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Typological Adaptation of Japanese Stops in Korean*

Juhee Lee
(Kyung Hee University)

Lee, Juhee. 2011. Typological Adaptation of Japanese Stops in Korean. *Linguistic Research* 28(1), 75-93. This paper examines the loanword adaptation patterns for Japanese stops into Korean. Numerous approaches have been used on the interaction between L1 and L2 as well as the phonetics and phonology interface for loanword adaptation (Silverman 1992, Yip 1993, Lee 2003, LaCharité and Paradis 2005, Kenstowicz and Suchato 2006, Ito et al. 2006, etc.). In this discussion, by using Japanese loanwords into Korean, we propose that the loan adaptation of laryngeal features depends heavily on the typological characteristics. More specifically, we argue that the phonemic vs. phonetic mapping patterns can be decided based on the laryngeal typology of the target and the recipient languages. Then, we show how the phonetic factors such as closure duration and voice onset time (VOT) function for the loanword adaptation. **(Kyung Hee University)**

Key Words Japanese stops, VOT, closure duration, loanword, typology

1. Introduction

As is widely known, there are numerous types of loanwords in the Korean lexicon. Due to historical factors, massive borrowing from Japanese occurred during the period between the late 18C and the first half of the 20C. Recently, many borrowings from English, filling lexical gaps or adding newly coined words, have also become crucial parts of the Korean language. The Korean government, including The National Institute of the Korean Language,[1] tries to eliminate the use of

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[1] The purpose of the institute is to study and investigate how the Korean people use the language, to set up rational language policies, and to enlighten and help the Korean people use the language properly and correctly (The National Institute of the Korean Language, http://www.korean.go.kr).

Japanese loanwords (see data (1)), as well as that of Anglo-Japanese (English loanwords via Japan) in (2). However, some product names have been already conventionalized, and they are not prone to be changed. That is, the stabilized loanwords are still in frequent use.

(1) Japanese loanwords (data from Ahn and Lee 2009)

Japanese	Korean	
ならし	[narasi]	'leveling of ground'
どかた	[nokata]	'construction worker'
きず	[kis'ɨ]	'scratch'
しょうぶ	[syobu]	'decision'
ひき	[p'ik'i][2]	'a tout(er)'
ちらし	[c'irasi]	'leaflets'
うんちゃん	[unc'aŋ]	'driver'

(2) Anglo-Japanese loanwords (data from Ahn and Lee 2009)

English		Japanese	Korean
dozen	ダス	[dasu]	[tasɨ, t^{h}asɨ]
truck	トラック	[torakku]	[torak'u]
bucket	バケット	[baketto]	[pak'es'ɨ, p'ak'es'ɨ]
battery	バッテリ-	[batterii]	[p'at'eri]
back	バック	[bakku]	[p'ak'u]
bumper	ベンパ-	[bambaa]	[pampa]
muffler	マフラ-	[mahuraa]	[mahura]
slipper	スリッパ	[suribba]	[s'ɨrep'a]
fan	ファン	[huaN]	[huaŋ]
fluke	フロック	[hurokku]	[hurok'u]

However, in this paper, we shall only focus on the loan adaptation of Japanese stops in Korean. To investigate the loan pattern for Japanese, we first consider

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[2] ひき /hiki/ would have something to do with 'pulling' in Japanese. However, this meaning has been used differently among Korean speakers. In Korean, [p'ik'i] is a person who try to pull or attract people in the street in order to advertise their 'bar'. The same thing goes to [huk'aʃi] (meaning as 'swell' in Korean) in which word came from [ɸukasi] (meaning as 'steaming') in Japanese. Of course, there is a word for [ɸukure] means 'swell' in Japanese. It is interesting to see that some part of loanwords in Japanese are adapted and then settled as different meaning. This means that they must be historical loans. According to Shigeko Shinohara (p.c.), she suggests that /hiki/ must be from /kyakuhiki/ since /kyaku/ means customers in Japanese.

previous works on loanword phonology. In the literature, the phonology of loanwords has received much attention (Silverman 1992, Yip 1993, Shinohara 1997, Paradis and LaCharité 1997, Lee 2003, Peperkamp and Dupoux 2003, LaCharité and Paradis 2005, Kenstowicz and Shuchato 2006, etc.). Nevertheless, the exact nature of the loan adaptation process is still under controversy as it is hard to judge the precise input for loan adaptation. Moreover, it is not clear whether the loanword phonology is part of a native grammar or an independent property. In spite of these controversies, however, the phonology of loanwords provides a window that enables us to understand the native phonology more deeply.

