

The Duration-based Analysis of English /s/ in Korean Loanword Phonology

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Choe, Jinsun. (2014). The Duration-based Analysis of English /s/ in Korean Loanword Phonology. *The Linguistic Association of Korea Journal*, 22(4), 1-20. The present paper argues for the duration-based analysis to explain the split borrowing pattern of English /s/ into Korean. When the English phoneme /s/ is borrowed into Korean, it is realized as either lax /s/ or tense /s*/ based on its environment: English initial /s/ occurring in a cluster is mapped onto Korean lax /s/ (English [s] in *smile* as Korean [s]), whereas English singleton /s/ is mapped onto Korean tense /s*/ (English [s] in *sale* as Korean [s*]). To account for this split borrowing, two accounts have been proposed: the duration-based analysis and the laryngeal-based analysis. This paper provides a critical evaluation of these two accounts by identifying their problems and limitations. In the end, we argue for the duration-based account over the other by showing how the seeming problems for this approach can be resolved as rather supporting evidence for the role of duration in the split borrowing.

Key Words: Borrowing, English, Korean, Loanwords, Fricatives

1. Introduction

In Korean loanword phonology, there is an interesting phenomenon in which the single phoneme of English /s/ is borrowed into two separate phonemes of Korean lax /s/ and tense /s*/. To account for this phenomenon, two different analyses have been proposed. The duration-based analysis (Kim, 1999; Kim & Curtis, 2002) argues that the duration of the English phoneme /s/ acts as a cue for native Korean speakers to differentiate between the two separate phonemes

in Korean. Specifically, they argue that the shorter [s] in English is borrowed as Korean lax /s/, and the longer [s] in English is borrowed as Korean tense /s^{*}/. On the other hand, Davis and Cho (2006) claim that the duration of English /s/ itself is not adequate to account for the borrowing pattern. Instead, they propose an alternative account which makes use of phenomena internal to Korean phonology. Namely, their laryngeal-based account suggests that English word-final /s/ is borrowed into Korean as tense /s^{*}/ because it is required to surface with a laryngeal feature.

The present paper critically evaluates these two accounts and points out their problems and limitations. In the end, however, we show that the seeming problems for the duration-based account may be resolved as rather supporting evidence for the role of duration in the split borrowing pattern, thus ultimately arguing for the duration-based account over the laryngeal-based account. The organization of this paper is as follows: Section 2 describes the phenomenon of the split borrowing of English /s/ into Korean and provides some background on models of loanword adaptations as well as on the phonetic characteristics of English /s/, Korean lax /s/ and tense /s^{*}/. Section 3 reviews two proposals that have been put forward to explain the split borrowing pattern: the duration-based account and the laryngeal-based account. Section 4 points out the problematic aspects of the laryngeal-based account itself as well as the weaknesses of its assumptions. Section 5 presents issues that have been raised against the duration-based account but shows how they are resolved as rather more supporting evidence for this account. Section 6 concludes the paper with a brief summary and suggestions for future research.

2. Split Borrowing of English /s/ into Korean

When English words containing the phoneme /s/ are borrowed into Korean, the single English phoneme /s/ is realized sometimes as Korean lax /s/ and sometimes as Korean tense /s^{*}/. This is rather surprising in that English /s/ seems to match Korean lax /s/ phonologically. Some examples of the way English /s/ is borrowed into Korean are listed in (1) below (data from Kim & Curtis, 2002:407).¹⁾

(1) English words borrowed to Korean	Korean phonemes
a. slump, smog, snack, spar, skate, etc.	/s/
b. ceramic, single, size, solo, etc.	/s*/
c. test, toast, postcard, disk, mask, etc.	/s/
d. gas, bus, peace, news, juice, DOS, etc.	/s*/

Words in (a) and (b) show cases of /s/ borrowing in onset position, and words in (c) and (d) show cases of /s/ in coda position. These loanword data suggest that the split borrowing pattern is related to English syllable structure: when initial in a cluster, English /s/ is borrowed as Korean lax /s/²); as a singleton, English /s/ is borrowed as Korean tense /s*/, regardless of whether it is in the onset or coda (e.g., Kang & Kang, 2004; Kim, 1999; Kim & Curtis, 2002 among others). What is not yet known, however, is what causes this particular borrowing pattern of English /s/ into Korean.

