문학석사 학위논문

Phonological Trends in English Loanword Word-initial Tensification in Korean

영어 차용어에서 발생하는 어두 경음화의
음운론적 경향

2017년 2월

서울대학교 대학원
언어학과 언어학전공
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Abstract

Phonological Trends in English Loanword Word-initial Tensification in Korean

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The main purpose of this thesis is to investigate the phonological trends in word-initial tensification of English loanwords in Korean, and to explore the reasons for the trends based on the phonological distribution of native phonology. In general, English voiced stops and affricate are adapted to Korean as voiceless lax stops and affricate, respectively. However, for some English voiced stops and affricate, not only a lax initial form but also its tense counterpart may appear. The majority of the previous accounts have focused on the origin of the tensification in question, rather than on the phonological condition of the tensification. This is likely because the

word-initial tensification of English loans is widely regarded as an idiosyncratic process that cannot be characterized by a phonological rule. To date, no previous studies have provided comprehensive explanations on the gradient tendency of the tensification.

Based on two different data sources, a judgment test, and newspapers from the 1890s to 1950s, I found that loanword tensification is more likely to occur when the place of articulation of the tensification site is alveopalatal, when the height of the vowel following the tensification site is non-high compared to high, when the word is monosyllabic rather than multisyllabic, and when the phonation type of the onset of the syllable following the tensification site is the tense fricative. I refer to these findings by four phonological conditions as place, height, length, and assimilation effect, respectively.

Given that the various patterns shown in loanwords may be influenced by their native phonology, two possible sources were investigated to explore the underlying reason for each effect. The first source was native tensification that shows optional tensification in a similar way to loanwords. If loanword and native tensification both show similar tendency by each effect, it might be possible that the loanword tensification is simply an extension of the active process in native tensification. Second, based on various arguments claiming that the variable patterns found in loanwords from other languages may reflect covert statistical generalizations of their native lexicon (Kubozono, 2006; Luke and Lau, 2008; Zuraw, 2010; among others), it is possible that the tendencies found in loanword tensification may also reflect

statistical trends displayed by Korean common nouns with initial tense stop and affricate.

To verify these possibilities, I investigated the contextual distribution of word-initial tense stop and affricate in the Korean lexicon. Based on an in-depth examination of the two sources, I found that the phonological trends in loanword tensification partially mirror phonological trends in both native tensification and the Korean lexicon. The place and height effect of the loanword tensification were also confirmed in native tensification. On the other hand, the height, length, and assimilation effect of loanword tensification mirror the extant distribution of Korean common nouns.

In addition, I discussed the phonetic background that motivates each contextual factor found in loanword tensification, focusing on the acoustic and articulatory properties of each context. For the height effect of loanword tensification, the relation between the voice onset time (VOT) value of the word-initial stop and the following vowel's height was considered. Regarding the assimilation effect, it seems that the effect requires additional articulatory effort which means that it does not have clear phonetic motivation. Rather, the assimilation effect substantially mirrors the salient distribution of the Korean lexicon.

In summary, this thesis has scrutinized phonological trends in loanword tensification based on two different datasets. Based on quantitative data, I not only systematically examined the trends, but also found new phonological factors that affect tensification rate. In addition, it is the first to explore the question of what

phonological aspects drive the contextual distribution of loanword tensification, which has not been discussed in detail in previous studies. As a result, this study demonstrated that the distribution of loanword tensification reflects that of the native phonology.

Keywords: Loanword tensification, Native tensification, Phonological trends, Korean lexicon, Phonotactics, Phonetic background

Student Number: 2014-22247

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1. Introduction

In contemporary Korean, the English voiced stops /b, d, g/ and the affricate /ʤ/ are usually adapted as voiceless lax stops /p, t, k/ and the affricate /ʧ/, respectively (e.g., [pɨɾipʰiŋ] 'briefing', [tiʧain] 'design', [kɨɾup] 'group', [ʧənəl] 'journal'). However, for voiced stops and affricates in some English words, not only these lax stops and affricate but also their tense counterparts /p', t', k', ʧ'/ may appear in the loanwords (e.g., [panana] ~ [p'anana] 'banana', [tɛns'ɨ] ~ [t'ɛns'ɨ] 'dance', [kol] ~ [k'ol] 'goal', [ʧəmpʰɨ] ~ [ʧ'əmpʰɨ] 'jump').[1]

There have been many proposals attempting to explain this variable mapping to tense stops in English loanwords. For instance, the variable mapping has been attributed to the influence of Japanese (Kim, 1976; Lee, 1993; Kwon, 1995; among others), to the extended processes of word-initial tensification in native Korean words (Yeo, 1985; Oh, 2004; Shin and Davis, 2004), or to the phonetic similarity between English voiced stops and Korean tense stops (Lee, 1982; Kang, 2008a). The majority of the previous accounts have focused on the origin of the tensification in question, rather than on the phonological condition of the tensification. This is likely because the word-initial tensification of English loans is widely regarded as a

[1] In example words in this study, /ʧ/, /ʰ/ and /'/ stand for the alveopalatal affricate, aspirated and tense, respectively. In addition, inter-sonorant voicing is not reflected in the phonetic transcription.

random idiosyncratic process that cannot be characterized by a phonological process (Yu, 1987; Kwon, 1995; Park, 2008).

Only a few previous studies have discussed the phonological environment of word-initial tensification of English loanwords. Oh (2004) claimed that tense variants may appear only when voiced stops are word-initial and pre-vocalic in the English source words. When English voiced stops are word-medial or pre-consonantal, they are only adapted as lax stops in Korean (e.g., [təpɨl] ~ [t'əpɨl], not *[t'əp'ɨl] 'double', and [tɨɾama], not *[t'ɨɾama] 'drama'). In addition, Oh (2009) found that the word-initial tensification of English loans is less likely to occur before high vowels compared to non-high vowels. Oh's (2009) findings implied that the optional tensification of English loanwords is sensitive to the phonological condition of the loanwords, as opposed to their corresponding English words. However, Oh (2009) did not pay much attention to the loanwords themselves, but focused on the phonological conditions of the English source words. To this date, no previous studies have provided a comprehensive explanation of the distribution of word-initial tensification with phonological factors.

The present study has three goals. The first one is to demonstrate that the variable tensification of English loanwords in Korean, which will be called "loanword tensification," is not a random process, but rather, is systematically influenced by phonological factors. The second goal is to answer what drives the contextual distribution of loanword tensification, focusing on two possible sources, word-initial tensification of native Korean words, which I will call "native

tensification," and the native Korean lexicon. The last goal is to explore the acoustic and articulatory motivations for loanword tensification.

In order to accomplish the first goal, two different data sources were selected: a judgment test, and newspapers from the 1890s to 1950s. Using these two sources, this study explores whether the frequency of the tense variants, relative to their lax counterparts, differs depending on the following four phonological factors: 1) the place of articulation of the target obstruent, 2) the quality of the vowel following the target obstruent, mainly its height, 3) the syllable count, and 4) the laryngeal status of the syllable onset following the tensification site.

The first two factors have already been discussed in Oh (2009), and this study will attempt to confirm its results. The latter two phonological factors, the word length and the onset of the following syllable, are similar to those considered in Ito's (2014) study on compound tensification in the Yanbian dialect of Korean, where tensification is known to occur in the onset consonant of the second element in noun compounds. In terms of word length, Ito (2014) found that compound tensification occurs with less frequency in longer compound words, while it is more likely to occur when both elements are monosyllabic. Although the target tensification site considered in the present study is different, Ito (2014) clearly demonstrated that word length could affect the rate of tensification. In the present study, I will examine if syllable count plays a role in determining loanword tensification rates in the word-initial position.

Similarly, the last factor was chosen from the same study conducted by Ito

(2014). Her study found that there is a co-occurrence restriction or OCP (Obligatory Contour Principle; Leben, 1973) effect on two laryngeally marked segments observed in compound noun tensification of Yanbian Korean. More specifically, compound tensification is less likely to occur when either of the two compound members include a laryngeally marked segment, or an aspirated or tense consonant (e.g., /mal+tɛk'u/ [maltɛk'u] ~ [malt'ɛk'u] 'talk back'). On the other hand, compound tensification is more likely to occur when the members have no laryngeally marked segments (e.g., /son+ʧa.kuk/ [sonʧakuk] ~ [sonʧ'akuk] 'handprint').

The observed co-occurrence restriction in Korean compound tensification suggests that a similar effect may also appear in loanword tensification, although it cannot be absolute since there are loanwords with word-initial tensification and medial laryngeally marked segments (e.g., tense-tense: [pəs'ɨ] ~ [p'əs'ɨ] 'bus'; [tɛns'ɨ] ~ [t'ɛns'ɨ] 'dance'; [paks'ɨ] ~ [p'aks'ɨ] 'box'; tense-aspirated: [kolpʰɨ] ~ [k'olpʰɨ] 'golf'; [təŋkʰɨ] ~ [t'əŋkʰɨ] 'dunk shot'; [pəntʰɨ] ~ [p'əntʰɨ] 'bunt'). The present study will consider whether the OCP effect on two laryngeally marked segments can also be found in loanword tensification.

From the two different data sources, the present study found that loanword tensification is more likely to occur when the place of articulation of the word-initial lax stop is alveopalatal, and less likely to occur when the initial stop is followed by a high vowel, confirming Oh (2009)'s findings. Additionally, the data showed that loanwords are more likely to undergo loanword tensification when the word in

question is monosyllabic, and the onset of the syllable following the tensification site is the tense fricative /s'/.

In order to achieve the second goal, I focused on two possible sources that demonstrated the observed trends. First, in native Korean words, word-initial lax stops undergo optional tensification (e.g. /komul/ [komul] ~ [k'omul] 'junk'; /tən ʧita/ [tənʧita] ~ [t'ənʧita] 'throw'). Given that voiced stops in English are usually adapted as lax stops in Korean, it might be possible that loanword tensification is simply an extension of the process being active in native tensification. Under this possibility, the four trends found in loanword tensification might be extensions of those active processes in native tensification. Second, based on various arguments claiming that the variable patterns found in loanwords from other languages may reflect covert statistical generalizations of the native lexicons (Zuraw, 2000, 2010; Kubozono, 2006; Luke and Lau, 2008), it is possible that the tendencies found in loanword tensification may also reflect statistical trends displayed by Korean common nouns with initial tense stops. To verify this possibility, I investigated the contextual distribution of word-initial tense stops in the Korean lexicon, focusing on the four factors which play a significant role in determining the rate of loanword tensification. Based on an in-depth discussion of the two sources, I will demonstrate that the phonological distribution of loanword tensification partially reflects the contextual distribution of native tensification and Korean lexicon, respectively.

For the last goal of the present study, I consider whether the phonological effects observed in loanword tensification are phonetically natural. In terms of the

height of the vowel following the tensification site, a relationship between the voice onset time of the preceding consonant and height of the following vowel will be discussed in-depth. Regarding the effect of the onset of the syllable following the tensification site, I will not only discuss Ito's (2014) explanation of the overrepresentation of two tense onsets in monomorphemic nouns, but also consider the effect from an articulatory phonetic perspective.

The present study is organized as follows. Section 2 briefly reviews the previous studies on loanword tensification. Section 3 investigates the basic trends in loanword tensification based on the previously mentioned data sources. It will be demonstrated that the loanword tensification is more likely to occur when initial lax stops are followed by non-high vowels, when the word in question is monosyllabic, and when the onset of the syllable following the tensification site is tense. Section 4 will examine two potential sources of the observed trends, native tensification and the Korean lexicon, to determine what drives the trends in loanword tensification. Section 5 will discuss whether the contextual factors observed in loanword tensification are phonetically natural, focusing on the acoustic and articulatory phonetic motivations. Finally, Section 6 summarizes and concludes the paper.

2. Previous studies

Several proposals have been made to explain the variable mapping of English loanwords to tense stops in Korean. It has been attributed to the influence of Japanese-style loanwords (Kim, 1976; Lee, 1993; Kwon, 1995; among others), general sound changes in Korean (Yeo, 1985; Shin and Davis, 2004; Oh, 2004), socio-psycholinguistic factors (Yu 1987, Kwon 1995, Park 2008, among others), or phonetic similarity, especially in voice onset time (VOT) and the following vowel's fundamental frequency (F0), between English voiced stops and Korean tense stops (Kang, 2008a). However, the majority of previous studies have been concerned with the origin of loanword tensification rather than the phonological condition of loanwords. To my knowledge, only a few previous studies on the variable mapping from English voiced stop or affricate to Korean tense stops look at the contextual distribution in the occurrence of tense stop variants of English loanwords. In the following subsections, I will review the previous studies that have examined the phonological environment of loanword tensification. In addition, the approaches investigating origin of the loanword tensification will be briefly discussed.

2.1 Phonological conditions of loanword tensification

Phonological conditions of loanword tensification have been discussed in only a few studies. Oh (2004) has claimed that loanword tensification may appear within a specific phonological environment of the English source words. (1) below provides a summary of Oh (2004)'s findings.

(1) Summary of Oh (2004)'s findings

a. Tensification occurs only for a voiced stop (e.g., [p'ɛk]~ [pɛk] 'back'), but not for a voiced fricative (e.g., [pɛks'in], but not *[p'ɛks'in] 'vaccine').

b. Tensification occurs only in word-initial position (e.g., [t'ɛm]~ [tɛm] 'dam'), but not in word-medial (e.g., [atam], but not *[at'am] 'Adam') or word-final position (e.g., [lɛkɨ], but not *[lɛk'ɨ] 'leg').

c. Tensification occurs only for a singleton voiced stop (e.g., [t'ɛm]~ [tɛm] 'dam'), but not for a consonant cluster (e.g., [tɨɾəm], but not *[t'ɨɾəm] 'drum').

As we can see in (1.a), Oh (2004) has claimed that only a voiced stop in English, /b/, /d/, /g/, can be adapted as tense in Korean. (1.b) and (1.c) suggest that the tense adaptation may occur only when the voiced stops are word-initial or pre-vocalic in the English source words. When English voiced stops are word-medial or pre-

consonantal, they are only adapted as lax stops in Korean (e.g., [təpɨl] ~ [t’əpɨl] but not *[t’əp’ɨl] ‘double’, [tɨɾama] but not *[t’ɨɾama] ‘drama’). However, Oh (2004)’s findings are insufficient to characterize loanword tensification in some aspects. First, she did not include the English voiced affricate in her analysis. Since loanword tensification may also arise when the initial consonant of the English word is a voiced affricate (e.g., [ʤəmpʰɨ] ~ [ʤ’əmpʰɨ] ‘jump’, and [ʤɛm] ~ [ʤ’ɛm] ‘jam’), it should be included as a possible target consonant. On top of this, Oh (2004) only explored the conditions of the loanword tensification, mainly its occurrence or absence, rather than the gradient tendency of the phenomenon. By considering the gradient tendency of loanword tensification, it is possible to observe in which conditions loanword tensification is more or less likely to occur.

