	**k**a.s'**ɨ**		De Gaulle	**tɨ**.**k**ol

Adopting the view that Korean voiceless obstruents are specified for the laryngeal features [±tense] and [±spread glottis] (henceforth, [±s.g.]), as shown in (3), Kim (2007a) has suggested that Korean speakers scan the acoustic signal of the English and French voicing contrasts for cues to the laryngeal features of Korean consonants.[2]

(3) The laryngeal feature specification of Korean obstruents
(Kim 2003, 2005 a, b; Kim et al. 2005a, b, 2007)

	lenis	fortis	aspirated
[tense]	–	+	+
[s.g.]	–	–	+

In the feature system in (3), it is proposed that the feature [tense] is defined in terms of the tensing of both the primary articulator and the vocal folds, in that closure/constriction duration and larynx raising are invariant articulatory correlates

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or mentioned specifically. This is because it is easy for readers to see how the L2 voicing contrasts are borrowed into Korean. If we transcribed surface representations instead of underlying ones, the Korean adaptation of the L2 contrasts would be less straightforward because Korean lenis stops are optionally voiced in intervocalic position on the surface. In addition, the adaptations of relevant L2 consonants as well as L1 counterparts are marked in bold throughout the present paper for the purpose of a reader's convenience.

2. As for other views on the feature specification of Korean consonants, see C.-W. Kim (1965), Halle & Stevens (1971), Kagaya (1974) and Y.-M. Cho (1990) among others. In the feature system in (3), Korean fortis consonants are considered as singletons, not geminates (see Cho & Inkelas 1994; Kim 2002, 2005a, b; Kim et al. 2007 for phonological and phonetic arguments contra gemination and Martin (1982); Silva (1992); Han (1996) and Avery & Idsardi (2001) for phonological arguments pro gemination).

of the feature [tense] (Kim et al. 2007) and that [s.g.] is defined in terms of glottal opening, as in Halle & Stevens (1971).[3] The main acoustic correlates of the features [tense] and [s.g.] are closure/constriction duration and aspiration, respectively.

Based on the laryngeal feature specification in (3) and the Korean adaptation of English and French voicing contrasts, Kim (2007a) has proposed that when L2 voiceless/voiced plosives have a closure duration difference with no perceived difference in aspiration, as in French, the L2 voicing contrast is interpreted as the tense vs. lax opposition ([±tense]), in terms of duration, within the framework of the L1 laryngeal features in (3). Thus, the Korean treatment of French voiceless plosives in (1b) is concerned with the feature [+tense] and that of French voiced ones in (2b) with [–tense] across all contexts. When the L2 voicing contrast is perceived as the presence vs. absence of VOT lag, as in English plosives, it is interpreted in terms of [±s.g.]. As to the closure duration difference between English voiced and voiceless plosives, it has been assumed that it reinforces a Korean speakers' perception of the English voicing contrast and that it is interpreted as cuing the feature [±tense] in Korean. Accordingly, English voiceless plosives in (1a) are adapted as aspirated ([+s.g., +tense]) and voiced ones in (2a) as lenis ([–s.g., –tense]). Note that the presence vs. absence of the vocal fold vibration in the source languages is not attended to by Korean speakers. Instead, redundant phonetic cues such as closure duration and aspiration of the source languages are readily perceived as distinctive phonetic attributes of the two features [±tense] and [±s.g.], respectively, in Korean.[4]

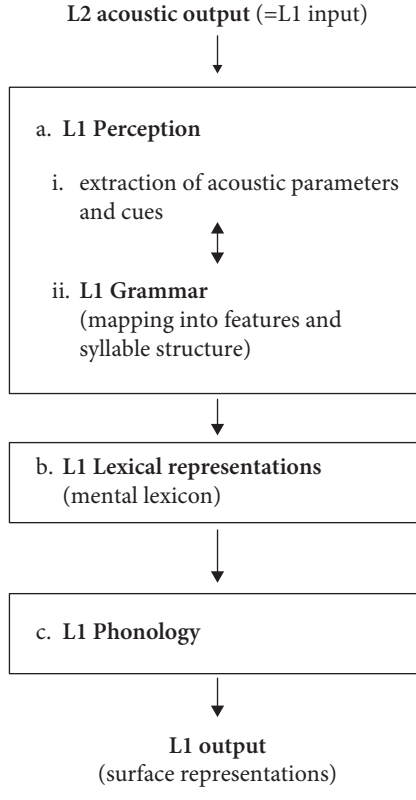
Given this, Kim (2007a) has proposed a feature-driven model of loanword adaptation, which is composed of three main levels between the L2 acoustic output (=L1 input) and the L1 output, as shown in (4). In this model, it is assumed that acoustic parameters and cues are extracted in the first stage of L1 perception (4a i) and that they are mapped into L1 linguistic entities such as distinctive features and syllable structure in conformity with the L1 grammar (4a ii). The bidirectional arrow is used to indicate that the extraction process is guided by the categories of the L1 grammar. In particular, it is assumed that, in the mental lexicon (4b), L2 sounds scanned by L1 grammar such as native distinctive features and syllable structure are lexicalized as new words in accordance with L1 structural restrictions and that they are represented as a sequence of syllabified distinctive feature

3. Following a tradition launched by C.-W. Kim (1965), Kim et al. (2007) further elaborate articulatory correlates of the feature [tense] in Korean.

4. See also Kim (2007b, 2008) for Korean adaptation of Japanese voicing contrast in favor of such an L1 feature-driven perception in loanword adaptation.

bundles stored in long-term memory in line with Stevens (2005).[5] The lexical representations may then undergo L1 phonology (4c) from which L1 outputs result as surface representations.

(4) A feature-driven model of loanword adaptation (Kim 2007a)



In the present study, we elaborate the feature-driven model of loanword adaptation in (4), on the basis of the Korean adaptation of English affricates and fricatives (/f, v, θ, ð, s, z, ʃ, ʒ, tʃ, dʒ/). The examination of Korean adaptation data will lead us to suggest an L1 grammar-driven perception of L2 sounds in that Korean (L1) speakers parse the acoustic signal of English (L2) affricates and fricatives within the framework of L1 distinctive features and syllable structure, rather than in terms of the unstructured L2 acoustical input per se or of L2 phonological categories. In

5. Note that lexical representations in the mental lexicon (4b) are not the same as lexical and underlying representations in Lexical Phonology (e.g., Kiparsky 1982; Mohanan 1986). See the Subsection 3.4 for discussion.

addition, we suggest that L1 structural restrictions play a role in L1 lexical representation (4b) where L2 sounds scanned by L1 grammar in L1 perception are lexicalized as new words, motivating the presence of the mental lexicon (4b) between L1 perception and L1 phonology in loanword adaptation. It is also proposed that L2 acoustic signals can be constrained by virtue of normalization or generalization, when they have no acoustic cues to L1 distinctive features, indicating that L1 grammar exerts a force in perception.

