

Vowel epenthesis in English word-final stops : the influence of orthography and inner speech

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Lee, Jonghyeon. 2015. Vowel Epenthesis in English Word-Final stops : The Influence of Orthography and Inner Speech. *SNU Working Papers in English Linguistics and Language* 13, 85-104. This study explored the possible influence of orthography and inner speech in the loanword adaptations through the on-line adaptations experiment with the vowel epenthesis after English word-final stops in Korean. The experiment is conducted to find the effect of the borrowing language orthography and its possible transference to similar non-words by the analogy, and the task difference between overt speech and inner speech. The result showed that the orthography of the borrowing language was influential on the loanword adaptations, but this orthographic representation was not large enough to be transferred to the similar nonce words by analogy. This result did not vary in the task differences. (Seoul National University)

Keywords: loanwords adaptation, phonology, vowel insertion, English plosive

1. Introduction

Most research on loanword adaptations has focused on whether the process is primarily phonetic or phonological. According to the phonetic view of loanword adaptation, most loanwords originate in perceptual assimilation, a process which maps the source language onto the phonetically similar native sounds (Peperkamp et al. 2008). In contrast, the phonological view adaptation proposes that perception plays a small role, since mainly bilinguals adapt loanwords on the basis of phonology of the borrowing language (Paradis & LaCharité, 2008). However, many other factors are also likely to influence the loanword adaptations. This study concentrates on one of the factors that may influence the nature of loanword adaptations: orthography and inner speech process. For the orthography, the focus will be the influence of

the knowledge of the borrowing language and the orthographic representation of non-words through the analogy with similar real words. Meanwhile, the influence of the inner speech output will be investigated in terms of the methodology, compared to the experiment with the overt speech output.

To examine the possible influence of the orthography and inner speech, the on-line adaptation experiment was conducted. The study focused on the variable adaptation of English word-final plosives into Korean. When Korean speakers adapt English word-final stops, they often insert the vowel /i/. This vowel epenthesis is one of the puzzling cases in loanword adaptations in that it is not entirely explained either by the native phonology or by the perceptual similarity. The study will explore a variance of the factors that influence the vowel epenthesis in the aspect of orthography and inner speech.

1.1. Vowel epenthesis in English word-final stops

Vowel epenthesis after English word-final stops in Korean is one of puzzling cases of loanword adaptations in two senses. First, the vowel epenthesis is not consistently applied to all loanwords that end in plosives, showing some variance among words and individuals. While some words always take the epenthetic vowel, /i/ (e.g., ‘pipe’ → /p^haip^hi/), others do not (e.g., ‘cup’ → /k^hʌp/). For some words, forms with and without the vowel epenthesis co-occur (e.g., ‘cake’ → /k^hɛik/ ~ /k^hɛik^hi/). Moreover, not all speakers agree on whether vowel would be inserted or not, and even the words which most speakers appeared to agree on still showed inter-speaker variation. (Kwon, submitted)

In addition, it is not motivated to apply the native phonology (Kang, 2003). Loanword adaptations are mainly transformations that try to repair foreign forms that would be ill-formed without modification (Peperkamp, 2004). However, vowel insertion in English loanwords that end in stops seems to be unnecessary in this sense. For example,

when English word, ‘bat’ is borrowed into Korean, it is usually adapted with an aspirated stop followed by an epenthetic vowel /i/, as [pæt^hi]. The vowel insertion in this case is not expected in the native phonology, because word-final /t/ is not ill-formed in Korean, where only the limited numbers of consonants are allowed in coda position. Even if [t] in ‘bat’ is perceived as an aspirated stop [t^h], which is not possible coda in Korean, the first option to modify it in the native phonology is deaspiration, as a Korean word, /pat^h/ (‘field’) is represented on the surface as [pat].

