



The role of L1 and L2 orthography on loanword phonology

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博士論文

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The role of L1 and L2 orthography on loanword phonology
(外来語音韻論における L1 と L2 つづり字の役割)

神戸大学大学院人文学研究科博士課程

後期課程

社会動態専攻 言語学

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Table of Contents

1.	Introduction	6
1.1.	Problems in Korean words borrowed from foreign language	6
1.3.	What is loanword?	7
1.4.	Why loanword phonology?	11
1.5.	Previous studies on loanword phonology.....	11
1.6.	Outline of the thesis.....	12
2.	Previous studies	14
2.1.	Controversies in Loanword Phonology	14
2.1.1.	Phonological approach	14
2.1.2.	Phonetic approach.....	18
2.1.3.	Orthographic approach	22
2.1.4.	Summary.....	25
2.1.5.	Discussions.....	26
2.2.	Korean Phonology	37
2.2.1.	Korean alphabet: Hangul	37
2.2.2.	Contemporary Korean	42
2.2.3.	The Romanization of Hangul	44
2.3.	How Korean perceives English vowels	48
2.3.1.	Korean and English vowel system	48
2.3.2.	High vowels [i], [ɪ], [u], [ʊ]	52
2.3.3.	Mid vowels [ɛ], [ə], [ɔ]	53
2.3.4.	Low vowels [æ], [ʌ], [ɑ]	55
2.3.5.	Summary.....	56
3.	Audio experiment	58
3.1.	The participant	58

3.2.	Materials	58
3.3.	Method.....	61
3.4.	Results.....	61
3.4.1.	High vowels.....	63
3.4.2.	Mid vowels	64
3.4.3.	Low vowels	65
3.5.	Conclusion.....	66
4.	Visual experiment	68
4.1.	Participants	68
4.2.	Materials	68
4.3.	Method.....	69
4.4.	Results.....	70
4.4.1.	Overall analysis.....	70
4.4.2.	High vowels.....	72
4.4.3.	Mid vowels	73
4.4.4.	Low vowels	74
4.5.	Conclusion	75
5.	Adaptation patterns of Korean established loanwords	76
5.1.	Introduction of the chapter and the research Predictions	76
5.1.1.	Introduction and construction of this chapter	76
5.1.2.	Prediction-phonetic account	76
5.1.3.	Prediction- orthographic account.....	77
5.2.	Method.....	78
5.2.1.	Corpus.....	78
5.2.2.	Data processing	79
5.2.3.	The reference of English pronunciation	80
5.3.	Results	80
5.3.1.	Overall analysis.....	80

5.3.2.	High vowels: Tense versus Lax.....	82
5.3.3.	Mid vowels	87
5.3.4.	Low vowels	92
5.3.5.	English [0]: Adapted as Korean vowel with no corresponding vowel in English word...	96
5.4.	Discussion.....	97
5.4.1.	English vowels borrowed into Korean under strong phonetic influence	98
5.4.2.	English vowels borrowed into Korean under strong orthographic influence	100
5.4.3.	English vowels borrowed into Korean under about the same strength of phonetic and orthographic influences.	101
5.5.	Conclusion.....	102
5.6.	Analysis on variation	105
6.	Discussion	109
6.1.	Visual experiment in comparison with established loanwords	109
6.2.	Visual experiment in comparison with audio experiment.....	109
6.2.1.	High vowels.....	109
6.2.2.	Mid vowels	115
6.2.3.	Low vowels	119
6.2.4.	Summary.....	122
6.3.	Audio experiment in comparison with established Korean loanwords.....	123
6.3.1.	Vowels with strong correspondence to Korean vowels.....	123
6.3.2.	Vowels with no strong correspondence to Korean vowels.....	124
6.4.	Two forms of input in language comprehension	126
6.4.1.	Previous studies on loanword phonology	126
6.4.2.	Means of language: sign, spoken, and written languages	127
6.4.3.	Language comprehension model	127
6.5.	Orthography and phonology.....	128
6.5.1.	Orthography reflects the phonology of the language.....	128
6.5.2.	Orthography is related to phonological awareness	129

6.6.	Reading adaptation	131
6.6.1.	Visual dominance effect	131
6.6.2.	Mismatch between written and spoken form	132
6.6.3.	Reading pronunciation	134
6.6.4.	Evidence for reading adaptation found in this thesis	136
6.7.	Summary	136
7.	Conclusion.....	138
8.	References.....	142

1. Introduction

The main purpose of the present dissertation is to demonstrate that current phonological and phonetic approaches to loanword adaptation are insufficient to successfully explain all aspects of the adaptation process. The present thesis proposes that orthographic factors, which are often excluded from scientific approaches, can play a key role in the analysis of loanwords, and that orthography combined with phonetic and phonological considerations can greatly improve our understanding of loanword adaptation.

1.1. Problems in Korean words borrowed from foreign language

In Korean, there are numbers of borrowed words from foreign languages. Before the 20th century, loanwords arrived mainly from Chinese. In 20th century and later, a large number of words were borrowed from Western languages including English. These borrowed words comprise a large portion of Korean vocabulary. In the corpus of National Institution of Korean Language (2002), words with Chinese origin make up 60% of Korean vocabulary, while this number with words from English origin is 5%.

Words borrowed from Chinese, the so called Sino-Korean words, are based on Chinese characters. With a few exceptions¹ each Chinese character has only one pronunciation. This is in sharp contrast with Japanese, where words borrowed from Chinese, that is Sino-Japanese words, can have both Japanese and Chinese readings. Additionally, the Chinese readings are not restricted to a single form. In Korean, however, there is only one reading for each Chinese character. For example, the character 場 is always read as 장 /tʃaŋ/. Thus, 市場 is pronounced as 시장 /ʃidʒaŋ/, and 運動場 is pronounced as 운동장 /undoŋdʒaŋ/.²

	<i>Chinese</i>	<i>Korean</i>	<i>pronunciation of Korean</i>
(1)	市場	시장	/ʃidʒaŋ/
(2)	場所	장소	/tʃaŋso/
(3)	運動場	운동장	/undoŋdʒaŋ/

¹For example the kanji 車 is usually read as /tʃ^ha/ in Korean (e.g., such in 自動車 자동차 /tʃadontʃ^ha/). Exceptionally, the same kanji, 車 from 自轉車 자전거 /tʃadʒəŋgə/, can also be read as /gə/. Similarly, 不 has two pronunciation variants; one is 불/pul/ as in 불편 不便, the other is 부/pu/ as in 부주의 不注意.

² Korean obstruents are voiced intervocalic position except /s/.

While the pronunciations of Sino-Korean words are systematic and consistent, borrowings from English show more discrepancy. It is not rare that English borrowings have more than one pronunciation. One English word sometimes is borrowed through two forms into Korean with no difference in meaning. For instance, the English word *shot* is borrowed in Korean both as 샷 /syat/ and as 쏷 /syot/. As a further example, the English word *type* is available in Korean both as 타이프 /t^haip^hi/ and as 타입 /t^haip/. Similarly, both 커트 /k^hət^hi/ and 컷 /k^hət/ go back to the English word *cut*.

(4)	shot	/'shat/	샷 /syat/
			쏘 /syot/
(5)	type	/'taip/	타이프 /t ^h aip ^h i/
			타입 /t ^h aip/
(6)	cut	/'kat/	커트 /k ^h ət ^h i/
			컷 /k ^h ət/

While such English words as *shot*, *type* and *cut* are adapted in Korean with variations, Chinese characters are always rendered to the same pronunciation. This discrepancy between English and Chinese borrowings is explained in this thesis by reference to differences in the input of the borrowing process. Chinese borrowings are apparently orthographic adaptation in which there is no relation between Sino-Korean and contemporary Chinese pronunciation. In opposition with this pattern, English borrowings in Korean can make reference to both the pronunciation and the orthography of English source words. This thesis holds that the main cause for variation in the phonological forms of English-origin loanwords is the differences between in two possible forms of input: spoken and written English. Before examining how these differences manifest themselves through the adaptation process we should have a look at Korean loanwords and loanwords in general.

1.3. What is loanword?

Loanwords are lexical items in a language that were borrowed from other languages. It is important to make a difference between loanwords and the somewhat similar concept of code-switching. Loanwords differ from code-switching in at least three points. First, in code-switching L2 words are introduced into L1 discourse on-the-fly (Haugen 1950). In contrast to code-switching, loanwords are lexicalized L2 words in L1 discourse. Second, code-switching usually occurs in bilingual communication or in language learners' communication (Poplack 1988). By

contrast, loanwords are used in all around L1 speaking communities. Third, loanwords are assimilated in L1 with emendations of L2 features (Hudson 1980), while in code-switching L2 features such as stress and acoustic features, are mostly preserved with no emendations.

Some examples of code-switched words are presented below. The sentence in (7) is an extract from a conversation between Korean Japanese bilinguals. The recipient language is Korean and the discourse is code-switched to Japanese during which the Japanese word コンビニ /kombini/ is used. The example in (8) is a conversation made by native speakers of English who are learning Japanese in Japan. This conversation shows a code-switching from English to Japanese. The base language is English and the speakers are referring their meeting place as 食堂 /jokudo:/ in Japanese. The third example in (9) is part of a discourse is made by Japanese speakers who are learning Korean as a foreign language. Similar to English speakers in (8), they are not good at Korean yet, though they refer their teacher as 선생님/sənsɛŋnim/ in Korean.

<i>code switching</i>	<i>gloss</i>
(7) <u>コンビニ</u> 갔다왔어. /kombini kattawassə/	I went to <u>the convenience store</u> .
(8) I will meet you at <u>食堂</u> . /jokudo:/	I will meet you at <u>the cafeteria</u> .
(9) <u>선생님</u> 에 <u>連絡</u> 했다? /sənsɛŋnimni renrakusita/	Did you call the <u>teacher</u> ?
<i>loanwords</i>	<i>gloss</i>
(10) <u>컴퓨터</u> 샀어? /k ^h əmp ^h yut ^h ə sassə/	Did you buy your <u>computer</u> ?
(11) Do you like <u>sushi</u> ?	Do you like <u>sushi</u> ?
(12) <u>パソコン</u> <u>買った</u> ? /pasokon katta/	Did you buy your <u>PC</u> ?

Loanwords are different from code-switching, since loanwords are used as part of the L1 vocabulary. The code-switched parts in sentences (7) (8) and (9) (コンビニ /kombini/, 食堂 /jokudo:/, 선생님 /sənsɛŋnim/), can be replaced with L1 words 편의점 /p^hjənidzəm/, cafeteria, and 先生 /sense:/, respectively. However loanwords usually cannot be replaced with L1 words. Because loanwords introduce a new concept, they are irreplaceable. The loanwords in (10)-(12) exemplify such cases. In other cases, when loanwords enter a language, they often replace native lexical items. For instance, in Korean 뽕 'mountain' and 즈믄 'hundred' had been absolutely

replaced by Sino-Korean words 산 (산 /san/), 백 (백 /pek/), and the former ones are no longer in use.

In contrast to code-switching, loanwords usually used in a wider range of the speech community and they have achieved a certain level of recognition or acceptance (Poplack et al. 1988). Most language speakers are aware of loanwords in their native vocabulary. The Japanese word コンビニ 'convenience store' in the code-switching example of (7) is a communicable word only for those Koreans who can speak Japanese. However, 컴퓨터 /kʰəmpʰyutʰər/ 'computer' in the loanword example of (10) is a communicable word in the whole Korean speaking community. Loanwords also can be used by L1 speakers who cannot speak L2 at all.

Another interesting feature of loanwords as opposed to code-switching is that loanwords are assimilated with some degrees of emendations. In code-switching, especially in bilingual communication, L2 phonetic characteristics including stress and intonation are preserved. In contrast, loanwords used in L1 discourse have L1 characteristics which did not exist in original L2 words with some loss of L2 characteristics. For example, 컴퓨터 /kʰəmpʰyutʰər/ in (10) is a borrowed word from English, however, when it is used in Korean discourse, the original English word stress is lost. Also *sushi* in sentence (11) is a borrowed word from Japanese, however, when it is used in English discourse it gains stress on the first syllable as if it were an English word. It is obvious that it is a foreign word because this word ends in the letter 'i'. If it were a native English word, it would be spelled with a 'y' (Whorf 1940).