This paper is structured as follows. Section 2 provides an overview of English and Korean consonants and syllable structure. Section 3 presents the Korean adaptation of English affricates and fricatives in support of the feature-driven model of loanword adaptation in (4). Section 4 discusses the phonetic approximation view and the purely phonological view of loanword adaptation in comparison with the proposal made in this study, and Section 5 is a brief conclusion.

2. Background

The English and Korean consonant inventories are shown in (5) and (6), respectively. English has eleven affricates and fricatives (/f, v, θ, ð, s, z, ʃ, ʒ, tʃ, dʒ, h/) which have voicing contrast, like plosives, except /h/, and their places of articulation range from labial-dental (/f, v/) through denti-alveolar (/θ, ð/), alveolar (/s, z/) and palato-alveolar (/tʃ, dʒ/) to glottal (/h/).

(5) English consonants (Ladefoged 2001)

			labial	coronal				dorsal	glottal
				dental	alveolar	palato-alveolar	palatal		
a.	stops	voiceless	p		t	tʃ		k	
		voiced	b		d	dʒ		g	
b.	fricatives	voiceless	f	θ	s	ʃ			h
		voiced	v	ð	z	ʒ			
c.	nasals		m		n			ŋ	
	liquid				l, r	ɳ			
	glides						j	w	

In contrast, Korean has six affricates and fricatives (/ts, ts^{h}, ts', s, s', h/) all of which are voiceless, and the strident coronal consonants are all alveolars with a three- or two-way laryngeal contrast: lenis (/ts/), aspirated (/ts^{h}/) and fortis (/ts'/) affricates and lenis (/s/) and fortis (/s'/) fricatives, as shown in (6).[6]

6. The Korean affricates in (6) are transcribed as alveolar in line with Skaličková (1960) and Kim (1999, 2001, 2004) and the fricatives as lenis (/s/) and fortis (/s'/), following Kim (2005b) and Kim et al. (2005a, b) among others.

(6) Korean consonants (Kim 2005a, b; Kim et al. 2005a, b)

			labial	coronal		dorsal	glottal
				alveolar	palatal		
a.	stops	lenis	p	t, ts		k	
		aspirated	p^h	t^h, ts^h		k^h	
		fortis	p’	t’, ts’		k’	
b.	fricatives	lenis		s			h
		fortis		s’			
c.	nasals		m	n		ŋ	
	liquid			l			
	glides				j	w	

The syllable in Korean is composed of (C)(G)V(C) where G refers to either of the two glides /j, w/. All the consonants except /ŋ/ are allowed in onset position in Korean. Acceptable coda consonants are confined to /p, t, k, m, n, l, ŋ/ due to the Coda Neutralization process whereby all the laryngeal contrasts of obstruents are reduced to lenis counterparts.[7] For example, the fricatives /s, s’, h/ and the affricates /ts, ts^h, ts’/ are neutralized into [t] in coda position like the coronal plosives /t, t^h, t’/.

The Korean adaptation data in the present study were collected from daily expressions used frequently in mass media such as advertisements in magazines, in newspapers, on the Internet or on television as well as in the spoken language.

3. L1 grammar-driven perception of L2 sounds

In this section, we examine how the English affricates and fricatives (/f, v, θ, ð, z, ʃ, ʒ, tʃ, dʒ/) are adapted into Korean in four subsections, as follows: (a) L1 feature-driven perception of English [s], (b) the role of native (L1) syllable structure as well as distinctive features in a Korean speakers’ perception of prevocalic [ʃ] and postvocalic [ʃ, ʒ, dʒ, tʃ], (c) the generalization of the feature-driven adaptation of the voicing contrast in English plosives into the adaptation of the voicing contrast in English affricates and fricatives, and (d) native structural restrictions in L1 lexical representations (4b).

3.1 L1 feature-driven perception

The Korean adaptation of English [s] supports the view of Kim (2006, 2007a,b, 2008) that the distinctive features of one’s native language steer speakers in their

7. See Kim & Jongman (1996) and relevant references therein for the Korean Coda Neutralization.

search to replace foreign sounds with native sounds. As shown in (7a), English single [s] is borrowed as fortis /s'/ across the contexts.[8] English [s] in consonant clusters is, on the other hand, borrowed as lenis /s/ in all contexts, as in (7b).

(7)	English words	Korean adapted forms
a.	salad	**s'**æl.lʌ.t**ɨ**
	sign	**s'**a.in
	single	s'iŋ.k**ɨ**l
	excite	ik.**s'**a.**ɨ**.t^{h}**ɨ**
	bus	pʌ.**s'ɨ**
	kiss	k^{h}i.**s'ɨ**
b.	sky	**sɨ**.k^{h}a.i
	snap	**sɨ**.næp
	disco	ti.**sɨ**.k^{h}o
	display	ti.**sɨ**.p^{h}**ɨ**l.lɛ.i
	test	t^{h}ɛ.**sɨ**.t^{h}**ɨ**
	mask	ma.**sɨ**.k^{h}**ɨ**

Phonetic studies of English [s] report that the oral constriction duration is shorter in [s] in consonant clusters than in the single [s]. According to Klatt's (1976) acoustic data, the average durational reduction of English [s] in consonant clusters is "approximately 15%" compared to the single [s] in an unstressed position. In Korean the fortis fricative /s'/ is longer in constriction duration than its lenis counterpart /s/ both word-initially and -medially (e.g., Kim et al. 2005a, b), and the difference in duration between the two types of fricatives is perceived distinctively by Korean speakers in some recent perception studies. For example, in S. Kim's (1999) perception test, Koreans perceive an English longer [s] as fortis /s'/ and a shorter [s] as lenis /s/, when exposed to digitally edited [sa] stimuli. Her subjects were likely to perceive stimuli under 110 ms as the lenis fricative /s/, stimuli above 140 ms as the fortis /s'/. In addition, Lee & Iverson (2006) have reported from their perception experiments that the English fricative [s] is short enough to be perceived as /s/ when it occurs before another consonant (e.g., *stop, snap; desk, fast*) but long enough to be perceived as /s'/ when it occurs after consonants including sonorants (e.g., *dance, false, matrix*).

Given the phonetic studies and the view of the laryngeal specification of Korean obstruents in (3) as well, we propose in line with Kim (2007a) that the duration difference in English [s], which is purely phonetic in the source language,

8. See Kim (2007a) for the Korean adaptation of French single [s] and [s] in consonant clusters which is the same as that of English single [s] and [s] in consonant clusters in (7).

is parsed for cues to the feature [±tense] in the initial processing of L1 perception (4a i). Accordingly, the long duration of a single [s] is parsed for a cue to [+tense] and the short one in consonant cluster to [–tense], as in (8).