Kang (2003) proposed that the vowel epenthesis in English word-final stops is motivated to maximize the perceptual similarity between English input and Korean output. Through the survey of a loanword list compiled by the National Academy of the Korean Language (Kwuklip kwuke yenkwuwen 1991; the NAKL list), Kang showed that vowel insertion is more likely (i) when the pre-final vowel is tense (e.g. lax : ‘quick’ → /k^hwi**k**/, tense : ‘week’ → /wi**k**^hi/), (ii) when the final stop is voiced (e.g. voiceless : ‘kick’ → /k^hi**k**/, voiced : ‘gag’ → /kæ**gi**/) and (iii) when the final stop is coronal (e.g. labial, dorsal : tip, kick → /t^hi**p**/, /k^hi**k**/, coronal : hit → /hi**t**^hi/). Particularly, the effect of pre-vowel tenseness is suggested to be related with the perceptual similarity to English input in that the Korean output with the vowel insertion is perceptually approximate to English released stops, which are more frequent after a tense vowel rather than after a lax vowel in English. In this regard, perceptual similarity considerations account for the vowel epenthesis after English word-final stops.

This survey using the written data is supported by Jun (2002) and Kwon (submitted) where the on-line adaptation experimental studies with nonce words were conducted. Tenseness of pre-vowel, voicing and place of final stops are the factors that cause Korean speakers to insert the vowel after final plosives, as Kang suggested. Only difference was that monolingual speakers did not show significantly different response in the voicing contexts, while those who were more experienced in

English inserted the vowel more in voiced stops than voiceless stops (Kwon, *op. cit.*). Besides three factors, the coda release was the most influential one on /i/-epenthesis. When English word-final stops were presented with released coda, the rate of the vowel insertion significantly increased. The effect of coda release is also expected in Kang, since it is partly explained by the tenseness of pre-vowel as English final stops tend to be released after the tense pre-vowel. In this regard, this study considered the coda release condition as the most influential factor on the /i/-insertion.

1.2 The influence of orthography on loanword adaptations

Orthography is one of many factors that can influence the loanword adaptations, including phonetic variation, level of bilingualism, and prestige of the source language (Vendelin & Peperkamp, 2006). Although it is marginally considered as a possible factor, there are several studies that found its effect on the loanword adaptations (Detey & Nespoulous, 2008; Jun, 2002; Vendelin & Peperkamp, *op. cit.*). The pattern of the adaptations changes when the orthography of source language is presented. In particular, Jun showed that participants, when they are given the written stimuli, inserted the vowel /i/ after English word-final stops 20 percent more than when given the auidial ones.

The auidial stimuli, however, may not factor out all the influence of the orthography, since speakers can establish the spelling of the loanwords with their knowledge in the source language. For this reason, Vendelin and Peperkamp suggested that integrated loanwords, or words that have become the lexicon of the borrowing language, are not the appropriate source for studying phonological and phonetic perception in loanword adaptations. Rather, the on-line adaptation experiment with nonce word is recommended to exclude the orthographic influence. In this respect, Jun (2002) and Kwon (*submitted*) properly ruled out the effect of the orthography since they used auidial non-word for stimuli.

Nevertheless, more considerations on the orthographic influence need to be done. First, the influence of the borrowing language is also necessary to be considered. Most research on the orthographic influence has focused on the source language. The reason is obvious in that the written form of loanword in the borrowing language already reflect the process of the adaptation. However, the orthography of L1 and L2 have different effect on L2 perception (Lim, 2004) and, it is reasonable to assume that when the stimuli are orally given, the orthographic knowledge in the borrowing language seems to be involved in adaptors' perception along with the source language. Especially in the case of the vowel epenthesis, since the spelling information in English does not help judge whether /ɪ/ is inserted or not, the knowledge of the native orthography should account for the orthographic influence on the adaptations.

Second, there is some possibility that orthographic influence still serves in non-words adaptation, because speakers can create an orthographic representation of them by the analogy with the similar real words (Vendelin & Peperkamp, 2006). For example, when the nonword *fub* is given, they can note the similarity to *cup* and construct an orthographic representation with it. In this sense, experimenting with the nonce word does not guarantee to exclude the orthographic effect entirely. Jun (2002) and Kwon (submitted), in fact, include some nonce words which can be similarly perceived as a real word, such as /zu:k^h/ (the analogy with 'book'), /zɛt/ (with 'jet'), /tip/ (with 'tip' /tɪp/) and /kid/ (with 'kid' /kɪd/). Therefore, even though non-word stimuli are presented through on-line adaptation, the part of them, at least, need to be reexamined in terms of the orthographic influence.