Finally, the word パソコン /pasokon/ in (12) is a shortened word for English word *personal computer*. The English word *personal computer* adapted as パーソナル・コンピューター /pa:sonarukompyu:ta:/ in the first step, then it is shortened in accordance with an abbreviation rule, the same way as if it were a Japanese compound (Kubozono 2002:137). However, it is not the case that all loanwords act the same way in L1 phonology. Some loanwords have been used for a quite long time and widely, so they are not recognized as words of foreign origin by native speakers. Some example words in Korean are demonstrated below. The words from (13) through (18) are all borrowed words from Chinese. In the first three words in (13)-(15) are easy to recognize the Sino-Korean origin, whereas the last three words in (16)-(18) are seldom associated with Sino-Korean origins.

Sino-Korean words with obvious Chinese origins

	<i>Korean</i>	<i>Chinese words</i>	<i>Korean pronunciation</i>
(13)	국가	國家	k ^h ukka
(14)	학생	學生	haksen
(15)	춘하추동	春夏秋冬	tj ^h unhatj ^h udon

Sino-Korean words with less obvious Chinese origins

	<i>Korean</i>	<i>Chinese words</i>	<i>Korean pronunciation</i>
(16)	양말	洋襪	yanmal
(17)	어차피	於此彼	ætj ^h aphi
(18)	호랑이	虎狼+i	horanji

In contrast to Sino-Korean words, Western words are easy to be recognized as loanwords due to their high frequency of aspirated consonants, epenthetic vowels ‘—/ɪ/’, and violations of phonotactic rules. For example, in Korean, word initial /r/ is usually deleted or replaced with /n/ (e.g., 料理 ‘cuisine’ 료리 /ryori/ → 요리 /yori/, 來日 ‘tomorrow’ 래일 /reil/ → 내일 /neil/). However, the word initial /r/ in Western words is preserved (e.g., 라디오 /radio/ ‘radio’, 리본 /ribon/ ‘ribbon’). Generally, in Korean, the term loanword refers to words borrowed from western languages. Loanwords have a special relevance to the lexicon. Even native speakers of a language have intuitions about the origins of words; at least they can point out if a word – even if it is native – sounds foreign. Developing this idea further some theories assume that there is a core-periphery relation within the lexicon. The core component holds the assimilated native words having long history in the language, while the periphery accommodates less assimilated items with foreign origins.

One of the most successful proponents of the core-periphery approach is Ito & Master (1995) who demonstrates through examples from Japanese how lexical strata align with phonological constraints. In Japanese there are four distinct strata: native Japanese words, Chinese loanwords, mimetic words and recent loanwords. This classification is not only etymological but also phonological. The general claim is that words residing in core of the lexicon, such as native words, are subject to more phonological restrictions than ones residing on the periphery. For example, word-initial /p/ sounds, or nasal-stop clusters with disagreeing voicing (e.g., /-nt-/ , /-nk-/) are not allowed within native Japanese words, but no such restrictions exists for loanwords. The transition between the core and the periphery is believed to be continuous, involving several phonological constraints. Following Ito’s classification, Korean lexicon is classified as Native Korean, Sino-Korean, and Western loans.

Table 1 Lexical strata in Japanese and Korean

<i>Japanese lexical strata</i>	<i>Korean lexical strata</i>
<i>Yamato</i>	<i>Native Korean</i>
<i>Sino-Japanese</i>	<i>Sino-Korean</i>
<i>Foreign</i>	<i>Western loans</i>
<i>onomatopoeia</i>	

Within western loanwords in Korean, the present thesis concentrates on English loanwords. This thesis provides an analysis of the established loanwords and conducts perception experiments. In order to examine how Korean speakers perceive English vowels, experiments are performed with visual and audio stimuli. With the results of the perception tests, Korean and English vowel correspondence in established loanwords were analyzed. Considering the results of the reanalysis, it is found that the orthography of L2 words is as important a factor in loanword phonology as the phonetic features of L2 words.

1.4. Why loanword phonology?

The topic of loanwords is a highly fruitful research domain contributing to several fields of linguistics including phonology. First, loanwords can provide independent evidence that can help settling issues in native phonology (Boersma & Hamann 2009). Second, since the borrowing process typically involves perceptual mechanisms, the research in this field can greatly contribute to problems in speech perception. Third, adaptation patterns can also highlight mechanisms behind first language acquisition (Pater 2004). Forth, a rather straight forward application of loanwords concerns approaches to language contact. Loanwords can be used as clear indications showing how uniform and independent language systems behave when they get in contact (Kenstowicz 2003). Fifth, understanding borrowing process provides valuable data for language teachers about how L2 speakers perceive L1 sounds and what strategy can help learners to learn L2 categories (Kim No-Ju 2003).

1.5. Previous studies on loanword phonology

One prominent group of studies in loanword phonology gives priority to phonological representations by assuming phonological categories in the borrowing mechanism (Bloomfield 1933;

Weinreich 1953, 1957; Hyman 1970; Lovins 1975; Danesi 1985; Ulrich 1997; Jacobs & Gussenhoven 2000). These approaches assume that the input of the adaptation process is not the surface, phonetic forms of the lexical items, but their mental representation as present in the source language (L2). In harmony with this view, it is also assumed that borrowings are introduced to the target language by bilingual speakers as they are the ones who have direct access to sound categories and underlying representations in both the source and the target language (Haugen 1950; Weinreich 1970; Grosjean 1982; Poplack et al. 1988; Paradis & LaCharité 1997; LaCharité & Paradis 2000; LaCharité & Paradis 2005).

As opposed to the phonemic views, phonetic approaches to loanwords assume that the input to loanword phonology is the acoustic signal (Silverman 1992). Researchers supporting this point of view also argue that adaptation operates on complete word forms rather than on individual segments as inputs. It is believed that the novel word forms in the target language (L1) are achieved by minimal phonetic modifications of the input L2 words (Dupoux et al. 1999; Peperkamp & Dupoux 2003; Peperkamp 2005). The phonetic view of the adaptation process is also referred to as phonetic approximation, perceptual assimilation, or the phonetic decoding.

While the debate across the borderline of phonemic-phonetic views has been enjoying ample attention in the current literature, this bipartite division is not capable of covering all relevant aspects. There are an increasing number of studies pointing out importance of orthography during the adaptation process (Vendelin & Peperkamp 2006; Smith 2006). Following these studies, the present study provides further arguments that support the view that orthographic factors play a key role in the analysis of loanwords. It is believed that orthography combined with phonetic and phonological considerations can greatly improve our understanding of loanword phonology.

1.6. Outline of the thesis

The main assumption of the present thesis is that the phonological variation in English cognate Korean loanwords is caused by differences in the routes how English words enter the language. One possible way, which is emphasized sufficiently in the past literature, consider the acoustic and/or phonological forms of English words to be the input of the borrowing process. The alternative route, which enjoys special attention here, starts off from the written of the foreign words. Since many new terms and concepts are brought into Korean by written materials, such as articles and journals, the influence of written English sources should not be underestimated.

In this thesis, we argue for a central role of orthography in loanword adaptation. Orthographic influences in loanword adaptation has been neglected and considered to be a marginal

factor. Prominent approaches to loanwords normally make no reference to the visual form of words. On the rare occasions they do, they drag orthography in as a last resort device, when all other explanations are proven to be moot.

The body of this thesis is organized as follows. Leading on from this overview, in Chapter 2, we review previous studies on loanword phonology and summarize previous researches on Korean loanword phonology those closely related to the subject of this thesis with introducing Korean phonology and Korean perception of English. Chapter 3 and 4 describe perceptual experiments on how Korean speakers perceive English. In Chapter 5, we analyze the data of Korean integrated loanwords to show that it cannot be explained only by phonetic approaches and also it can be explained by orthographic factors. In chapter 6, we suggest an explanation that relies on orthographic influence on loanword adaptation. In order to support the explanation, characteristics of human language comprehension and phonological awareness are highlighted. Finally, we close the thesis with conclusions in chapter 7.

2. Previous studies

This chapter gives an overview of the previous research on the topic of loanword phonology. The first section explains the major trends in the field highlighting their differences and topics of interest. The following section focuses on previous work on Korean phonology. The last section in this chapter discusses the perceptual aspects of how Korean listeners perceive English utterances.

2.1. Controversies in Loanword Phonology

This section deals with loanword phonology in general. There are three points of views in this topic -phonetic, phonological, and orthographic approach. After briefing the differences in terms of borrowers, ingredients of the input, and the process through 2.1.1 to 2.1.3, the problems that each three view possesses will be argued in 2.1.4.

2.1.1. Phonological approach

2.1.1.1. Overview

One prominent group of studies in loanword phonology gives priority to phonological representations by assuming phonological categories in the borrowing mechanism (Bloomfield 1933; Weinreich 1953, 1957; Hyman 1970; Lovins 1975; Danesi 1985; Ulrich 1997; Jacobs & Gussenhoven 2000 among others). The figure below illustrates a communication based on phonology. According to the phonological view, input of the source is assumed as phonological abstract, and the output of the adaptation also assumed as phonological abstract.

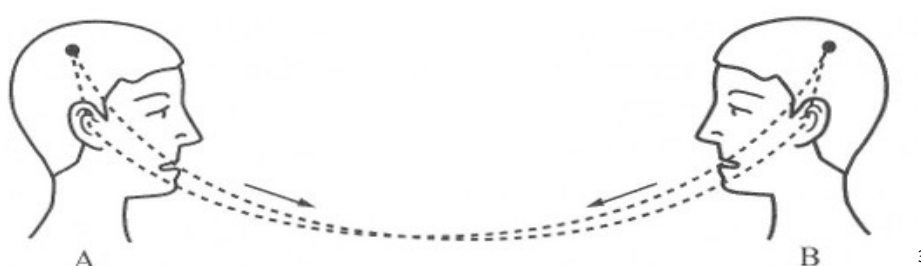


Figure 1 Communication based on phonology

³ De Saussure (1959:11)

2.1.1.2. Borrowers

In harmony with this phonological view, it is also assumed that borrowings are introduced to the target language by bilingual speakers as they are the ones who have direct access to sound categories and underlying representations in both the source and the target language (Haugen 1950, Weinreich 1970, Grosjean 1982, Poplack et al. 1988, Paradis & LaCharité 1997, LaCharité & Paradis 2000, LaCharité & Paradis 2005). The term bilingual in these literatures usually refers to “balanced bilinguals” (or coordinate bilinguals).

Balanced bilinguals are those individuals who have complete control over both the source and the target languages. On the contrary to compound bilinguals who have one meaning system, balanced bilinguals have two meaning systems which each language operates (Brown 2007: 72). Likewise, phonologically, they have access to both L1 and L2 phoneme inventory, so when hear L2 sounds they assign them to L2 categories. In the adaptation process, they map underlying L2 phonemes directly to underlying L1 phones without making any reference to surface phonetic information (LaCharité & Paradis 2005). Adaptations by these by bilinguals are believed to operate only on mental representations.

2.1.1.3. Ingredients of adaptation

Phonological approaches assume that the input of the adaptation process is not the surface, phonetic forms of the lexical items, but their mental representation as present in the source language (L2).

Based on the instances that the phonetic variations are often ignored during adaptation (Paradis & LaCharité 1997), it is argued that input of the loanword adaptation process is based on the L2 (not the L1) referenced perception of L2 phoneme categories (LaCharité & Paradis 2005). Bilinguals take underlying L2 forms as inputs and adapt them to conform to the structural requirements of L1 (Kenstowicz 2003). That is, from the beginning to till the end, the adaptation process does not reference the phonetic level. Therefore, phonological approaches set the instruments of adaptation as both L1 and L2 phonological information.

Additionally, it is important to note that phonological approaches consider categorized individual segments as inputs, whereas phonetic approaches, which will be discussed in later section, take complete word forms (Peperkamp & Dupoux 2003) or segment sized chunks (Silverman 1992) as their inputs.