On the other hand, Oh (2009) found that loanword tensification is less likely to occur when the tensification site is followed by a high vowel compared to a non-high vowel in the English loanword (e.g., [piə] but not *[p’iə] ‘beer’ vs. [pɛk] ~ [p’ɛk] ‘bag’). This finding implies that the optional tensification of English loans may be sensitive to the phonological conditions of the loanwords themselves, not just to those of the English source words. However, to this date, no previous studies have provided a comprehensive explanation on the gradient tendency of loanword tensification.

2.2 Japanese influence

Other than the phonological approaches to loanword tensification, the majority of previous studies have attributed loanword tensification to the influence of English loanwords in Japanese (Kim, 1976; Lee, 1993; Kwon, 1995; Kim, 2003; among others). Among other studies, Kim (1976) posits that many English words have been adapted to Korean via Japanese. He has proposed that English voiced stops were adapted as Japanese voiced stops, and Korean speakers have adapted these Japanese voiced stops as Korean tense stops because Korean phonemes do not include voiced stops. However, Kim (1976) did not explain why Korean speakers have adapted Japanese voiced stops to Korean tense stops rather than lax stops. Kwon (1995) has pointed out that loanword tensification might be influenced by Japanese, since most loanwords which undergo word-initial tensification were adapted before Korea gained independence from Japan in 1945. However, Kim (1976) and Kwon (1995) did not provide a detailed discussion of the cause of loanword tensification nor present which characteristics of the different consonant systems of Japanese and Korean cause loanword tensification.

Most previous studies that hold this view are based on some examples which are affected by Japanese-style loanwords. One conspicuous example is the adaptation of the English voiceless fricative [f] to Korean. The English [f] is adapted in Korean as an aspirated stop [p^h] in most cases (e.g., English 'fish' > Korean [p^hisi]).

However, in some words, the English [f] is adapted as [h] (e.g., English ‘fry’ > Korean [huɾai]), demonstrating the influence of Japanese-style loanwords. More specifically, the adaption of English [f] to Korean [h] is due to the fact that the English [f] is adapted as Japanese [ɸ], an allophone of Japanese /h/ (e.g., English ‘fry’ > Japanese [ɸɯɾai]), and the Japanese /h/ is consistently adapted as Korean [h]. Thus, the reason for realizing Korean [h] in English loanwords is that Korean speakers accepted the Japanese-style adaptation (e.g., English ‘fry’ > Japanese [ɸɯɾai] > Korean [huɾai], but not *[pʰɨɾai]).

Although some loanwords are affected by Japanese, the previous proposals from Japanese influence are unlikely to be applicable to the adaptation patterns of English word-initial voiced stops or affricate. Unlike Korean, both English and Japanese show voicing contrast, which drives the consistent correspondence of English voiced stops and affricate to Japanese voiced stops. Examples in (2) below show this consistent correspondence of English voiced consonants to those of Japanese.

(2) English initial voiced stops and affricate > Japanese initial voiced stops and affricate

	English		Japanese	Example			
a.	/b/	>	/b/	/bʌs/	>	/basu/	'bus'
b.	/d/	>	/d/	/dæns/	>	/dansu/	'dance'
c.	/g/	>	/g/	/gʌm/	>	/gamu/	'gum'
d.	/ʤ/	>	[dʑ][2]	/ʤæz/	>	[dʑazu]	'jazz'

On the other hand, Japanese word-initial voiced stops are realized as voiceless lax stops when borrowed into Korean, almost without exception (Ito *et al.*, 2006). Examples of the consistent adaptation of Japanese voiced stops to Korean lax stops are provided in (3) below.

(3) Japanese initial voiced stop > Korean initial lax stop

	Japanese		Korean	Example			
a.	/b/	>	/p/	/beɴtoo/	>	/pɛnt'o/	'lunch box'
b.	/d/	>	/t/	/dai/	>	/tai/	'table'
c.	/g/	>	/k/	/gata/	>	/kata/	'shape'

Thus, English initial voiced stops and affricate correspond to Japanese voiced

[2] Japanese [dʑ] is an allophone of /z/ in native Japanese words, but tends to occur phonemically in recent loanwords (Labrune, 2012).

ones, however, Japanese initial voiced stops and affricate correspond to Korean initial lax ones, but not to tense ones. These adaptation patterns among English, Japanese, and Korean indicate that loanword tensification has nothing to do with Japanese or Japanese-origin loanwords. Considering the issues mentioned above, the proposals on Japanese influence are not likely to explain loanword tensification properly. Due to this insufficient explanation of Japanese influence, loanword tensification needs to be viewed by other perspectives.

2.3 General sound change in Korean

Other proposals have suggested that the word-initial tensification of English loanwords is an extension of historical sound changes from early Middle Korean or the same phonological process observed in Korean word-initial tensification (Yeo, 1985; Shin and Davis, 2004; Oh, 2004). Yeo (1985) mentioned that the process of word-initial tensification of adapted words is similar to the process observed in the diachronic sound change from 16th century to 18th century Korean, in that both processes show reinforcement in the word-initial position. (4) and (5) provide examples of sound change from early Middle Korean, and of native tensification, respectively.

(4) Examples of diachronic change from early Middle Korean (Heo, 1965)

a. /koʧ/ → /k'oʧʰ/	'flower'
b. /pulhwi/ → /p'uli/	'root'
c. /kaʧʰi/ → /k'aʧʰi/	'magpie'
d. /kɨtʰ/ → /k'ɨtʰ/	'end'

(5) Examples of native tensification

a. /koʧkam/	[kotk'am] ~ [k'otk'am]	'dried persimmon
b. /talɨn/	[taɾɨn] ~ [t'aɾɨn]	'different'
c. /toŋkɨlami/	[toŋkɨɾami] ~ [t'oŋkɨɾami]	'circle'
d. /ʧokɨm/	[ʧokɨm] ~ [ʧ'okɨm]	'a little'

On the other hand, Kang (2008a) has proposed that native tensification and loanword tensification should be considered different phonological processes for three reasons. The first reason is that both processes have shown different rates of rise and fall over time. Indeed, the rates of native tensification have increased, whereas rates of loanword tensification have significantly declined since the 1930s. Secondly, she has pointed out the fairly low rates of native tensification (1.1% of tensification, reported by Park (2000)) compared to those of loanword tensification (about 20% of tensification, reported by Kang (2008a)). Lastly, while native tensification brings semantic change in some words (e.g., [ʧinhata] ~ [ʧ'inhata]

‘thick’), loanword tensification shows no corresponding semantic changes.

However, the claim that the two processes should be distinguished because they have shown different rates of application over time might be a premature conclusion, since this claim overlooks the fact that native English pronunciation has become familiar to many Korean speakers, resulting in an increasing tendency of producing the English phonemes as they are. As a consequence, this tendency would lower the frequency of tense stop adaptation. In order to examine the relationship between loanword and native tensification, phonological trends in both tensification processes may be compared, rather than the tensification rates over time. I think if the two processes show similar contextual distribution, it might be considered as evidence that the optional tensification of English loanwords is generalized from the same process in native Korean.

Additionally, several researchers have proposed that variation in English loanwords is an extension of processes existing in the native language, arguing that the reason for word-initial tensification of both native words and loanwords is attributed to sociolinguistic factors, such as residence distribution or age (Yu, 1987; Kwon, 1995). Yu (1987) claimed that word-initial tensification is more likely to occur in younger generations than older generations, and in the city than in the countryside. For the psycholinguistic approach, Kwon (1995) suggested that tensification in word-initial position occurs when speakers want to present their idea or intention with emphasis.

2.4 Phonetic similarity between English and Korean

Other accounts for loanword tensification have been proposed in the perspective of phonetic similarity between English voiced stops and Korean stops (Lee, 1982; Kang, 2008a). Lee (1982) claimed that Korean speakers may perceive English voiced stops as Korean tense stops instead of lax or aspirated stops because tense stops are the most phonetically similar to voiced stops in English. To support the claim, Lee (1982) reasoned that both Korean tense stops and English voiced stops are characterized as having narrow gaps between the vocal folds, which make them more suitable to vibrate the vocal folds, compared to aspirated or lax stops. Based on the fact that Korean tense stops and English voiced stops share some phonetic characteristics, Lee (1982) assumed that the voiced stops in English words are realized as Korean tense stops, but may not be realized as lax stops. However, this is not consistent with the fact that, as mentioned in Section 1, Korean speakers usually adapt English voiced stops to lax stops rather than tense stops. Oh (2004, 2009) has also pointed out that English voiced stops are normally adapted as lax stops, and loanword tensification only appears in the specific phonological conditions mentioned previously in Section 2.1. Therefore, the basic assumption made by Lee (1982) does not seem correct.

In a recent study, Kang (2008a) provided a phonetic account of loanword tensification. In that study, she proposed that variation in the word-initial position is

due to phonetic similarity, especially in the VOT and F0 of the following vowel, between English voiced stops and Korean tense stops. The VOT and F0 of English word-initial voiced stops provides conflicting information for Korean speakers as they try to map them to a single laryngeal category in Korean.

(6) Comparison between English voiced stops and Korean stops by phonetic cue (a: from Hombert et al., 1979; b: from Stevens and Klatt, 1974; c: from Cho et al., 2002; d: from Silva, 2006)[3]

	Stop type	F0	VOT
English	voiced	lower (120~125 Hz)[a]	lower (less than 20~30ms)[b]
Korean	lax	lower (120~124 Hz)[c]	higher (40~70ms)[d]
	tense	higher (135~140 Hz)[c]	lower (6~18ms)[d]

As we can see in (6), the F0 of vowels after voiced stops is relatively lower (average 120~125 Hz) than after voiceless stops. The average F0 value of vowels following English voiced stops is better matched with the average F0 value of the

[3] The table in (6) is based on Kang (2008a)'s data, though it does not appear in her paper. Although Kang (2008a) has proposed the phonetic similarity between English and Korean stops, she did not provide detailed numerical values for each VOT and F0 parameter.

vowels following Korean lax stops (average 120~124 Hz) than tense stops (average 135~140 Hz). Thus, Korean speakers perceive English word-initial voiced stops as Korean lax stops when they focus on the F0 value of the following vowels. In terms of VOT value, on the other hand, English voiced stops (less than 20~30ms) have relatively lower or negative value when compared to voiceless stops. These characteristics of VOT in English are more similar with the VOT value of Korean tense stops (average 6~18ms) than lax stops (average 40~70ms). Thus, Korean speakers would perceive English word-initial voiced stops as Korean tense stops when they focus on the VOT cue.

Based on these similarities in phonetic cues between English and Korean, Kang (2008a) proposed that the reason for the general tendency of lax adaptation in present day Korean is the vocalic cue outweighing the VOT cue, while the reason for the adaptation of tense stops is the Korean speaker putting more weight on the VOT than the F0 cue in the earlier loanword adaptation stage. Thus, the reason for the loanword tensification is due to Korean's primary cue on the initial stops varying between the VOT and F0 cues.

2.5 Summary

Previous studies with various points of view on the word-initial tensification of

English loanwords have been introduced so far. Most have proposed that loanword tensification should be attributed to the influence of Japanese or Japanese-style loanwords. However, most of the studies with this view did not provide sufficient evidence to illustrate how Japanese affects loanword tensification in Korean, and also did not give sufficient consideration to the consonant systems of English, Japanese, and Korean. In some studies, it has been suggested that the variation is a part of a historical sound change, or extended processes of the native tensification. For phonetic similarity based accounts, Kang (2008a) proposed that the reason for the optional tensification of English loanwords is due to the phonetic similarity between English voiced stops and Korean stops, prompting speakers' change in primary cue between VOT and F0 over time.

On the other hand, there has not been sufficient research on loanword tensification under phonological approaches. Furthermore, the few studies taking this view mostly consider the phonological environment of the source word, but not that of the loanword itself. Based on the data from two different data sources, Section 3 will demonstrate that the optional tensification of loanwords is sensitive to the contextual distribution of the loanwords themselves.

3. Data

To investigate the contextual factors that trigger loanword tensification, I collected data from two different sources, a judgment test and newspapers from the 1890s to 1950s. The judgment test was conducted in order to determine how speakers actually produce the initial stops of English loanwords. In addition, loanwords appearing in the newspapers are examined, since the rate of word-initial tensification of older generation loans is much higher than that of present day loans. As mentioned in the previous section, while Kim (2003) reported that English loans from the 1930s showed a 60% rate of word-initial tensification, those in the present day are below 20%, as reported by Kang (2008a) and Oh (2009). Given the higher tensification rate of early-adapted English loans before 1950, earlier data is more suitable to determine the contextual effect on loanword tensification.

The investigation will be primarily concerned with four phonological environments. For each contextual effect under consideration, statistical analysis will be conducted. In particular, for the data from the judgment test, a mixed effect logistic regression model will be constructed to determine how significantly each phonological factor plays a role in determining the rate of loanword tensification.

3.1 Judgment test

I first conducted a judgment test to determine tendencies in loanword tensification. The words used in the test include 310 loanwords which are all nouns. The loanwords were selected from the loanword list compiled by the National Institute of Korean Language (NIKL, 2007). The type frequencies of the selected words are provided in (7) below.[4]

(7) Type frequencies of the word list by each subcategory

By place of initial stop	bilabial	alveolar	alveopalatal	velar	total
	123	95	28	64	310

By vowel quality	/i/	/ɨ/	/u/	/ɛ/	/ə/	/o/	/a/	total
	54	50	17	59	40	42	48	310

By syllable count	monosyllabic	multisyllabic	total
	29	281	310

By phonation type of 2nd onset	lax	aspirated	tense	sonorants	total
	71	64	16	130	281

[4] For the full list of the words used in the judgment test, refer to Appendix I.

It is worth mentioning that the loanword list given in NIKL (2007) does not necessarily reflect the speakers' actual pronunciation, as it was complied with the loanword orthography regulation enacted by NIKL in 1986, which does not allow the transcription of any English obstruents to Korean tense stops. For this reason, loanwords given in NIKL (2007) do not contain tense stops. Therefore, one might be concerned about the segments that are classified as a tense category in (7). In this study, this tense category refers to the case where the English prevocalic and word-final /s/ or the word-final /θ/ is adapted to the Korean tense /s'/. Indeed, it has already been pointed out in many studies that English prevocalic or word-final /s/ is consistently mapped to Korean tense /s'/, e.g., [s'aitʃɨ] but not *[saitʃɨ] 'size' (Oh 1996, Kang 2008b). The English word-final /θ/ is also consistently borrowed into Korean as tense /s'/, e.g., [mɛs'ɨ], not *[mɛsɨ] 'math', [pɛs'ɨ] not *[pɛsɨ] 'bath' (Ahn, 2003; Davis and Cho, 2006).