(8)

English (L2)		cues		Korean (L1)
single [s]	⟷	long duration	⟷	[+tense]
[s] in clusters	⟷	short duration	⟷	[–tense]

In addition, large acoustic intensity during constriction and the location of noise above 4 kHz in English [s] are extracted and parsed for cues to the Korean features [+continuant, +strident] and [+anterior, coronal], respectively, in the first stage of L1 perception (4a i). In the next stage (4a ii), where features are formally mapped in accordance with L1 grammar, the extracted cues are interpreted in terms of the L1 features. Therefore, in the lexical representations in (4b), the English [s] is represented as fortis /s'/ ([+continuant, +strident, +anterior, coronal, +tense, –s.g.]) or lenis /s/ ([+continuant, +strident, +anterior, coronal, –tense, –s.g.]), depending on whether it is long or short.[9] As a result, English [s] is realised as either fortis [s'] or lenis [s] in the Korean surface representations.

The Korean adaptation of English [s] indicates that distinctive features of the host language play a crucial role in interlanguage loanword adaptation. In the next subsection, other data is presented which shows that not only native distinctive features but also syllable structure exerts an influence on a Korean speakers' perception of English prevocalic [ʃ] and postvocalic [ʃ, dʒ, tʃ].

3.2 The role of L1 syllable structure as well as distinctive features

Prevocalic palato-alveolar [ʃ] is realised as a sequence of /s/ and /j/ before a non-front vowel, as shown in (9a) or that of /s/ and /w/ before a front vowel, as in (9b).

(9)

	English words	Korean adapted forms	
a.	shop	**sj**ap	
	super (market)	**sj**u.p^{h}ʌ	
	special	sɨ.p^{h}ɛ.**sj**ʌl	
	audition	o.ti.**sj**ʌn	
	show	**sj**o	(~ **s'j**o)
	tissue	t^{h}i.**sj**u	(~ t^{h}i.**s'j**u)
	issue	i.**sj**u	(~ i.**s'j**u)

9. The Korean fricatives are specified for [–s.g.] in the laryngeal feature system in (3). See Kim et al. (2005a, b) and Kim (2005b) for both phonetic and phonological discussions for the feature specification of the Korean fricatives.

b.	membership	mɛm.pʌ.**swip**
	gossip	ka.**swip**
	sheath (dress)	**swi**.t**ɨ**
	Shell (oil company)	**swɛl**
	Sheraton (a hotel chain)	**swɛ**.la.t^{h}on

We assume that a large acoustic intensity (stridency) of onset [ʃ] is extracted and parsed for cues to the features [+continuant, +strident] in the initial processing of L1 perception (4a i).[10] In particular, during the extraction, its low-frequency energy around 2–3.5 kHz (e.g., Kent & Read 2002) and locus are parsed for cues to the features [+anterior, coronal] and one of the glides /j/ or /w/ according to the native distinctive features and syllable structure, as shown in (10).

(10)

English (L2) prevoicalic [ʃ]		cues		Korean (L1) /sj/ or /sw/
[–anterior, coronal]	⟷	noise around 2–3.5 kHz and the locus	⟷	[+anterior, coronal] with the addition of the glide /j/ or /w/

When the English fricative is followed by front vowels, the glide /j/ whose place of articulation is coronal like a front vowel is not allowed due to the violation of the Obligatory Contour Principle (henceforth, OCP. e.g., Leben 1973; McCarthy 1986; Yip 1988). Instead, the other glide /w/ is inserted by virtue of the native syllable structure, as in (9b). The extracted acoustic cues are then mapped into the L1 features and syllable structure within the framework of L1 grammar in the second stage of L1 perception (4a ii). Therefore, English [ʃ] is borrowed as either /sj/ before a non-front vowel or /sw/ before a front vowel. This results in a Korean adaptation which most closely approximates the onset palato-alveolar fricative of the source language.

Note that length is not decisive in the adaptation of English palato-alveolar fricative in (9). The presence of the anterior lenis /s/ and fortis /s'/ in the Korean consonant inventory (6) leads to L1 feature-driven perception of English [s], as in (8), and thus Korean adapters are sensitive to the purely phonetic length difference in English [s], as in (7). However, the adaptation of English palato-alveolar fricative [ʃ] in (9) is affected by L1 syllable structure according to which one of the glides /j/

10. Given the feature [+anterior] is not distinctive in Korean because all coronal obstruents are [+anterior], L2 sounds which are either [+anterior] or [–anterior] are parsed for the native feature [coronal], and when they are [–anterior], the native syllable structure exerts a force, as we will see in (9) and (13).

or /w/ is inserted after the lenis /s/ to denote the place of articulation of the source sound. In addition, the onset sequences of /s'j, s'w/ are not allowed in Korean except in a few loans. For example, among the loans in (9), the Korean adaptation of [ʃ] in the English words *show, tissue* and *issue* alternates between [sj] and [s'j] on the surface. The alternation is reminicent of that between lenis and fortis consonants in intensified expressions in some native Korean words whose initial consonants are either lenis plosives or fricative /s/ in (11a) and also in some English loans (11b), as shown below. A fortis consonant in word-initial position in (11) reflects a more emphasized expression than its lenis counterpart in both some native vocabulary and English loans whose frequency is relatively higher than any others.

(11) The alternation of the lenis and fortis consonants in native Korean words (Kim 2005a, b)

			intensified expressions		
a.	pʌn.tɛ.ki	~	p'ʌn.tɛ.ki	* pʰʌn.tɛ.ki	'chrysalis, pupa'
	tæ.tsuŋ	~	t'æ.tsuŋ	* tʰæ.tsuŋ	'Daejung (former president)'
	tsa.sik	~	ts'a.sik	*tsʰa.sik	'chap'
	koŋ.ts'a	~	k'oŋ.ts'a	*kʰoŋ.ts'a	'something got for nothing'
	so.tsu	~	s'o.tsu		'Korean distilled liquor'
	sa.raŋ	~	s'a.raŋ		'love'
	sa.na.i	~	s'a.na.i		'man'
b.	pæk	~	p'æk	*pʰæk	'bag'
	pæn.tɨ	~	p'æn.tɨ	* pʰæn.tɨ	'(musical) band'
	tæn.sɨ	~	t'æn.sɨ	* tʰæn.sɨ	'dance'
	tæm	~	t'æm	* tʰæm	'dam'
	tsæm	~	ts'æm	* tsʰæm	'jam'
	kɛ.im	~	k'ɛ.im	* kʰɛ.im	'game'
	ka.s'ɨ.	~	k'a.s'ɨ.	* kʰa.s'ɨ.	'gas'

The alternation pattern in the three English words in (9a) which is similar to that in (11) leads us to suggest that it results from a lexical diffusion of the emphasized expressions of word-initial consonants in (11). Hence, the lenis fricative of the sequence /sj/ in the English loans is emphasized into /s'j/ not only word-initially, as in [**sj**o] ~ [**s'j**o] 'show', as in (11), but also word-medially, as in [tʰi.**sj**u] ~ [tʰi.**s'j**u] 'tissue' and [i.**sj**u] ~ [i.**s'j**u] 'issue'.[11,12]

The influence of the native syllable structure as well as distinctive features on a Korean speakers'perception is further supported by the adaptation of English

11. We hardly find loans beginning with /s'w/.

12. The alternation in (11) provides evidence for the features [±tense] and [±s.g.] of the Korean obstruents (Kim 2005a, b). The sound pattern of lenis and fortis consonants to the exclusion of aspirated ones as well as the alternation is accounted for under the feature specification in (3).

words ending in palato-alveolar [ʃ, dʒ, tʃ] and anterior affricates and fricatives [s, z, f, v, θ, ð]. As shown in (12a), when the English word-final anterior affricates and fricatives are borrowed into Korean, the vowel /ɨ/ is inserted after the consonants.[13] This is also true of English word-final labial, coronal and dorsal stops, as in (12b). However, English word-final [ʃ, dʒ, tʃ] are borrowed as onsets with the insertion of the vowel /i/.[14] In particular, note the alternation between /swi/ and /si/ in the adaptation of the coda [ʃ] in (13a), and the sequence /si/ in (13a ii) is much more preferred.