2.1. Models of Loanword Adaptations

A number of different models of loanword adaptations attempt to explain various cases of borrowing around the world. As the focus of this paper is the borrowing of English /s/ into Korean, the comparison of different models will be dealt with in terms of the split borrowing pattern. According to the Category Preservation approach (e.g., Best, 1994, 1995; Paradis & LaCharité, 1997; LaCharité & Paradis, 2002), loanword adaptation is clearly phonological rather than phonetic. This approach claims that borrowers can accurately identify the sound categories of the source language, and thus, what they operate on is their mental (phonemic) representation of the source sound, not its surface phonetic

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- 1) The influence of orthography in loanword adaptation seems to be a confounding factor in explaining how the source sounds are borrowed. According to the National Institute of the Korean Language (*Gukrip Gukeowon*, online edition), English /s/ is represented by a single 's' in Korean orthography regardless of how it is actually pronounced (either lax /s/ or tense /s*/). Thus, we would like to highlight that what the current paper is interested in is the actual phonetic realization of English /s/ by native Korean speakers, rather than how it is orthographically represented.
 - 2) More specifically, a voice vowel /i/ is inserted between the /s/ and the following consonant in a cluster, due to the constraint of Korean syllable structure.

form. Apparently, this model leaves almost no role for phonetic variants in either the source or the borrowing language. Since it predicts a consistent matching between the phoneme of the source language and that of the borrowing language, in the case of English /s/ being borrowed into Korean, it is expected that English /s/ would be mapped onto one and only one phoneme of Korean whether it be lax /s/ or tense /s*/, but not both. Therefore, this model is not able to account for the split borrowing of one phoneme in the source language to two phonemes in the borrowing language.

An entirely different approach is taken by the Perceptual Assimilation model (e.g., Dupoux et al., 1999; Peperkamp & Dupoux, 2003; Peperkamp, 2005), which argues that loanword adaptations are phonetically minimal transformations where much attention is given to the role of phonetic variants. Upon hearing the source sound, the borrowers put the emphasis on perceptual similarity to find the closest equivalent sound in their native language's inventory. In other words, it is during perception that loanword adaptations take place, and this results from the automatic process of phonetic decoding. This approach could be compatible with the Korean split borrowing pattern, given that there exist phonetic differences between the two environments mentioned above. As such, one could argue that the durational difference in English /s/ is the key factor in determining whether it is borrowed as Korean lax /s/ or tense /s*/. This is known as the duration-based analysis, and will be described in detail below (Section 3.2).

On the other hand, there exist models of borrowing that are relevant to both phonetics and phonology. For example, Iverson and Lee (2006) note that in loanword adaptations, phonetic representations from the source language are interpreted and structured according to the salient categories of the borrowing language. That is, the phonetic properties are filtered through the distinctive feature and phonological constraints of borrowing language. Davis and Cho (2006) also consider various perspectives on loanword adaptations and give an example of split borrowing pattern of English /s/ into Korean to suggest that both phonetic and phonological factors play a role in loanword phonology. Their approach will be described in Section 3.3.

2.2. Phonetic Properties of English /s/

English fricative /s/ is distinguished from other fricatives by showing its high spectral peak (3.5-5 kHz; Behrens & Blumstein, 1988) and high amplitude of the frication noise (Heinz & Stevens, 1961). In addition, previous studies found that the duration of English /s/ varies significantly depending on its phonetic and phonological environments, such as stress, number of syllables and syllable length, among others (Klatt, 1973, 1974; Schwartz 1970). According to Klatt (1974), /s/ was 15% longer in the stressed syllable than in an unstressed syllable (e.g., *sixteen* vs. *support*). There was also an effect of number-of-syllables (within the stressed syllable) wherein the duration of /s/ was 15% shorter in disyllabic words and 20% shorter in trisyllabic words than in monosyllabic words. Furthermore, regarding syllable length, Schwartz (1970) found that /s/ in a cluster was shorter than /s/ in a singleton (143 ms vs. 177 ms).