Considering the consistent mapping of the prevocalic and word-final /s/, or word-final /θ/ in English to Korean /s'/, I classified these segments in English words as tense in loanwords, although the loans from NIKL (2007) mark those segments as lax fricative /s/ (e.g., [pəs'ɨ] 'bus', [tɛns'ɨ] 'dance', [pus'ɨ] 'booth', and [tɛs'ɨ] 'death'). On the other hand, English /s/ in a consonant cluster was classified to the lax category, because it is not realized as a tense fricative (e.g., [tɛsɨkʰɨ], not *[tɛs'ɨkʰɨ] 'desk'; [kosɨtʰɨ] not *[kos'ɨtʰɨ] 'ghost'; and [kɛsɨtʰɨ] not *[kɛs'ɨtʰɨ] 'guest').

The test participants were 20 native Seoul-Gyeonggi Korean speakers in their twenties who have had no experience living abroad. On the test, both the loanword

form (written in the Korean alphabet) and its corresponding English source word (written in the English alphabet) were provided for each test word. The participants were asked to choose their preferred pronunciation from the two options, lax initial and tense initial form (written in the Korean alphabet). They were not allowed to choose more than one option, but they could write their own response in a blank space in case their preferred pronunciation was not given as an option. An example of the test form, shown here using International Phonetic Alphabet (IPA), is given in (8) below.

(8) Example of the judgment test form

	Loanword	English word	Option A (lax initial)	Option B (tense initial)
a.	panana	banana	pa.na.na	p’a.na.na
b.	ʧusɨ	juice	ʧu.s’ɨ	ʧ’u.s’ɨ
c.	pusɨ	booth	pu.s’ɨ	p’u.s’ɨ

As shown in (8.b) and (8.c), in the case of the tense /s’/ given in Option A and B, it appears as word-final /s/ and /θ/ in the English source word, respectively. As I mentioned previously, this is due to the fact that English prevocalic or word-final /s/ and word-final /θ/ are consistently adapted as the Korean tense /s’/ (Oh, 1996; Ahn, 2003; Kang, 2008b; Davis and Cho, 2006).

The judgment test results organized by place of articulation of the tensification

site are provided below in (9).[5]

(9) Tensification rate (%) in judgment test by place of articulation of the tensification site

Initial stop	Lax response	Tense response	Tensification rate
Bilabial	2,119	341	13.9
Alveolar	1,730	170	8.9
Alveopalatal	419	141	25.2
Velar	1,121	159	12.4
Total	5,389	811	13.0

Among the initial stops, the tensification rate is the highest when the place of articulation of the tensification site is alveopalatal, /ʧ/. The results of a chi-square independence test showed that the differences among the initial stops were statistically significant ($\chi^2 = 102.4$, df = 3, $p < 0.001$). This result suggests that the loanword tensification is not independent from the place of articulation of the initial stop. I will refer to this increase in tensification rate on an initial alveopalatal affricate as a "place effect".

The results by place of articulation of initial stops and affricate are compared

[5] The frequencies provided in the judgment test results are the sum of the responses for each word and for each subject.

with those of Kang (2008a) and Oh (2009), as provided in the table below.

(10) Comparison of the judgment test results by place of articulation with those of Kang (2008a) and Oh (2009) in percentages: raw tense frequencies are provided in parenthesis

	Kang (2008a)	Oh (2009)	Present study
Bilabial	17.7 (25)	15.3 (480)	13.9 (341)
Alveolar	8.2 (8)	12.4 (260)	8.9 (170)
Alveopalatal	29.2 (7)	25.7 (180)	25.2 (141)
Velar	21.3 (10)	20.0 (180)	12.4 (159)
Total	16.1 (50)	16.1 (1100)	13.0 (811)

Kang (2008a) and Oh (2009) both show that the tensification rate was the highest when the place of the initial stop was alveopalatal. The results by place of articulation from the three different studies show similar distribution (among the three studies: $\chi^2 = 6.7$, df = 6, $p > 0.05$; Oh (2009) vs. present study: $\chi^2 = 4.8$, df = 3, $p > 0.05$; Kang (2008a) vs. present study: $\chi^2 = 1.6$, df = 3, $p > 0.05$). Thus, the place effect is also confirmed in both the previous studies. However, the tensification rates of other places are slightly different compared to both of the previous studies. The results of both Kang (2008a) and Oh (2009) showed that an initial velar stop is more likely to undergo tensification than an initial bilabial stop. In contrast, my test results show a

slightly higher tensification rate for initial bilabial stops. In addition, Kang (2008a) pointed out that there is asymmetry in the rate of tensification between bilabial and alveolar, whereas Oh (2009) did not find such asymmetry. In my test results, the difference between bilabial and alveolar stops is significant ($\chi^2 = 24.5$, df = 1, $p < 0.001$), which is consistent with Kang's (2008a) results. Although the loanword tensification rates by different places of initial stops show differences in the three sets of data, all results clearly demonstrate that the highest tensification rate occurs for the initial alveopalatal affricate.

In terms of the following vowel, results of the judgment test organized by the following vowels are provided below in (11).

(11) Results of the judgment test by the following vowel quality

Following vowel	Lax response	Tense response	Tensification rate (%)
/i/	1,054	26	2.4
/ɨ/	1,000	0	0.0
/u/	340	0	0.0
/ɛ/	922	258	21.9
/ə/	573	207	25.9
/o/	693	147	17.5
/a/	807	173	17.7
Total	5,389	811	13.0

As shown in (11), there is virtually no initial-tensed adaptation when the height of the following vowel is high. On the other hand, the tensification rates are 21.9%, 25.9%, 17.5%, and 17.7% before non-high vowels, /ɛ/, /ə/, /o/ and /a/, respectively. These results are consistent with Oh (2009)'s finding that word-initial tensification hardly occurs when the target consonant of tensification is followed by a high vowel. The judgment test results also indicate that loanword tensification is blocked when the vowel following the tensification site is high, whereas it occurs much more frequently when the vowel of the initial syllable is a non-high vowel. This can be seen in the following table for the tensification rates by the following vowel height.

(12) Results of the judgment test by the following vowel height

	High	Non-high
Tensification (%)	1.1	20.8
Total response	2,420	3,780

About 1% of English loanwords with a high vowel in the initial syllable undergo tensification, whereas over 20% of loanwords with a non-high vowel show word-initial tensification. A Pearson's chi-square test shows that the difference between a high and non-high vowel was statistically significant ($\chi^2 = 501.5$, df = 1, $p < 0.001$), indicating that English voiced stops and affricate are more likely to be adapted as

tense stops in Korean before non-high vowels. I will refer to this difference in tensification rate between high and non-high vowels as a “height effect”.

Let us now consider the distribution of the judgment test results by word length. This is shown below in (13).

(13) Results of the judgment test by syllable count

	Monosyllabic	Multisyllabic
Tensification (%)	37.9	10.5
Total response	580	5,620

The judgment test results show that 37.9% of monosyllabic loans undergo loanword tensification, whereas 10.5% of multisyllabic loans bear a tense variant in the word-initial position. The difference between the monosyllabic and multisyllabic rate was statistically significant ($\chi^2 = 345.1$, df = 1, $p < 0.001$). Thus, loanword tensification is more likely to occur when the word is monosyllabic. I will refer to the difference in tensification rate depending on the word length as a “length effect”.

In terms of the phonation type of the onset of the syllable following the tensification site, the table in (14) shows the tensification rate and total frequencies organized by the four subcategories.

(14) Results of the judgment test by the phonation type of the second syllable onset

2nd Onset / 1st Onset	Lax	Aspirated	Tense	Sonorant
Tensification (%)	8.7	13.8	33.8	7.0
Total response	1,420	1,280	320	2,600

As observed in the table above, the highest tensification rate was found when the second syllable began with a tense fricative. Loanword tensification is more likely to occur when the phonation type of the second syllable onset is tense. In addition, the tensification rate is higher when the loans contain an aspirated obstruent in the onset of the second syllable, compared to when the phonation type of the second syllable onset is lax. The results from a chi-square independence test, given in (16), show that the differences among the subcategories of the second syllable onset were statistically significant ($\chi^2 = 237$, df = 3, $p < 0.001$), indicating that the word-initial tensification rate is correlated with the phonation type of the second syllable onset.

Based on the test results, it is confirmed that the loanword tensification occurs most frequently when the onset of the syllable following the tensification site is a tense /s'/. These results show that the tensification rate is higher when the second syllable onset is a laryngeally marked segment (i.e. tense fricative /s'/) than when it is an unmarked segment (i.e. lax consonant), suggesting that the OCP effect on

laryngeally marked segments does not play a role in loanword tensification. Rather, the results imply that the co-occurrence of these two tense onsets is preferred in loanword tensification.

This apparent violation of the OCP effect on laryngeally marked segments in loanword tensification may be characterized by an assimilation type of long-distance laryngeal restrictions, which is discussed by Gallagher (2010). According to Gallagher, three types classify the laryngeal co-occurrence restrictions existing in many languages: dissimilation, assimilation, and mixed. Among these three types, the assimilation type states that every obstruent given in a root must be specified for the same laryngeal feature, as is illustrated in (15) below.

(15) Assimilation type of long-distance laryngeal restrictions (Gallagher, 2010):

’ stands for a laryngeally marked segment, and T and K indicate obstruents with a different place of articulation.

T’-K’	*T’-K	T-K
T’-T’	*T’-T	T-T

The results of the judgment test clearly showed that loanword tensification has a preference for the co-occurrence of two laryngeally marked segments, which can be characterized by the assimilation type: T’-K’ or T’-T’. Inspired by the term used in Gallagher (2010), I will refer to this characteristic of loanword tensification as an “assimilation effect”.

In order to evaluate how well each factor explains the observed distribution of loanword tensification, a mixed effect logistic regression model was constructed with the *glmer* function of the lme4 package (Bates *et al*., 2011) in R (R Development Core Team, 2014). The dependent variable was each subject's response on each test word. As the responses were either tense or lax, we can set the dependent variable as binary. The subjects and loanwords were included as random intercepts. The fixed factors included the following: the place of the initial stop (bilabial, alveolar, alveopalatal (reference), and velar), the height of the following vowel (high (reference), non-high), the word's length (monosyllabic, multisyllabic (reference)), and the phonation type of the onset of the syllable following the tensification site (lax, aspirated, tense (reference), and sonorant). The results are given below in (16).

(16) Results of a mixed effect logistic regression model for the judgment test: C_2 stands for the onset of the syllable following tensification site.

	Estimate	Standard Error	Pr(>|z|)
(Intercept)	-4.7202	1.1927	< 0.001***
initial (bilabial)	-0.3437	0.1287	< 0.01**
initial (alveolar)	-0.6804	0.1432	< 0.001***
initial (velar)	-0.9664	0.1533	< 0.001***
vowel height (non-high)	3.2382	0.2087	< 0.001***
word length (monosyllabic)	4.5835	2.2432	< 0.05*
C_2 (aspirated)	-1.6464	0.1672	< 0.001***
C_2 (lax)	-2.0057	0.1727	< 0.001***
C_2 (sonorants)	-1.5842	0.1679	< 0.001***

(Significance codes: *** ($p < 0.001$), ** ($p < 0.01$), * ($p < 0.05$) and . ($p < 0.1$))

In the first rows of the table above, “initial (bilabial)”, “initial (alveolar)”, and “initial (velar)”, which illustrate that the place of the initial consonant is bilabial, alveolar, and velar, respectively, had significantly lower tensification rates than the reference “initial (alveopalatal)”. In the fifth row, “vowel height (non-high)”, which indicates that following vowel height is non-high, had significantly higher ratings than the reference (i.e. vowel height (high)). The next row illustrates that monosyllabic words (i.e. word length (mono)) showed significantly higher

tensification ratings than multi syllabic words (i.e. word length (multi)). In the next three rows, all types of C_2 have significantly lower rates of loanword tensification than the C_2 type with tense fricative /s'/ in the second syllable onset (i.e. C_2 (tense)).

To summarize, the judgment test results have clearly shown that loanword tensification is more likely to occur when the place of articulation of the initial stop is alveopalatal (i.e. the place effect), and when the height of the vowel following the tensification site is non-high, while tensification is less likely before high vowels (i.e. the height effect). When it comes to the word length, loanword tensification is more likely to occur when the word length is monosyllabic (i.e. the length effect). In terms of the phonation type of the onset of the second syllable, tensification is more likely to occur when the following onset begins with the laryngeally marked segment, tense /s'/ (i.e. the assimilation effect). In the following subsection, I will continue to investigate whether these four phonological effects also actively play a role in different data by analyzing the newspapers from the 1890s to 1950s.

3.2 Newspapers from the 1890s to 1950s

In this section, I will continue to examine more trends in loanword tensification from another data source, newspapers that were published between the 1890s and 1950s.

A large number of English words were borrowed in this early adaptation stage (Kim, 2012; Ito *et al.*, 2006). During this period, initial voiced stops or affricate in the English source words were adapted as Korean tense stops in many cases, where such initial tense stop adaptation does not appear in loanwords adapted in the present day. The loanword tensification rate was also much higher than that of the present day. This is demonstrated by the tensification rate of early loans being about 60% (Kim, 2003), whereas much lower rates are observed, as in the judgment test results (11.4%) (cf. Kang (2008a) reported that around 20% of loanwords undergo word-initial tensification). The examples given in (17) below demonstrate this frequent adaptation of English voiced stops and affricates to Korean tense stops as seen in Korean newspapers from the1890s to 1950s.

(17) English loans taken from newspapers printed during the 1890s to 1950s (newspaper name and issue date are in parentheses)

a.	/k'oltɨ/	'gold'	(*Dongailbo,* 07-12-1937)
b.	/t'ainamaitʰɨ/	'dynamite'	(*Chosunilbo,* 03-05-1931)
c.	/t'əkɨllasɨ/	'Douglas'	(*Dongailbo,* 26-08-1938)
d.	/p'alomɛtʰə/	'barometer'	(*Dongailbo,* 16-12-1934)
e.	/ʧ'ənaliʧɨm/	'journalism'	(*Chosunilbo,* 01-07-1938)

Interestingly, most of the early-adapted loanwords in (17) no longer appear in present day Korean. For instance, all participants in the judgment test did not adapt

‘gold’ with the initial tense stop, but rather adapted it only with an initial lax stop (e.g., [kolt̪ɨ] but not *[k’olt̪ɨ] ‘gold’). Since there were more words undergoing tensification than the data from my own judgment test, there was a much greater number of phonological environments that affected loanword tensification. Hence, it would be much more efficient to examine which phonological factors have an influence on the loanword tensification from this older data.