In previous works on this subject, discussion has centered on the issue of whether the input is phonetic (Silverman 1992, Yip 1993, Dupoux et al. 1999, Peperkamp and Dupoux 2003) or phonological in the borrowing language (Paradis and LaCharité 1997, LaCharité and Paradis 2005, etc.), regardless of the framework that the analysis is couched in. For example, Silverman (1992) initiated the discussion by proposing a concrete model of loanword phonology with a perceptual level added to the loanword input. With this view, in essence, he distinguishes between a perceptual level at which segmental adaptations take place and which is phonetic and automatic in nature and an operative level, which is phonological in nature. Silverman's model is reflected in the latest efforts by Dupoux et al. (1999) and Peperkamp and Dupoux (2003), which have been discussed in psycholinguistic experimental work in the loanword context. On the other hand, LaCharité and Paradis (2005) argue that the tradition of "Category Preservation and Proximity" to pursue that loanword adaptation is, by and large, based on the perception by the bilingual speaker's contrastive categories in the source language.

More recently, there have been alternative views, which researchers take into account the intermediate position (Shinohara 1997, 2006, Steriade 2001, Kenstowicz and Suchato 2006). That is, the adaptation process can account for a variety of factors to achieve the best match to the source word. However, we propose another model of "typological adaptation" in loanword phonology (Ahn and Lee 2007, 2008). Within this model, we examine the loanword adaptation patterns for laryngeal features and argue that the representational, i.e., laryngeal, contrast and the phonetic factors play crucial roles in loan adaptation as the loan adaptation of laryngeal features heavily depends on the language typology. To be more specific, they argue that the phonemic vs. phonetic mapping patterns can be decided based on the

laryngeal typology of the target and the recipient languages, e.g. mapping from English-Thai-Korean. Since Japanese and Korean belong to the different laryngeal typology, we will argue that the phonetic factors such as closure duration and VOT function play major roles in the adaptation of Japanese loanwords in Korean. To elaborate this proposal, we shall move to discuss typological characterization of laryngeal contrasts.

2. Typological Characterization of Laryngeal Contrasts

The conventional description of the simple two-way laryngeal contrast found in many of the world's languages pits a series of voiceless stops, marked [−voice], against a series of voiced stops, marked [+voice]. This particular binary opposition requires that all languages be categorized with respect to the phonological voicing distinction even when their phonetic properties are noticeably different (Ahn and Iverson 2004). However, it has long been appreciated that the voice onset time (VOT) values of Romance and Slavic languages, on the one hand, and most Germanic languages, on the other, are quite different (Lisker and Abramson 1964). For example, the voiced stops of French are thoroughly voiced, with early VOT, but the "voiced" stops of English are often not voiced at all at the beginning of the word and in other voicing-unfriendly environments, with comparatively late VOT, causing many phoneticians to consider the English-type to be "lenis" rather than truly voiced. Similarly, the voiceless stops of French are produced with relatively early VOT, whereas the VOT of the English voiceless stop series is considerably delayed, well into a following vowel or sonorant consonant, with the result that French voiceless stops are regularly "unaspirated" whereas those of English are rather heavily "aspirated" (Iverson and Salmons 1995, Flemming 1995, Ewen and van der Hulst 2001). Therefore, by using the binary feature [±voice] to encode this contrast at the phonemic level, the articulation of English stops turns out to be different from that of French stops.