2.3. Phonetic Properties of Korean Lax /s/ and Tense /s*/

Earlier studies on Korean post-fricative vowels found that F0 at the onset of the vowel following /s*/ was higher than that of the vowel following /s/ (Ahn, 1999; Kagaya, 1974; Han, 1996; Iverson 1983). Recent studies, however, found that this difference is not significant enough (Ahn, 2011; Cho, Jun & Ladefoged, 2002; Park 1999, 2002; Chang, 2007; Kang, 2008). Instead, studies have found that H1-H2 value, the difference between the amplitude of the first harmonic (H1) and the second harmonic (H2), at the vowel following /s/ was significantly higher than that at the vowel following /s*/ (Ahn, 1999; Ahn, 2011; Cho et al., 2002; Chang, 2007). In other words, the following vowel has more breathy voicing after /s/, while there was pressed voicing quality after /s*/. Another major difference between /s/ and /s*/ is that the duration of frication is longer in /s*/ than in /s/. (Cho et al., 2002; Chang, 2008; Kim, 1999; Kim & Curtis, 2002). However, when the period of aspiration following /s/ was included in its duration, Cho et al. (2002) reported that the lax /s/ was significantly longer than the tense /s*/, while Chang (2008) found that /s* / was still longer than /s/.

3. Two Analyses for Split Borrowing

3.1. The Duration-based Analysis

Kim (1999) and Kim and Curtis (2002) argue that the split borrowing of English /s/ is due to a systematic duration difference in English /s/ (e.g., Klatt, 1974), and that Korean listeners make use of this difference as a cue to decide whether English /s/ is borrowed as Korean lax /s/ or tense /s^{*}/. While they agree with the previous studies (Han, 1996; Iverson, 1983; Kagaya, 1974) and the more recent work of Kang and Kang (2004) that the major acoustic feature to distinguish between tense and lax fricatives is the quality of the post-fricative vowel (i.e., a high-pitched vowel is to follow Korean tense /s^{*}/), they point out that these cues are not available in English³⁾ and conclude that it must be the characteristic of the English phoneme /s/ itself that acts as a cue for Koreans in terms of the split borrowing. As an alternative, it was revealed that there is another difference between Korean tense and lax fricatives, namely that the tense fricative /s^{*}/ has longer frication or duration period than the lax fricative /s/. Thus, Kim and Curtis propose that although the duration difference may be a secondary cue, native speakers of Korean recognize this difference between Korean fricatives and use this information when they borrow English words containing the English phoneme /s/. Specifically, they argue that the shorter [s] in English is borrowed as Korean lax /s/ and the longer [s] in English as Korean tense /s^{*}/.

To prove their hypothesis, they conducted two experiments: a production experiment and a perception experiment. First, eight native speakers of English participated in a production experiment that measured the duration difference between singleton and cluster /s/ in English, in both word-initial and word-final position. The results demonstrated how the duration of /s/ was longer when it appeared alone as a singleton [s] than in the initial position inside a cluster [sC]. The average duration of initial [s] was 37 ms longer than

3) According to Kim (1999) and Kim and Curtis (2002), there is no discernible F0 difference in vowels following English [s]. Furthermore, as noted by an anonymous reviewer, when English [s] appears initially inside a cluster, it is not possible to evaluate the quality of the post-fricative vowel.