To investigate the tendencies in the loanword tensification of earlier loans, I now introduce a list of loans printed in newspapers from the 1890s to 1950s. The loanwords of the newspapers were imported from the loanword list presented in Kim (2009). According to Kim (2009), the words were collected from five different newspapers: *Doklipshinmun, Daehanmaeilshinbo, Hwangsungshinmun, Chosunilbo,* and *Dongailbo.* The word list does not contain all the printed loanwords. In the case of *Chosunilbo* and *Dongailbo,* data before the 1920s is unavailable since they began printing after 1920. Additionally, in the case of *Chosunilbo* and *Dongailbo*, twelve newspapers a year were randomly selected due to the large amount of relevant data. The word collecting criteria presented in Kim (2009) are given in (18) below.

(18) Criteria for loanword selection adopted by Kim (2009)

a. Loanwords were chosen only when both pronunciations and spellings of their corresponding English words were known.

b. Names of people and places that had very low frequencies were excluded.

c. Loanwords that are clearly regarded as Japanese origin loanwords were excluded.

Of all the 3,623 tokens in Kim (2009), 458 tokens having initial voiced stops and affricate in English, were analyzed to examine whether the four phonological effects, the place, height, length, and assimilation effects, also actively affected the distributions of loanword tensification in the earlier adapted loanwords.

(19) Results from newspapers from the 1890s to 1950s by place of articulation

	Lax adaptation	Tense adaptation	Tensification rate (%)
Bilabial	133	79	37.3
Alveolar	69	30	30.3
Alveopalatal	25	27	51.9
Velar	51	44	46.3
Total	278	180	39.3

Tensification rate is the highest when the place of the tensification site is

alveopalatal /ʧ/. On the other hand, the tensification rate is the lowest when the place of articulation of a word-initial stop is alveolar /t/. The differences among the place of articulation was significant ($\chi^2 = 9.1$, df = 3, $p < 0.05$), indicating the distribution of adaptation is not independent from the initial obstruent's place of articulation. These results by places of the target stops seem to corroborate the general tendency observed in the judgment test, since the general tendencies in the judgment test also demonstrated the highest tensification rate for the alveopalatal affricate and the lowest tensification rate for alveolar stops (alveopalatal: 25.2% vs. alveolar: 8.9%).

In terms of the height effect, the distribution of tensification organized by the height of the vowel following the tensification site is provided in (20) below.

(20) Results from newspapers from the 1890s to 1950s by following vowel height

	High	Non-high
Tensification (%)	20.6	46.8
Total	131	327

As we can see in the table above, while the tensification rate is 20.6% when the tensification site is followed by a high vowel, the rate is 46.8% when the word-initial stop is followed by a non-high vowel. A Pearson's Chi-square test with Yates' continuity correction indicated that this difference is statistically significant ($\chi^2 = 25.8$, df = 1, $p = 0.001$). Therefore, the height effect is also confirmed as a significant

factor in the newspapers data.

(21) Results from newspapers from the 1890s to 1950s by syllable count

	Monosyllabic	Multisyllabic
Tensification (%)	76.2	37.5
Total	21	437

Turning now to word length (length effect), Table (21) above shows a higher loanword tensification rate in monosyllabic words than that of multisyllabic words. A Pearson's chi-square test with Yates' continuity correction showed the difference between monosyllabic and multisyllabic tensification to be statistically significant ($\chi^2 = 10.9$, df = 1, $p < 0.001$), providing further evidence that the length effect plays a significant role in loanword tensification.[6]

Finally, in relation to the assimilation effect, English loanwords appearing in newspapers from the 1890s to 1950s again showed the highest tensification rate when the onset of the syllable following the tensification site was the tense fricative.

[6] Considering the small sample size of monosyllabic words (the token frequency of the monosyllabic-lax category was 5), Fisher's exact test was conducted as well. The significant difference between monosyllabic and multisyllabic remains the same. (The Fisher's exact test statistic value is 0.0008; the results are significant at $p < 0.01$.)

(22) Results from newspapers from the 1890s to the 1950s by second syllable onset

2nd Onset / 1st Onset	Lax	Aspirated	Tense	Sonorants
Tensification (%)	38.8	25.5	68.9	29.7
Total	80	47	74	236

The differences between the second syllable subcategories were statistically significant ($\chi^2 = 40.2$, df = 3, $p < 0.001$), suggesting that the tensification rate of the early loans was influenced by the onset of the syllable following the tensification site. Therefore, we can conclude that the assimilation effect plays a role in loanword tensification, as supported by the newspapers from the 1890s to 1950s.

The results of the newspaper data clearly demonstrate that the place, height, length and assimilation effect play a role in loanword tensification. These results suggest that the four effects also actively applied in the tensification of older adapted loanwords. In other words, although the rates of present day loanword tensification have greatly decreased compared to early adaptations, the four phonological factors have been and continue to affect loanword tensification.

3.3 Summary

To summarize, the two different datasets show four contextual factors under consideration (i.e. the place, height, length, and assimilation effect) influence the rate of loanword tensification. The table in (23) summarizes the trends found in loanword tensification according to the two data sources.

(23) Summary of findings

Factor	Judgment test	Newspaper survey
Place of the initial stop	alveopalatal > bilabial, velar > alveolar	alveopalatal > velar > bilabial > alveolar
Following vowel height	non-high > high	non-high > high
Syllable count	monosyllabic > multisyllabic	monosyllabic > multisyllabic
Phonation type of the 2nd onset	tense > aspirated > lax > sonorants	tense > aspirated, lax > sonorants

The effects of the four phonological factors on loanword tensification were found to be statistically significant in all data. Based on the observations from two

different data sets, the tendencies uncovered in the distribution of loanword tensification are summarized as follows.

(24) Trends in loanword tensification

a. Loanword tensification is more likely to occur when place of articulation of the tensification site is alveopalatal than other places. (place effect)

b. Loanword tensification is more likely to occur when the vowel following the tensification site is a non-high vowel /ɛ, ə, o, a/, and it is less likely to occur before a high vowel /i, ɨ, u/. (height effect)

c. Loanword tensification is more likely to occur within monosyllabic words than within multisyllabic words. (length effect)

d. Loanword tensification is more likely to occur when the onset of the syllable following the tensification site is tense /s'/. (assimilation effect)

Now we can question where these tendencies come from. Why are word-initial voiced stops or affricate in English more likely to undergo tensification in loanword adaption in Korean when the place of articulation is alveopalatal, when the stops are followed by non-high vowels, when the words are monosyllabic, and when the onset of the syllable following the tensification site is tense? In the following section, I will discuss two possible sources of the observed trends. First, in Korean, word-initial lax stops undergo optional tensification (e.g., /komul/ [komul] ~ [k'omul] 'junk'). Given that voiced stops in English are usually adapted as lax stops in Korean,

it might be possible that loanword tensification is simply an extension of the tensification process active in native Korean words, which I referred to as “native tensification” in Section 1. In that case, the four trends found above might be extensions of those active in native tensification. In order to explore this possibility, I investigated the distribution of native tensification.

Second, it is possible that the trends in loanword tensification may reflect the statistical trends displayed by native words with an initial tense obstruent in the Korean lexicon. To verify this hypothesis, I will examine the contextual distribution of word-initial tense stops in the Korean lexicon, focusing on the four factors which play a significant role in determining the rate of tensification in English loanwords.

4. What drives the trends in loanword tensification?

In this section, I will explore the causes of the four contextual effects found in loanword tensification, focusing on distributions existing in two different sources, native tensification and native Korean words. Loanword and native tensification share the target and output consonant types, and even the position of the target. If the four effects found in loanword tensification also play a significant role in native tensification, this will suggest that the phonological effects found in loanword tensification are simply generalized from the same phonological effects active in native tensification. With this in mind, I will first investigate the contextual distribution occurring in native tensification, and then compare its results with those of loanword tensification. If these two tensification processes show similar tendencies, it is possible to say that the trends in loanword tensification are influenced by the phonological distributions of native tensification.

The second possible source that may drive the trends in loanword tensification is the distribution of tense consonants in native Korean words. The effect of the native lexicon or phonotactic knowledge on the emergent patterns in loanwords has been discussed often in the literature (Hancin-Bhatt, 1994; Clements, 2001; Herd, 2005; Davison, 2006; Rose and Demuth, 2006; Kang, 2011; among others). More specifically, the variable patterns in loanwords are affected by the covert statistical

generalizations of the native lexical distribution (Zuraw, 2000, 2010, Kubozono, 2006; Luke and Lau, 2008; Walter, 2008). For instance, Zuraw (2010) showed that the nasal substitution of Spanish loanwords in Tagalog directly reflects the statistical trends in the native Tagalog lexicon. In addition, Luke and Lau (2008) found a monosyllabicity preference for verbs and a bisyllabicity preference for nouns in the truncation of recent English loans in Cantonese. They demonstrated that this noun–verb asymmetry is consistent with the lexical statistics in native Cantonese words.

In this regard, it is possible that the tendencies in loanword tensification may reflect the statistical trends displayed by native words with initial tense stops in the Korean lexicon. If it is true that the trends in loanword tensification are generalized from the extant distribution existing in Korean lexicon, the distribution has to be characterized by each effect as follows: 1) the place effect of loanword tensification reflects the overrepresentation of the word-initial tense alveopalatal affricate in native Korean words, 2) the height effect reflects the underrepresentation of word-initial tense stops being followed by high vowels in native Korean words, 3) the length effect mirrors the overrepresentation of word-initial tense stops in monosyllabic native Korean words, and 4) the assimilation effect reflects the overrepresentation of word-initial tense stops when the onset of the following syllable is a tense consonant. In the following subsections, I will investigate the distributions of the two possible sources in order to examine which hypothesis is more suitable for explaining the tendencies in loanword tensification.

4.1 Does native tensification show the same phonological trends?

In this section, I will explore whether the four phonological factors found in loanword tensification actively play a role in native tensification. Before investigating the trends in native tensification, I will briefly discuss previous studies on native tensification and previous accounts of the relationship between loanword tensification and native tensification.

Some Korean words undergo optional word-initial tensification in a similar way to loanwords tensification, as shown in (25) below.

(25) Examples of native tensification

a. /komul/	[komul] ~ [k'omul]	'junk'
b. /ʧatʰuli/	[ʧatʰuɾi] ~ [ʧ'atʰuɾi]	'remnant'
c. /koʧkam/	[kotk'am] ~ [k'otk'am]	'dried persimmon'
d. /toŋkɨlami/	[toŋkɨɾami] ~ [t'oŋkɨɾami]	'circle'

Word-initial tensification in native Korean words is a minor phonological process. According to Park (2000), 233 out of 22,166 existing words (about 1%) show word-initial tensification. Many proposals have been made on this optional tensification in

native words (Heo ,1965; Choi, 1983; Park, 2000; Kim, 2001; Lee, 1989; Han, 2010). However, the majority of the previous accounts have considered native tensification as a random phonological process. Rather, it has been proposed that native tensification is a process of semantic variation, such as adding a negative nuance (e.g., [ʧolpjəŋ] 'soldier' ~ [ʧʾolpjəŋ] 'servant'), or adding an emphatic nuance (e.g., [ʧinhan] 'thick' ~ [ʧʾinhan] 'thicker') (Park, 2000).

Nearly all relevant studies did not pay much attention to the relationship between native tensification and loanword tensification, since the latter is usually regarded as a simple extension of the former (Yeo, 1985; Shin and Davis, 2004; Oh, 2004, 2009). For a more detailed comparison between loanword tensification and native tensification, I examined whether the phonological factors that play significant roles in loanword tensification also actively affect native tensification. If there are such effects in native tensification, the phonological trends found in loanword tensification are simply generalized from the same phonological trends active in optional tensification appearing in Korean words.

4.1.1 Survey

For the purpose of investigating the contextual distribution of native tensification, I conducted a judgment test with 209 Korean words, which were reported in previous

studies to undergo native tensification in the Seoul-Gyeonggi dialect. These words were selected from the word list with native tensification in Park (2000) and Han (2010). The test words include not only native Korean words but also some Sino-Korean words.[7]

These 209 words were tested by twenty participants who were native Seoul Korean speakers in their twenties, with no experience living abroad. All participants had lived in the Seoul-Gyeonggi area for more than twenty years. In the judgment test, both initial lax and initial tense forms for each test word were provided as options (written in the Korean alphabet). The participants were instructed to choose the pronunciation form used in their everyday life between the two possible forms, and multiple answers were not allowed. If their pronunciation did not correspond to one of the options, they were asked to write their own pronunciation in a blank space on the test form. An example of the test form, where pronunciations are shown in IPA, is provided in (26) below.

(26) Example test form

	Word		Option A	Option B
a.	/ʧakta/	'be small'	ʧakt'a	ʧ'akt'a
b.	/koʧkam/	'dried persimmon'	kotk'am	k'otk'am
c.	/toŋkɨlami/	'circle'	toŋkɨɾami	t'oŋkɨɾami

[7] The full list of the test words for native tensification is provided in Appendix II.

It should be noted that the pronunciations given in the options (except the target tensification site) follow the standard pronunciation provided in the Standard Korean Dictionary (henceforth, SKD).[8] The pronunciations given in the SKD reflect a phonological process, such as the so-called Korean Post Obstruent Tensing rule, which realizes lax obstruents of the onset following an obstruent coda as tense. Reflecting this characteristic of the SKD, the second syllable initial lax stops of the words given in (26.a) and (26.b) are presented as tense stops in the options (e.g., /ʧakta/ [ʧakt'a] 'be small' and /koʧkam/ [kotk'am] 'dried persimmon').

4.1.2 Results

The test results on native tensification were analyzed for each contextual effect under consideration (i.e. the place, height, length, and assimilation effects). I first examined whether the place effect also played a role in native tensification. The results by place of articulation of tensification site are presented in (27).

[8] The SKD is available at *http://stdweb2.korean.go.kr/search/List_dic.jsp*.

(27) Native tensification results by place of articulation

Initial stop	Lax response	Tense response	Tensification rate (%)
Bilabial	458	202	30.6
Alveolar	488	172	26.1
Alveopalatal	736	544	42.5
Velar	1,083	497	31.3
Total	2,765	1,415	33.9

The results showed that native tensification is most likely to occur when the place of articulation of tensification for a stop is alveopalatal /ʧ/. The rate of native tensification in the words with an initial velar stop was 31.3%, which was preceded by the rate of alveopalatal tensification. The native words starting with a bilabial stop showed a similar tensification rate with velar stops. Finally, the words with initial alveolar stops showed the lowest tensification rate. Chi-square independence test results show that the differences among the initial stops are significant ($\chi^2 = 67.8$, df = 3, $p < 0.001$). The results clearly demonstrate that native tensification is significantly more likely to occur when the place of articulation of tensification site is alveopalatal /ʧ/. Thus, the place effect is also confirmed in native tensification.