2.1.1.4. Process of adaptation

As discussed above, phonological approaches claim that the agents of adaptation process are bilinguals who are capable of accessing both L1 and L2 phonological information. This assumption is based on the fact that adaptations often abstract away from phonetic details.

In General American English alveolar stops can be realized phonetically as alveolar flaps under certain circumstances (e.g., 'Betty' → /beti/ → [beri]). Speakers with native or close-to-native phonological knowledge have no problems interpreting English intervocalic flaps [ɾ] as alveolar stops /t/ as opposed to the phonetically closer alveolar approximant [ɹ]. Likewise, their phonological knowledge enables them to assign phonetic [t̬] or [tʰ] sounds to the same phoneme /t/. For these speakers, [ɾ] in *water*, [t̬] in the *suntan*, and [tʰ] in *top* belong to the same /t/ phoneme.

	L2 English		L1 Japanese
(1)	<i>wa<u>t</u>er</i> [wɔɹ̥əɾ]	→	ウォー <u>ター</u>
(2)	<i>su<u>n</u>tan</i> [sʌnt̬æn]	→	サン <u>タン</u>
(3)	<i>to<u>p</u></i> [tʰop]	→	ト <u>ップ</u>

L1= target language, L2= source language

As a result, when these words are adapted into Japanese by bilinguals, English phoneme /t/ is borrowed as Japanese /t/ no matter how the words are pronounced. For example, English word *water* is adapted into Japanese as ウォーター, and English word *suntan* is adapted into Japanese as サンタン.

Furthermore, we will look into how phonological views explain loanword adaptation process in detail. Paradis & LaCharité (1997) propose a theoretical model named the Theory of Constraints and Repair Strategies (TCRS). The so called TCRS model is based on the concept of constraint violation and repair. Loanwords in their original L2 forms violate constraints of L1 phonology. These violations need to be repaired to conform to the L1 phonology on the adaptation process. However, the repair is determined in accordance with restrictions.

Firstly, segmental information from L2 is to be maximally preserved in L2 forms (the preservation Principle). Secondly, there is a tolerance threshold regarding the amount of repair that can be utilized to enforce segment preservation (Threshold Principle). The tolerance threshold is believed to be two repair steps in all languages. If the repair strategy involves more than two steps, the segment is deleted.

Thirdly, repair must involve as few number of repair steps as possible; and that repair strategies are to be applied at the lowest phonological level possible (Minimality Principle). The

requirement for minimizing the number of repair steps is straightforward. The reference to phonological levels is based upon the Phonological Level Hierarchy.

(4) Phonological Level Hierarchy (PLH)

metrical level > syllabic level > skeletal level > root level >

> feature with a dependent > feature without a dependent

To give an example, if an ill-formed structure can be repaired at both segment and syllable level, the solution operating at segment level is preferred. The Minimality Principle serves the Preservation Principle, as the constraints on the quantity and the quality of structure-changing operations minimizes the distance between input and output forms.

Fourthly, in a situation involving two or more violated constraints, priority is given to the constraint that refers to the highest phonological level (Precedence Convention). The Precedence Convention relies on the same phonological level hierarchy as Minimality Principle does, however the priority order is reversed. For an instance, if an ill-formed structure needs to be repaired at both segment and syllable level, repairing on syllable level operates prior to repairing on segment level.

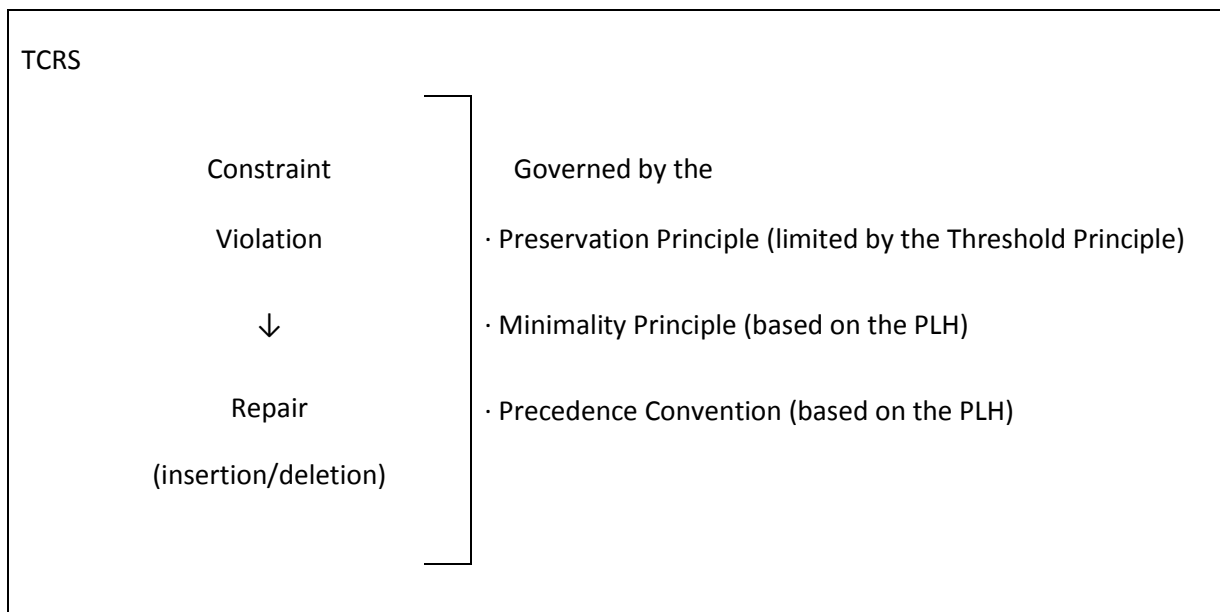
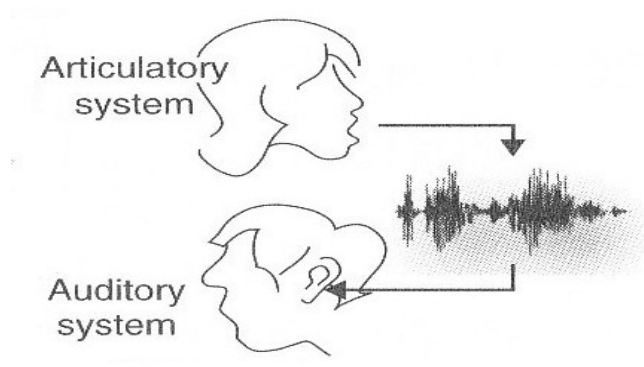


Figure 2 from Paradis & LaCharité 1997:387

2.1.2. Phonetic approach

2.1.2.1. Overview

The greatest competitors to the phonological views of loanword adaption are the phonetic approaches. Phonetic approaches share the view that phonetic details play a crucial role during the borrowing process (Silverman 1992, Shinohara 1997, Kang Y. 2003, Peperkamp & Dupoux 2003, Vendeline & Peperkamp 2004, Oh & Kim H. S. 2006). In the phonetic approaches, it is assumed that the adaptations are driven by constraints that require perceptual similarity across phonetic forms in the source and in the borrowing languages (Kang Y. 2003).



4

Figure 3 Speech perception

2.1.2.2. Borrowers

Phonetic views do not subscribe to the bilingual agent hypothesis of phonological approaches. They believe that mostly native speakers of L1 are the borrowers, and these agents have only limited access to the phonology and phonetics of L2.

2.1.2.3. Ingredients of adaptation

As opposed to the phonemic views, phonetic approaches to loanwords assume that the input to the loanword phonology is the acoustic signal (Silverman 1992). Phonetic approach explains loanword adaptation as a mapping a foreign sound (L2) to phonetically similar L1 phoneme. Therefore, even the sound represents a single phoneme in L2, it can be adapted as more than one phoneme into L1, according to its phonetic characteristics. For instance, English /s/ is adapted into Korean as /s/ or /s'/⁵.

⁴ See Fernandez and Cairns 2011.

⁵ In Korean loanwords, English /s/ is always written as Korean lax /s/. The reason for this uniformity in written form can be thought of that Korean Orthographic Rules bans the use of tense segments in written form.

	English words	Korean loanwords
(5)	sign	/s'ain/
(6)	pass	/p ^h es'i/
(7)	last	/lesit ^h i/
(8)	smile	/simail/
(9)	style	/sit ^h ail/
(10)	lace	/reisi/
(11)	city	/s'it ^h i/

English phoneme /s/, which followed by consonant, are adapted as lax /s/ in Korean, and the others are adapted as /s'/. The reason for this distinction cannot be found in English since they all are the same phoneme /s/ in English. Also orthographically, English /s/ sometimes is spelled with 'c' not with 's'. However, Korean loanwords variations are not related to English spelling variations, since whether is it spelled as 's' or 'c' they are adapted into Korean as /s/ and /s'/ according to what kind of segments it is followed by.

In this way, ingredients of phonetic adaptation are L2 sounds and L1 phonology. Moreover, L1 phonology also works as an interpreter of L2 sounds that do not exist in L1. Since this kind of operation never occurs in L1 native phonology, phonetic adaptation assumes the existence of loanword phonology, which does not conform to the L1 native phonology.

2.1.2.4. The process of adaptation

The phonetic view of the adaptation process is also referred to as phonetic approximation, perceptual assimilation, or the phonetic decoding. Although it is difficult task to single out a single model as the representative of phonetic approaches, Silverman (1992)'s views on the adaptation process is a widely accepted and often-cited one, summarizing the main features of phonetic models (Figure 4). Silverman (1992)'s analysis of the borrowing process contains two distinct levels; a Perceptual Level (Scansion 1), and an Operative Level (Scansion 2). In this analysis, the input to the Perceptual Level is the non-linguistic acoustic sign.

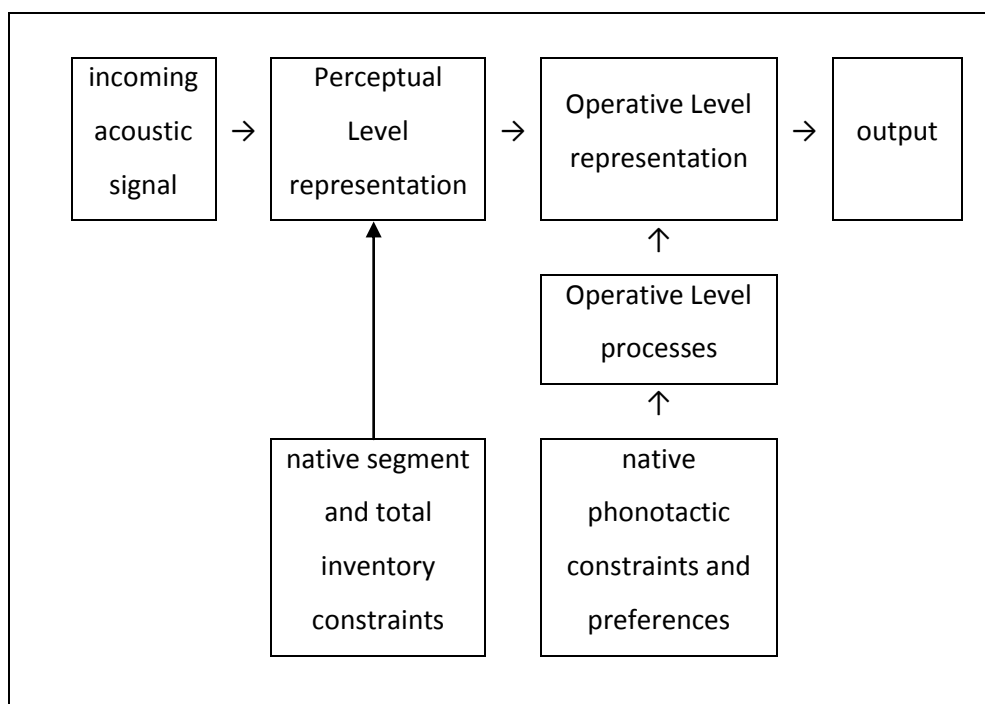


Figure 4 Multiple Scansion Model (Silverman 1992)

The first step at the Perceptual Level is the parsing of the acoustic input into segmental representation. This segmentation is conducted by L1 perceptual module not that of L2. As it is mentioned already, agents of the borrowing process do not necessary have access to L2 phonetics and phonology. Words in (12) demonstrate an example for English loanwords in Cantonese. Since Cantonese lacks contrast between coronal sibilant and non-sibilant fricatives, English /ʃ/ is perceived as Cantonese/s/, which is considered to be the best perceptual approximate to the input.