1.3. Difference between inner and overt speech

In the aspect of methodology in loanword adaptations, what needs to be regarded is the possible difference between inner speech and overt

speech. Inner speech, as a form of mental imagery, is a soundless voice that people can hear inside their heads while thinking, reading, writing, and remembering (Oppenheim & Dell, 2008). People produce it in the same way as normal speech, except that articulation is not present (Levelt, Roelofs, & Meyer, 1999).

For its definition, inner speech seems to have the same properties with overt speech, but there are several different hypotheses on the relation between them. In one hypothesis, inner speech is suggested to be planned exactly as overt speech, consistently activating both phonological and semantical nodes (Corley, Brocklehurst & Moat, 2011). On the other hand, Oppenheim and Dell (2008) proposed that inner speech is impoverished at a surface level, having weakened phonological property, assuming that it should be more abstract in the level than overt speech, since it is a form of mental imagery and lacks articulation. If this proposal is more appropriate in the account for inner speech, the adaptation experiment based on production should consider the difference between inner speech and overt speech to be one of the influential factors.

The process of inner speech was involved in the experimental design of Jun (2002) and Kwon (submitted). In Kwon, the task did not include any overt production. Participants were only asked to choose the proper case marker that showed the vowel epenthesis after orally given nonword. Thus, what they did in the task is to perceive the input, subvocally produce the output, and then judge whether to insert the vowel or not according to mentally imagined output. Meanwhile, Jun used dictation as the method to collect the participants' responses. As mentioned above, writing is one of the cognitive activities involving inner speech. The method of Jun and Kwon cannot be compared at the same level, since the case of Jun also entail the probable influence of writing. But they have one thing in common in that inner speech is mainly treated as the method to collect the output.

1.4. Present study

The present study aims for investigating the influence of orthography and inner speech in the loanword adaptations. Particularly it will concentrate on the vowel /i/ epenthesis after English-word final stops in Korean, which is one of the unique cases in the loanword adaptations. In regards to the orthographic effect, two factors will be concerned. The first question is whether the orthography of the borrowing language influences the vowel insertion even when the input is orally presented. Since the integrated loanwords have the characteristics of both the source language and the borrowing language, the adaptations of the integrated loanwords will be affected by both of them, particularly to speakers who know the source language. However, because the vowel epenthesis [i] is not related with the English orthography, in which all the target words end in stops, it is an appropriate source to figure out the influence of the Korean orthography. If the knowledge of the orthography is a distinct factor to the vowel epenthesis, adapters will not be bothered by other perceptual cues than the orthography of the target words. In this study, the coda release will be presented as the perceptual cue to influence the vowel insertion, and if the participants are affected by the knowledge of the orthography, they will show the insertion pattern that follows the orthography irrespective of the coda release condition.

The second question is whether orthographic influence still arises in on-line nonword adaptation. If the nonwords are influenced by the orthographic representation which is constructed by the analogy with the similar real words, those words will show the similar pattern of the vowel epenthesis with their counterparts. Or else, they will follow the other perceptual cue rather than the orthography of their similar words. In this study, unless the nonce words are influenced by the orthographic representation, they will induce more vowel insertion in the released coda condition than in the unreleased one.

Methodologically it is necessary to examine the possible difference between inner speech and overt speech. If they are exactly the same process, the results will not be distinguished either by using the inner speech output or the overt speech output as the methodology collecting the data. On the other hand, if inner speech, as Oppenheim and Dell (2008) suggested, is the weakened process in the phonemic level, there will be difference between them. The result of the overt speech output will be phonetically more sensitive and become more apparent than that of the inner speech output. But this study will not consider the probable difference caused by the written output. Although writing is also one of the cognitive activities using inner speech, since the written output is involved in more complex matter such as the correspondence of grapheme - phoneme, it should be separately dealt with.