that of initial [sC], and the average duration of final [s] was 45 ms longer than that of final [sC]. There was also a duration difference by syllable position in that the duration of word-initial [s] and [sC] was longer than that of word-final [s] and [sC]. Based on the results of the inferential statistical test, the duration difference between [s] and [sC] was statistically significant, as was the effect of the syllable position, indicating that this difference is both systematic and consistent, although this is a sub-phonemic feature in English since native English speakers are not aware of any such difference. Following this production experiment, a perception experiment was conducted with sixteen native Korean speakers to see how the duration difference affects Koreans' perception. Seven stimuli were created from a control stimulus (140 ms of [s] frication + 50 ms of vowel [a]) with the duration of frication varying from 60 ms to 300 ms.⁴⁾ Participants were asked to choose between Korean lax /s/ and tense /s*/ after listening to each stimulus. The results showed that the durational changes in the stimuli had an effect on the choice of native Korean speakers: as the frication duration increased, so did the number of responses for tense /s*/. In contrast, Korean speakers did not show any difference for the English [sa] stimuli when it was presented with varying degree of intensity, indicating that the amplitude difference does not affect their perception. Rather, it is the duration of the frication that Korean speakers notice when hearing the English phoneme /s/. Based on these two experiments, Kim (1999) and Kim and Curtis (2002) argue that the characteristic of the English phoneme /s/ itself, namely the duration, acts as a key phonetic cue for native Korean speakers in terms of the split borrowing.

3.2. The Laryngeal-based Analysis

Regarding the split borrowing of English /s/ and its relationship to a duration difference, an entirely different account is offered by Davis and Cho (2006). While they acknowledge that the duration difference exists in English /s/ depending on whether it appears alone or in a cluster, they do not consider it to be the main factor that determines the split borrowing. Instead, Davis and

4) The results of their production experiment showed that the average duration of initial [s] was 170 ms, and that of initial [sC] was 133 ms. The average duration of final [s] was 145 ms, and that of final [sC] was 100 ms.

Cho's claim is that English word-final /s/ is borrowed into Korean as tense /s*/ because it is in a position where it should be aspirated. However, since Korean does not have a phoneme /s^h/, it becomes tense /s*/ instead, with the marked laryngeal feature [constricted glottis]. The evidence of this repair strategy comes from Korean phonology that when a voiceless lax stop occurs after /h/, it becomes aspirated, as in (2), but if it were a lax /s/ following /h/, it would undergo tensification, instead, as in (3).

(2) Korean h-merger before a following stop

<i>Underlying Forms</i>	<i>Phonetic Forms</i>	<i>Gloss</i>
a. /coh + ko/	[co.k ^h o]	'like (and)'
b. /nah + ta/	[na.t ^h a]	'give birth'
c. /nolah + ta/	[no.ra.t ^h a]	'is yellow'
d. /coh + ta/	[co.t ^h a]	'like (declarative)'

(data from Davis & Cho, 2006:1015)

(3) Korean h-merger before /s/

<i>Underlying Forms</i>	<i>Phonetic Forms</i>	<i>Gloss</i>
a. /coh + so/	[co.s*o]	'good idea' (I like it)
b. /noh + so/	[no.s*o]	'put it'

(data from Davis & Cho, 2006:1015)

As can be seen above, the deletion of the phoneme /h/ triggers aspiration of the following voiceless stops, while it triggers tensification of the following /s/. This fact suggests that /s/ becomes tense /s*/ in environments where voiceless stops are aspirated.

Now, when we consider the English borrowings with a word-final released voiceless stop, it undergoes aspiration, as illustrated below.

(4) Borrowings with a single word-final voiceless stop

- a. English 'coke' is borrowed as [k^hok^hi]
- b. English 'rope' is borrowed as [rop^hi]
- c. English 'tape' is borrowed as [t^heip^hi]

(data from Davis & Cho, 2006:1017)

As expected from the above discussion, if words with a single word-final /s/ are borrowed from English, /s/ becomes tense /s^{*}/, which is shown in (5), because it must have a laryngeal feature like the voiceless stops, but since it cannot be realized as /s^h/, the alternative is chosen.

(5) Borrowings with a single word-final /s/

- a. English 'gas' is borrowed as [k^{*}es^{*}i]
- b. English 'bus' is borrowed as [p^{*}əs^{*}i]
- c. English 'mass' is borrowed as [mæs^{*}i]

(data from Davis & Cho, 2006:1018)

This view of Davis and Cho's (2006) has its advantage in that it can account for the examples in (6), for the borrowing of /s/ at the end of a cluster as tense /s^{*}/ which the duration-based analysis of Kim and Curtis (2002) failed to explain.⁵⁾

(6) Borrowings with a final /s/ in a cluster

- a. English 'dance' is borrowed as [t^{*}æns^{*}i]
- b. English 'false' is borrowed as [p^hols^{*}i]

(data from Davis & Cho, 2006:1018)

Notice that this borrowing pattern is expected on Davis and Cho's account, given that English voiceless stops at the end of a word final cluster are borrowed as aspirated, as in (7).