(12)	<i>Input</i>	<i>shaft</i>	<i>lift</i>
	<i>Perceptual Level</i>	[sef]	[lif]
	<i>Operative Level</i>	[sep]	[lip]

After the segmentation process, the possibly ill-formed segment string enters the Operative Level. At this level the string is evaluated against phonotactic constraints. The violation of phonotactic constraints against triggers phonological processes in order to eliminate illegal segments from the representation. In the Cantonese example, the illegal syllable-final English fricatives, such as /f/, are turned into stops.

The following case study illustrates how phonetic attributes can solve problems that are beyond phonological domains. The following data is from Korean. In Korean, syllables can have

voiceless stops as codas (13). However, coda consonants from English loanwords do not necessarily borrowed in a straightforward fashion. English coda stops can be adapted as either final stops or aspirated stops followed by epenthetic vowels (14).

(13) Native Korean words

[pat]	‘field’
[kæk]	‘guest’
[tʃip]	‘house’

(14) Korean loanword English

[pæt ^h i]	<	‘bat’
[tek ^h i]	<	‘deck’
[hip ^h i]	<	‘hip’
[set]	<	‘set’
[p ^h ek]	<	‘pack’
[t ^h ip]	<	‘tip’

Kang Y. 2003 and Oh & Kim H. S.2006 claims that the presence versus absence of epenthesis depends mainly on phonetic factors. Since final stops are strictly unreleased in Korean, epenthesis is more likely to occur if the stop is released in the English source form. According to them, the vowel insertion is more likely to occur under the following conditions; (1) when the pre-final vowel is tense rather than lax (the vowel-tenseness effect), (2) when the final stop is voiced rather than voiceless (the voicing effect), (3) the probability of insertion is influenced by the point of articulation of the final stop, and it increases in the following order: labial < velar < coronal (the place of articulation effect). In English, these three conditions all provoke the preceding vowel to be longer. In Korean, on the other hand, vowel insertion after coda consonant lengthen preceding vowel. For this reason, Kang Y. 2003 and Oh & Kim H. S.2006 find the motivation of the vowel epenthesis in Korean loanwords is phonetic approximate.

2.1.3. *Orthographic approach*

2.1.3.1. Overview

While the debate across the borderline of phonemic-phonetic views has been enjoying ample attention in the current literature, this bipartite division is not capable of covering all relevant aspects. However, orthography as an important influencing factor enjoys great attention also in interphonology studies (Bohn & Flege 1990, Pennington 1996, Bassetti 2006). Recently, there are an increasing number of studies pointing out importance of orthography during the adaptation process (Iverson 2005, Vendelin & Peperkamp 2006, Smith 2006, Detey et al. 2007, Kang Y. 2009). Following these studies, the present study provides further arguments that support the view that orthographic factors play a key role in the analysis of loanwords.

2.1.3.2. Borrowers

Similarly to phonetic approaches, research with orthographic background assumes that agents of the borrowing process are generally native speakers of L1. These L1 native speakers have limited phonetic and phonological awareness of L2. Although their knowledge is strongly limited, they can formulate hypotheses about L1 forms of L2 words based on orthography. These assumptions are believed to have analogical nature (Antilla 1972).

2.1.3.3. Ingredients of adaptation

Most of the research in this domain considers two factors as input for the adaptation process: acoustic forms and graphemic forms. In case there is only acoustic information available as input, the adaptation is based solely on phonetic proximity. However, when the orthography of the source word only is available, the possibility of phonetic approximation is ruled out.

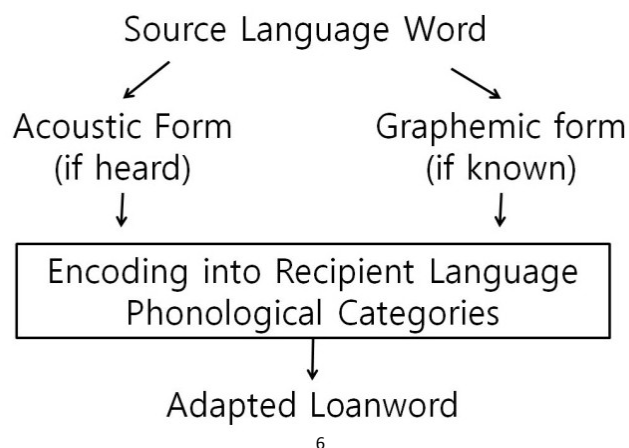


Figure 5 Orthographic adaptation

Yet, in reality, we can also easily think of the situations in which both acoustic and graphemic forms are utilized. As a result, the same phoneme can be adapted as different forms. For example, in English, there is no pronunciation difference between single /m/ and geminate /mm/. On the contrary, in Korean, there is contrast between single and geminate consonant (많아요/*manayo*/ ‘there is many of ...’; 만나요 /*mannayo*/ ‘meet’). Since, written forms of English have single and geminate consonant, these consonants are adapted into Korean as single and geminate form.

(15)	L2 English	L1 Korean
	<u>comm</u> a [ka <u>m</u> ə]	k ^h o <u>mm</u> a
	co <u>m</u> a [ko <u>u</u> mə]	k ^h o <u>m</u> a ⁷

It is impossible to separate L2 from L1 in L2 learners’ mind, since L2 learners already have L1 system that includes phonology, morphology and syntax (Anton & DiCamilla 1998). The analysis of spelling pronunciation is complicated by the fact that borrowers readily mix grapheme-to-phoneme rules from their native language with ones that they believe to be valid (but not necessary so) in the source language. The various rules can apply within a single word, possibly resulting in rather exotic adaptations.

⁶ Iverson 2005

⁷ Cho 2009

2.1.3.4. The process of adaptation

Obviously, it is not always easy to unequivocally identify the nature of the input. Iverson (2005) demonstrates a case in which the input can be narrowed down to orthographic origins. The analysis examines the word “banana”, a fruit name from foreign origin used in Korean.

(16)	<i>candidate of Korean loanword for 'banana'</i>	<i>possible source language based on the phonetic approximate</i>	<i>pronunciation of source word</i>
	<i>*/pənənə/</i>	English	[b̥ənənə]
	<i>*/p'ənənə/</i>	English	[b̥ənənə]
	<i>/panana/</i>	Japanese	[banana]
	<i>*/p'anana/</i>	Japanese, Portuguese, Spanish	[banana]

In case the word is borrowed from English [b̥ənənə] utilizing phonological or phonetic strategies, the Korean form would be something like [pənənə], as Korean vowel phonemes ㅏ /ə/ and /e/ gives good phonetic and phonological approximations of English [ə] and [æ] in L2 form [b̥ənənə]. In fact, established loanword refers to ‘banana’ is /panana/. If /panama/ is the phonetic approximate of source word, then it can be assumed that the word first came into Korean indirectly from Japanese [banana]. In this case, /p'anana/ can also be a candidate for Japanese [banana], since VOT of Japanese /b/ is similar to Korean /p'/. If we can put /p'anana/ as Korean loanword, this word first came into Korean directly from Portuguese or Spanish, because VOT of /b/ these languages also are similar to Korean /p'/ than /p/.

Therefore, unless we put the source of /panana/ as language other than English, a phonetic or phonological analysis arrives to a dead end. If English nonetheless is the source, then presumably it is the awareness of the English spelling that influences the adaptation of the vowels. Since educated Korean have good knowledge of English spelling conventions, it can be assumed that letter *a* throughout the word is responsible for the Korean /a/.

The examples below (17) represent Korean words of English origin which can only explained by assuming orthographic input.

(17) *swordfish* [sɔɹdfi] → [siwədip^hifwi], *[sədip^hifwi], *[sodip^hifwi]

stop [st^hap] → [sit^hop], [sithap]

sponge [sp^hʌnʒi] → [sip^honji] *[sip^hanji]

lobby [labi] → [robi] *[rabi]

radio [ɹeidio] → [radio] *[reidio]

For example the movie titled *Swordfish* [sɔɹdfi] – starring John Travolta – rendered as [siwədip^hifwi] in Korean (Iverson 2005). Although there is no [w] pronounced in the first element *sword*, the adapted form in Korean contains a /w/ here corresponding to the silent orthographic *w*. The laxness of the initial sibilant /s/ also supports the orthographic interpretation. English sibilants that are followed by vowels are adapted as tense sibilants in Korean. Thus the initial fricative in [sɔɹdfi] is expected to be tense in Korean. However, the initial fricative is adapted as lax, assuming phonetic realization for the only orthographically present *w*.

In other example words such as *stop* [sit^hop] or *sponge* [sip^honji] – as Iverson (2005) pointed out – the adapted vowels reflect neither the phonemic categories nor the phonetic details of the source, but rather the spelling. The phonemic value of letter *o* is either ɪ /a/ or ʌ/ in these words. Yet the borrowed forms uniformly contain /o/, which can be considered as an adaptation triggered by letter ‘o’ in the words.

2.1.4. Summary

The main characteristics of the three most prominent approaches mentioned above is summarized with reference to three concepts: the *agent* of adaptation, *ingredients* of the process, and the description of *process* itself.

Firstly, these three views are different in borrowers. Phonological approach assumes borrowers of adaptation as balanced bilinguals (Baker and Jones 1998) who have complete control over both L1 and L2 languages. On the contrary, phonetic and orthographic approaches do not set strong restriction on borrowers. Both of the views assume borrowers as bilinguals of L1 native speakers. Secondly, the ingredients for each view set differently to each other. In phonological approach, ingredient of adaptation is L1 and L2 phonology since bilinguals have access to both L1 and L2 phoneme inventory. Contrastively, in phonetic approach, ingredient of adaptation is L1 and L2 phonetic outputs, which means that this adaptation relies on the perceptual similarity across

phonetic forms in the source (Kang Y 2003). Orthographic approaches, on the other hand, assume input of loanwords adaptation as L1 and L2 orthography.

Table 2 Characteristic features of the three main views of loanword adaptation

	<i>phonological approach</i>	<i>phonetic approach</i>	<i>orthographic approach</i>
<i>agents</i>	balanced bilinguals	bilinguals or L1 native speakers	bilinguals or L1 native speakers
<i>ingredients</i>	L1 and L2 phonology	L1 and L2 phonetic outputs	L1 and L2 orthography
<i>process</i>	mapping based on phonological categories in L1 and L2	mapping based on acoustics of L1 and L2	reading adaptation

Thirdly, the processes on adaptation also differ among three views. Phonological approach explains adaptation process as mapping underlying L2 phonemes directly to underlying L1. In phonetic account, the mapping performs based on the phonetic cues of L1 and L2 outputs. Process of orthographic approach can be described as “reading adaptation” which borrowers read the orthography of L2 as if it is L1 orthography.

Later in this subsection, adaptation patterns and problems in three views will be reviewed in detail.

2.1.5. Discussions

2.1.5.1. Discussion of phonological approaches

According to Paradis & LaCharité (1997), which takes phonological stance in loanword adaptation, phonetic adaptations are divided into two large groups. One is phoneme deletion and the other is incorrect phoneme categorization. As for the first one, L2 phoneme deletion occurs when it is not heard by L1 borrowers.⁸ However, in their database, these kinds of phoneme deletion cases were very rare. As for the second pattern, that is incorrect phoneme categorization, or phoneme mismatching in other words, it occurs because of the perceptual confusion caused by the perceptual proximity of the involved sounds. For example, English /r/ – phonetically transcribed as [ɹ] – may be adapted as Japanese /w/ because [ɹ] is phonetically more similar to Japanese /w/ than Japanese /r/ - the phonetic trill [r]. If we accept that an L2 phoneme that does not exist in L1 is

⁸ Which is somewhat odd argument for that phonological view assumes borrowers as bilinguals.

adapted as the perceptually closest L1 phoneme, it is expected that English /i/ is adapted into French as /e/ – instead of /i/. As a matter of fact, this is almost the only occurring adaptation strategy in the corpus in Paradis & LaCharité (1997) that is considered to be perceptually motivated - according to authors' standards. Because of that, there is no considerable number of cases which can be interpreted as a phonetic adaptation. Based on these assumptions and facts Paradis & LaCharité (1997) concludes that loanword adaptation is mainly affected by phonological categories.