2. Method

2.1. Participants

The participants were 6 native Korean speakers, 2 male and 4 female, ranging in age from 19 to 21. All participants were the undergraduate students of Seoul National University, and none of them was students in a linguistics department nor an English department. They learned English in an academic situation for more than 10 years and do not have any problems to understand simple English conversations of the difficulty level of the English section in Korean SAT. Five of participants had no experience of living in an English-speaking country and one of them spent less than a year in an English-speaking country.

2.2. Stimuli

Target stimuli which participants listened to and responded were 10 loan word and non-word pairs. Selected loanwords for experiment were

5 monosyllabic English loanwords (*pipe*, *group*, *truck*, *cup*, and *plug*). Each of them varied in two coda release conditions (released or unreleased)¹. Even though there are other factors influencing the vowel epenthesis such as tenseness of the pre-vowel, voicing and place of the coda, in this experiment, as a pilot study, only the coda release condition was taken into the consideration. But all the words consistently had non-coronal coda and tensed vowel before the coda. In voicing condition, only *plug* had voiced coda. However, voicing was not considered here as a distinct factor, since according to Kwon (submitted) monolingual Korean speakers did not show any difference in the vowel insertion between voiced and voiceless condition.

Five loan words were chosen for several reasons. First, they were the words that were more likely to be perceived as the part of the Korean lexicon to the speakers. It is because one of the goals of the study was to find the effect of the borrowing language orthography and its possible transferring to similar non-words. For those words, pre-test were conducted among the most frequently used loanwords in the NAKL. In the pre-test, people were given the list of the loanwords and asked to translate them into Korean on a basis of what first comes to their mind. Only the words that the participants did not translate into the Korean native equivalent were selected. Second, they had relatively fixed orthography in Korean. The words which show a variety of the vowel insertion in orthography were excluded according to the NAKL list. Selected words were the words that show no variance, which were again confirmed by the pre-test. While three of them (*group*, *cup*, and *truck*) were the words consistently taking the epenthetic vowel, the other words (*pipe* and *plug*) were the words never taking the epenthetic vowel.

¹ In original design, 'mat' was also included as a loanword stimulus, but since most participants perceived the unreleased 'mat' as /mæp/ and translated it into the Korean native equivalent, it is not used in the result analysis.

Non-word stimuli (*kipe*, *proup*, *gruck*, *jup*, and *trug*) were created as minimal pairs of their loanword counterparts to be perceived similarly to the real words. They varied in two coda release conditions. 14 fillers, both real word and non-word, were also included. They were one of the most frequent loanwords in the NAKL list and minimal pairs of the real words.

The stimuli were recorded by the English native speakers who majored in English linguistics and have been phonetically trained. Each of the target stimuli were read ten times and the best tokens of them were selected. Reading the nonword stimuli, the recorder was asked to read them as minimal pairs of the real words counterparts. Although each items were recorded in two different coda release condition, only released version was used for the experiment. For the unreleased item, the signal following stop closure was deleted from the released one, using Praat (Boersma and Weenink 2008).

2.3. Procedure

Participants were individually tested at a quiet classroom. The experiment was implemented using Praat on a laptop computer and their productions were recorded under their permission. After the experiment, they were informed of the purpose of the study in detail if they wanted to know, and they were paid 10,000 won for participating. The experiment consisted of two tasks: overt speech task and inner speech task. In the overt speech task, the participants heard English sentences, and then were asked to record the Korean translation. The target sentence was “I saw WORD. He brought NONWORD,” and when they translated it, they were required to use the complete Korean sentence structure including the case marker. Using the case marking system in Korean, which was also used in Kwon (submitted) is a simple way to find out whether a speaker inserts the vowel after the word or not. In Korean case marking system, accusative suffix, like nominative

and topic marker, varies in the coda conditions of the preceding noun. If the noun ends in a vowel (e.g., /k^hεik^hi / ‘cake’), the consonant-initial allomorph /lil/ is selected (e.g., /k^hεik^hi - lil/). On the other hand, the noun that ends in a consonant (e.g., /k^hεik/ ‘cake’) precedes the vowel-initial allomorph /il/ (e.g., /k^hεik - il/). In other words, if the participants take the epenthetic vowel, they will choose /lil/ as the case marker, or else, /il/ will be used. Nonword stimuli were suggested to them as the name of a person, presented along with a picture of the figure.