(12) The insertion of the vowel /ɨ/

	English words	Korean adapted forms
a.	rose	lo.**tsɨ**
	quiz	k^{h}wi.**tsɨ**
	size	s'a.i.**tsɨ**
	bath	pa.**s'ɨ**[15]
	beef	pi.**p^{h}ɨ**
	life	la.i.**p^{h}ɨ**
	love	lʌ.**pɨ**
	five	p^{h}a.i.**pɨ**
b.	Cape (Town)	k^{h}ɛ.i.p^{h}ɨ
	print	p^{h}ɨ.lin.**t^{h}ɨ**
	guide	ka.i.**tɨ**
	peak	p^{h}i.**k^{h}ɨ**
	gag	kæ.**kɨ**

(13) The insertion of the vowel /i/

	English words	Korean adapted forms		
		i.		ii.
a.	cash	k^{h}æ.**swi**	~	k^{h}æ.**si**
	rush (hour)	lʌ.**swi**	~	lʌ.**si**
	English	iŋ.kɨl.li.**swi**	~	iŋ.kɨl.li.**si**
	Bush	pu.**swi**	~	pu.**si**
	fish	p^{h}i.**swi**	~	p^{h}i.**si**

13. The Korean adaptation of English /z, f, v, θ, ð, ʒ, dʒ, tʃ/ will be discussed in detail in the next subsection.

14. We have not found Korean adaptation of English words ending in [ʒ].

15. Note that the English name *Elizabeth* is borrowed either as /ɛl.li.tsa.pɛ.s'ɨ/ or as /ɛl.li.tsa.pɛs/. When the feature bundle of /s'/ is syllabified as coda of a preceding syllable, the vowel /ɨ/ is not inserted, and neutralized into /t/ in L1 perception (4a). Yet, due to L1 structural restrictions in L1 lexical representations (4b), the word-final neutralized consonant is stored as the lenis fricative /s/. See the Subsection 3.4 for discussion about the word-final lenis fricative /s/ as in /ɛl.li.tsa.pɛs/.

b.	change	ts^{h}ɛ.in.**tsi**
	orange	o.lɛn.**tsi**
	cabbage	k^{h}æ.pi.**tsi**
	sponge	sɨ.p^{h}ʌn.**tsi**
	page	p^{h}ɛ.i.**tsi**
c.	match	mæ.**ts^{h}i**
	beach	pi.**ts^{h}i**
	pitch	p^{h}i.**ts^{h}i**
	coach	k^{h}o.u.**ts^{h}i**
	bench	pɛn.**ts^{h}i**
	catch	k^{h}æ.**ts^{h}i**
	touch	t^{h}ʌ.**ts^{h}i**

We assume that the insertion of the vowel /ɨ/ in (12) or /i/ in (13) occurs in L1 perception (4a) when the L2 word-final sounds are scanned as onsets by virtue of L1 syllable structure. The insertion of the vowel /i/ in (13) can be attributed to a Korean adapters' attempt to denote the place of articulation of the source sounds [ʃ, dʒ, tʃ] within the framework of Korean grammar (Kim 1999, 2004). Since there are only alveolar stridents except /h/ in Korean, as shown in (6), the acoustic signal of the English palato-alveolar stridents are parsed for cues to features of L1 relevant alveolar stridents /s, ts, ts^{h}/ with the insertion of the vowel /i/ in the initial processing of L1 perception (4a i), as in (14).

(14)

English (L2) [ʃ, dʒ, tʃ] in coda position		cues		Korean (L1)
[–anterior, coronal]	⟷	noise around 2–3.5 kHz and the locus	⟷	[+anterior, coronal] with the addition of /i/

Given that the vowel /i/ is similar to palato-alveolar consonants in place of articulation (e.g., Hume 1992; Clements & Hume 1995), the vowel /i/ insertion after the L1 anterior coronal consonants in (13) makes the adapted sounds as close as the L2 word-final palato-alveolar consonants. On the other hand, when English words end in anterior affricates and fricatives as well as plosives, the vowel /ɨ/ is inserted by default, as in (12). Therefore, the L2 word-final palato-alveolar sounds are perceived with the insertion of the vowel /i/, as in (13), differently from non-palato-alveolar ones in accordance with L1 syllable structure.

The preference of /si/ to /swi/ in the adaptation of English word-final [ʃ] in (13a) suggests that native distinctive features and syllable structure exert an influence on a Korean speakers' perception rather than perceptual similarity per se. The sequence of /sw/ is phonetically more faithul to the source sound than that

of /si/ in that the English fricative has a secondary articulation of labialization (e.g., Stevens 1998; Ladefoged 2001). Thus, the adaptation in (13a i) can be considered as resulting from a Korean speakers' effort to mimic the source sound as close as possible with the addition of the vowel /i/. However, the much more preferred adaptated form /si/ indicates that, regardless of the labialization of the English voiceless palato-alveolar fricative, the acoustic signal of the source sound is parsed as a single /s/ with the insertion of the vowel /i/, within the framework of L1 grammar rather than perceptual similarity.[16] This is also true of the adaptation of English word-final [dʒ, tʃ] in (13b, c). Like [ʃ], the palato-alveolar affricates have a lip rounding as a secondary articulation in English. In the aspect of perceptual similarity, then, the insertion of the glide /w/ in (13b, c) would be expected. But this is not the case.

3.3 Generalization of L1 feature-driven perception of the voicing contrast in English plosives

In this subsection, we provide further support for the view that an L1 speakers' perception of the L2 acoustic output is conditioned by cues to L1 distinctive features and syllable structure. In particular, based on the Korean adaptation of the voicing contrast of English [z, ʒ, dʒ, tʃ, f, v, θ, ð], we suggest that the L2 acoustic signal can be constrained by L1 features through the normalization or generalization of the voicing contrast in English plosives, when the L2 signal has no acoustic cues to L1 distinctive features.