(7) Borrowings with a final voiceless stop in a cluster

- a. English 'lamp' is borrowed as [ræmp^hi]
- b. English 'print' is borrowed as [p^hirint^hi]
- c. English 'milk' is borrowed as [milk^hi]

(data from Davis & Cho, 2006:1018)

As for the borrowing of English /s/ in s-plus-stop clusters, Davis and Cho

5) How the duration-based analysis deals with this issue is discussed in detail in Section 5.

attempt to resolve the issue by adopting the principle of uniform substitution, where “identical sounds or sequences are consistently borrowed in an identical manner regardless of their position in a word” (Davis & Cho, 2006:1020). They argue that no matter where an English s-cluster occurs, the stop inside the cluster is always borrowed as aspirated in Korean, and the English /s/ inside the cluster always as lax /s/. The examples of the borrowing of English /s/ in s-plus-stop clusters are presented below in (8).

(8) The borrowing of English sp, st, and sk into Korean

<i>English</i>	<i>Korean</i>	<i>English</i>	<i>Korean</i>
a. sketch	[sik ^h ec ^h i]	e. strike	[sit ^h iraik] or [sit ^h iraik ^h i]
b. sponge	[sip ^h onji]	f. stress	[sit ^h ires'i]
c. stop	[sit ^h op]	g. piston	[p ^h isit ^h on]
d. stick	[sit ^h ik]	h. test	[t ^h esit ^h i]

(data from Davis & Cho, 2006:1020)

Note that the examples in (8) reflect four different environments. In (8a-d), the s-plus-stop clusters occur word-initially before a vowel. In (8e-f), they appear word-initially before a liquid, in (8g), the cluster is intervocalic word-medially, and in (8h), it occurs word-finally. Thus, Davis and Cho argue that the data in (8) can only be explained by the notion of uniform substitution. In other words, they conclude that the borrowing of English initial /s/ in a cluster as lax /s/ is just one of the examples that reflect a principle of uniform substitution.

4. Issues Against the Laryngeal-based Account

The laryngeal-based account put forward by Davis and Cho (2006) states that the realization of English final /s/ as tense /s*/ in Korean is a repair strategy used when Korean /s/ is in a position where it should be aspirated. The core argument is that since Korean does not have a phoneme /s^h/ (with the laryngeal feature [spread glottis]), the alternative is chosen, which is the tense /s*/ with the other laryngeal feature [constricted glottis]. Yet, the following problems can be identified in this analysis.

First of all, the laryngeal-based account rests on the assumption that Korean lax /s/ should behave the same way as the Korean lax stops do. Davis and Cho (2006) argue that English word-final /s/ is borrowed as tense /s*/ because it is in a position where other English voiceless stops are realized as aspirated stops in Korean. In other words, it presupposes that Korean lax /s/ acts similarly to the lax stops. However, this is not always true. While there may be some phonological processes that group the lax stops and the lax fricative together, and thus they may behave similarly in terms of those processes, not all phonological processes put them in the same category. It is apparent that they are different even based on a simple comparison where stops bear the feature [-continuant], and fricatives have [+continuant]. One phonological process that treats them differently is the case of medial voicing in Korean, in which only the lax stops, but not the lax fricative, are voiced between other voiced segments. The examples are presented below in (9) and (10) (data from Kim-Renaud, 1974:9-10):

(9) Medial voicing of the lax stops

- a. /k^hoŋ + pap/ [k^hoŋpap] ‘bean-mixed rice’
- b. /kut + ini/ [kudini] ‘as it hardens’
- c. /muən + kik/ [muəngik] ‘pantomime’

(10) No medial voicing of the lax fricative

- a. /ka + se/ [kase] ‘Let’s go!’ *[kaze]
- b. /kam + sa/ [kamsa] ‘gratitude’ *[kamza]
- c. /sa:ljal/ [sa:ljal] ‘gently’ *[sa:ljal]

As can be seen above, there exist phonological processes which distinguishes the lax fricative from the lax stops in Korean. Therefore, it may be incorrect to assume the behavior of the lax fricatives based on that of lax stops.