The inner speech task followed the adaptation experiment used in Kwon. Participants saw Korean carrier sentence, hearing English stimuli, and then selected the accusative marking suffix. The target sentence was the same as the one used in the overt speech task, and the carrier sentence was Korean translation where target position was blanked (Figure 1). All other procedure was identical with the overt speech task.

Figure 1. A sample of Korean carrier sentences

Korean:	나는 _____ 을/를 보았다.	그는
	_____ 을/를 가져왔다.	
Phonemic:	na-nin _____ il/lil po-ass-ta.	ki-nin
	_____ il/lil kace-wass-ta.	
Gloss :	I-NOM _____ -ACC saw.	He-NOM
	_____ -ACC brought.	
Translation:	I saw _____ . He brought _____ .	

To minimize the possible effect of processing strategy, the 10 minutes break and intervening task was given to the participants between two tasks. Because the size of stimuli was relatively small and, moreover, participants had to listen twice the items that are identical except the coda release variation, it is possible that they could judge, when they met the same word in the second time, by following the judgment they made in the first time, not by what they heard. During the intervening

task, they read a science article consisting of 13 sentences, and were asked to memorize the keywords in it to answer the question. It could help avoid the effect of processing strategy by weakening the memory of the former task.

3. Results

The results were analyzed with generalized linear mixed model, using the lme4 library (Bates, Maechler, Bolker, & Walker, 2014) in the R environment (R Core Team, 2014). The model assumed fixed effects from word state, coda release, and task. Participants and items were treated as random effects. Out of 240 responses, 12 were excluded because they were translated with Korean equivalents, not with integrated loan words.

Table 1. Vowel insertion rate for fixed effects in each condition

Speech Task		Coda Release		Word State	
Overt	Inner	Released	Unreleased	Word	Nonword
55.26 %	50.00 %	57.89 %	47.37 %	58.33 %	46.29 %

As seen in table 1, the participants tended to use the vowel insertion more frequently in overt speech, released coda, and word condition than inner speech, unreleased, and nonword condition each. The tendency was not statistically justified since there was no significant main effect of word states, coda release, and task difference ($p < 1$)² in the mixed model (table 2). There, however, was a significant interaction between the coda release and the word state ($z = 2.187$, $p = 0.0288^*$). The participants tended to take the epenthetic vowel about 25% more

² There was only a marginal main effect of coda release, where the released coda induced more vowel insertions ($z = 1.763$, $p = 0.0778$).

when given non-words with released coda, than real words with released coda. This suggested that the influence of the coda release varied in the word states. As show in Figure 2-a, the percentage of the vowel epenthesis in nonce words with released coda were higher than those with unreleased coda, which was consistent with the previous studies. However, the vowel epenthesis in the real word did not seem to be influenced by the coda release condition, showing no difference between the released and unreleased coda.

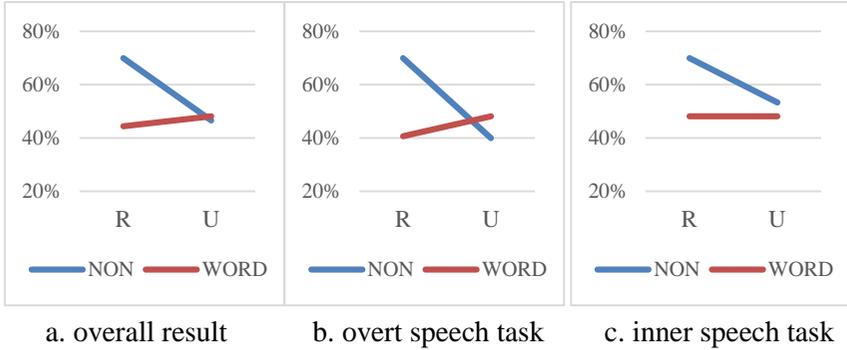
Table 2. Generalized linear mixed model: Results of main effects and interaction effects.