As shown in (15), voiced [z, ʒ, dʒ] are borrowed as lenis affricate /ts/ and voiceless [tʃ] as aspirated /ts^{h}/. Note that the glide /j/ is added for the onset palato-alveolar [ʒ, dʒ, tʃ] when a following vowel is non-front, as in (9a), in order to denote the place of articulation of the stridents. No glide is inserted when the L2 sounds are followed by a front vowel, though the insertion of the glide /w/ would be perceptually closer to the source sounds.

(15)	English words		Korean adapted forms
a.	i.	zoom	**ts**um
		join	**ts**o.in
		design	ti.**ts**a.in
		pizza	p^{h}i.**ts**a
		music	mju.**ts**ik
	ii.	fusion	p^{h}ju.**tsj**ʌn
		vision	pi.**tsj**ʌn

16. The adaptation in (13a ii) leads us to take an example of the same adaptation of the onset English /ʃ/ in /si.t^{h}**i**/ 'sheet'.

	iii.	manager	mæ.ni.**tsj**ʌ
		journal	**tsj**ʌ.nʌl
		junior	**tsj**u.ni.ʌ
		joy	**tsj**o.i
		jean	**ts**in
		original	o.li.**tsi**.nal
		digital	ti.**tsi**.tʰal
		General (Motors)	**ts**ɛ.nʌ.lʌl
		Jane	**ts**ɛ.in
		jam	**ts**æm
b.	i.	chocolate	**ts**^{h}**j**o.k^{h}ol.lɛt
		chart	**ts**^{h}**j**a.t^{h}ɨ
		ketchup	k^{h}ɛ.**ts**^{h}**j**ap
		chewing (gum)	**ts**^{h}**j**u.iŋ
		miniature	mi.ni.ʌ.**ts**^{h}jʌ
	ii.	chip	**ts**^{h}ip
		cheeze	**ts**^{h}i.tsɨ
		chain	**ts**^{h}ɛ.in
		chatting	**ts**^{h}æ.t^{h}iŋ

From a phonetic point of view, it would be a little peculiar if English [tʃ] is borrowed as aspirated /ts^{h}/ because the source sound has no aspiration. However, the consideration of how the voicing contrast in English plosives in (1a) and (2a) is adapted into Korean (Kim 2007a) leads us to make the following suggestion: the Korean adaptation of English voicing contrast in plosives is generalized in that of the voicing contrast in English stridents in (15), no matter whether there is no aspiration after the friction of English [tʃ]. That is, because English voiceless plosives are aspirated, as in (1a), aspiration is, now as a loan strategy, imposed on any voiceless English affricate or fricative except [s].[17]

It is noteworthy that the Korean adaptation of the voicing contrast in the English stridents in (15) is in accordance with that of the voicing contrast in English plosives: as English voiceless plosives in (1a) are adapted as aspirated plosives ([+s.g., +tense]) and voiced ones in (2a) as lenis ([–s.g., –tense]), voiceless strident [tʃ] is borrowed as aspirated ([+s.g., +tense]) /ts^{h}/ and voiced [z, ʒ, dʒ] as lenis ([–s.g., –tense]) / ts/. Given this, it is assumed that Korean speakers instantiate the generalization of English voicing contrast in plosives when they perceive the stridents [z, ʒ, dʒ, tʃ] in the initial processing of L1 perception (4a i). That is, regardless of whether the English stridents have aspiration or not, the voicing contrast in the English

17. Note that Korean anterior coronal fricatives /s/ and /s'/ are not distinctive in terms of aspiration (Kim 2005b; Kim et al. 2005a, b).

stridents is generalized by the feature-driven adaptation of the voicing contrast in plosives. Thus, the acoustic signal of the voiceless [tʃ] is generalized as [+s.g.] like voiceless plosives, and the voiced stridents as [–s.g.] like voiced ones, as marked by solid line arrows in (16). Moreover, the duration difference between the voiceless and voiced stridents is parsed for a cue to [±tense], enhancing the generalization of the voicing contrast, as marked by dotted line arrows in (16).[18]

(16)

English (L2)		cues		Korean (L1)
[–voice] ([tʃ])	⟷	by generalization	⟷	[+s.g.]
		(with the enhancement of long duration)	⇢	[+tense]
[+voice] ([z,ʒ, dʒ])	⟷	by generalization	⟷	[–s.g.]
		(with the enhancement of short duration)	⇢	[–tense]

In addition, a large acoustic intensity of English [z, ʒ, dʒ, tʃ] is parsed for cues to [–continuant, +strident] within the framework of the Korean feature system, regardless of whether English [z] is a fricative ([+continuant]). Among the Korean stridents in (6), it is only the lenis affricate /ts/ that is redundantly voiced in intervocalic position, just like the lenis plosives /p, t, k/. Furthermore, a high-frequency energy above 4 kHz and the locus of onset [z] is extracted and parsed for cues to [+anterior, coroanl], and a comparatively low-frequency energy around 2–3.5 kHz and the locus of onset [ʒ, dʒ, tʃ] to [+anterior, coroanl] with the addition of the glide /j/ in accordance with L1 syllable structure, when followed by a non-front vowel, as in (15a ii, iii) and (15b i). Yet, the glide /j/ is not allowed by virtue of OCP, when the stridents [ʒ, dʒ, tʃ] are followed by the vowel /i/.

In the next processing of L1 perception (4a ii), the extracted cues in English [z] are mapped into the features [–continuant, +strident, –tense, –s.g.], whereas those in onset [ʒ, dʒ] and [tʃ] are mapped into [–continuant, +strident, –tense, –s.g.] and [–continuant, +strident, +tense, +s.g.], respectively. As a result, onset voiced [z, ʒ, dʒ] are borrowed as /ts(j)/ and voiceless [tʃ] as /ts^{h}(j)/ into Korean.

The Korean adaptation of English [f] ~ [v] contrast further supports that the generalization of English voicing contrast in plosives constrain a Korean speakers' perception of the voicing contrast of English affricates and fricatives. As shown in (17), onset labio-dental fricatives [f, v] are borrowed as aspirated /p^{h}/ and lenis /p/, respectively.

18. See Kim (2008) for the enhancement in loanword adaptation.

(17)	English words	Korean adapted forms
a.	phone	**pʰ**on
	focus	**pʰ**o.u.k**ʰ**ʌ.s'**ɨ**
	after (service)	æ.**pʰɨ**.tʰʌ
	coffee	kʰʌ.**pʰ**i
	soft	s'o.**pʰɨ**.tʰ**ɨ**
	sofa	s'o.**pʰ**a
	uniform	ju.ni.**pʰ**om
b.	visa	**p**i.tsa
	violin	**p**a.i.ol.lin
	lavender	la.**p**ɛn.tʌ
	oven	o.**p**in
	service	s'ʌ.**p**i.s'**ɨ**

We suggest that the voicing contrast in English [f] and [v] is generalized for [+s.g.] vs. [–s.g.] contrast, as marked by solid lines in (16) in the above and that the long vs. short constriction duration in [f] ~ [v] contrast is parsed for cues to [+tense] for [f] and to [–tense] for [v] as an enhancement of the voicing contrast in the initial processing of L1 perception (4a i), as marked by dotted line arrows in (16).