Second, even if we accept the previous assumption that the lax fricative acts similarly to the lax stops, there is another assumption that underlies the repair strategy of the laryngeal-based account. The assumption is that when the word-final /s/ is borrowed, it is in a position where Korean /s/ should be aspirated. Again, this assumption is based on the observation that word-final

released voiceless stops are borrowed as aspirated. However, while it is true that the deletion of the phoneme /h/ triggers aspiration of the following stops, it is not so clear whether the word-final voiceless stops are also in that same position where aspiration is triggered. Even Davis and Cho (2006) note that the reason for the realization of the aspirated stop in this case is not because aspiration is triggered but because either the tense or lax stop would be a perceptual mismatch with the English word-final voiceless stop. The tense stop is rejected as it occurs most often immediately before a stressed vowel in English loanwords into Korean. Furthermore, the reason for rejecting the lax stop is because it would be subject to medial voicing since the English word-final stop is interpreted as intervocalic in Korean, causing a perceptual mismatch with the English voiceless stop. Therefore, when the word-final released voiceless stop is borrowed, an aspirated stop is chosen since it is the least worst option, given the alternatives. Davis and Cho further argue that the same principle applies to the borrowing of /s/ in that English word-final /s/ should be realized as the aspirated /s^h/ in Korean. However, as mentioned before, Korean /s/ is not voiced between other voiced segments. That is, there is no reason to reject the lax /s/ in this case, in contrary to the case of the lax stop. Unless there is another reason that the aspirated /s^h/ needs to be chosen over the lax /s/, no justification is provided for the assumption that the position of the English word-final /s/ is the position where Korean /s/ should be aspirated.

Finally, even supposing that the above problematic assumptions are all validated and a proposed repair strategy is at work, there is a fundamental weakness in the laryngeal-based account itself. While Davis and Cho provide a reason for the realization of English word-final /s/ as tense /s^{*}/, no satisfactory account is given to why English initial /s/ in a cluster is borrowed as lax /s/. They claim that the notion of uniform substitution may motivate the borrowing of the initial /s/ in a cluster as lax /s/ rather than tense /s^{*}/. However, they fail to give a sufficient explanation as to why this principle of uniform substitution does not apply to the borrowing of English /s/ as a whole. That is, if this principle were to apply to all the borrowings of English /s/ whether it is a singleton or inside a cluster, there would be no split borrowing to begin with. It looks rather peculiar as to why this principle would apply only to English

initial /s/ in clusters. Moreover, no claim is made in their account as to why lax /s/ is chosen over tense /s*/, especially when stops in those clusters are uniformly borrowed as aspirated ones just like when they appear alone in word-initial or word-final position. To put it another way, the laryngeal-based account is insufficient in reaching its primary goal which was to explain the phenomenon of the split borrowing of English /s/.

5. Supporting Evidence for the Duration-based Account

Let us now turn to the potential problems of the duration-based account, which argues that duration of English /s/ is the key factor in determining the split borrowing pattern. Specifically, Davis and Cho (2006) raise the following four issues toward this approach (Davis & Cho, 2006: 1013-1014):

- (11) a. Duration would have to be relative to position of the /s/.
- b. High pitch on a following vowel is a more important cue than length for distinguishing a tense consonant from its lax counterpart.
- c. Words like ‘dance’ and ‘false’ are borrowed into Korean with the tense /s*/, even though the /s/ is of shorter duration in the cluster.
- d. The English voiceless interdental fricative, /θ/, is consistently borrowed into Korean as tense /s*/ regardless of its position.

At first glance, these issues seem to severely weaken the arguments of the duration-based account. A scrutiny of these issues, however, reveals that they are not obstacles to the duration-based approach. Rather, some of them turn out to be supporting evidence for this account.