It appears that all known laryngeal systems can be represented via combinations of the three privative features [voice], [spread], and [constricted]. For a system with no laryngeal feature specifications (one series is always marked), as is the case with Hawaiian, there are no laryngeal feature specifications, whereas languages with a

two-way contrast require specification of just one of the three (Ahn and Iverson 2004, Iverson and Ahn 2007). In Germanic languages (save Dutch and Yiddish), however, the distinction is expressed in terms of the feature [spread] standing in opposition to laryngeally marked ([ ]) segments, whereas for Slavic and Romance and many other two-way systems, the marked feature is [voice]. The feature [spread] and [voice] are also involved in many three-way contrastive systems, distinguishing, for example, the voiceless, voiced, and aspirated phonemes of Thai. Moreover, by adding "voiced aspirates," Hindi has the most complex four-way system in laryngeal typology.

(3) Laryngeal contrasts employing privative [voice], [spread], [constricted]

	/p~b̥/	/b/	/p^{h}/	/p'/	/b^{h}/	Others
Hawaiian	[ ]					
K'ekchi	[ ]			[constr]		
French	[ ]	[voice]				
Japanese		[voice]				
English	[ ]		[spread]			
Korean	[ ]		[spread]			CC(tense)
Thai	[ ]	[voice]	[spread]			
Hindi	[ ]	[voice]	[spread]		[spread],[voice]	

As the [spread] property plays a major role in the distribution of stops, English and Korean belong to the same "laryngeal typology," lacking the [voice] property. For example, the laryngeal distinction of a word-initial English stop employs the [spread] property, rather than the [voice] distinction. According to Ahn and Lee (2008), Thai also employs the [spread] property for phonemic distinction but the function of the [voice] distinction is crucial as well. That is, Thai has phonetically long VOT just like other [voice] languages. In the similar vein, since Japanese is [voice] type of language, the adaptation of Japanese stops into Korean is crucially influenced by phonetic factors. Since Korean is [spread] type, this different type of laryngeal typology plays a key role to understand the Japanese adaptation pattern we observed. Let us move to analyze this case at hand.

3. Adaptation of Japanese Stops in Korean

3.1 Closure Duration and F_0

Throughout this paper, we assume the following obstruent inventories for Japanese (Katayama 1998, Itô and Mester 2003) and Korean, in which the stops are located in the shaded areas.

(4) a. Japanese obstruents

p, b	**t, d**		**k, g**	
	s, z	ʃ		h
	ʦ	tʃ		

b. Korean obstruents (pp=p', tt=t', kk=k', cc=c', ss=s')

p, pp, p^h	**t, tt, t^h**		**k, kk, k^h**	
	s, ss			h
		c, cc, c^h		

Japanese has both the two-way voicing distinction and the length distinction for voiceless stops, while Korean has the three-way stop contrasts. Given the typological difference, therefore, there is no direct correspondence relationship between these two languages, as shown in (5) and the examples in (6) show that the voiced stop is mapped onto the plain stop.[3]

(5) Mapping between Japanese stops into Korean
J: (voiced) C → K: (voiceless) C
J: (voiceless) C → K: (tense) CC
J: (long voiceless) CC → K: (tense) CC

(6)

Japanese	Korean	
beNtoo	pent'o (t'=tt)	'lunch box'
dai	tai	'table'
gara	kara	'fake'

[3] The adaptation of Sino-Japanese words is not considered here because the pronunciations of the target Chinese words have taken a different path of change in the history of Korean. Moreover, Korean plain C ([spread]) is not assigned for the adaptation of Japanese stops as described in (5).

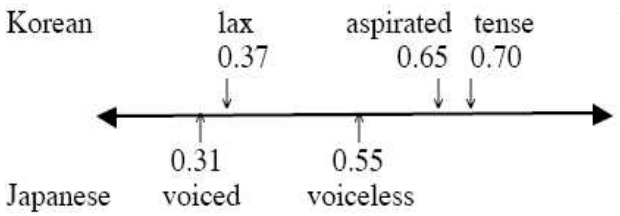
As Korean lacks the voiced stops in the phonemic inventory, we could consider the possible VOT mapping between the two languages, but the average negative VOT value of the Japanese 'voiceless' stops is closer to the Korean 'tense' stops, not to the plain ones. Having the shortest average VOT duration, however, the 'plain' stops are chosen as the correspondents for the Japanese 'voiced' stops. Therefore, VOT may not be a deciding factor in perceptually distinguishing tense and plain stops.