However, outside of their corpus, numerous counterexamples can be found. One of them is the adaptation of English /s/ into Korean. Although all English /s/ is adapted into Korean as sibilant /s/ in the written form, the pronunciation of /s/ in these loanwords varies between lax /s/ and tense /s'/, depending on what segment follows. When /s/ is followed by a vowel, or when it is a word final coda, it is pronounced as tense [s'] (e.g., *sun* /sun/ [s'un], *pass* /p^hesi/ [p^hes'i]). In other positions, the alveolar sibilants are pronounced as [s] in Korean (e.g., *snow* /sinou/ [sinou], *past* /pesit^hi/ [pesit^hi]). These alterations do not exist originally in Korean. The two sibilants /s/ and /s'/ phonemically contrast in Korean (cf. /sal/ 'fresh', /s'al/ 'rice').

From a phonetic point of view, the two Korean fricatives /s/ and /s'/ differ in their friction and aspiration duration (Kim S. H. and E. Curtis 2002). In word initial position, friction duration of /s/ is longer than that of /s'/. In intervocalic position, aspiration duration of /s'/ is longer than that of /s/. In contrast of Korean, English has only one type of voiceless alveolar sibilant /s/. However, English /s/ do exhibit durational differences depending on what segment it follows or what segment it is followed by (Klatt 1974:60). If English /s/ is followed by a plosive in a two-element cluster, the /s/ duration is shortened to 60% of the value of prevocalic /s/.

A similar experiment to investigate sibilants was conducted by Ahn & Iverson (2004). They asked two English native speakers to pronounce word lists including /s/, and recorded the utterances (e.g., *Greece, Alps, dance* etc.). When they measured the recorded utterances they found durational variations similar to results of Klatt (1974). Their speakers showed longer duration for English /s/ in word-final positions than in preconsonantal positions.

As a follow-up study they asked Korean students to indicate whether the final English sound includes /si/ or /s'i/. The two variants had the plain and the tense Korean sibilants. Their results showed that the Korean participants perceived the phonetically longer English final /s/ as a Korean tense sibilant (87%), while the phonetically shorter one /s/ (e.g., *crust, desk*) as a Korean plain /s/. Only 4% of the responses were registered as Korean tense /s'/ for English preconsonantal coda /s/ sounds. These findings are in accordance with Klatt (1974)'s claim that /s/ in consonant clusters are shorter than in other positions. To sum it up, the English phoneme /s/ can be adapted into Korean as either plain (/s/) or tense (/s'/) consonant based on the duration of the target fricative. From this /s/

case, we can see a necessity of phonetic interpretation in loanword adaptation. Phonological approach alone cannot explain all adaptation patterns loanwords.

From a phonological point of view, the process of loanword adaptation can be viewed as a transfer between L1 and L2 phonemes. While leaving out the phoneme sound mapping and working directly with phonemes is undeniably attractive for phonologists, there has been no sufficient explanation offered by the phonological view about how the L1 to L2 phoneme correspondence shall be defined. There is no straightforward definition regarding which phonemes in the source and borrowing languages are related; or under what conditions they are entitled to be identical. There are at least three possible approaches to address this issue. First, when two phonemes in L1 and L2 share the same orthographic symbol, then they can be treated as identical phonemes. If this is the premise of the phonological point of view, then the phonological adaptation coincides with the orthographic adaptation. Second, it is possible to define the equivalence of L1 and L2 phonemes by reference to phonetic forms. That is, if two sounds are transcribed by the same IPA symbol, their phonemic equivalence is established. Obviously, this approach faces several problems. For one thing, the same IPA symbol can represent physically rather different sounds across languages (Flege 1997). Also, even if the sounds are physically similar their roles and functions defined in the phonological systems they belong to can be rather different – questioning their equivalency (Pinter 2013).⁹ Third, it is possible to define correspondence between L1 and L2 phonemes grounded on the definition of ‘same’, ‘similar’ and ‘different’ in the manner proposed by research in Second Language Acquisition (SLA). Since distinction of ‘same’, ‘similar’ and ‘different’ are based on the perception filtered by L1 phonology (Trubetzkoy 1932, 1969), if this is the postulation that phonological approaches take, then it has to be claimed that phonological adaptation is based on perception to a certain some degree.

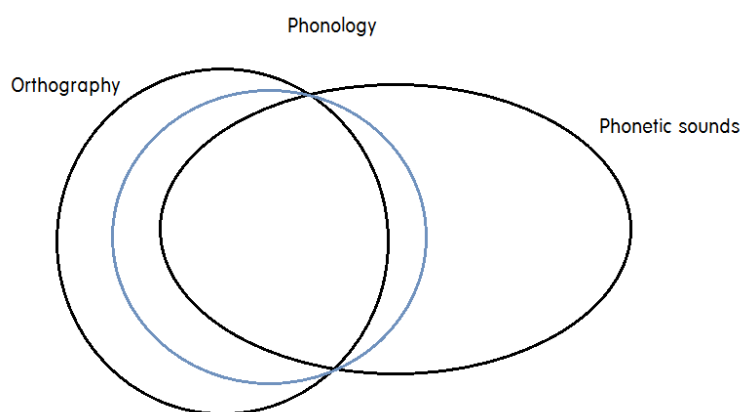


Figure 6 Intersection of influencing factors

⁹ The fact that phonemes of different languages are defined within different inertial systems of phonologies questions the viability of any approach that aims to find correspondence between these units.

Given these considerations, phonological approach can be viewed as a proper subset of the union of phonetic and orthographic approach. Relation among orthography, phonology and phonetic sounds will be discussed in details later, in Chapter 6.

2.1.5.2. Discussions of phonetic approaches

The phonetic approach can provide several counter evidences against the phonological approach. For example, according to the phonological view, the same phoneme should enter the language in the same form, even if they are originating in different languages. There are some cases when this hypothesis does not carry out. For instance, English and French loanwords in Japanese provide such an example. Japanese borrows lexical items from both English and French with phoneme /n/ in both of these languages. However, coda /n/ from English is adapted into Japanese as /n/ while coda /n/ from French is adapted into Japanese as /nnu/.

Japanese language has coda /n/ in its inventory. As (18) below shows Japanese native words can end in moraic nasal /n/. Therefore, it does not seem problematic to borrow coda /n/ from any foreign language into Japanese.

(18)

	<i>meaning</i>	<i>output</i>
Japanese /n/	'point'	<i>Ten</i>
	'book'	<i>hon</i>
	'Japan'	<i>nippon</i>

However, in on-line adaptations of French words ending in /n/, Japanese speakers transform /n/ into a geminated nasal followed by an epenthetic vowel (Shinohara 1997). For instance, French word 'douane', 'piscine', and 'prochaine' are adapted as /duannu/, /pisinnu/ and /purofennu/, respectively.

(19)

<i>French word</i>	<i>French pronunciation</i>	<i>meaning</i>	<i>Japanese output</i>
<i>douane</i>	[dwan]	'customs'	/duannu/
<i>piscine</i>	[pisin]	'swimming pool'	/pisinnu/
<i>prochaine</i>	[proʃɛn]	'next-FEM'	/purofennu/

Such investigations by Shinohara (1997) have been confirmed later by experiments on Japanese loanword adaptations by Vendelin & Peperkamp (2004). Examples in (20) display some of the English words that are used in the experiment of Vendelin & Peperkamp (2004). Unlike French, English coda /n/ is adapted into Japanese as coda /n/. For example English words *screen*, *napkin*, *shine*, and *cotton* are adapted into Japanese as /sukuriin/, /napukin/, /ʃain/ and /kotton/, respectively.

(20)

English			Japanese output
<i>screen</i>	[skrin]	→	sukuriin
<i>napkin</i>	[næpkin]	→	napukin
<i>shine</i>	[ʃain]	→	ʃain
<i>cotton</i>	[kɑ:tn]	→	kotton

Since it is rather difficult to find phonological justification for different adaptation strategies of the same phoneme, Vendelin & Peperkamp (2004) had a look at phonetic factors. Their explanation hangs upon the phonetic differences in the realization of the alveolar nasal [n] in English and French. The results of phonetic experiments show that French coda nasals tend to be released and have longer duration than their English counterparts (Figure 7). That is, differences in the strategies of adaptation are due to differences in the phonetic realizations of the same phoneme. While this explanation is rather plausible, it is unavailable for phonological approaches to loanword adaptation.

However, the phonetic account cannot explain all adaptation patterns. Cho (2009) conducted experiments investigating the production and perception of English nasal consonants of Korean speakers' English. She used such word pairs as *coma* and *comma*, in which the pronunciation of 'm' and 'mm' parts were identical, only the written forms were not alike. She found that duration of nasal consonants in those words that are spelled with double graphemes tend to be longer in the pronunciation of Korean speakers (Figure 8). This was in contrast with native English speakers who pronounced both the singleton and geminate graphemes with approximately the same durations. The lengthened pronunciation in Korean speakers reflects the fact that doubled consonants in the Korean writing system are pronounced with longer duration.