It is also assumed that the locus of English [f, v] (e.g., F2 transition) is parsed for cues to the feature [labial]. Given that it is only labial plosives ([–continuant, –strident]) that are specified for [labial] among Korean obstruents, the acoustic signal of less and random noise over a wide range of frequencies during constriction of the L2 sounds is constrained by the Korean feature system, being parsed for cues to [–continuant, –strident]. In the second processing of L1 perception (4a ii), the extracted cues are mapped into the features [–continuant, –strident, labial, ±tense, ±s.g.]. As a result, English [f] and [v] are borrowed as /pʰ/ and /p/, respectively, which is fit into the native feature system.

It is of interest that, though not often, the word-initial [f] in some English words can be borrowed as either /pʰ/ or /hw/, or as /hw/, as shown in (18).

(18)	English words	Korean adapted forms		
	fine	**pʰ**a.in	~	**hw**a.in
	family	**pʰ**æ.mil.li	~	**hwæ.mil.li**
	feminism	**pʰ**ɛ.mi.ni.ts**ɨ**m	~	**hw**ɛ.mi.ni.ts**ɨ**m
	fresh			**hw**u.lɛ.swi
	Fanta (soft drink)			**hw**an.tʰa
	Fiber (soft drink)			**hw**a.i.pʌ

The sequence of /hw/ would be phonetically closer to English [f] than aspirated /pʰ/ in that /h/ is a fricative ([+continuant, –strident]) like [f]. Yet, English [f] is borrowed much more as /pʰ/, as in (17a), than /hw/. From this, we may suggest that the generalization of English voicing contrast in plosives is preferred to

perceptual similarity, that is, purely phonetic approximation when [f, v] are borrowed into Korean.

On the other hand, the Korean adaptation of [θ, ð] shows that feature-driven perception is preferred to the generalization of English voicing contrast in plosives. The English voiceless [θ] is adapted as the fortis fricative /s'/, similar to a single /s/ in (7a), as shown in (19a), whereas the voiced [ð] is borrowed as lenis /t/, as in (19b).[19]

(19)	English words	Korean adapted forms
a.	theraphy	**s'**ɛ.lʌ.p^{h}i
	three	**s'**ɨ.li
	think	**s'**iŋ.k^{h}**ɨ**
	Anthony	æn.**s'**o.ni
	something	s'ʌm.**s'**iŋ
	thank you	**s'**æŋ.k^{h}ju
	bath	pa.**s'**ɨ
	health (club)	hɛl.**s'**ɨ
b.	this	**t**i.**s'**ɨ
	the (Body Shop)	**t**ʌ
	Brother (brand name)	pɨ.la.**t**ʌ
	smoothie	sɨ.mu.**t**i
	smooth	sɨ.mu.**t**ɨ

We assume that the presence of acoustic intensity in voiceless [θ] is parsed for cues to the features [+continuant, +strident], and its long constriction duration to a cue to the feature [+tense] like /s'/, as in (8), in accordance with the Korean feature system. A higher second formant of a neighboring vowel after the [θ, ð] than the labio-dental fricatives [f, v] would lead Korean speakers to parse it to cues to the feature [coronal]. As a result, the voiceless [θ] is borrowed as /s'/ into Korean. In the case of the English [ð], the near absence of acoustic intensity during oral constriction is parsed for cues to the features [–continuant, –strident], its short duration than [θ] to [–tense]. Thus, English [ð] is borrowed as lenis /t/ into Korean.

3.4 Native structural restrictions in L1 lexical representations

In this subsection, we examine Korean adaptation of English word-final coronal plosive consonants and propose that native structural restrictions play a role in L1 lexical representations (4b) where L2 sounds scanned by L1 grammar in L1 perception are lexicalized as new words.

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19. There are a few exceptions for this. The English expression *thank you* is sometimes borrowed as [**t'**æŋ.k^{h}ju], and the word *smooth* as [sɨ.mu.**s'**ɨ].

When English words end in non-coronal consonants [p, k, g], the consonants are borrowed either as /p^{h}/, /k^{h}/ and /k/, respectively, in onset position with the vowel /**ɨ**/ insertion, as shown in (20a i), or as /p/ and /k/ in coda position with no vowel insertion, as in (20a ii). When followed by a vowel-initial suffix such as the subject marker /-i/, the object marker /-**ɨl**/ and the locative marker /-ɛ/ in L1 phonology (4c), the word-final coda consonants /p, k/ in (20a ii) are syllabified as onset consonants, as in (20a iii). In the case of English word-final coronal consonants [t] and [d], they are borrowed either as /t^{h}/ and /t/, respectively, in onset position with the the /**ɨ**/ vowel insertion, as shown in (20b i). Yet, the coronal consonants are borrowed as the lenis fricative /s/, not /t^{h}/ or /t/, in coda position with no vowel insertion, as in (20b ii). Therefore, when followed by the same vowel-initial suffixes in L1 phonology (4c), the fricative /s/ is syllabified as onset consonants, as in (20a iii). It is noteworthy that the word-final consonants in (20b ii) surface as [s], not [s'], different from those in [pʌ.**s'ɨ**] 'bus' and [k^{h}i.**s'ɨ**] 'kiss', as in (7a).

(20)	English words	Korean adapted forms					
		i.		ii.	iii. L1 phonology		
a.	soup	su.p^{h}**ɨ**	~	su**p**	su.**p**i	su.**p**i**l**	su.**p**ɛ
	tip			t^{h}i**p**	t^{h}i.**p**i	t^{h}i.**p**i**l**	t^{h}i.**p**ɛ
	kick			k^{h}i**k**	k^{h}i.**k**i	k^{h}i.**k**i**l**	k^{h}i.**k**ɛ
	rock (music)			lo**k**	lo.**k**i	lo.**k**i**l**	lo.**k**ɛ
	tag	t^{h}æ.k**ɨ**	~	t^{h}æ**k**	t^{h}æ.**k**i	t^{h}æ.**k**i**l**	t^{h}æ.**k**ɛ
	(hot)dog	to.k**ɨ**	~	to**k**	to.**k**i	to.**k**i**l**	to.**k**ɛ
b.	cut	k^{h}ʌ.t^{h}**ɨ**	~	**k**^{h}ʌ**s**	k^{h}ʌ.**s**i	**k**^{h}ʌ.**s**i**l**	**k**^{h}ʌ.**s**ɛ
	set	s'ɛ.t^{h}**ɨ**	~	s'ɛ**s**	s'ɛ.**s**i	s'ɛ.**s**i**l**	s'ɛ.**s**ɛ
	shot	sja.t^{h}**ɨ**	~	sja**s**	sja.**s**i	sja.**s**i**l**	sja.**s**ɛ
	robot	lo.po.t^{h}**ɨ**	~	lo.po**s**	lo.po.**s**i	lo.po.**s**i**l**	lo.po.**s**ɛ
	(deep) throat	s'**ɨ**.lo.t^{h}**ɨ**	~	s'**ɨ**.lo**s**	s'**ɨ**.lo.**s**i	s'**ɨ**.lo.**s**i**l**	s'**ɨ**.lo.**s**ɛ
	(i-) pod	p^{h}a.t**ɨ**	~	p^{h}a**s**	p^{h}a.**s**i	p^{h}a.**s**i**l**	p^{h}a.**s**ɛ