(7) Average VOT values (ms)

	Korean Lisker and Abramson (1964)		Japanese (Honma 1981)	
	Word-initial	Word-medial	Word-initial	Word-medial
/b, d, g/	-	-	−27~0 ms	No data
/p, t, k/	7~20 ms	5~21 ms	27~53 ms	7~24 ms
/p', t', k'/	22~48 ms	13~44 ms	11~28 ms (intervocalic geminate)	
/p^h,t^h,k^h/	89~125 ms	75~93 ms	-	

For this problem, we may consider the closure duration of the stops to be the same as the closure duration of the Japanese voiced stop which is closer to that of the Korean plain (i.e., lax) stop (Ito et al. 2006).

(8) Relativized closure duration of Korean and Japanese stops (Ito et al. 2006: 95)



On the other hand, the earlier studies (Han 1996, H.-K. Ahn 1999, Ahn and Iverson 2004, etc.) show that the closure duration of tense stops is much longer than the plain counterparts; the closure (or frication) duration of the tense obstruent is

significantly longer than that of the lax and aspirated ones (by about 1/3, according to medial measurements reported by H.-K. Ahn (1999: 30) [207 ms, 145 and 146 ms]). The tense series also differs from the other two by not undergoing lenition in medial environments, while the plain and aspirated series experience substantial reduction in VOT lag in the same (i.e., intervoiced) environments.[4]

Consideration on duration gets further support from the adaptation of Japanese geminates in Korean.[5] As mentioned above, Japanese has the single vs. geminate distinction for word-medial stops as the phonemic voiceless stops can be used as geminates adding an extra mora to the preceding syllable, i.e., Nippon 'Japan', ippai 'fully', tekkiri 'certainly', etc. Moreover, the distinction is realized in two different mapping patterns as Japanese voiceless singleton stops are adapted as tense stops in Korean only word-medially (and as plain stops word-initially), whereas the geminates are always adapted as tense stops in Korean.

(9)	Japanese	Korean (p'=pp, t'=tt, k'=kk)
tama	tama	'ball'
kao	kao	'face'
itai	it'ai	'painful'
Kyoto	kyot'o	'place name'
sake	sak'e	'Japanese liquor'
kaNpai	kanp'ai	'cheers'
ippai	ip'ai	'fully'
tekkiri	tek'iri	'certainly'

Note that the Japanese voiceless stops have a longer duration than voiced stops

4 Refer to Jun (1994) for a similar geminate view for Korean reduplication.

5 Ito et al. (2006), however, employ another criterion replacing the VOT consideration, i.e., vocalic cues for tense and aspirated consonants: i.e., higher F_0 values in vowels following tense/aspirated stops. They claim that while a long VOT lag is a clear cue for the aspirated stops, the distinction between tense and plain stops is signaled by the F_0 of the following vowel. As already discussed (Kim et al. 2002, Cho et al. 2002, Ahn and Iverson 2004), voiced consonants have lower F_0 on the initial portion of the following vowel, while F_0 is higher for voiceless ones. Ito et al. (2006) claim that the absence of a high F_0 on the following vowel in voiced stops of Japanese makes them a better match to Korean plain stops than to tense/ aspirated stops. (Ito et al. (2006) cite Kawasaki (1983) that the lowering of F_0 following a voiced stop is observed even in a word with an accented mora carrying a high tone).

and voiceless geminates which are close to three times longer than voiceless singletons (Honma 1981).

(10) Average closure duration of intervocalic stops (ms.) (Honma 1981).

/b/	55/p/	77/pp/	183
/d/	35/t/	62/tt/	170
/g/	41/k/	61/kk/	175

Regarding the closure durations, the geminates are adapted, considering that the Korean tense stops whose closure duration is much longer than that of the aspirated stops.