The first issue is that the position of English /s/ has to be taken into consideration with the duration approach, since a single word-final /s/ does not differ significantly in duration from a word-initial /s/ in a cluster. It is true that they do not show a significant difference based on Kim and Curtis’ experiment (2002). Specifically, the difference between them turned out to be only 12 ms. However, the duration difference between a word-initial /s/ and a word-final

/s/ does not seem to be the fair comparison to test for the role of duration. It is possible, or rather plausible, to think that people have different expectations when dealing with English */s/* in word-initial position and the one in word-final position. For example, if it appears at the end of the word, one would expect the longer duration because of the final lengthening effect (Klatt, 1976; Jun, 2004). Although the further research is necessary to confirm this claim, it does not seem to undermine the validity of the argument.

The second issue raised has to do with what is the more salient cue in distinguishing a tense consonant from its lax counterpart: is it high pitch on a following vowel or the length of the consonant itself? This objection of Davis and Cho is supported by Kang and Kang (2004) who propose that the prosodic characteristic of the following segment is what Korean speakers use as a cue for the split borrowing of English onset */s/*. They note that in Korean, a high-pitched vowel is said to appear after Korean tense */s^{*}/*, whereas a low-pitched vowel follows Korean lax */s/*. More specifically, the initial portion of this low-pitched vowel is voiceless because of the aspiration of lax */s/*. Thus, in the case of */s/* borrowing, when English */s/* is positioned before a high-pitched stressed vowel, it is realized as Korean tense */s^{*}/*. However, when English */s/* appears inside the cluster before another consonant, it is realized as Korean lax */s/* since English initial */s/* in cluster is perceived as one syllable with a voiceless vowel */i/*, due to the constraint of Korean syllable structure. Kang and Kang's analysis is supported by a perception test in which English */s/* from *smile* and *sale* were cross-spliced so that they were placed in front of 'V' and 'CV' types of words, respectively. For example, the */s/* from *smile* replaced the */s/* in *sale*, and vice versa. When the native Korean speakers were asked to identify the given */s/* between Korean lax */s/* and tense */s^{*}/*, the results showed that the position of */s/* in the word determined its perception, regardless of the origin of */s/* itself. This suggests that the property of the following segment, instead of the characteristic of */s/* itself, affects the perception of Korean speakers more in determining the adaptation of English */s/* as either lax */s/* or tense */s^{*}/* in Korean. However, Kang and Kang's pitch-based analysis has the following possible limitations. First of all, their account cannot explain fully the split borrowing of English */s/* since it only deals with */s/* in onset position, comparing the difference between word-initial

[s] and [sC] in terms of the following segment. Thus, it fails to provide an answer to why English singleton [s] in coda position is borrowed as Korean tense /s*/. According to their account, it should be realized as Korean lax /s/, since no high-pitched vowel follows /s/. Moreover, there is a possibility that top-down knowledge may have interfered with the results of their experiment, since they used real English words as their stimuli. Assuming that participants already knew those words and how they are borrowed in Korean, it is possible that the participants may have used the internalized high level information only, ignoring or not paying enough attention to the low level acoustic cues such as the duration of /s/. Thus, to sum up, while high pitch on the following vowel may be a salient cue that distinguishes between Korean fricatives, it seems problematic as the main cue for the split borrowing of English /s/.