With respect to the adaptation of English word-final plosives in onset position with the vowel /**ɨ**/ insertion in (20 i), we assume that it is L1 perception (4a) that the plosives which are perceived as aspirated for English voiceless ones and as lenis for voiced ones, as in (1a) and (2a), respectively, are syllabified as onset with the vowel insertion and then that the L2 sounds are stored as new words in L1 lexical representations, as in (20 i).[20] As for English loans in (20 ii), we assume that it is due to a Korean adapters' effort to mimic English word-final plosives, as closely as

20. See Kang (2003) for a phonetic view on the presence/absence of the vowel /**ɨ**/ insertion in Korean adaptation of English words and Kim (2007a) for a different interpretation.

possible such that English word-final plosives are linked to coda position with no vowel insertion. Then the English non-coronal plosives which are borrowed as /pʰ/ and /kʰ/ are subject to the L1 phonological process of Coda Neutralization in L1 perception (4a).[21] Therefore, the loans with the neutralized word-final plosives /p/ and /k/ are lexicalized in L1 lexical representations as new words, as in (20a ii).

On the other hand, the adaptation of English word-final coronal plosives as the lenis fricative /s/ in (20b ii) is attributed to the effect of L1 structural restrictions in L1 lexical representations. That is, when linked to coda position in L1 perception, the /tʰ/ and /t/ which Korean adapters perceive for English word-final coronal plosives [t] and [d], respectively, are subject to Coda Neutralization, being reduced to /t/. But the neutralized coronal consonant is not allowed in L1 lexical repesentations (4b), due to the native structural restriction that a Korean word is likely to end with the lenis fricative /s/ rather than with the coronal plosives /t, tʰ, t'/ in the lexicon.[22,23] Thus, the English loans in (20b ii) have the lenis fricative /s/ in word-final position in L1 lexical representations. In L1 phonology, then, the lenis fricative /s/ is syllabified as an onset, as in (20b iii), when followed by a suffix beginning with a vowel. Since English word-final coronal plosives are lexically stored as /s/ in L1 lexical representations, as in (20b ii), they do surface as [s], not [s'] in onset position when followed by a vowel-initial suffix, as in (20b iii). However, when no suffix follows it in L1 phonology, the word-final /s/ in (20b ii) would undergo the L1 phonological process of Coda Neutralization, as shown in (21 ii), and surface as [t].

(21)	i. L1 lexical representations	ii. L1 phonology
cut	kʰʌ**s**	kʰʌ**t**
set	s'ɛ**s**	s'ɛ**t**
shot	sja**s**	sja**t**
robot	lo.po**s**	lo.po**t**
(deep) throat	s'ɨ.lo**s**	s'ɨ.lo**t**
(i-)pod	pʰa**s**	pʰa**t**

21. Alternatively one might suggest that the L1 phonological process of Coda Neutralization applies only in L1 phonology (4c). This alternative, however, would be hard to account for why the lenis consonants /p, k/ come into onset position when followed by a vowel-initial suffix in (20a iii).

22. The structural restriction is caused by native-word frequency. Though there are a few native words ending in the coronal plosive /t/ or /tʰ/ (e.g., /kot/ 'immediately', /tat-/ 'to close', /tot-/ 'to rise', /sotʰ/ 'pot', /katʰ-/ 'to be the same'), most of Korean words end in /s/ in the lexicon. No Korean words end in /t'/.

23. See also Boersma & Hamann in this volume for the role of native structural restrictions in loanword adaptation.

The presence of the lenis fricative /s/ (20b ii) for English word-final coronal plosives suggests that there is an intermediate level of L1 lexical representations between L1 perception (4a) and L1 phonology (4c) in loanword adaptation, as shown in (4). If we assume that the L2 acoustic signal is scanned by L1 grammar and then subject to L1 phonology without the level of L1 lexical representations, the alternation between /s/ (20b iii) and /t/ (21 ii) in L1 phonology cannot be accounted for. Moreover, the adaptation data in (20b) suggest that L1 lexical representations (4b) are different from lexical and underlying representations in Lexical Phonology (e.g., Kiparsky 1982; Mohanan 1986). In the view of Lexical Phonology, the derivation of a word involves a shuttling back and forth between the morphological component and the phonological component through several levels, and each input to the phonology at each level is considered as an underlying form. In L1 lexical representations (4b), however, L2 sounds scanned by L1 grammar are stored as new words in accordance with L1 structural restrictions and their representations as a sequence of syllabified distinctive feature bundles are lexical or underlying forms which may undergo L1 phonology (4c). For example, the lexical representations of the loans with the lenis fricative /s/ in word-final position in (20b ii) are underlying representations which undergo L1 phonology, as in (20b iii) and (21ii).

So far we have examined how English affricates and fricatives [f, v, θ, ð, s, z, ʃ, ʒ, tʃ, dʒ] are borrowed into Korean in Kim's (2007a) feature-driven model of loanword adaptation. We have proposed that Korean speakers parse the acoustic signal of the source sounds within the framework of the native distinctive features and syllable structure, rather than in terms of the unstructured L2 acoustical input per se or of L2 phonological categories. We have also proposed that the feature-driven perception of the voicing contrast in English plosives is generalized in a Korean speakers' perception of the voicing contrast in English [f, v, z, ʃ, ʒ, tʃ, dʒ]. Furthermore, native structural restrictions are proposed to come into play in L1 lexical representations, motivating the presence of L1 lexical representations between L1 perception and L1 phonology in the model of loanword adaptation in (4).

4. Discussion

In this section, we discuss the phonetic approximation and the purely phonological views of loanword adaptation that are found in the literature in comparison with the analysis proposed in the present study and suggest that the present view in this study supports an intermediate view of loanword adaptation, that is, L1 grammar-driven perception of L2 sounds.