3.2 VOT Mapping

As we move on to the adaptation of the Japanese voiceless stops, however, either account, that is, closure duration or the F_0 difference, does not work since the voiceless stops are realized as tense, rather than aspirated. If we take account of the closure duration, we incorrectly predict the mapping of aspirated stops since their duration is the closest to that of the Japanese voiceless stops. On the other hand, the F_0 account would face an indeterminacy problem in that both tense and aspirated stops elevate the F_0 values of the following vowels. Citing Kawahara (2005), Ito et al. (2006) claim that F_0 overrides closure duration and VOT as a cue to distinguishing tense and lax stops when in conflict. But such a solution does not provide any mechanism to determine between tense and aspirated stops.

There have been numerous studies (Nozawa et al. 2000, H. Kim 2006) assuming that the Japanese voiceless stops are adapted as the aspirated stops in Korean since the transcription guidelines were made by the The National Institute of the Korean Language. According to this guideline, all of the Japanese voiceless sounds are transcribed as aspirated ones in Korean writing. For example, although place names such as Tokyo and Osaka are to be written as <tokhyo> and <osakha> in Korean, these transcriptions merely reflect the orthographic guideline, rather than the actual pronunciation like [tok'yo] and [osak'a] with tensing (i.e., due to gemination). In other words, the representation of aspiration is an *artificial* or *unnatural* pronunciation enforced by the Romanization principle, and is thus neither natural nor

realistic. Most Korean speakers do not follow the orthographic representation in actual communication. The practical motivation for the unrealistic orthographic representation is the mere tendency of avoiding tensed consonants in writing.[6] This tendency is observed not only in Japanese loanwords, but also in the transcription of the loanwords of other languages. For example, English /s/ (unless in a consonant cluster) is adapted as a tense [s'] (i.e., /ss/) in Korean, but it is written as a single /s/. For example, (unless followed by another consonant), the English /s/ is adapted as a tense fricative [ss] in Korean, even though it is spelled as a single <s>.

(11) <seil> [s'eil], *[seil] 'sale'
<saunt̚> [s'aund̚], *[saund̚] 'sound'
<soŋ> [s'oŋ], *[soŋ] 'song'

Due to this tendency, The National Institute of the Korean Language made an unrealistic guideline for the transcription of those loanwords from a non-aspiration language. For example, Paris and Espagna are transcribed as <phali> and <es̚phanya> even though they are pronounced as [p'ari] and [es̚p'anya].[7]

As mentioned above, the Korean aspirated stops should be a match for the Japanese voiceless ones in terms of closure duration. However, this incorrect mapping based on closure duration causes artificial or unrealistic pronunciation.

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6 For example, the Chinese loanword <cajangmyeon> *<c'ajangmyeon> 'Chinese noodle' is actually pronounced as [c'ajaŋmyən] by most Korean speakers. According to a report (2002) from The National Institute of the Korean Language, 72% of Korean speakers would pronounce it as tense. Then, why do we have a plain [c] for 28%? This is due to the orthographic representation which forces Korean speakers to pronounce as [c] as suggested in the transcription guideline. Hence, announcers from TV, radio and some other media do pronounce it as [c] because tense one is not regarded as a standard pronunciation. In fact, this tendency also affects the speakers of Korean because some people try to pronounce [c] since that is regarded as standard. This conception is formulated by the guideline from The National Institute of the Korean Language. Therefore, we may argue that the tendency of avoiding tenseness in spelling actually affects speaker's perception as well as pronunciation.

7 Due to this governmental policy of transcription, the Thai plain voiceless stops (i.e., mostly place names, like phuket) are often perceived as aspirated since those words were introduced to the Korean speakers as written forms when Korean speakers did not have much knowledge about Thai. So, the only way to adapt the Thai pronunciation was to follow the transcription. Recently, however, having realized the importance of the three-way laryngeal contrast in Thai, The National Institute of the Korean Language has changed the transcription system suggesting the use of geminate transcription of the Thai plain stops. So, [p^{h}uk'et], not the previously used [p^{h}uk^{h}et], is the official transcription now, which makes most Korean speakers puzzled.