In terms of the height effect, native tensification rate by the height of the vowel following the tensification site showed the following results.

(28) Native tensification results by following vowel height

	High	Non-high
Tensification (%)	24.7	37.7
Total response	1,240	2,940

The rate of native tensification was 24.7% when the following vowel was high, whereas it was 37.6% when the height of the following vowel was non-high. A Pearson's chi-square test with Yates' continuity correction showed that the difference between high and non-high tensification was statistically significant (χ^2 = 65.7, df = 1, $p < 0.001$), indicating that the height effect was also confirmed as significant in the native tensification.

Nevertheless, when considering the number of syllables, tensification rates remain almost the same regardless of the syllable count. Indeed, the tensification rates actually seem to increase slightly in words with multiple syllables.

(29) Native tensification results by syllable count

	Monosyllabic	Multisyllabic
Tensification (%)	32.1	33.9
Total response	140	4,040

A chi-square independence test indicated that the difference between the

monosyllabic and multisyllabic rates was not statistically significant ($\chi^2 = 0.1182$, df = 1, p = 0.731). Thus, the rate of native tensification does not appear to be significantly related to word length, which means that the length effect is not confirmed in native tensification.

Next, I inspected the tensification rate by the onset of the syllable following the tensification site. The results showed that, unlike the loanword tensification data, the native tensification rate with tense consonants in the second syllable onset was not the highest. The following table in (30) shows that the highest rate of tensification occurs in the aspirated category rather than in the tense category onsets.

(30) Native tensification results by phonation type of the second syllable onset

2nd Onset / 1st Onset	Lax	Aspirated	Tense	Sonorant
Tensification (%)	34.5	35.3	34.6	31.7
Total response	1,600	320	1,160	960

The differences among the subcategories of the second syllable onset were not statistically significant ($\chi^2 = 2.909$, df = 3, p = 0.4057), suggesting that there is no association between the native tensification and the onset of the second syllable. Therefore, the assimilation effect does not appear to have any bearing on native tensification.

For the native tensification data, a mixed effect logistic regression model analysis was performed via R (*glmer* function in the lmer4 package of the R statistical software, R Development Core Team, 2014) in order to examine how well each factor could predict a native tensification model. Subject and test words were included as random effects. The fixed factors are the same as the factors adopted in the model for the judgment test on loanword tensification. Results are shown in (31).

(31) Results of a mixed effect logistic regression model for native tensification: C_2 stands for the onset of the syllable following the tensification site.

	Estimate	Standard Error	Pr(>|z|)
(Intercept)	-0.2458	0.4207	0.5589
initial (velar)	-0.5318	0.0853	< 0.001***
initial (bilabial)	-0.5098	0.1148	< 0.001***
initial (alveolar)	-0.9120	0.1183	< 0.001***
vowel height (non-high)	0.5859	0.0817	< 0.001***
word length (mono)	-0.4942	0.9646	0.6084
C_2 (aspirated)	0.0139	0.1434	0.9230
C_2 (lax)	-0.0576	0.0922	0.5323
C_2 (sonorants)	-0.2800	0.1013	< 0.01**

(Significance codes: *** ($p < 0.001$), ** ($p < 0.01$), * ($p < 0.05$) and . ($p < 0.1$))

As expected and revealed by the chi-square test analysis, the mixed effect logistic regression model shows that the significant factors are the place of articulation of the word-initial stop, and the following vowel's height. Native tensification is more likely to occur when the place of articulation is alveopalatal (i.e. reference, initial (alveopalatal)) than the other place of articulation. In addition, tensification is more likely to occur when the height of the vowel following the tensification site is non-high vowel, with a statistical significance. On the other hand, other effects (i.e. the length and the assimilation effect) do not seem to bear any significant influence on the native tensification model. The results indicate that the place effect and the height effect are confirmed as bearing significant influence on both native tensification and loanword tensification.

It should be mentioned that the results of the present study are in disagreement with those of H. Kang and Oh (2016), which shows that a preference for a sequence of two tense consonants exists in the native tensification. However, Kang and Oh (2016) includes the native words with initial fricative /s/ in their survey, which is most likely to contribute to the highest rate of native tensification. Even though they include fricative /s/ in the survey, the effect of the second onset was marginally significant ($F(5,70) = 2.325$, $p=.052$), and the rate of tensification was highest when the second onset was a liquid rather than tense consonant. Considering both results of the present study and of Kang and Oh (2016), I conjecture that the assimilation effect does not appear in the native tensification. Even if the effect does exist, it would appear as an extremely weak effect.

4.1.3 Summary

In summary, the tendencies in native tensification are partially attributed to the height of the following vowel, which implies that the height effect holds for both native Korean words and English loanwords. However, unlike loanword tensification, native tensification did not demonstrate any significant length effect nor assimilation effect. The trends in native tensification are summarized in (32).

(32) Trends in native tensification (N/A: not applicable)

Factor	Judgment test
Place of the initial stop	alveopalatal > bilabial, velar, alveolar
Following vowel height	non-high > high
Syllable count	N/A
Phonation type of the 2nd onset	N/A

In other words, it seems that the contextual distribution of native tensification is generally different from that of English loanwords. Although it is possible to argue that loanword tensification actively reflects the same height effect observed in the native phonological process (i.e. native tensification), we can still question the

reason for the significant length effect and assimilation effect. In the following section, the question whether the trends in loanword tensification are affected by the distribution of the native word lexicon will be explored.

4.2 Do the trends in loanword tensification reflect the distribution of the Korean lexicon?

In this section, I continue to investigate what might affect the trends observed in loanword tensification, focusing on the contextual distribution of word-initial stops in the Korean lexicon. A potential explanation of the tendencies in loanword tensification can be found in the distribution of native words. That is, if the four phonological factors influencing the loanword tensification are reflected in the distribution of native words, it is possible to conclude that the trends in English loanwords reflect the existing contextual distribution of the native word lexicon.

4.2.1. Survey

In order to investigate the distribution of the Korean lexicon by the contextual factors found in loanword tensification, Korean common nouns were collected from the *Frequency of Korean* (Kang and Kim, 2009), which contains 117,333 types, and 7,889,661 tokens. From the corpus of Kang and Kim (2009), 34,501 common nouns registered in the SKD with a frequency value greater than five were selected. Among these common nouns, 13,252 words (including 12,843 words with initial lax stop and affricate and 409 words with initial tense stop and affricate) were used to examine the distribution of native words. For the selected data, the ratio of observed frequency to expected frequency (henceforth, O/E) was calculated for each category. If the O/E values are greater than 1.0, this indicates that the category occurs more than expected (i.e. overrepresentation), whereas the O/E values less than 1.0 indicate that the category occurs less than expected (i.e. underrepresentation). The detailed calculation process for the O/E values will be outlined in the following subsection.

4.2.2. Results

From the selected word list, I calculated the ratio of observed frequency to expected frequency in order to examine whether the distribution of native words is sensitive to each factor found in loanword tensification. I first observed the distribution of native words by the place of articulation of the word-initial stop and affricate. The table in (33) shows the observed number of Korean common nouns organized by the different place of articulation.

(33) Observed frequency of Korean common nouns by the place of articulation of the word-initial stop and affricate

	Bilabial	Alveolar	Alveopalatal	Velar	total
Lax	2,809	1,937	4,396	3,701	12,843
Tense	34	152	56	167	409
Total	2,843	2,089	4,452	3,868	13,252

Based on the observed frequencies in (33), the expected frequency of each cell was calculated. The expected number for each (x, y) pair is written as E(x, y) = P(x) * P(y) * N, where P(x) is the probability of x, P(y) is the probability of y, and N is

the total number of each cell (Kawahara *et al*. 2006). For example, looking at the table in (33), the probability of a tense stop occurring in word-initial position is 409/13,252 = 0.0308, and the probability of a bilabial /p/ occurring as the place of articulation for a word-initial stop is 2,843/13,252 = 0.2145. This being the case, the probability of tense stop and affricate being bilabial /p/ is 0.0308 * 0.2145 = 0.0066. Thus, the expected frequency of tense ones with a bilabial place of articulation is 0.0066 * 13,252 = 87.7. The expected number and the O/E values for common Korean nouns organized by the following vowel height are provided in (34) below.

(34) O/E values for the place of articulation of initial stop and affricate: O stands for observed frequency and E for expected frequency.

	Bilabial	Alveolar	Alveopalatal	Velar
Lax	E = 2755.3 O/E = 1.02	E = 2024.5 O/E = 0.96	E = 4314.6 O/E = 1.02	E = 3748.6 O/E = 0.99
Tense	E = 87.7 O/E = 0.39	E = 64.5 O/E = 2.36	E = 137.4 O/E = 0.41	E = 119.4 O/E = 1.4

The results show that tense stop and affricate with an initial alveolar have the highest O/E value (2.36), suggesting Korean common nouns with initial alveolar tense stops are overrepresented. In contrast, bilabial tense stop and alveopalatal tense fricative have lower O/E values (0.39 and 0.41, respectively). These relatively low

values imply that word-initial bilabial tense stop and alveopalatal tense affricate are underrepresented in Korean common nouns. Given that the place effect of loanword tensification illustrates a high tensification rate with an initial alveopalatal affricate, the distribution of native words by the place of articulation does not have a direct relationship to the place effect of loanword tensification.

Prior to examining the distribution of native words by the following vowel, it should be recalled that loanword tensification is less likely to occur when the height of the vowel following the tensification site is high. If the distribution of Korean common nouns shows an underrepresentation of the initial tense stop and affricate being followed by high vowel, the height effect of loanword tensification could be generalized from the distribution of the native word lexicon. The table in (35) below shows the O/E values for Korean common nouns organized by the height of the vowel following the initial stop and affricate.

(35) O/E values for Korean common nouns by the height of the following vowel

	High	Non-high
Lax	O = 4,289 O/E = 1.01	O = 8,554 O/E = 1.00
Tense	O = 93 O/E = 0.69	O = 316 O/E = 1.15

As we can see in the shaded boxes in (35), the O/E values for initial tense stops with a following high vowel are lower than 1.0, whereas tense stops with a following non-high vowel are higher than 1.0. These results indicate that word-initial tense stops followed by a high vowel are underrepresented, while those followed by a non-high vowel are overrepresented. In addition, a chi-square independence test showed that the difference between high and non-high is significant ($\chi^2 = 19.8$, df = 1, $p < 0.001$), suggesting that the distribution of word-initial lax and tense stop is correlated with the following vowel's height.

The underrepresentation of tense stops followed by a high vowel further supports the height effect of loanword tensification. That is, a possible reason for the low tensification rate before a high-vowel in English loanwords may simply be because tense consonants are less likely to be followed by a high vowel in the native Korean lexicon. Thus, the underrepresented pattern of the initial tense consonants with following high vowels in comparison to the overrepresented pattern of initial tense consonants being followed by non-high vowels could be one reason for the lower rate of loanword tensification when the vowel following the tensification site is high. This implies that the variable tensification patterns in the English loanwords could be generalized from the existing lexical distribution of common nouns in Korean. Although we cannot emphatically conclude that the height effect in the loanword tensification is fully generalized by the native lexical distribution, it seems that the lexical distribution of Korean common nouns might be one answer to the question of what drives the significant role of the height effect in loanword

tensification.

Another significant phonological factor found in loanword tensification was the length effect. English loanwords showed a significantly higher tendency of word-initial tensification when the word was monosyllabic compared to multisyllabic. One possible reason for this might be the distribution in the existing Korean lexicon. If monosyllabic words starting with tense stops are overrepresented in the lexicon, it is not too much to say that the native word distribution has an influence on the length effect of loanword tensification. In order to verify this, O/E values by word length were calculated based on the same list of Korean common nouns from B. Kang and H. Kim (2009). The results are illustrated in (36) below.

(36) O/E values for Korean common nouns by syllable count

	Monosyllabic	Multisyllabic
Lax	O = 330 O/E = 0.91	O = 12,513 O/E = 1.00
Tense	O = 46 O/E = 3.96	O = 363 O/E = 0.91

The difference between word-initial tensification in monosyllabic and multisyllabic words was statistically significant (χ^2 = 105.1, df = 1, $p < 0.001$), suggesting that the distribution of word-initial lax and tense stops is dependent on the word length. The O/E value of the monosyllabic-tense category (the shaded box

in (36)) indicates that the word-initial tense stops in monosyllabic words are highly overrepresented, whereas the multisyllabic-tense category is underrepresented (O/E = 0.91). The high O/E value of the monosyllabic-tense category suggests that word-initial tense stops in monosyllabic words are highly overrepresented in Korean common nouns, indicating that the length effect of loanword tensification may reflect the distribution observed in native Korean words.

As presented in Section 3, the differences among the subcategories of the onset of the syllable following the tensification site were seen to affect loanword tensification. More specifically, loanword tensification is more likely to occur when the onset of the syllable following the tensification site is tense /s'/, implying that the observed tendencies seem to be regarded as an assimilation type of the long-distance laryngeal co-occurrence restriction. What, then, drives the assimilation effect observed in loanword tensification? As a possible hypothesis, the assimilation effect might be attributed to the frequent co-occurrence of two tense pairs in native lexical entries. If this hypothesis is correct, then we may conclude that the assimilation effect of loanword tensification is generalized from the distribution, which exists across the native word lexicon. For the analysis of the lexical distributions of Korean common nouns by the onset of the syllable following the word-initial stops, the same word list was used. It should be noted that monosyllabic words are excluded because they lack of a second syllable. The O/E values for onset pairs are provided in (37) below.

(37) O/E values for Korean common nouns by the phonation type of the first and second onsets

2nd Onset / 1st Onset	Lax	Aspirated	Tense	Sonorants
Lax	O = 6,341 O/E = 1.02	O = 1,356 O/E = 1.01	O = 1,442 O/E = 0.92	O = 3,374 O/E = 1.00
Tense	O = 74 O/E = 0.41	O = 32 O/E = 0.82	O = 169 O/E = 3.72	O =88 O/E = 0.90

The O/E values of the second syllable tense onset are the highest (O/E = 3.72) among words with word-initial tense stop and affricate. This suggests that the co-occurrence of a tense-tense onset pair is highly overrepresented. Given the observed frequencies, the differences among the phonation type subcategories of the second syllable onset were statistically significant ($\chi^2 = 413.3$, df = 3, $p < 0.01$), meaning that the phonation type of the second syllable onset and that of the word-initial stop are correlated.