In the phonetic approximation view (e.g., Silverman 1992; Yip 1993; Kenstowicz 2003; Peperkamp & Dupoux 2003; Hsieh et al. in this volume), when confronted

with an L2 segment whose feature matrix does not exist in L1, L1 speakers will perceive and produce the native segment which most closely approximates the input in articulatory and/or acoustic properties. For example, we have noted that coda English [ʃ] is borrowed as either /swi/ or /si/, as in (13a). In the phonetic approximation view, the sequence [swi] would be the best candidate for the source sound in Korean adaptation. However, this is not always the case. The sequence /si/ is much more preferred. This is remenicent of the Korean adaptation of English [f] as either /pʰ/ or /hw/, as shown in (17) and (18). While /hw/ would be perceptually more similar to the source sound, /pʰ/ is more preferred. In addition, we have noted that in the Korean adaptation of the voicing contrast in English stridents [z, ʒ, dʒ, tʃ] in (15), the English voiceless strident is borrowed as /tsʰ/, though the source sound has no aspiration. This indicates that the adaptation is not based on phonetic or perceptual similarity to L2 sounds. Rather we have suggested that the feature-driven adaptation of the voicing contrast in English plosives is generalized in the adaptation of the voicing contrast in the English affricates and fricatives. This shows that L1 grammar, that is, L1 distinctive features play a crucial role in the adaptation.

In the purely phonological view, loanword adaptation is based on phonological category mappings between L2 and L1 (e.g., Paradis & LaCharité 1997; LaCharité & Paradis 2005; Paradis & Tremblay in this volume). In this view, Korean adapters are expected to make phonological category mappings between English and Korean consonants. Thus, we could expect English [s] to be borrowed as /s/ into Korean, because the two sounds are categorically the same in that it is an anterior coronal strident fricative in the two languages. However, the Korean adaptation of the source sound as /s/ or /s'/ in (7) makes it evident that what is concerned here is not phonological mappings but phonetic difference in duration which is not categorical or phonemic in English. Hence, as shown in (8), the duration difference of English [s] is parsed for cues to the Korean feature [tense].

Moreover, the examination of how plural forms of English words are borrowed into Korean reveals that it is the L2 acoustic signal, not phonological representation, that is parsed within the framework of Korean grammar. As shown in (22), the sequence of the English stem-final [t] and the plural suffix [s] is borrowed as aspirated affricate /tsʰ/ with the insertion of the vowel /ɨ/.

(22)	English words	Korean adapted forms
a.	results	li.tsʌl.**tsʰɨ**
	fruits	pʰu.lu.**tsʰɨ**
	(off) limits	li.mi.**tsʰɨ**
	pants	pʰæn.**tsʰɨ**
	sports	sɨ.pʰo.**tsʰɨ**
b.	Cats (musical)	kʰæ(**t**).**tsʰɨ**
	nuts	nʌ(**t**).**tsʰɨ**

If phonological category mappings between L2 and L1 are concerned in loanword adaptation, it would be hard to account for why the English stem-final consonant and the plural suffix are borrowed into Korean as the sequence of the aspirated affricate /ts^{h}/ and the vowel /ɨ/. The data in (22) indicate that the morphological information of the source language is not attended to by Korean speakers. Rather the sequence of the source sounds is perceived as the single anterior coronal aspirated affricate, and the vowel /ɨ/, not /i/ as in (13c), is inserted after the anterior affricate to meet L1 syllable structure, as in (12a). In addition, it is noteworthy that the coda consonant /t/ optionally precedes the adapted sequence of the aspirated affricate /ts^{h}/ and the vowel /ɨ/, as shown in (22b). The presence of the coda consonant /t/ in the adaptation is neither phonetically nor phonologically faithful to the source sounds, because there is only the word-final coronal plosive [t] in the L2 acoustic signal of the English words [k^{h}æts] 'cats' and [nʌts] 'nuts' as well as in their phonological representations.

The adaptation in (22) follows if we assume that loanword operations proceed from L2 phonetic outputs, and not L2 phonological categories and that L2 phonetic outputs are constrained by L1 distinctive features and syllable structure. That is, the acoustic signal of English word-final [t] and plural suffix [s] is parsed for cues to the Korean features [–continuant, +strident, +tense, +s.g.] in the initial processing of L1 perception (4a i). In particular, the generalization of English voicing contrast holds on, such that the acoustic signal of the voiceless consonants [t] and [s] is constrained by L1 distinctive features [+tense, +s.g.]. The vowel /ɨ/ is inserted by default, as in (12), to preserve the adapted sound in onset position by virtue of L1 syllable structure. In the second processing (4a ii), where features and syllable structure are formally mapped in accordance with L1 grammar, the English sequence is mapped into the features [–continuant, +strident, +tense, +s.g.]. As a result, the sequence of the English stem-final [t] and the plural suffix [s] is borrowed as /ts^{h}ɨ/, as in (22).

With respect to the coda consonant /t/ in (22b), we suggest that it results from the influence of L1 syllable structure on an L1 speakers' perception of L2 sounds. According to the place markedness constraint in coda position in Korean, the coronal plosive is unmarked, with the dorsal one being more marked than the labial one (e.g., Cho 1990; Jun 1995), and the unmarked coronal plosive is often deleted when followed by a consonant in Korean (e.g., Kim-Renaud 1974). We assume that the L1 syllable structure constraint in coda position also affects a Korean speakers' perception of the English words in (22b) in L1 perception (4a).

24. See also Kim (2008) for a similar adaptation of Japanese geminates.

Thus, the coronal plosive is in coda position or deleted within the framework of Korean syllable structure.[24]

So assuming that loanword phonology proceeds from L2 acoustic signal possessing, not from phonological structure and that the generalization of the voicing contrast in English plosives is instantiated according to the system of L1 distinctive features, we can account for the Korean adaptation in (22) in an intuitive manner. The influence of L1 features/syllable structure on an L1 speakers' perception of L2 acoustic signals in the present study supports an L1 grammar-driven perception of L2 sounds (e.g., Kim 2006, 2007a,b, 2008), in support of Polivanov (1931), Trubetzkoy (1939) and Hyman (1970) among others.[25]

5. Conclusion

In the present study, we have looked into how English affricates and fricatives are borrowed into Korean. Based on the adaptation data, we have proposed that L2 acoustic signals are parsed for cues to L1 distinctive features, that not only L1 distinctive features but also syllable structure plays a cruical role in a Korean speakers' perception and that the feature-driven adaptation of the voicing contrast in English plosives is generalized in the adaptation of the voicing contrast in English affricates and fricatives, when they have no acoustic cues to L1 distinctive features. We have also proposed that L1 structural restrictions come into play in L1 lexical representations where L2 sounds scanned by L1 grammar are lexicalized as new words.

Some theoretical implications can be drawn. First, the present study confirms the claim that distinctive features play an explicit and crucial role in interlanguage loanword adaptation, as in Kim (2006, 2007a,b, 2008). Second, our view that an L1 speakers' perception of L2 sounds is made within the framework of L1 grammar, that is, L1 distinctive features and syllable structure supports a traditional insight going back to Polivanov (1931), Trubetzkoy (1939) and Hyman (1970) among others.

Acknowledgements

I would like to express my thanks to W. Leo Wetzels for his comments. Any errors remain my own. This work was supported by the 2008 Hongik University Research Fund.

25. See also Kenstowicz (2005), Kubozono (2006) and Yip (2006).

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