	Estimate	Std. Error	z value	Pr(> z)
Task	-0.31401	0.23243	-1.351	0.1767
Coda	-0.41136	0.23328	-1.763	0.0778
Word	-0.5448	1.09879	-0.496	0.62
Task:coda	0.03625	0.23151	0.157	0.8756
Task:word	-0.05289	0.23608	-0.224	0.8227
Coda:word	0.52933	0.24209	2.187	0.0288 *
Task:coda:word	0.31775	0.23801	1.335	0.1819

Signif. codes: ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

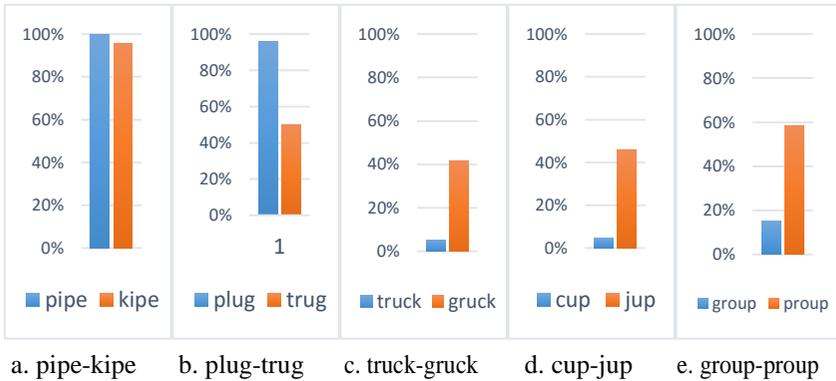
When the result is analyzed separately between two tasks, the result of the overt speech task was agreeing with the overall analysis (Figure 2-b). There was no main effect of the coda condition and word ($p < 1$) but a significant interaction between them ($z = 2.220$, $p = 0.0264^*$). However, in the inner speech task (Figure 2-c), there was neither main effect nor interaction ($p < 1$). This different result might be due to the task difference, but, as above mentioned, there was no main effect of the task condition but also no significant interaction, when considered the model including the task condition as a possible factor.

Figure 2. The percentage of the vowel insertion between the word state and the coda release condition (R= released U= Unreleased)



The different pattern between word and nonword became more apparent when each item was separately analyzed (Figure 3). Except *pipe-kipe* (3-a), all the pairs showed a significant difference between the word states. Whereas the word *plug* that was supposed to be adapted with the vowel insertion in Korean orthography, consistently took the epenthetic vowel regardless of the coda release, its minimal pair, *trug*, elicited epenthetic responses with 50 percent chance. On the other hand, the vowel insertion rate of the words that are less likely to have the epenthesis in Korean orthography such as *group*, *cup*, and *truck* was about 40 percent lower than that of their minimal pairs, *proup*, *jup*, and *gruck*. But *kipe* was exceptional to this tendency. Its vowel insertion pattern was similar to its pair loan words, *pipe*, which received the vowel insertion both in released and unreleased condition.

Figure 3. Vowel insertion rate between words and nonwords by items



4. Discussion

This study explored the possible influence of orthography and inner speech in the loanword adaptations, through the on-line adaptations experiment with the vowel epenthesis after English word-final stops in Korean. The results showed that the orthography of the borrowing language was influential on the loanword adaptations as well as that of the source language. The rate of vowel insertion in the integrated loanwords did not vary in the coda release conditions. Most participants inserted the vowel when presented the words that take the epenthetic vowel in the Korean orthography, while they did not insert it after the words that did not include the epenthetic vowel. The result was disagreeing with the claim that adaptors inserted vowel to maximize the perceptual similarity between English input and Korean output. Even though the vowel insertion yields a perceptual approximation to the coda release (Kang, 2003), participants did not choose to insert the vowel according to the coda release condition. They, rather, were influenced by the orthography of the borrowing language, Korean. This orthography effect could be attributed to that of the source language, not the borrowing language, because the input was presented with the source language and the participants knew the orthography of