It should be mentioned that this observation in Korean common nouns is consistent with other studies including Kang and Oh (2016), and Ito (2014). In Kang and Oh (2016), they investigated 67,258 words from the Standard Korean Pronouncing Dictionary, which was constructed by Lee (2002). Based on the observed frequency of the onsets in the first and second syllables, the O/E values

were calculated. The results of Kang and Oh (2016) are provided in (38) below.

(38) O/E values for onset pairs in the first and the second onsets (Kang and Oh, 2016)

2nd Onset / 1st Onset	Lax	Tense	Aspirated	Nasal	Liquid	Vocoid
Lax	1.03	0.91	1.01	1.00	0.96	1.05
Tense	1.04	2.35	0.33	0.75	1.38	0.74
Aspirated	1.00	0.95	1.07	1.02	0.86	0.98

Excluding the ratios of tense-tense pairs and tense-aspirated pairs, the O/E ratios are all approximately 1. The ratio of pairs containing a tense obstruents bears the highest ratio. My observation on Korean common nouns also confirms the highest O/E value for the tense-tense category (O/E = 3.72). Given the high O/E ratios of pairs with a tense obstruents, it is possible to suggest that the assimilation effect of the loanword tensification is attributed to the salient distribution of the native lexicon. On the other hand, this salience does not affect native tensification because the assimilation effect was not found to be significant in native tensification.

Further supporting evidence for the overrepresentation of the co-occurrence of two tense onsets in the lexical distribution of Korean nouns can be found in Ito (2014). In her study of Korean compound nouns, she investigated the O/E values for onset types in initial and peninitial syllables in order to see if the OCP effect appeared

in compound tensification in Korean. Table in (39) shows the results of Ito (2014).

(39) O/E values for onset types in initial and peninitial syllables in disyllabic and trisyllabic monomorphemic nouns: significant correlations ($p < 0.05$) are indicated by * (Ito, 2014)

2nd Onset / 1st Onset	Aspirated	Tense	Lax	Sonorant	Total
Aspirated	0.44 *	0.80	1.09	1.11	141
Tense	0.94	2.30 *	0.83	0.80	267
Lax	1.08	0.82 *	1.00	1.04	1,624
Sonorant	0.97	0.97	1.05	0.96	843
Total	275	333	1,236	1,031	2,875

The findings of Ito (2014) also denotes that the lexical distribution of Korean words shows a significant overrepresentation of tense-tense onset pairs in initial and second syllables. These findings have clearly shown that the overrepresentation of the tense-tense onset pairs in initial and second syllables is a salient characteristic of Korean nouns.

The assimilation effect of loanword tensification has illustrated that word-initial lax stops of loanwords vary with tense stops. This effect drives loanwords to have one more laryngeally marked segment, even though the word already contains a

laryngeally marked segment in the second syllable onset. Given the observations from the present study and from the previous studies, this tendency in loanword tensification may reflect a lexical trend in Korean nouns, which shows an overrepresentation of tense-tense onset pairs despite having more laryngeally marked segments within a word. That is, the assimilation effect of loanword tensification has been generalized from the existing lexical trends in Korean words.

4.2.3 Summary

In this section, I have examined whether the distribution of the native Korean lexicon affects the trends observed in loanword tensification. The distribution of Korean common nouns can be characterized as follows.

(40) Trends in Korean common nouns

a. Underrepresentation of word-initial tense stop and affricate followed by high vowels

b. Overrepresentation of word-initial tense stop and affricate in monosyllabic words

c. Overrepresentation of two tense onsets in the first and second syllable

This lexical distribution of Korean common nouns suggests that loanword

tensification is partially affected by the trends in the native Korean lexicon. In particular, the significantly low rate of loanword tensification before high vowels (i.e. the height effect) might be influenced by the underrepresentation of word-initial tense stop and affricate followed by high vowels in Korean common nouns. In terms of the word length, the high rate of loanword tensification in monosyllabic words (i.e. the length effect) may be affected by the overrepresentation of word-initial tense stops in monosyllabic words. Finally, the high rate of the loanword tensification when the onset of the syllable following the tensification site is tense /s'/ (i.e. the assimilation effect), is possibly affected by a high overrepresentation of two tense onsets in Korean common nouns. However, the distribution of Korean common nouns did not show an overrepresentation of word-initial tense stops with the alveopalatal place of articulation. Rather, word-initial alveolar tense stops were overrepresented, which is the opposite distribution compared to loanword tensification. Thus, the highest rate of loanword tensification being in word-initial alveopalatal /ʧ/ (i.e. the place effect) is not likely to reflect the existing distribution of the native lexicon.

Based on the findings in the native word lexicon, it is likely that the contextual distribution of loanword tensification partially reflects salient patterns existing in the distribution of the native word lexicon. Then, we should ask ourselves whether the four phonological factors found to influence loanword tensification are phonetically natural. In the following section, I will discuss the phonetic or phonological naturalness of each effect with supporting evidence.

5. Phonetic background

Based on two different data sources, I have thus far demonstrated that four phonological factors - place effect, height effect, length effect, and assimilation effect - have a significant influence on the distribution of loanword tensification. We have also observed a similar process of variation appearing in native tensification while exploring the question of what drives the contextual distribution of loanword tensification. From the survey results, the distribution of native tensification has partially shown the same effects in loanword tensification: the place and height effect. Then, the distribution of Korean common nouns was investigated as another possible source of loanword tensification. The covert distribution of Korean common nouns has shown that all the effects (except for the place effect) found in loanword tensification are generalized from the overrepresented distribution in the native word lexicon.

In this section, I will continue the discussion on possible motivations for each factor observed in the distribution of loanword tensification. Specifically, the main goal of this section is to consider the phonetic naturalness of each contextual effect, focusing on the acoustic and articulatory motivations of the observed phonological factors.

5.1 The height effect

As we have seen, the height effect has been a significant factor in both loanword tensification and native tensification. Furthermore, the examination of Korean common nouns has indicated that this height effect may reflect the extant patterns of the native word lexicon; underrepresentation of word-initial tense stops followed by high vowels. To what, then, might we attribute the effect of the following vowel's height on the word-initial stop? Specifically, is the height effect phonetically natural?

One response to this question can be drawn from acoustic motives, especially from the relation between the VOT of the preceding stop and the height of the following vowel. Since the height effect of the loanword tensification has illustrated a variation of preceding consonants in accordance with the height of the following vowel, we can reason that there is a vowel-dependent variation in the consonant.

In terms of the VOT duration of a Korean stop series, tense stops are of the shortest type (6~18ms) compared to lax (40~70ms) and aspirated (85~105ms) (Silva 2006). On the basis of these characteristics, if the VOT duration increases as the height of the following vowel increases, it would suggest that higher vowels tend not to be compatible with tense stops which have the shortest VOT. This hypothesis with respect to the phonetic naturalness of the height effect can be examined through several previous studies on the relation between the VOT value of word-initial stops and the height of the following vowel.

Among previous studies, Klatt (1975) has found that the VOT value of the preceding stop is slightly longer before high vowels, and shorter before low vowels. As for this tendency between the VOT parameter and the height of the vowel, Klatt (1975) has claimed that high vowels influence the larynx, resulting in a difficult voicing. This influence can be attributed to the fact that the raising of the tongue body can result in a slight upward pull on the larynx, which in turn may make it harder for phonation to start. Thus, a slightly higher subglottal pressure would be required to initiate phonation.

In addition, Ohala (1981) has also found that VOT becomes longer before high vowels and shorter before mid or low vowels. Ohala (1976, 1981) has suggested that the effect of the following vowel's height occurs when high vowels offer greater resistance to air escaping from the oral cavity, which delays the achievement of a trans-glottal pressure suitable for voicing. Likewise, Docherty (1992) has supported this relationship between the VOT duration of the preceding stop and the height of the following vowel. His experiment showed that vowel quality is a significant factor with respect to the VOT parameter since a longer VOT duration occurs more often before high front vowels compared to low front vowels.

A wide range of previous studies provide a firm phonetic background to the observed height effect of the loanword tensification. Due to the necessarily shorter VOT for tense consonants, the longer VOT before high vowels implies that the occurrence of the tense variant followed by high vowels is discouraged. In contrast, the shorter VOT before mid and low vowels suggests that the preceding lax stops are

prone to being realized as tense variants when the height of the following vowel is mid or low. Thus, the previous studies offer further support for the height effect found in loanword tensification and show that the height effect is indeed phonetically natural.

On the other hand, Oh (2009) has suggested that the height effect of loanword tensification is not attributed to a phonetic correlation between a stop's VOT values and the height of the following vowel. She has citied the results of Nearey and Rochet (1994) which conclude that the height effect is suitable for English tense vowels, but not for lax vowels because English high lax vowels are not necessarily associated with the shortest VOT. This implies that loanword tensification rates should have remained high when the vowel following the tensification site is a lax high vowel if the height effect is attributed to the phonetic correlation between the VOT and following vowel's height. English high lax and tense vowels behave the same way in loanword tensification in that they rarely trigger loanword tensification even though lax high vowels are associated with the shortest VOT values of the preceding stops. For this reason, Ok (2009) concluded that some modulation of VOT by vowel context in English cannot be the phonetic grounds for the height effect. However, it seems that Oh (2009)’s interpretation is not consistent with the results presented in Nearey and Rochet (1994). Although the phonetic relationship between a shorter VOT value and high lax vowels shows a significant difference with voiceless stops, it is not likely to apply to the voiced stops (Nearey and Rochet, 1994). Loanword tensification occurs when the target initial stops are voiced stops in English source

words. For English voiced stops, vowel-dependent differences on the VOT duration of the initial stops is still a possible reason for the height effect.

On top of this, the vocalic context effect on VOT has been found not only in English, but also in many other languages, such as Danish (Fischer-Jørgensen, 1980, Mortensen and Tøndering, 2013), Dutch (Fischer-Jørgensen, 1979), Italian (Esposito, 2002), French and Lebanese Arabic (Yeni-Komshian *et al.*, 1977). Esposito (2002), for example, has explained that vocalic context effects on VOT are based on the supraglottal articulatory adjustments that occur during consonant-vowel production. The progressively narrower constrictions (low, mid, high) needed to produce different vowels, together with the consonant constrictions, delay the complete release of air from the oral cavity. The narrower the constriction, the longer the time needed to allow the drop in supraglottal pressure and the onset of vocal fold vibrations.

In this respect, another critical aspect of the height effect may be considered in typology. One implication of the height effect on typology was noted by Moreton (2008). In his paper, the phonetic precursor of the HV pattern is examined in order to verify that its phonetic precursor is actually stronger than the HH pattern.[9] The author divided the status of consonants into two different contexts; one he called *Raising Context*, and the other *Lowering Context*. In his HV analyses, the *Raising*

[9] H and V stand for 'Height' and 'Voicing', respectively. Hence, the HV pattern can be seen as a vowel-consonant sequence, and the HH pattern can be seen as a vowel sequence in a hetero-syllable.

Context was for voiced, unaspirated, and lenis obstruents, while the *Lowering Context* was for voiceless, aspirated, and fortis obstruents. The context effect was defined by the first formant frequency (F1) of the target vowel in the *Lowering Context* divided by the values in the *Raising Context*.[10] The results show that there is a higher F1 value in the *Lowering Context*, which illustrates that the voiceless, aspirated, and fortis status of obstruents causes the preceding vowel to have a [-high] feature. The status of the following consonant has an effect on the height of the preceding vowel, and this relationship is phonetically attested.

Given this, it is reasonable to conclude that the status of the preceding consonant can also affect the following vowel. However, it should be noted that the input high vowel always maintains its height feature in the output form. In other words, an English high vowel is always mapped to a Korean high vowel. Taking this discussion on vowel height further, the consonant would change its tense feature in accordance with its preceding vowel's feature, which is [± high]. That is, if there is a pattern where the fortis status of the following consonant prefers a non-high feature in the preceding vowel, then conversely, a pattern which prefers a fortis status in the preceding consonant, when the following vowel has a non-high feature, could exist.

However, Moreton (2008) has demonstrated that this HV pattern rarely emerges

[10] In Moreton (2008:93), this part is labeled backwards. Figure 2 actually shows the *Lowering Context* (bigger F1) divided by the *Raising Context* (smaller F1), which means it should be "Target Vowel F1 in the *Lowering Context* divided by Target Vowel F1 in the *Raising Context*" in order for a ratio of >1 to signify a higher F1 in the *Lowering Context*. (This error was confirmed through personal communication with the author.)

or the pattern is not easily acquired. In this regard, the height effect confirmed in the present study is worth discussing because both loanword and native tensification displayed a categorical difference with regards to the height effect. This implies that the vocalic context effect on the status of the preceding stop may arise categorically in Korean. Yet, it is still questionable whether these patterns would actually be productive and learnable to Korean speakers, or if the pattern is strongly affected by the exiting trends in Korean phonotactics. Furthermore, it needs to be verified that the correlation between VOT and the height of the following vowel usually exists in English. For now, I do not deeply analyze this correlation, but leave it for the future research.

5.2 The assimilation effect

As demonstrated in Section 3, the rate of loanword tensification is sensitive to the onset of the syllable following the tensification site (i.e. the assimilation effect). In addition, this effect on the loanword tensification is likely to reflect the lexical distribution of Korean words. Then, to what acoustic property might the assimilation effect and the overrepresentation of two tense onset pairs in the native word lexicon be attributed?

In order to explain this question, Ito (2014) hypothesized about the long-distance creakiness assimilation between vowels in the relevant syllables. In Korean, a vowel followed by a tense consonant typically has a creaky voice. According to Ito's (2014) suggestion, the vowel in the word-initial syllable assimilates in creakiness to the one in the following syllable with a tense onset (e.g., CV. C'V̰ → CV̰.C'V̰). Following this, the lax consonant in the word-initial syllable is affected by the creaky voice of the following vowel, resulting in the tensification of the preceding consonant (e.g., CV̰.C'V̰ → C'V̰.C'V̰). In addition, Ito (2014) has suggested a diachronic sound change to support her explanation: e.g., /kos.kal/ → /ko.k'al/ → [k'o.k'al] 'Buddhist priest's hood', and /tuk.tə.pi/ → /tut.kə.pi/ (metathesis) → /tu.k'ə.pi/ → [t'u.k'ə.pi] 'toad' (Ito, 2014: 389).