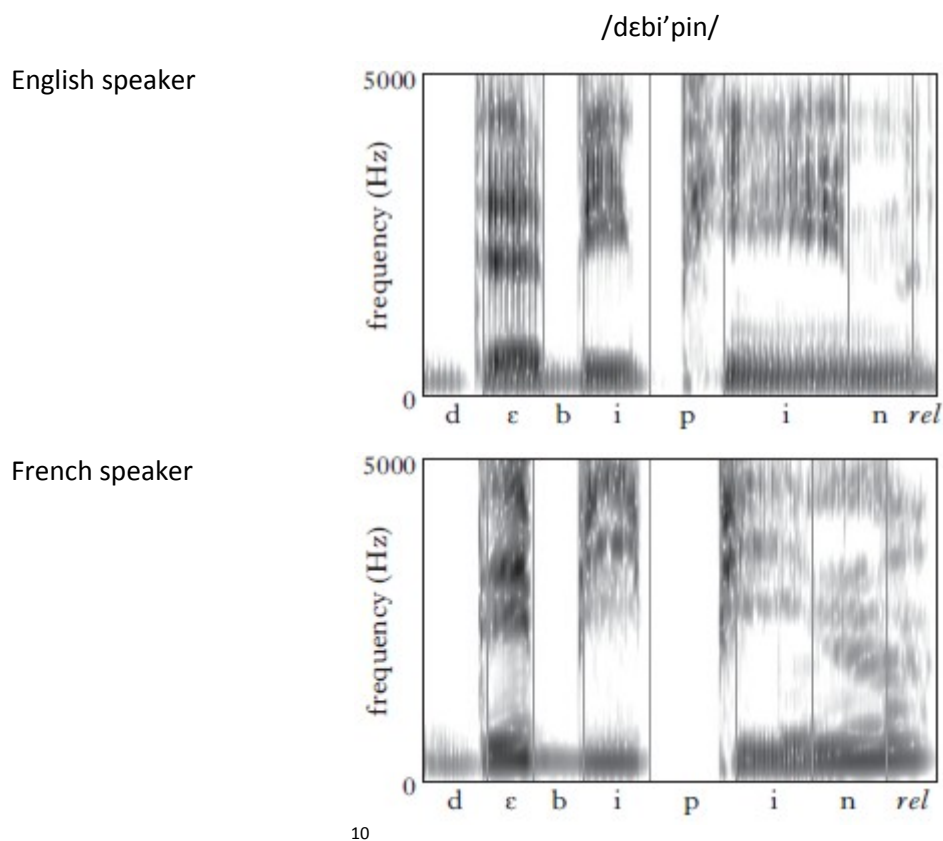


Figure 7 Coda /n/ pronounced by English and French speaker

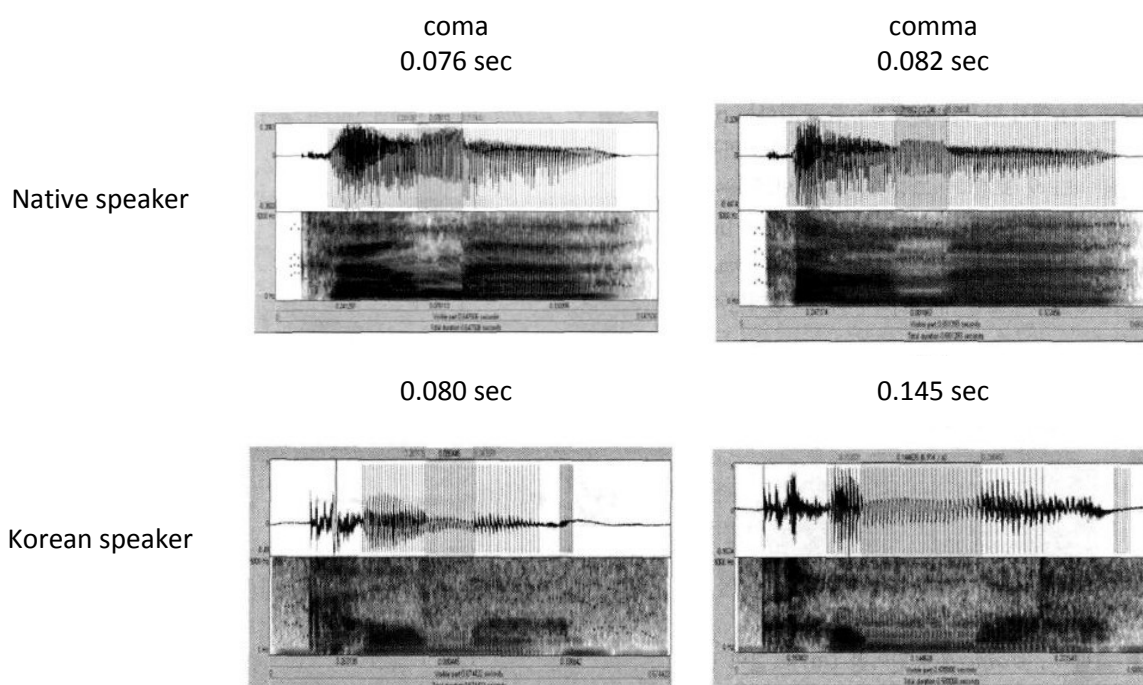


Figure 8 Duration of [m] by English and Korean speakers

¹⁰ Vendelin and Peperkamp 2008

2.1.5.3. Discussion of orthographic approaches

Orthographic approaches explain how adaptation pattern can be different under orthographic influences. In this subsection, adaptation patterns will be interpreted with instances. First, we will look at how adaptation pattern can be different in one language from the same source language depending on when there are only inputs with spoken and when there are inputs with both spoken and written forms.

Smith 2006 insists that loan phonology is not all perception based on the evidence from Japanese loan doublets. In Hawaiian Japanese and in older loans which were borrowed when the exposure of Japanese people to English was not so extensive, adaptation rules were different. Older loans show adaptation from auditory information, and contemporary loans show adaptation from orthographic information.

In Hawaiian Japanese coda consonants are deleted in adapted form (21). The English word *inside* becomes /insai/, *outside* becomes /ausai/, *husband* becomes /hazuben/, *last* becomes /rasu/. From a theoretical point of view it can be argued that the coda consonants are absent because the input of the borrowing process is the spoken form, and in casual speech these coda consonants are targets of contraction. In general, adaptations that are based mainly on phonetic input tend to have more deletions (Haugen 1950).

(21)

English	Japanese	
	Hawaiian Japanese	Contemporary loans
<i>inside</i>	インサイ /insai/	インサイド /insaido/
<i>outside</i>	アウトサイ /ausai/	アウトサイド /autosaido/
<i>husband</i>	ハズベン /hazuben/	ハズバンド /hazubendo/
<i>last</i>	ラス /rasu/	ラスト ¹¹ /rasuto/

In contemporary Japanese, on the other hand, these coda consonants are all savaged by introducing epenthetic vowels after the consonants (21). Vowel epenthesis is faithful to orthographic information, though the sound actually might not be caught by Japanese speakers' ear. The

¹¹ Higa 1970

difference between the two strategies can be explained by reference to the input. Hawaiian Japanese is used in an environment in which speakers are in contact with casual spoken English on a daily bases. The circumstance of language contact is in support for the view that the input of the borrowing process is phonetic in nature. As opposed to Hawaiian Japanese standard Japanese is used in monolingual environment. However, although in everyday situations English is not used, especially as a result of growing intensity of English education, English texts and signs are present almost everywhere. So, the linguistic environment is rich in written English, which can form the primary input of borrowing processes. Since written forms are not subject to contractions and reductions to the extent that is usual in spoken forms, deletions are less likely to occur.

A rather similar phenomenon can be seen between older and contemporary loans in Japanese (22). In older loans, English *pocket* has been adapted as /pokke/ in Japanese with the coda consonant deleted. The same word appears in Japanese as /poketto/ among recent loans with the coda consonant retained. Since Japanese syllable structure does not allow obstruent in coda position, the retained consonant is retained as the onset of a new syllable augmented with an epenthetic vowel. The truncated forms in older loan are most likely due to incomplete auditory input.

(22)

<i>English</i>	<i>Japanese</i>	
	<i>Contemporary loan</i>	<i>19th-20th century loan</i>
<i>pocket</i>	ポケット /poketto/	ポッケ /poke/
<i>lemonade</i>	レモネード /remone:do/	ラムネ /ramune/
<i>crank</i>	クランク /kuranku/	カラン /karan/
<i>cement</i>	セメント /semento/	セメン /semen/
<i>roast</i>	ロスト /rosuto/	ロース /ro:su/

In Korean loanwords, we can see the adaptation patterns difference between when orthography offers constant pronunciation information and when it does not. Even when we know the source words spelling, because of the orthographic system of source language, there are times

that we are not fully provided how the word sounds. Kang (2009) found the instances for this matter in 1930s Korean loans from English. She dealt with the adaptation of the English affricate /z/. English morphemic /z/ is adapted to Korean as /s/ 65%, /s'/ 34%, and /ch/ 1% of all the cases (23).

(23)	<i>English phoneme</i>	<i>pronunciation</i>	<i>Korean phonetic proximate</i>
	/z/	[s]	/s/ /s'/
		[z]	/ch/

Since Morphemic /z/ is always written with the letter s, and the pronunciation is depend on the environment what sound it follows; [s] after voiceless consonant and [z] after voiced consonant or vowel. Korean adaptation of morphemic /z/ varies because the orthography of morphemic /z/ does not provide solid information for its pronunciation. Below (24) shows the example words in Korean 1930s loans.

(24)	English	Korean loans
	<i>beans</i>	/pinsi/ ~ /p'insi/ ~ /p'ins' i/
	<i>General Motors</i>	/cheneral motasi/ ~ /cheneral mo:təsi/
	<i>New York Yankees</i>	/nju: jokjaki:si/
	<i>bronze</i>	/p'uronchi/

However, English Non morphemic /z/, which almost always written with letter 'z', is constantly adapted as /ch/ in Korean. There she summarize this phenomenon like below.

- written with 'z' → Korean /ch/
- written with 's' → Korean /s/, /s'/, /ch/

There are two main strategies how orthography can contribute to the adaptation process. The present thesis supports the view expressed by Vendelin & Peperkamp 2005, in that orthography can influence the phonological structure of borrowings either through so called *reading adaptations* or by the standardization of grapheme-to-phoneme associations (standardization of borrowing).

The term *reading adaptations* refers to the process in which borrowed forms derive through reading foreign words with native pronunciation. That is, grapheme-to-phoneme rules of the borrowing language are applied to the foreign spelling. For example, the French word *cul-de-sac* is adapted as /kʌldəsæk/ in English, which is obviously cannot be derived from the French

pronunciation [kytsak]. Rather, the English form reflects the way how English speakers would read the word with no reference to French at all. The other strategy in which orthography plays a crucial role is the standardization of grapheme rules. It means that there may be a certain amount of standardization as to how graphemes of the source language are pronounced in the borrowing language. For example, French school children learn to pronounce the English grapheme <u> in words like *but* using the native French vowel /œ/, and the English grapheme <oo> in words like *book* using the French vowel ㅜ/u/. Although in many cases these simple rules are misleading, borrowers tend to base their adaptation strategy on these kinds of between-language grapheme-to-phoneme correspondence rules (Vendelin & Peperkamp 2005).

We can easily imagine that this kind of adaptation occur to adaptations among European languages which share Roman alphabet as their orthographic symbols. However, under Sino sphere, Chinese characters can function as a sort of lingua franca for written materials. The words in (25) display Japanese names adapted into Korean.

(25) Japanese names adapted into Korean

Japanese	→	Korean
豊臣秀吉(1536-1598)	풍신수길	/p ^h uŋsinsugil/
木村拓哉(1972-)	키무라타쿠야	/k ^h imurat ^h ak ^h uya/

Old loans like 풍신수길 /p^huŋsinsugil/ is reading adaptation, it borrowed exact word of Japanese Kanji¹², then it is read as if it were Korean Hanja.¹³ Recent loans like 키무라타쿠야 /k^himurat^hak^huya/ is adapted based on the phonetic sounds of the words. The latter entirely seems like a phonetic adaptation, but it can also be analyzed as “standardization of borrowing”, because the /ku/ in Japanese is rendered as Korean /k^hu/. Japanese *u* is [-rounded], and Korean has unrounded ㅡ/i/ and rounded ㅜ/u/. If the adaptation is based on the phonetic approximation, then Japanese ㅜ/u/ should be rendered as Korean ㅜ/u/, especially after the consonant /k/, where the vowel tends to be unvoiced in Japanese. Therefore, use of the Korean ㅜ/u/ for the Japanese ㅜ/u/ can be classified as orthographic or phonological adaptation.

Vendelin & Peperkamp (2005) already has pointed out that reading adaptations are relatively well identified, but adaptations based on between-language grapheme-to-phoneme correspondence rules will often go unnoticed, since they typically resemble or are even

¹² Chinese Character used in Japan.

¹³ Chinese Character used in Korea.

undistinguishable from phonologically-based adaptations. For example, the French adaptation of English *brunch* as [bʁœntʃ] can at first sight be attributed to either a phonological principle that maps English /ʌ/ onto French /œ/ or the between-language grapheme-to-phoneme rule according to which French speakers pronounce English <u> as their native vowel /œ/.

Vendelin & Peperkamp (2005) carried out experiments investigating English vowel discrimination with French native speakers. As an oral condition, only audio stimuli were presented. As a mixed condition, both audio stimuli and orthographic stimuli were presented. The results show different borrowing patterns between oral adaptation and mixed-condition adaptation (Table 3).

The adaptations in the mixed condition follow the between-language grapheme –to-phoneme strategy more often than the adaptations in the oral condition. The difference between the percentages was significant for the vowels /ɔ/, /ʌ/, and ʊ/ only. As for ‘Reading’ adaptations, /ʌ/ (grapheme <u>) was adapted as /y/ in 22.9% of cases and ʊ/ (grapheme <oo>) as /o/ in 4.9% of cases. The vowel /ʊ/, also represented by the grapheme <oo>, was likewise adapted as /o/ in 6.3% of cases.