it. However, since the integrated loanwords are the words that have become the part of lexicon in the borrowing language, it is not possible to exclude the influence of the borrowing language. When the participants were given the loanwords, they would simultaneously perceive both source language and borrowing language, for the loanwords belong to each lexicon of them. Or they might first recognize it as the source language and then convert it into the borrowing language. In either case, the process possibly arouse the orthographic representation in both source language and borrowing language. In this on-line adaptation experiment, since the English orthography itself could not reflected the vowel insertion, it is more plausible to assume that the participants would be influenced by the borrowing language orthography. For this reason, as Vendelin and Peperkamp (2006) pointed out, the integrated loanwords might not be the best source for analyzing the phonetic and phonological principle in loanword adaptations, even though they are presented as audial stimuli. This orthographic representation, however, was not large enough to be transferred to the similar nonce words. Non-word stimuli showed the different insertion pattern with their loanwords counterparts. The pattern revealed that they were influenced by the coda release condition, as those with the released coda elicited the vowel insertion 25% more than those with the unreleased coda. The vowel epenthesis rate of each word was about 50 percent, which were discrepancy with the pattern of the loanwords pair which are influenced by the orthography. Thus, it did not support that participants can be influenced by the orthography of nonwords, which were constructed by the analogy with the similar real words. Nevertheless, it does not necessarily mean that speakers cannot construct the orthographic representation with the analogy. There is possibility that it can be created but it is just not large enough or not a main factor to determine the vowel insertion in the nonword adaptation.

Meanwhile, there was one exceptional case that the nonword showed the similar pattern with its counterpart. *kipe* derived about 95 percent rate of the vowel insertion from the participants. It might suggest that the orthographic representation is more influential on some nonwords like *kipe* for some reasons. The alternative explanation is that *kipe* is phonologically different in that it involves diphthong [aɪ] as the pre-vowel. Most words with [aɪ] such as *gudie*, *byte*, *light*, *slide*, and *spike* consistently take the epenthetic vowel in the NAKL list. [aɪ] seems to be a strong factor to influence the vowel insertion. Kwon (submitted) also showed that the tenseness of the pre-vowel affected the pattern of the vowel insertion, irrespective of the coda release. Thus, some tense vowels could be more influential than others, which is enough to ignore other factors such as the coda release and the orthography. The alternative seems to be more plausible, but the experiments with more items will be necessary to confirm it.

Lastly, the inner speech and overt speech task did not show a significant difference. Only difference was that while there was a significant interaction between the coda release and the word state in the overt speech task, it was not the case in the inner speech. This might support the claim that inner speech is attenuated at a surface level, having weakened phonological feature, since the result meant that the difference among the conditions were larger in the overt speech task than in the inner speech task. However, it is not a meaningful analysis because the result was derived from relatively small samples and there was no significant difference between two tasks. Nevertheless, the result left some places for further research on the task difference with larger samples. In addition, when considered the case where the written output was collected as in Jun (2002), it is possible to examine the influence of the different output method more closely.

5. Conclusion

The vowel epenthesis /i/ after English word-final stops in Korean is a puzzling case in the loanword adaptations. It has a variance of the insertion pattern and often result the unnecessary insertion in the native phonology. For this, the vowel epenthesis is suggested to be motivated to maximize the perceptual similarity between the source language and the borrowing language. However, there are some other factors that influence the vowel epenthesis, which cannot be explained only by the perceptual similarity. One of them is the orthographic influence. For the orthography, that of the borrowing language needs to be considered as well as that of the source language. There is a claim that the orthographic representation could influence nonword by the analogy with the similar real word, but the result so far did not support it. Another factor is the methodology collecting the output, since the inner speech might be different from the overt speech. However, from the experiment, it is tentatively concluded that the difference between the inner speech and the overt speech is not large enough to influence the loanword adaptations.

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