The third problematic point is that the duration-based account fails to explain the borrowing with tense /s*/ of the words like *dance* and *false*. Davis and Cho (2006) as well as Kim and Curtis (2002) note that this is one of the major problems for the duration-based approach since the English /s/ inside a cluster is usually borrowed as Korean lax /s/. In particular, this was one of the advantages of the laryngeal-based account. However, this claim was based on the mere assumption that the duration of the English /s/ in those clusters would be as short as English /s/ in other kinds of clusters. This assumption has, in fact, been proven to be incorrect by the experimental studies of Klatt (1974) and Lee and Iverson (2007). Klatt showed that when compared to a singleton /s/, the initial /s/ inside a cluster is shorter by 40%, but the final /s/ inside a cluster is shorter by only 15%. Furthermore, Lee and Iverson conducted a production task with Korean native speakers in which they were asked to produce English words with /s/ in coda position which were divided into three types: words containing a word-final /s/ preceded by a vowel (Vs#), words having a final /s/ after a consonant (VCs#), and words with /s/ between a vowel and a final consonant (VsC#). The results showed that the duration of word-final /s/, whether after a vowel (Vs#) or after a consonant (VCs#), is longer by almost 60% than that of the initial /s/ in a cluster (VsC#). Therefore, it was shown in this experiment that not all English /s/ in a cluster is short in its duration. Rather, it is when English /s/ appears before another consonant in a cluster that its duration is short enough to be realized as Korean lax /s/, but

not when it comes after. That is, when English /s/ occurs after a sonorant such as in words like *dance* and *false*, the duration is long enough to be perceived and borrowed as Korean tense /s*/. This finding of Lee and Iverson (2007) confirms the duration-based account which claims that the duration difference is what Korean listeners are sensitive to when English /s/ is borrowed, and that this is the reason for the split borrowing. Thus, what had looked like a problem to the duration-based account turns out to strengthen this view instead.

Finally, the borrowing of the English voiceless interdental fricative, /θ/, is at issue, since it is consistently realized in Korean as tense /s*/ regardless of its position, as in (12) (data mostly from Ahn, 2003:991-992).

(12) Borrowings with the English voiceless interdental fricative

- a. think [s*ɪŋk^{hi}]
- b. bath [pes*ɪ]
- c. month [mans*ɪ]
- d. three [s*ɪri]

As can be seen above, the environment of /θ/, whether it is in word-initial or word-final, or whether it is inside a cluster or not does not seem to matter in the case of the borrowing of English voiceless interdental fricative. It is always borrowed as tense /s*/ in Korean. This is particularly problematic when we consider the finding that its duration is shorter than that of English /s/ (Miller & Nicely, 1955). However, a close look at the data above shows that English /θ/ never appears in the environment where English /s/ would be realized as lax /s/ in Korean, which is when it is inside a cluster before a stop. The English voiceless interdental fricative may occur only before /r/ when appearing inside a cluster, due to the phonotactics of English. Thus, it is impossible to make a proper comparison with English /s/ since they do not share the same environment. Hypothetically speaking, if English /θ/ appearing before a stop in a cluster had not violated the syllable structure of English, it may have been the case that English /θ/ also shows the split borrowing phenomenon just like English /s/. As for the duration issue compared to English /s/, further research is needed to see whether the duration really is a factor involved in the borrowing of /θ/, since it may as well be due to other factors such as the voice onset time, for example.

6. Conclusion

When the English phoneme /s/ is borrowed into Korean, it is realized either as lax /s/ or tense /s*/ based on its environment. Two different accounts, the duration-based and the laryngeal-based, have been proposed in order to explain the phenomenon of this split borrowing. We have shown in this paper that both analyses seem to bear a number of problematic aspects and limitations. However, in the case of the duration-based account, what seem to be the problems do not, in fact, pose an obstacle to this approach. Rather, they turned out to be more supporting evidence for such a view. Therefore, based on the present findings, we conclude that the duration-based account is so far in a better position than the laryngeal-based account to explain the split borrowing of English /s/ into Korean.

Nonetheless, it should be noted that there are a variety of factors involved in determining how a sound is borrowed from the source language to the borrowing language. There are still a number of unanswered questions such as what phonetic cues, other than the duration of English /s/, are involved and how influential each phonetic cue is, compared to other cues. Furthermore, one should not overlook the possibility that the phenomenon of split borrowing has become a learned pattern now for some native Korean speakers. That is, it may be possible that it has switched to an established pattern where the syllable type plays a larger role than any other phonetic cues, as Korean speakers learned how the distribution of /s/ in English affects loanword adaptations. Thus, as for the further research, the empirical studies should be conducted which carefully manipulate or control the phonetic cues of English /s/ as well as its phonological environment.

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