Therefore, none of the earlier accounts (i.e., VOT, closure duration, and F_0) would work for the realization of tense stops for the Japanese voiceless stops. In order to solve these problems, we employ a procedural account, based on the laryngeal typology. As two languages belong to the different laryngeal typology, the adaptation process is rather phonetically-based but we need further refinement, as sketched below.[8]

(12)

Japanese	[voice] /g/	[ ] /k/			phonemic	
	[g]	Initial	elsewhere	[kk]	allophonic	
Korean	/k/		/kk/			*/k^h/

Here the first step of the adaptation process is the substitution of the more salient /b/ into Korean, showing that Korean speakers adapt the Japanese voiced stops as voiceless ones in Korean, based on phonetic information such as closure duration. Moreover, the same procedure applies to the adaptation of the geminate consonants. For the adaptation of /p/ as the tensed /pp/, rather than /p^h/, we need different phonetic information as the closure duration account does not hold here. Thus, we go back to the VOT measurements for this case. That is, the VOT value of the Japanese voiceless stop is as short as the Korean tensed consonant which is far shorter than the VOT value of the Korean aspirated stop. Consequently, we need to employ both criteria for these two processes.

3.3 Word-initial Neutralization

As indicated in the table (13), a question arises why Korean speakers prefer a plain stop to an aspirated one in a word-initial position. Based on the English sound system, the orthographic guidelines of the Korean government (i.e., Ministry of Culture and Tourism) require that the Japanese voiceless stops be adapted as aspirated ones in Korean, which causes the production of artificial pronunciation.

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[8] In the context of Japanese phonology (Itô and Mester 1995:819), there is a constraint against single [p]. Yamato (native) and Sino-Japanese forms tolerate /p/ only in a geminated or at least partially geminated form (kappa "river imp", nippoN "Japan" and kampai "cheers", but never *kapa or *nipoN). The *P-constraint, however, governs neither mimetics (cf. pika-pika "glittering") nor foreign items (cf. peepaa "paper").

Perceiving the short VOT of the Japanese voiceless stops, however, most Korean speakers do not reflect the orthographic representations in actual pronunciation and the voiceless stops are realized as plain stops word-initially just like the voiced stops, while non-initial voiceless stops are adapted as tensed/geminates.

This initial laryngeal neutralization is quite peculiar in that, unlike those of Japanese, the initial stops in English and French loanwords can be realized as aspirated or tensed stops, depending on the laryngeal type of the target language. The following table shows how the voiceless stops in English and French (and Japanese) are adapted differently in Korean, depending on the laryngeal typology.

(13)

English	Korean	French	Korean	Japanese	Korean
pet	$p^{h}et^{h}$ɨ	Paris	p'ali	teNpura 'fry'	temp'ula
tank	t^{h}ɛŋk^{h}ɨ	Toulouse	t'ulluc ɨ	teriyaki 'grilled beef'	teliyak'i
kit	k^{h}ɨt^{h}ɨ	Claude (Monet)	k'ɨllot ɨ	kawasaki 'name'	kawasak'i

The asymmetric adaptations of the English and French initial stops can be attributed to the difference in the laryngeal typology in that English belongs to the aspiration type, while French to the voice type. As for the difference between French and Japanese loanwords, we first consider the suggestion in Ito et al. (2006) citing Honma (1981) and Shimizu (1999) for measuring the F_0 values for Japanese vowels following voiceless stops, while also noting O'Shaughnessy's account (1981) for French. According to these works, the French voiceless stops slightly lower for the F_0 values than do the corresponding Japanese stops. Ito et al. (2006) thus argue that the different adaptation patterns of initial stops of French and Japanese words (i.e., French /t/ → Korean /t'/, Japanese /t/ → Korean /t/) are due to the different roles of F_0 in these languages.

This account, however, cannot explain why the initial voiced and voiceless stops of Japanese loanwords undergo neutralization. For this problem, we claim that the neutralization is a result of the effort required to avoid tense stops initially. Note that, having been introduced after the Middle Korean period, the tensed consonants are the new members of the Korean phonemic system and seem to be avoided in the adaptation of loanwords, especially in a word-initial position. And this tendency ends up with the orthographic guidelines of transcribing Japanese voiceless stops as

aspirated ones. The word-initial realization [p, t, k] for both /p, t, k/ and /b, d, g/ is thus a result of laryngeal neutralization reflecting the psychological tendency toward avoiding tenseness which risks the possible semantic ambiguity. Shown below are some of the famous neutralization examples used by Korean speakers, which cause such confusion among Japanese listeners.