Table 3 Effects of oral only and oral + visual stimulus during adaptations

AE input vowel	condition	French response vowels						
		i	u	e	o	a	ø	y
ɛ	<i>mixed</i>	0.7		82.6	0.3	0.7	15.6	
	<i>oral</i>	1.4		76.4		8.3	13.9	
ʌ	<i>mixed</i>		3.1	1	4.5	0.7	67.7	22.9
	<i>oral</i>		2.1	0.3	54.5	10.8	31.6	0.7
ɪ	<i>mixed</i>	100						
	<i>oral</i>	95.1	1.4	1.4			2.1	
ʊ	<i>mixed</i>		93.8		6.3			
	<i>oral</i>		76.6		12.9		9.4	1

As mentioned earlier in this section, orthographic approach does not deny adaptation based on the pronunciation of L2. They only insist orthographic adaptation under certain circumstances. The conditions of orthographic adaptation can be derived from previous studies. First, orthographic adaptation occurs when there is no pronunciation information. On this matter, Iverson (2005) also mentioned on this matter (Figure 5), and we could find the instances in old loanwords from Japanese in Korean (25). Second, orthographic adaptation can be triggered when there are

plural types of spelling convention although they all represent only a single sound. Korean adaptation of English [m] is the example of this case (Figure 8 and the followed sub-section). Third, when plural sounds share one type of spelling convention, there can be adaptation triggered by orthography than pronunciation. For example, English morphemic /z/ always written as 's' and the pronunciation varies [s] to [z] according to the segment it follows. However, Korean adapts English phonemic /z/ as ㅈ/s/ even when the pronunciation in English is [z] ((23)(24)). These conditions of orthographic adaptation will be investigated later in chapter 6 in detail.

In chapters 3 to 5, we the adaptation pattern in Korean established loanwords will be revealed accompanied by a perception experiment. The pattern in established loanwords and the result of perception tests will be analyzed in relation to English vowels. Orthographic and pronunciation adaptation will be compared in terms of frequency. Before detailed investigation of Korean loanwords, Korean phonology and Korean perception of English will be reviewed in the following subsections, in 2.2 and 2.3.

2.2. Korean Phonology

This section will deal with the phonology and orthography of Korean language. Korean is written in Hangul which is an original writing system for Korean language. Hangul consists of 24 phonetic symbols. Unlike English, there is strong consistency between Hangul and Korean pronunciations. That is one who knows the sounds of individual Hangul characters can decode any Korean text written in Hangul to sound. For this reason, Korean phonology will be introduced along with Hangul orthography in this section.

2.2.1. Korean alphabet: Hangul

Until the 15th century the Korean language was written using Chinese characters. This practice was rather cumbersome because of the significant differences between the Korean and Chinese sound systems. As a resolution of the problem, a new writing system, the now called Hangul was created and introduced by King Sejong in 1446. In the Hangul alphabet, each character corresponds to a sound, and the alphabets are grouped into syllables in writing. What makes this system is outstanding, is not only the fact that it had been invented by a scholarly king, but also the deep phonological knowledge it encourages.

2.2.1.1. Vowels

In the Hangul system, vowel graphemes are defined by a long base stroke. This long base stroke can be augmented by one or two short ones. Vowel graphemes can be categorized into two main groups based on the orientation of their long stroke. One group featuring a horizontal stroke consist of $\perp$ /o/, $\perp$ /yo/, $\top$ /u/, π /yu/, and $-$ /i/. The other group having a vertical stroke comprises $\vdash$ /a/, $\vdash$ /ya/, $\dashv$ /ə/, $\dashv$ /yə/, $\lvert$ /i/, $\lvert$ /e/, $\lvert$ /ye/, $\lvert$ /e/ and $\lvert$ /ye/.

(26) vertical vowels	$\vdash$ $\vdash$ $\dashv$ $\dashv$ $\lvert$ $\lvert$ $\lvert$ $\lvert$
horizontal vowels	$\perp$ $\perp$ $\top$ π $-$

There are interesting linguistic correlations encoded in this writing system. For example, vertical vowels occupy the front region of the vowel space and are distinguished by tongue height: $\lvert$ /i/ is a high, $\dashv$ /ə/ is a mid, and $\vdash$ /a/ is a low vowel. Horizontal vowels are located on the non-low, non-front portion of the vowel space. The simple horizontal stroke $-$ is an unrounded central /i/, $\top$ is a rounded back /u/, and $\perp$ is for rounded mid back /o/. The short vertical line acts as a roundedness marker. As for mid front vowels, $\lvert$ /e/ and $\dashv$ /e/ are traditionally interpreted as combination of simple vertical vowels. The open-mid $\lvert$ /e/ is the combination of $\vdash$ /a/ and $\lvert$ /i/; the close-mid $\dashv$ /e/ is a combination of $\dashv$ /ə/ and $\lvert$ /i/. Another feature that illustrates the compositionality of the system is the doubling of small strokes. A doubled small stroke marks pre-vocalic palatal glides: for example, $\vdash$ /a/ $\rightarrow$ $\vdash$ /ya/, $\perp$ /o/ $\rightarrow$ $\perp$ /yo/, and so on.

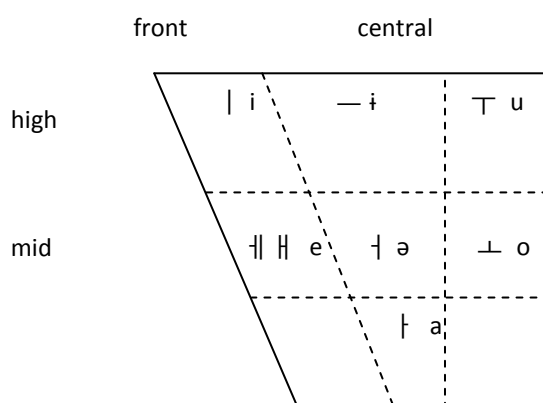


Figure 9 Vowel chart of Korean (from Kim C. W. 1999)¹

2.2.1.2. Consonants

When King Sejong created Hangul, he divided consonants into 5 groups, with each group representing a typical manner and/or place of articulation. The canonical letters of the groups are: ㄱ/k/, ㄴ/n/, ㅁ/m/, ㅅ/s/, and ㅇ/ŋ/. The shape of the basic letters was modeled symbolizing the shape of the articulators.



Figure 10 Position of the vocal organs producing a velar sound (From Ahn S. C. 1998)

First, the symbol ㄱ stands for the velar consonant /k/ and it mimics the shape of the tongue root (See figure 10). The symbol ㄴ stands for the alveolar consonant /n/ and it mimics the shape of the tip of the tongue touching the alveolar ridge. The symbol ㅁ stands for the bilabial consonant /m/ and it mimics the shape of closed lips. The symbol ㅅ stands for the alveolar fricative consonant /s/ and it mimics the shape of the teeth. In this last case it may not be obvious how the alveolar /s/ is related to the teeth, but the teeth are responsible for creating the high frequency components in the pronunciation of sibilants. Finally, the symbol ㅇ stands for velar nasal consonant /ŋ/ and it mimics the shape of the throat (see Sejong 1446, Kim C. W. 1999, Ahn S. C. 1998, among others).

Table 4 Consonants system of Korean (refer to Kang S. H. (2010:34))

<i>canonical letter for each group</i>	<i>place of articulation</i>	<i>nasal stop</i>	<i>stop</i>	<i>fricative</i>	<i>affricate</i>	<i>aspirated</i>	<i>tense</i>
ㄱ	velar		ㄱ/k/			ㅋ/k ^h /	꺄/k'/
ㄴ	alveolar	ㄴ/n/	ㄷ/t/			ㄸ/t ^h /	ㄸ'/t'/
ㅁ	bilabial	ㅁ/m/	ㅂ/p/			ㅍ/p ^h /	ㅍ'/p'/
ㅅ	alveolar			ㅅ/s/	ㅆ/tʃ/	ㅆ ^h /tʃ ^h /	ㅆ'/s'/, ㅆ'/tʃ'/
ㅇ	velar	ㅇ/ŋ/				ㅎ/h/	

Similarly to vowels, the consonant system also features some level of compositionality. An extra horizontal stroke on an obstruent letter denotes aspiration. For example, the symbol ㅋ which is a composition of the basic letter ㄱ augmented by a horizontal stroke, represents the aspirated velar stop /k^h/. The symbol ㄴ represents alveolar nasal /n/ and has no aspirated counterpart. However, ㄴ with additional stroke, ㄷ stands for /t/. Then with one more additional stroke to ㄷ, the symbol ㅌ stands for an aspirated /t^h/. Similar to ㄴ, the symbol ㅅ representing alveolar fricative /s/, and has no aspirated counterpart. However, ㅅ with an additional stroke ㅆ creates /tʃ/ and which does have an aspirated pair. Similarly to previous examples, the aspirated sound ㅆ^h/tʃ^h/ is created by adding a stroke to the non-aspirated symbol ㅆ/tʃ/. The symbol ㅁ represents bilabial nasal /m/ and no aspirated counterpart. However, ㅁ with additional stroke ㅂ stands for /p/ and then with one more additional stroke, the symbol ㅅㅂ stands for /p^h/.

The symbol ㅇ which mimics the shape of throat, shows a complex behavior. If it is in the onset position it represents zero, that is, no sound (cf. Table 5a). In coda position it is pronounced as velar nasal /ŋ/ (cf. Table 5b). Its derivative letter ㅎ is created by adding strokes onto symbol ㅇ. In onset position the symbol ㅎ stands for /h/. In coda position, if followed by a vowel, it is not pronounced (cf. Table 5c). As a coda, if ㅎ/h/ is word final or followed by a consonant, it is pronounced as /t/ (cf. Table 5d). In the special case, if ㅎ/h/ is followed by a plain obstruent which has aspirated counterpart, the aspirated counterpart is pronounced (cf. Table 5e).

Table 5 Pronunciations of the symbol ㅇ and ㅎ

	<i>consonant</i>	<i>Hangul</i>	<i>pronunciation</i>	<i>meaning</i>
(a)	with initial 'ㅇ'	아이스	/aɪsɪ/	<i>ice</i>
(b)	with final 'ㅇ'	쇼핑	/ʃop ^h ɪŋ/	<i>shopping</i>
(c)	intervocalic 'ㅎ'	좋아요	/tʃoajo/	<i>good</i>
(d)	pre-consonantal 'ㅎ'	놓는	/nannɪn/ ¹⁴	<i>laying</i>
(e)	pre-obstruent 'ㅎ'	좋다	/tʃot ^h a/	<i>good</i>

Another example for compositionality and a certain extent to sound symbolism is the doubling of consonants ㄲ, ㄸ, ㅂㅂ, ㅆㅆ. The doubled representations denote tense consonants, which tend to be pronounced as long in intervocalic position. This practice, representing long

¹⁴ Under Korean regressive assimilation, /t/ followed by /n/ becomes /n/.

segments by doubling spelling, is comparable with the doubling of consonant letters to denote geminates in certain European languages (cf. Italian *fato* 'fate' <-> *fatto* 'done').

2.2.1.3. Syllables

In Hangul, phonemic letters are organized into syllable units. One syllable unit is written as a combination of consonants and vowel characters.

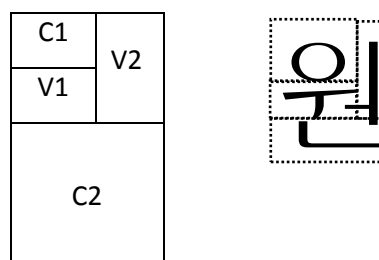


Figure 11 Syllable unit of Hangul

As Korean phonotactics permits onset and coda consonants, one Hangul syllable can accommodate two consonants (C1 and C2). The C1 slot in top left of the orthographic unit represents an optimal onset consonant. When there is no onset consonant, the C1 spot is occupied by the symbol ㅇ representing no pronunciation (cf. Table 5a). The C2 slot in the bottom is for the coda consonant. When the syllable does not have coda consonant, this slot is left empty. The symbol ㅇ in this position represents the velar nasal /ŋ/ (cf. Table 5b).

If the V1 slot in the middle left is present, it expresses the first part of an opening diphthong. This spot can only be occupied by horizontal vowels; ㅏ, ㅑ, ㅓ. The V2 spot can only accommodate vertical vowels (e.g., ㅗ, ㅛ, ㅜ, ㅠ, ㅡ). There are constraints about the possible combination of V1 and V2 vowels. For example, V1 ㅏ cannot be combined with ㅗ or its derivatives: ㅑ, ㅓ. V1 ㅑ cannot be combined with ㅗ or its derivatives: ㅓ, ㅕ. V1 ㅓ can only be combined with ㅗ.