The present study supports Ito's (2014) account in that it can also be applied to the trends observed in loanword tensification. As previously mentioned, English prevocalic and word-final /s/ is consistently adapted as the Korean tense fricative /s'/ (Oh, 1996; Kim, 1999; Kang, 2003, 2008b). The onset of the vowel following the tense fricative /s'/ has either low or negative H1-H2 values, which indicate that it contains a creaky voice (Ito, 2014; Kong *et al.*, 2011). The creakiness of the vowel in the following syllable extends to the first syllable, and in turn, the creakiness of the preceding syllable triggers the tensification of the initial stop. For instance, the English word 'bus' is adapted as [pə.s'ɨ], where the vowel /ɨ/ in the second syllable contains the creaky voice. Following this, the creaky voice in /ɨ/ extends to the vowel in the initial syllable, resulting in [pə̰.s'ɨ̰]. Finally, the creakiness of /ə/ forces a

preceding stop tensification on /p/, which is more harmonic with the creaky voice of /ə/ than /p/, resulting in [p’ə̰.s’ɨ̰] (e.g., /pə.s’ɨ̰/ > /pə̰.s’ɨ̰/ > [p’ə̰.s’ɨ̰] ‘bus’).

One might be concerned about the fact that there is a slight difference between the Yanbian and Seoul dialects of Korean, in that the former takes the creaky voice as a major distinctive cue to distinguish tense from lax consonants (Ito, 2014), while in the case of the latter, the VOT parameter is sufficient to distinguish tense from lax stops (Kim, 2004; Kong *et al*., 2011). Creaky voice as a major distinctive cue in Yanbian Korean is more likely to encourage the assimilation of the creaky voice from the following syllable’s vowel to the vowel of the preceding syllable, which, in turn, triggers the regressive assimilation of two tense onset pairs. Nevertheless, the creakiness in the following vowel still plays a role in distinguishing tense from lax consonants in Seoul Korean (Oh and Yang, 2013), therefore supporting the present study’s assumption that the creaky voice may act as a trigger for the regressive assimilation of the two tense onset pairs in loanword tensification.

However, when we consider the articulatory movement of the assimilation effect of loanwords, the situation becomes quite tricky. Note that the tense consonants are typically characterized by the feature [+constricted glottis], and aspirated consonant by [+spread glottis] (Halle and Stevens, 1971; Hayes, 2009). [+constricted glottis] is the opposite of [+spread glottis] in that the vocal cords make a narrow or closed glottis in the former, whereas in the latter, a wide glottis is produced (Hayes, 2009). The extreme glottal status of both aspirated and tense consonants would make the articulatory effort greater than in lax consonants, which

is laryngeally unmarked so that they need less articulatory effort than tense consonants. For example, Ito (2014) has attributed the co-occurrence restriction in aspirated-tense pairs to this difference in glottal states between aspirated and tense stops. In other words, it requires a significantly large amount of articulatory effort to pronounce two opposing glottal states, resulting in the co-occurrence restriction in aspirated-tense pairs.

Given this, the assimilation effect of loanword tensification also bears a great amount of articulatory effort, since the effect brings about two tense consonants within a word. That is, the effect requires much more articulatory effort than if the original word had a lax-tense pairs (e.g., it takes more articulatory effort to pronounce [t'ɛns'ɨ] than [tɛns'ɨ] 'dance'). Thus, the assimilation effect seems unnatural respecting the articulatory movement. Even if there is no clear phonetic motive for the assimilation effect, it is one of the effects that shape the tendency in loanword tensification. This implies that the assimilation effect may be heavily dependent on the phonotactic knowledge of the Korean speaker.

6. Conclusion

In this study, I have explored the variable tensification of word-initial stops observed in English loanwords, as they are adapted into Korean. This new approach is based on the idea that the loanword tensification reflects the distribution of native tensification or extant patterns of the native word lexicon. In order to verify this idea, I first investigated the contextual distribution of loanword tensification from two different sets of data: a judgment test and newspapers from the 1890s to 1950s. From the survey results of these two different data sources, I confirmed that there are four statistically significant phonological factors that shape tendencies in loanword tensification. The trends showed that loanword tensification is more likely to occur when the place of articulation of the tensification site is an alveopalatal (i.e. the place effect), when the height of vowel following the tensification site is non-high (i.e. the height effect), when the word is monosyllabic (i.e. the length effect), and when the onset of the syllable following the tensification site has a phonation type of tense (i.e. the assimilation effect). Given the contextual distribution of loanword tensification, I examined the two possible sources, native tensification and native word lexicon, which are thought to affect the trends in loanword tensification. The results of the two possible sources showed that the effects of loanword tensification partially reflected the salient distribution of both sources. The place and height effects of

loanword tensification were also confirmed in native tensification. On the other hand, the height, length, and assimilation effects of loanword tensification mirror the extant distribution of Korean common nouns. In addition, I have discussed the phonetic background that motivates each contextual factor found in loanword tensification, focusing on the acoustic and articulatory property of each context. For the height effect of loanword tensification, the relation between the VOT value of the word-initial stop and the following vowel's height was considered. Previous studies have shown that the VOT values of word-initial stops become longer before high vowels, and in contrast, become shorter before non-high vowels, implying that the height effect is supported by a phonetic motive. However, it is still questionable whether the effect is actually learnable by Korean speakers. Regarding the assimilation effect, loanword tensification substantially mirrors the salient distribution of Korean nouns, even though the effect requires an additional articulatory effort. This study offers an observational contribution in that new factors affecting loanword tensification were found, premised on the idea that loanword phonology reflects native phonological patterns. In addition, it is the first to explore the question of what phonological aspects drive the contextual distribution of loanword tensification, which has not been discussed in detail in previous studies.

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Appendix I. List of English loanwords

The words in the list represent phonemic representation of the selected 310 loanwords from NIKL (2007). Inter-vocalic flapping of alveolar lateral approximant /l/, post obstruent tensing and inter-sonorant voicing are not reflected in the word list.

English word	**Loanword**	**English word**	**Loanword**
baby	pɛ.i.pi	bear	pɛ.ə
back	pɛk	beast	pi.sɨ.tʰɨ
bacteria	pak.tʰɛ.li.a	beat	pi.tʰɨ
badminton	pɛ.tɨ.min.tʰən	bed	pɛ.tɨ
bag	pɛk	beef	pi.pʰɨ
balance	pɛl.lən.s’ɨ	beer	pi.ə
balcony	pal.kʰo.ni	beginner	pi.ki.nə
ball	pol	bell	pɛl
ballad	pal.la.dɨ	belly	pɛl.li
balloon	pəl.lun	belt	pɛl.tʰɨ
banana	pa.na.na	bench	pɛn.ʧʰi
band	pɛn.tɨ	best	pɛ.sɨ.tʰɨ
banking	pɛŋ.kʰiŋ	beta	pɛ.tʰa
bar	pa	betting	pɛ.tʰiŋ

barbecue	pa.pi.kʰu	B (alphabet)	pi
barbell	pa.pɛl	bicycle	pa.i.si.kʰɨl
barista	pa.li.sɨ.tʰa	big	pik
baritone	pa.li.tʰon	bikini	pi.kʰi.ni
barricade	pa.li.kʰɛ.i.tɨ	bill	pil
base	pɛ.i.s’ɨ	binder	pa.in.tə
basic	pɛ.i.ʧik	bingo	piŋ.ko
bat	pɛ.tʰɨ	bio	pa.i.o
battery	pɛ.tʰə.li	bird	pə.tɨ
battle	pɛ.tʰɨl	birthday	pə.sɨ.dɛ.i
beach	pi.ʧʰi	biscuit	pi.sɨ.kʰit
beaker	pi.kʰə	black	pɨl.lɛk
beam	pim	blend	pɨl.lɛn.dɨ
bean	pin	blind	pɨl.la.in.dɨ
block	pɨl.lok	British	pɨ.li.tʰi.si
blog	pɨl.lo.kɨ	brother	pɨ.la.tə
blouse	pɨl.la.u.s’ɨ	brown	pɨ.la.un
blue	pɨl.lu	brunch	pɨ.lən.ʧʰi
board	po.tɨ	brush	pɨ.lə.si
boat	po.tʰɨ	bubble	pə.pɨl
body	po.ti	buckle	pə.kʰɨl
Boeing	po.iŋ	Buddha	pu.ta
boiler	po.il.lə	buddy	pə.ti

bold	pol.tɨ	buffering	pə.pʰə.liŋ
bolt	pol.tʰɨ	bug	pə.kɨ
bond	pon.tɨ	build	pil.tɨ
bonus	po.nə.s’ɨ	building	pil.tiŋ
booby trap	pu.pi.tʰɨ.lɛp	bulk	pəl.kʰɨ
book	puk	bulldog	pul.tok
boom	pum	bulldozer	pul.to.ʧə
boomerang	pu.mɛ.laŋ	bumper	pəm.pʰə
booster	pu.sɨ.tʰə	bungee	pən.ʧi
booth	pu.s’ɨ	bunker	pəŋ.kʰə
booting	pu.tʰiŋ	bunt	pən.tʰɨ
boots	pu.ʧʰɨ	burger	pə.kə
border	po.tə	burner	pə.nə
boss	po.s’ɨ	bus	pə.s’ɨ
bottle	pa.tʰɨl	business	pi.ʧɨ.ni.s’ɨ
bottom	pa.tʰəm	busker	pə.sɨ.kʰə
bounce	pa.un.s’ɨ	butane	pu.tʰan
bouquet	pu.kʰɛ	butter	pə.tʰə
bow	po.u	button	pə.tʰɨn
bowl	po.ul	buyer	pa.i.ə
bowling	pol.liŋ	byte	pa.i.tɨ
box	pak.s’ɨ	D (alphabet)	ti
boxing	pok.s’iŋ	dam	tɛm

boy	po.i	dance	tɛn.s’ɨ
brain	pɨ.lɛ.in	dandy	tɛn.ti
brand	pɨ.lɛn.dɨ	dark	ta.kʰɨ
bravo	pu.la.po	darling	tal.liŋ
break	pɨ.lɛ.i.kʰɨ	dart	ta.tʰɨ
bridge	pɨ.lit.ʧ’i	data	tɛ.i.tʰə
briefing	pɨ.li.pʰiŋ	date	tɛ.i.tʰɨ
day	tɛ.i	dioxin	ta.i.ok.s’in
dealer	til.lə	dip	tip
dear	ti.ə	disco	ti.sɨ.kʰo
death	tɛ.sɨ	discovery	ti.sɨ.kʰə.pə.li
deck	tɛ.kʰɨ	disk	ti.sɨ.kʰɨ
decline	ti.kʰɨl.la.in	diving	ta.i.piŋ
decoration	tɛ.kʰo.lɛ.i.sjən	docking	to.kʰiŋ
deejay (DJ)	ti.ʧɛ.i	doctor	tak.tʰə
defense	ti.pʰɛn.s’ɨ	doctrine	tok.tʰɨ.lin
definition	tɛ.pʰi.ni.sjən	documentary	ta.kʰju.mɛn.tʰə.li
delay	til.lɛ.i	dog	to.kɨ
delete	til.li.tʰɨ	dollar	tal.lə
delivery	til.li.pə.li	dolphin	tol.pʰin
delta	tɛl.tʰa	domain	to.mɛ.in
demo	tɛ.mo	dome	tom
democracy	tɛ.mo.kʰɨ.la.s’i	domino	to.mi.no

denim	tɛ.nim	donation	to.nɛ.i.sjən
dentist	tɛn.tʰi.sɨ.tɨ	door	to.ə
department	ti.pʰa.tʰɨ.mən.tɨ	double	tə.pɨl
departure	ti.pʰa.ʧʰjə	doughnut	to.nət
derby	tə.pi	dove	to.pɨ
design	ti.ʧa.in	down	ta.un
desk	tɛ.sɨ.kɨ	Dracula	tɨ.la.kʰjul.la
dessert	ti.ʧə.tɨ	drag	tɨ.lɛ.kɨ
destiny	tɛ.sɨ.tʰi.ni	drama	tɨ.la.ma
destroyer	ti.sɨ.tʰɨ.lo.i.ə	drawing	tɨ.lo.iŋ
detector	ti.tʰɛk.tə	dream	tɨ.lim
detox	ti.tʰok.s’ɨ	dress	tɨ.lɛ.s’ɨ
development	ti.pɛl.lop.mən.tʰɨ	dressing	tɨ.lɛ.s’iŋ
device	ti.pa.i.s’ɨ	dribble	tɨ.li.pɨl
devil	tɛ.pil	drill	tɨ.lil
dial	ta.i.əl	drink	tɨ.liŋ.kɨ
diamond	ta.i.a.mon.tɨ	drip	tɨ.lip
diary	ta.i.ə.li	drive	tɨ.la.i.pɨ
dictionary	tik.ʃə.nə.li	drop	tɨ.lap
diet	ta.i.ə.tʰɨ	drug	tɨ.lə.kɨ
digest	ta.i.ʧɛ.sɨ.tɨ	drum	tɨ.ləm
digital	ti.ʧi.tʰəl	dry	tɨ.la.i
dilemma	til.lɛ.ma	dubbing	tə.piŋ

duck	tuk	glory	kɨl.lo.li
dumbbell	təm.pɛl	glove	kɨl.lə.pɨ
dummy	tə.mi	go	ko
dump	təm.pʰɨ	goal	kol
dumping	təm.pʰiŋ	goat	ko.tʰɨ
dunk	təŋ.kʰɨ	goblin	ko.pɨl.lin
dusk	tə.sɨ.kʰɨ	god	kat
Dutch	tə.ʧʰi	goggle	ko.kɨl
dynamite	ta.i.nə.ma.i.tʰɨ	gold	kol.tɨ
gag	kɛ.kɨ	golf	kol.pʰɨ
gallery	kɛl.lə.li	goliath	kol.li.at
game	kɛ.im	goofy	ku.pʰi
gamma	kam.ma	google	ku.kɨl
gang	kɛŋ	goose	ku.sɨ
gap	kɛp	gorilla	ko.lil.la
garage	ka.ra.ʧi	gossip	ka.s’ip
garden	ka.tɨn	gothic	ko.tik
garlic	kal.lik	gown	ka.un
gas	ka.s’ɨ	grace	kɨ.lɛ.i.s’ɨ
gasoline	ka.s’ol.lin	gram	kɨ.lɛm
gate	kɛ.i.tʰɨ	grammar	kɨ.lɛ.mə
gauge	kɛ.i.ʧi	grape	kɨ.lɛi.pʰɨ
gauze	kə.ʧɨ	graph	kɨ.lɛ.pʰɨ

gay	kɛ.i	grass	kɨ.lɛ.s’ɨ
gear	ki.ə	gravity	kɨ.lɛ.pi.tʰi
gender	ʧɛn.tə	gray	kɨ.lɛ.i
genius	ʧi.ni.ə.s’ɨ	Greece	kɨ.li.s’ɨ
gentleman	ʧɛn.tʰɨl.mɛn	green	kɨ.lin
ghost	ko.sɨ.tʰɨ	ground	kɨ.la.un.dɨ
giant	ʧa.i.ən.tɨ	group	kɨ.lup
gift	ki.pʰɨ.tʰɨ	guarantee	kɛ.lən.tʰi
giga	ki.ka	guard	ka.tɨ
ginger	ʧin.ʧə	guess	kɛ.s’ɨ
gyps	kip.s’ɨ	guest	kɛ.sɨ.tɨ
giraffe	ʧi.la.pʰɨ	guide	ka.i.dɨ
girl	kəl	guild	kil.tɨ
glamor	kɨl.lɛ.mə	Guinness	ki.nɛ.s’ɨ
glass	kɨl.lɛ.s’ɨ	guitar	ki.tʰa
globe	kɨl.lo.pɨ	gulp	kəl.pʰɨ
gum	kəm	jinx	ʧiŋ.kʰɨ.s’ɨ
gun	kən	job	ʧap
guy	ka.i	jogging	ʧo.kiŋ
gym	ʧim	join	ʧo.in
gypsy	ʧip.s’i	joint	ʧo.in.tʰɨ
jab	ʧɛp	joke	ʧo.kʰɨ
jack	ʧɛk	journal	ʧə.nəl

jacket	ʧɛ.kʰit	judge	ʧə.ʧˀi
jam	ʧɛm	juice	ʧu.s’ɨ
jazz	ʧɛ.ʧɨ	jumbo	ʧəm.po
jean	ʧin	jump	ʧəm.pʰɨ
jelly	ʧɛl.li	jungle	ʧəŋ.kɨl
jet	ʧɛ.tʰɨ	junk	ʧəŋ.kʰɨ

Appendix II. List of native tensification words

The words in the list represent phonemic representation of the selected 210 Korean words from Park (2000) and Han (2010). Inter-vocalic flapping of alveolar lateral approximant /l/, post obstruent tensing and inter-sonorant voicing are not reflected in the word list.