(14) [kin]: kin medaru, 'gold medal' vs. gin medaru 'silver medal'
kin kakuji 'Golden pavillon' vs. gin kakuji 'Silver pavillon'
[tok'yo]: Tokyo (東京) University Dokkyo (獨協) University

Given that a voiceless stop lowers the F_0 of the following vowel, it is difficult to account for the initial neutralization with the F_0 account. We need to incorporate the tendency of avoiding initial tensing/aspiration for Japanese loanwords.[9]

(15)

Japanese (initial)		Korean	Japanese (medial)		Korean
			kan**p**ai	'cheers'	kan**p'**ai
			Sa**pp**oro	'place name'	sa**p'**oro
tama	'ball'	tama	beN**t**oo	'lunch box'	pen**t'**o
Tokyo		tok'yo	na**tt**oo	'fermented bean'	na**t'**o
kao	'face'	kao	sa**k**e	'Japanese liquor'	sa**k'**e
			te**kk**iri	'certainly'	te**k'**iri

In sum, unlike the claim in Ito et al. (2006), the F_0 factor does not play much of a role in the adaptation of Japanese loanwords.[10] Based on the discussion so far, the overall adaptation pattern of Japanese loanwords can be summarized as follows, where the two typologically different languages like Japanese and Korean undergo

[9] Note, however, that this tendency does not function in the adaptation of the Anglo-Japanese loanwords, e.g., p'at'a 'bat', p'ol 'ball', p'in 'pin', t'ɛm 'dam', k'olp^{h}i 'golf', k'ol 'goal'.

[10] In Ito et al. (2006), the hierarchy "F_0 > VOT > Vowel quality" is proposed for the process of Japanese loanword adaptation.

phonetically-based adaptation patterns.[11]

(16)

Japanese	[voice] /g/	[ ] /k/			phonemic rep.	
	[k]	W-initial	elsewhere	[kk]	allophonic rep.	
Korean	/k/		/kk/			*/k^h/

First, we search for the optimal Korean correspondent for the more salient /b/ in Japanese. As shown in the table, Korean speakers adapt the Japanese voiced stops as voiceless ones in Korean based on the phonetic information such as closure duration. Then, the same procedure applies for the adaptation of the geminate consonants, mapping a Japanese geminate /CC/ to a tense stop in Korean. Next, the least marked voiceless stops are mapped to the tense stops /CC/, rather than the aspirated ones. As the closure account does not work, we re-employ the VOT account as the VOT value of the Japanese voiceless stop is as short as the Korean tensed consonant, that is, far shorter than the VOT value of the Korean aspirated stop. Thus, both closure duration and VOT accounts are required for different steps of adaptation, i.e., closure duration for more marked stops but VOT for unmarked ones. Rather, the closure duration account is further supported by the numerous works representing the tense consonants as geminates (Jun 1994, J.-I. Han 1996, Avery and Idsardi 2001, Ahn and Iverson 2004, etc.).

Finally, the initial neutralization of Japanese /p, b/ cannot be accounted for by the F_0 account in Ito et al. (2006). Rather, it is explained in terms of the tendency toward avoiding initial laryngeal marking. Note that the Korean aspirated stops are reserved in the overall adaptation processes of Japanese loanwords. Consequently, unlike in Ito et al. (2006), there is no ground for the F_0 account in the adaptation of the Japanese loanwords in Korean.

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[11] The typological adaptation pattern can be verified in other languages. For example, Shinohara (1997) shows that the adaptation pattern of French loanwords in Japanese follows the voicing correspondence between these two [voice] languages.

French	Japanese	French	Japanese
pâté	pate	bagatelle	baga'teru
table	taaburu	difficulté	difikju'rute
cadre	kaadoru	grave	guraabu

4. Concluding Remark and Possibility of Orthographic Influence

In order to analyze Japanese stop adaptation in Korean, we proposed "typological adaptation" as the model of loanword phonology. Within this model, we argued that typological categorization, either phonemic (same laryngeal typology) or phonetic mapping (different laryngeal typology), plays an important role in determining the strategy for loan adaptation. In this line of analysis, we proposed the loan adaptation of laryngeal features heavily depends on the language.