Word	**Gloss**	**Word**	**Gloss**
ka.tɨk.ha.ta	(be) full of	ko.mul	junk
ka.ɾa.aŋʧ.ta	sink	ko.sa.li	bracken
ka.lak.ʧi	ring	ko.so.ha.ta	tasty; savory
ka.mah.ta	(be) black	ko.ʧʰu	red pepper
ka.si	thorn	ko.ʧʰu.ʧaŋ	red pepper paste
ka.ʧuk	leather	ko.ʧʰus.ka.lu	chili powder
ka.ʧi	branch (tree)	kot.ʧaŋ	right away
ka.ʧʾa	fake	kol.mok	alley
kam.ta	wash, bathe	kol.ʧʾa.ki	valley
kam.paŋ	jail	kol.ʧʰo	heavy smoker
kam.ʧʾok.katʰ.i	completely	kol.tʰoŋ	skull
kap.kap.ha.ta	(be) stuffy	kom.po	pockmarked person

kas.nan.a.ki	newborn baby	kom.ʧaŋ.ə	sea eel
kaŋ.nɛŋ.i	corn	kop.p’ɛ.ki	double portion
kaŋ.so.ʧu	Soju (Korean liquor)	kop.sɛm	multiplication
kɛ.ku.li	frog	kop.sɨl.mə.li	curly hair
kɛ.mi	ant	kop.ʧʰu	hunchback
kɛ.un.ha.ta	(be) refreshed	koŋ.ʧʾa	free
kə.k’u.lə.ʧi.ta	fall down	koʧ.kam	dried persimmon
kə.k’u.lo	upside down	ku.ki.ta	wrinkle
kə.li.k’im	hesitation	ku.kim.sal	rumples
kə.məh.ta	(be) black	ku.lin.nɛ	bad smell
kə.ʧək	straw mat	ku.pu.li.ta	bend
kə.ʧuk	the surface	ku.pul.ku.pul	meanderingly
kə.ʧʰil.ta	(be) rough	ku.sək	corner
kə.ʧʰim.əps.i	without a hitch	ku.ʧəŋ.mul	dirty water
kə.pʰu.ʧip	mold	ku.ʧil.ku.ʧil.ha.ta	squalid
kən.nəl.mok	crosswalk	kul.t’uk	chimney
kən.nɛ.ta	hand over	kulk.ta	(be) thick
kən.tə.ki	solid ingredient	kup.ta	grill
kən.su	number of case	kɨ.ɨl.ta	(be) tanned
kən.ʧi.ta	recoup	kɨ.ɨl.ɨm	soot
kəl.pʰis.ha.mjən	easily	kɨ.ʧʰi.ta	cease
kəm.ta	(be) dark	kɨlk.ta	scrape
kəm.tuŋ.i	black dog	kɨp	rank

kɛ.ɨ.lɨ.ta	lazy	kɨs.ta	draw
ko.k’al	Buddhist’s conical hat	ki	spirit
ko.tu.pap	hard-steamed rice	ki.t’oŋ.ʧʰa.ta	(be) fantastic
ki.us.kə.li.ta	peep	ki.ul.ta	lean
kil.ʧʾuk.ha.ta	(be) long	pal.ka.pəs.ta	strip
ta.tak.ta.tak	back-to-back	pal.kah.ta	bright-red
ta.tɨm.ta	trim	pal.kɨ.lɛ.ha.ta	ruddy; rosy
ta.lak	an attic	pal.pʰan	toehold; footplate
ta.lɛ.k’i	sty	pə.ʧəs.i	openly; overtly
ta.lɨn	different	pə.tʰi.ta	resist; endure
ta.hoŋ.piʧʰ	scarlet color, light	pə.tʰiŋ.ki.ta	resist
tak’ta	wipe	pən.tɛ.ki	pupa
tal.laŋ	alone; only	pəl.kə.pəs.ta	strip
tal.laŋ.swe	careless person	pəl.kə.suŋ.i	naked body
tal.li.ta	run	pəs.ki.ta	take off; peel
tam.pjə.lak	wall	pɛ.k’i.ta	copy
taŋ.ki.ta	pull	pok’.ta	roast; stir-fry
tɛ.loŋ	a slender tube	pok’.ɨm	stir-fried food
tə.tɨm.ta	stammer; grope	pon.t’ɛ	model; standard
tən.ʧì.ta	throw	pon.t’ɨ.ta	(be) modeled on
təŋ.kul	vine	pol.t’ɛ.ki	cheek
to.k’ɛ.pi	goblin	pu.lə.ʧì.ta	(be) broken
to.laŋ	ditch	pu.sə.ʧì.ta	(be) shattered

tol	stone	pu.su.ta	break; smash
toŋ.kɨ.la.mi	circle	pusɨləki	fragments
toŋ.kɨ.lah.ta	(be) round	pu.sɨ.lə.ʧì.ta	break; crumble
toŋ.kɨ.lɛ.ʧì.ta	curl up in	pu.sɨ.sɨ.ha.ta	disheveled
tu.k’ə.pi	toad	pul.ta	macerate
tu.k’əp.ta	(be) thick	pul.ə.na.ta	increase; pile up
tu.ta	put; set	pulk.ta	red; ruddy
tu.tɨ.lə.ki	hives	pi.tul.ki	pigeon
tu.tɨ.li.ta	knock; beat	pi.t’ul.ta	crooked
tu.lɛ.pak	bucket	pi.tʰɨl.ta	twist
tu.pu	tofu	ʧa.kuk	mark; stain
tuk	bank; weir	ʧa.lu	sack
tuŋ.kɨ.ləh.ta	round	ʧa.lɨ.ta	cut; fire
tuŋ.kɨ.lɛ.ʧì.ta	get round	ʧa.sik	child
tuŋ.kɨl.ta	round	ʧa.ʧal.ha.ta	trivial
pa.ku.ni	basket	ʧa.tʰu.li	offcut; leftover
pa.su.ta	smash	ʧak.ta	(be) small
pa.ʧ’ak	close; parched	ʧak.tal.mak.ha.ta	(be) short
pan.tɨ.si	surely	ʧak.tɛ.ki	stick; rod
ʧak.ɨn.a.tɨl	younger son	ʧok.ʧɛ.pi	weasel
ʧal.la.mək.ta	eat by cutting into pieces	ʧok.ʧìp.kɛ	tweezers
ʧal.li.ta	be snapped, get fired	ʧol.ta	boil down

ʧaŋ	chief	ʧol.pjəŋ	private
ʧaŋ.ku.pəl.lɛ	a mosquito larva	ʧol.a.tɨl.ta	shrink; boil down
ʧaŋ.tɛ	long pole	ʧom	a little
ʧaŋ.tol.pɛŋ.i	itinerant vendor	ʧom.sɨ.ləp.ta	small-minded
ʧaŋ.t’an.ʧì	calf	ʧop.ta.lah.ta	(be) narrow
ʧaŋ.a.ʧ’i	pickled vegetables	ʧop.ta	(be) narrow
ʧɛ.k’a.tak	instantly	ʧoʧʰ.ta	follow; obey
ʧɛ.k’ak	instantly	ʧoʧʰ.a.ka.ta	Follow
ʧə.ki	over there	ʧu.k’u.mi	webfoot octopus
ʧə.pən.ɛ	last time	ʧu.lɨm.sal	Wrinkles
ʧə.ʧ’ok	over there	ʧuk.ta	Die
ʧək.ta	few; little	ʧul.kə.li	synopsis
ʧəl.ta	(be) salted	ʧul.ki	stem
ʧɛ.k’ə.tək	instantly	ʧul.ta	decrease
ʧɛ.il	the first	ʧup.ta	pick up
ʧo.kak	piece	ʧuŋ.kuk	China
ʧo.kɨ.mah.ta	(be) small	ʧɨp	juice
ʧo.kɨm	a little	ʧì.li.ta	wet one’s pants
ʧo.lɨ.ta	pester	ʧì.lin.nɛ	stench smell
ʧo.li.ta	boil down	ʧìn.tɨ.ki	mite
ʧo.lim	boiled down food	ʧìn.ha.ta	deep; thick
ʧo.mu.lɛ.ki	little kids	ʧìl.ki.ta	tough
ʧo.i.ta	tighten	ʧìp.kɛ	tongs

ʧok.tu.li	Korean bridal crown	ʧìp.ta	pick up
ʧitʰ.ta	deep (color)		

Korean Abstract

영어 차용어에서 발생하는 어두 경음화의 음운론적 경향

본 논문은 영어 차용어에서 발생하는 어두 경음화의 음운론적 양상을 관찰 및 분석하고, 그러한 양상의 근원을 한국어 고유어의 내재적 특성에서 찾고자 하였다. 영어의 어두 유성 파열음 및 파찰음은 한국어에서 어두 무성 평파열음 및 평파찰음으로 차용되는 것이 일반적이나 몇몇 영어 단어의 어두 유성 파열음 및 파찰음은 한국어의 무성 경파열음 및 경파찰음에 대응하기도 한다. 이러한 어두 경음화의 발생이 음운 환경 요인에 영향을 받는지 살펴보기 위해 탐색한 음운론적 요인은 자음의 조음 위치, 어두 자음에 후행 하는 모음의 높이, 해당 단어의 음절 수, 두 번째 음절 두음의 발성 유형의 네 가지이다.

먼저, 한국어 화자를 대상으로 설문조사를 실시하여 영어 차용어 어두 경음화에 대한 음운론적 인식을 양적으로 포착하고자 했다. 이에 더해, 1890년대에서 1950년대까지 발행된 신문을 탐색하여 영어 차용어 유입 초기에도 동일한 음운론적 경향성이 드러나는지 살펴보았다. 두 자료를 분석한 결과, 영어 차용어에서 발생하는 어두 경음화는 어두의 조음 위치가 치-경구개음일 경우, 어두에 후행 하는 모음의

높이가 고모음이 아닐 경우, 단어가 단음절일 경우, 두 번째 음절 두음의 발성 유형이 경음일 경우에 어두 경음화의 발생 비율이 유의미하게 높다는 것을 확인하였다. 본 논문은 각 요인에 따라 발견한 음운론적 경향성에 대해 각각 위치 효과, 높이 효과, 길이 효과, 동화 효과라고 이름 붙였다.

본 연구에서는 이러한 영어 차용어 어두 경음화 양상의 원인을 한국어에 내재된 통계적 양상에서 찾고자 하였다. 이미 다수의 연구(Kubozono, 2006; Luke and Lau, 2008; Zuraw, 2010)가 차용어에서 나타나는 다양한 패턴들이 해당 모국어에 내재한 통계적 패턴에 영향을 받는다는 점을 지적하였다. 본 연구에서는 한국어의 통계적 패턴을 '한국어 고유의 어두 경음화 양상'과 '한국어 어휘부의 음소배열제약'으로 나누어 살펴보았다.

먼저, 설문조사를 통해 한국어 어두 경음화에서는 위치 효과와 높이 효과는 확인이 되었으나, 길이 효과나 동화 효과는 유의미하게 나타나지 않았다. 한편, 한국어 어휘부에 내재된 경향성을 살펴보기 위해서는 강범모, 김흥규 (2009)의 한국어 빈도 자료 중 일반명사에 대하여 각 맥락 요인에 따른 어두 자음의 관측 빈도와 예측 빈도를 계산하였다. 그 결과 영어 차용어 어두 경음화 에서 나타났던 높이 효과, 길이 효과, 동화 효과가 각각 어휘부 내 어두 자음의 분포에서도 확인되었다. 결론적으로 영어 차용어에서 발생하는 어두 경음화는 한국어 어두 경음화와 한국어 어휘부에 존재하는 음운론적 경향성을 각각 부분적으로 반영하고 있다.

다음으로 각 음운론적 요인들의 음성적 동기를 조사하였다. 우선 높이 효과에 대해서는 어두 자음의 성대진동시작시간(voice onset time)과 그에 후행 하는 모음의 높이 간 유의미한 상관관계가 있음을 선행연구들을 통해 알 수 있었다. 이는 높이 효과에 대한 음성적 근거가 있음을 시사한다. 한편, 동화 효과는 어두 경음화의 결과 경음이 복수로 출현하게 되므로 조음 노력이 더 많이 든다고 해석될 수 있는 바, '조음 노력의 경제성'과 관련된 음성적 근거는 없는 것으로 결론지었다.

본 논문은 영어 차용어 어두 경음화 현상에 대한 양적 자료를 바탕으로, 기존 연구들이 부분적이고 산발적으로 논의한 음운론적 요인들에 대한 체계적 분석을 제시하였다. 또한, 차용어 어두 경음화의 양상이 한국어 고유어 단어에서 관찰되는 어두 경음화 양상과 한국어 어휘부의 어두 경음 분포를 부분적으로 반영한다는 것을 포착하였다. 이는 차용어 어두 경음화의 양상이 한국어 고유어의 내재적 특성의 영향을 받는다는 점을 시사한다.

주요어: 영어 차용어, 차용어 어두 경음화, 한국어 어두 경음화, 음운론적 경향, 한국어 어휘부, 음소배열제약, 음성적 동기

학번: 2014-22247