Following Ahn and Lee (2008), we argued that the phonemic vs. phonetic mapping patterns can be also decided based on the laryngeal typology of the target (Japanese) and the recipient (Korean) languages. Then, we argued how the phonetic factors such as closure duration and VOT function play major roles in the adaptation of Japanese loanwords in Korean. Based on the experimental data, we suggested that F_0 is not crucial for the mapping between Korean and Japanese. In this way, we contented following mapping procedure.

(17) Mapping
1) Voice (i.e. marked) in Japanese
→ Plain in Korean (closure duration)
2) Voiceless (i.e. unmarked) in Japanese
→ Geminate (*aspirate) in Korean (VOT (?), *Closure duration/*F_0)
3) Geminate in Japanese
→ Geminate in Korean (closure duration, VOT)
4) Word-initial voice/voiceless
→ Plain in Korean (neutralization)

We have argued that phonetic information is required in the loan adaptation of a typologically different language. There are, however, many cases where a [voice] language speaker may not employ the phonetic-based adaptation process for English loanwords. For example, if a [voice] language such as Spanish adapts the voiced English stops, the result is realized as a corresponding voiced stop, rather than a voiceless one, even though the VOT values of the English voiced stops phonetically correspond to those of the Spanish voiceless stops.[12]

(18) Loan adaptation in Spanish (data from LaCharité and Paradis 2005)

	English	Spanish		
/b/	bar	[bɑɹ]	→	[baɾ] *[paɾ]
	baseball	[besbɑl]	→	[besbɔl] *[pesbɔl]
/d/	dip	[dɪp]	→	[dip] *[tip]
	darling	[dɑɹlɪŋ]	→	[daɾlin] *[taɾlin]
/g/	golf	[ɡɑlf]	→	[ɡɔlf] *[kɔlf]
	gang	[ɡæŋ]	→	[ɡaɲ] *[kaɲ]

Being Indo-European, both languages have the same orthographic system using Roman alphabets, so the orthographic information here seems to override the phonetic factor, forcing the Spanish speakers to follow the voiced stops. Note that there is only one laryngeal distinction in English and Spanish and there exists an orthographic similarity between those stops in the two languages. Therefore, Spanish speakers match the English /p, t, k/ with the Spanish /p, t, k/ even though the VOT values of the English stops are much longer than those in the [voice] language Spanish (Ladefoged 2001).

A similar adaptation pattern can be found in Calabrese Italian in which all the English voiced stops are adapted as the corresponding voiced stops and there is no case of mapping to Italian voiceless stops (LaCharité and Paradis 2005).

(19) English voiced onset stops in Calabrese Italian

	/b/	/d/	/g/	total
Number of cases	663	656	216	1535
Phonetic approximation cases (devoicing)	0	0	0	0
Same phoneme cases	663	656	216	1535

This result shows that if the target language has the same number of laryngeal contrasts, the recipient language chooses the phonemic match, following the

12 VOT contrasts in English and Spanish (LaCharité and Paradis 2005)

	English	Spanish
/p, t, k/	+VOT (> 50 ms)	+VOT (0-30 ms)
/b, d, g/	+VOT (0-30 ms)	−VOT (-40-0 ms)

orthographic similarity reflecting the etymological connection.[13] Therefore, for two typologically different languages, the orthographic information of the two languages should be incorporated for the adaptation strategies if they share the same type of orthographic representation (e.g., Indo-European languages using similar orthographic (i.e., alphabet) systems).

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[13] In our analysis, the issue of orthography is different from Peperkamp and Dupoux (2003) since they did not consider the difference in phonological typology. Here we use the term of orthography more loosely and that is controlled by language-specific typology.

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Juhee Lee
Department of Korean Language and Literature
Kyung Hee University
Seoul, Korea 130-701
E-mail: juhee@khu.ac.kr

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