Table 6 Combination of two vowels- diphthongs

ㅏ affiliated diphthongs	ㅑㅗ	ㅑㅛ	ㅑㅓ
ㅑ affiliated diphthongs	ㅓㅗ	ㅓㅛ	ㅓㅓ
ㅓ affiliated diphthongs		ㅕㅗ	

2.2.2. Contemporary Korean

2.2.2.1. Vowel inventory

According to traditional grammar books, Korean has 10 short vowels and 11 diphthongs.

Table below 7 shows Korean vowel inventory.

Table 7 Korean vowels in Korean grammar book (According to Pronunciation of Standard Korean 1988)

<i>short</i>	ㅏ	ㅓ	ㅣ	ㅡ	ㅜ		ㅗ		ㅝ	ㅞ	ㅟ	ㅠ
<i>vowels</i>	a	ə	i	ɪ	u		o		e	ɛ	ø	ɣ
<i>diphthongs</i>	ㅑ	ㅓ		ㅕ	ㅠ		ㅟ		ㅝ	ㅞ		
	ya	yə		hi	yu		yo		ye	yɛ		
				ㅗ	ㅟ		ㅟ					
				wə			wa					
				ㅝ			ㅞ					
				we			wɛ					

Actually the exact number of short vowels is subject to debate (Table 8). It is controversial how many short vowels exist in Korean. The numbers of Korean short vowels vary depending on references. A 10-vowel system is supported by Huh W. (1965) and Lee H. Y. (1996) including [a, ə, i, ɪ, u, o, e, ɛ, ø, ɣ]. A nine vowel system is supported by Choi H. B. (1937) and Martin (1954) excluding [ɣ] from the previously mentioned 10-vowel inventory. In contemporary Korean the front rounded [ø] and [ɣ] are pronounced as diphthongs [we] and [wi] respectively. This diphthongization had started around the 1950s. According to the analysis of spoken corpus from the 1950s to the 2000s (Chung M. S. 2002), [ø] and [ɣ] were pronounced as diphthongs [we] and [wi] at 44.4% and 58.6% of the total utterances in 2000. With this diphthongization, diphthong [we], the counterpart of short vowels [ø] showed its allophone [ø] in 60% of cases in 2000s. Therefore, some studies including Oh J. R. (1993) insist that Korean has only eight short vowels [a, ə, i, ɪ, u, o, e, ɛ].

As for mid vowels, in contemporary Korean, the front vowels /e/ and /ɛ/ merged into [e] (Hong Y. 1988, Ahn S. C. 1998, Pae J. C. 2006, Shin J. Y. 2006, Cha J. E. 2007, Ahn Byung Sup. 2010). The height difference between /ɛ/ and /e/ has been neutralized in contemporary Korean, graphemes with double vertical lines, ㅝ, ㅞ, are both pronounced as /e/. Hence, It is generally accepted among recent researches that standard Korean has as seven vowels: [a, e, i, o, u, ʌ, ɪ] (Chung M. S. 2002, Pae J. C. 2006, Shin J. Y. 2006, Cha J.E. 2007).

Table 8 Korean vowel inventory

	vowel inventory	references
10 vowel system	a, ə, i, ɪ, u, o, e, ε, ø, ʏ	Huh W. (1965) , Lee H. Y. (1996)
9 vowel system	a, ə, i, ɪ, u, o, e, ε, ø	Choi H. B. (1937) , Martin (1954)
8 vowel system	a, ə, i, ɪ, u, o, e, ε	Kim C. W. (1999), Oh J. R. (1993),
7 vowel system	a, ə, i, ɪ, u, o, e	Chung M. S. (2002), Pae J. C. (2006), Shin J. Y. (2006), Cha J.E. (2007)

2.2.2.2. Vowel length contrast in Korean

In traditional grammar books, vowel length is considered to be distinctive in Korean (Choi H. B. 1937, Martin 1954, Huh 1965, Lee H. B. 1989). However, contemporary Korean has no vowel length contrast (Magen & Blumstein 1993). Since 1960s, it has been reported that Koreans from younger generation cannot distinguish between short and long vowels (Hong Y. 1988 among others). According to Chung M. S. and Hwang K. C. (2000) vowel length contrast has not completely disappeared but it is an ongoing process. In fact, many Koreans from the younger generation (younger than 45) perceptually cannot distinguish between short and long vowels despite the fact that they tend to pronounce the two groups with a difference in duration (Park G. R. 1993).

Table 9 Vowel length contrast Park G. R. (1993:72)

<i>age</i>	<i>perceptual discrimination rate</i>	<i>articulatory discrimination rate</i>
80-	95.8	100
70-	94.4	100
60-	68.8	89.6
50-	19.3	93.2
40-	8.0	77.3
30-	6.9	62.5
20-	2.8	58.3
10-	0.6	46.9

Drawing a conclusion from recent studies, it can be summarized that contemporary Korean has seven short vowels ([a, ə, ɪ, ɪ, u, o, e]) and no vowel contrast in length.

2.2.3. The Romanization of Hangul

For the analysis on Korean loanword in later chapter, it is necessary to be clear about Romanization of Hangul in this thesis. This subsection will summarize standard Korean Romanization and present the phonetic transcription which this thesis debates the Korean loanword in conformity with.

The first attempts to Romanize Korean were devised by western missionaries. The efforts by Western scholars to develop a system that is based on the Roman alphabet have been continuing up until modern times with variable rates of success. The two most successful Romanization system devised by non-Koreans are the McCune-Reischauer and the Yale system. Not only westerners but also the Koreans felt the need for a Romanization system. Based on the cooperation of Korean phonologists, a committee called “Korean Language Society” was formulated, which managed to harmonize various views and issued a recommendation on the Romanization of Hangul (1940). This highest level of recommendation was revised by the ministry of education in 1948, 1959 and in 1984. The most recent revision of the Romanization system was conducted by the Ministry of Culture in 2000.

2.2.3.1. Vowels

The Table 10 summarizes the inventory of Korean vowels in Romanization.

Table 10 Standard Romanization of Korea vowels 2000

<i>short vowels</i>	<i>simple stroke</i>	ㅏ	ㅑ	ㅓ	ㅕ	ㅡ	ㅣ	ㅗ	ㅛ
		a	eo	o	u	eu	i	ae	e
<i>diphthongs</i>	<i>double stroke</i>	ㅗㅓ	ㅑㅓ	ㅓㅕ	ㅕㅕ			ㅗㅗ	ㅑㅗ
		ya	yeo	yo	yu			yae	ye
	<i>complex vowel (V1+V2; Table 6)</i>	ㅗㅑ	ㅑㅓ				ㅓㅣ	ㅑㅗ	ㅑㅓ
		wa	wo				oe	wae	we
							ㅓㅣ		
							ui		

Since Korean has more vowel graphemes than the Roman alphabet does (i.e., a, e, i, o, u), a combination of Roman vowel letters, so called digraphs, are used to cover the whole Korean

inventory. While the use of digraphs to denote glide-vowel sequences is straightforward, they also have to be utilized to cover Korean monophthong vowels. In these cases (i.e., eo, eu, ae), the vowel used in the transliteration has special meaning. For example, ‘e’ as a first component of digraph ‘eo’ and ‘eu’ refers to central position of the vowel. Hangul ‘ㅡ/ɨ/’ is transliterated as ‘eu’ expressing the fact that it is a centralized /u/ sound. Hangul ‘ㅓ/ə/’ is transliterated as ‘eo’ which can be phonetically interpreted as a centralized ㅓ/o/. Hangul ‘ㅕ’ is transliterated as ‘ae’ expressing the original pronunciation of this vowel is between /a/ and /e/, that is /e/ with lower tongue height.

It can be seen that this standard Romanization system is based on the Korean alphabet, Hangul, rather than on the actual phonetic forms of the words. The system was designed intentionally to preserve the orthographic contrasts in Korean. For example, in the contemporary pronunciation of Korean all of the following vowel graphemes ㅓ, ㅕ, and ㅛ are all pronounced as /we/. Under current Romanization practices they are transcribed as ‘oe’, ‘wae’, and ‘we’ respectively. Further cases exemplifying for this concept are listed in (27). While the pronunciation of ㅓ in (a)외국, 왜 in (b)왜 and ㅛ in (c)스웨덴 are all pronounced as /we/, their standard Romanization differ; ‘oe’, ‘wae’ and ‘we’, respectively.

(27)	Hangul	Standard Korean Romanization	Pronunciation	meaning
(a)	외국	oeguk	/weguk/	‘foreign’
(b)	왜	wae	/we/	‘why’
(c)	스웨덴	seuweden	/siweden/	‘Sweden’

This thesis adopts the phonetic transcription summarized in Table 11 over Korean Standard Romanization for that Korean Standard Romanization is faithful to Korean orthography than Korean pronunciation. In later section, all Hangul vowel characters will be transliterated in conformity with Table 11.

Table 11 Phonetic transcription of Korean vowels

Hangul	ㅏ	ㅓ, ㅕ	ㅗ	ㅜ	ㅡ	ㅣ
IPA	a	e	ə	o	u	ɨ

2.2.3.2. Consonants

Korean has a three way plain-aspirated-tense distinction, which is apparent in the native writing system. Table 12 below displays the Romanization of the Korean consonants.

Table 12 Romanization of Korean consonants

<i>Hangul</i>	ㅇ	ㄱ	ㄴ	ㄷ	ㄹ	ㅁ	ㅂ	ㅅ	ㅈ	ㅊ	ㅋ	ㅌ	ㅍ	ㅎ
<i>Korean Standard Romanization 2000</i>	ng	g	n	d	r	m	b	s	j	ch	k	t	p	h
<i>phonetic transcription</i>	ŋ	k	n	t	r	m	p	s	ch	ch ^h	k ^h	t ^h	p ^h	h

As noted above, the standard Romanization is based on the writing system, which means that the same mapping rules are used leaving actual pronunciation out of consideration. In general, letters for voiced consonants ('b, d, g, j') in Roman Alphabet are adapted in the Korean standard Romanization to denote not the phonetically voiced, but phonemically plain series of obstruent. For example, the Korean word 방 (meaning *room*) is transliterated as /bang/ in Korean. The same orthographic unit 방 in 가방 (meaning *bag*) is also transliterated as /bang/ in Korean Romanization, irrespective of the fact that the actual pronunciation of 방 (meaning *room*) is /paŋ/, as Korean does not have voiced obstruent in word initial positions (28).

(28)	<i>Korean Romanization</i>	<i>phonetic transcription</i>	<i>meaning</i>
방	bang	paŋ	'room'
가방	gabang	kabaŋ	'bag'

Korean Romanization utilizes a three way contrast in obstruent by using as letters of voiced consonants, voiceless consonants, and doubled voiceless consonants for geminates. For example, native Korean word 달 with a plain stop in the onset position is transliterated as /dal/, the aspirated stop in 탈 is transliterated as /tal/, and 딸 with a geminate consonant is transliterated as /ttal/.

(29)	<i>Hangul</i>	<i>phonetic transcription</i>	<i>Korean Romanization</i>	<i>meaning</i>
	달	/tal/	/dal/	‘moon’
	탈	/t ^h al/	/tal/	‘mask’
	딸	/t’al/	/ttal/	‘daughter’
	글	/kil/	/geul/	‘sentence’
	굴	/kul/	/gul/	‘turnel’
	고기	/kogi/	/gogi/	‘meat’
	거기	/kægi/	/geogi/	‘there’

Since this thesis is concerned with both pronunciation and orthography of Korean, it is necessary to dealing with Korean loanwords keep orthography and pronunciation separately. Therefore, through this thesis phonetic transcription is being used for the pronunciation of the Korean loanwords (Table 13).

Table 13 Phonetic transcription of Korean consonants

Hangul	ㄱ	ㄴ	ㄷ	ㄹ	ㅁ	ㅂ	ㅅ	ㅈ	ㅇ ¹⁵	ㅎ
IPA	k	n	t	r	m	p	s	tʃ	ŋ	h
Hangul	ㅋ	ㆁ	ㄷᄇ	ㄹᄇ	ㅁᄇ	ㅂᄇ	ㅅᄇ	ㅈᄇ	ㅇᄇ	
IPA	k ^h	k’	t ^h	t’	p ^h	p’	s’	tʃ ^h	tʃ’	

For the aspirated and tense consonants, diacritics will be used such as /k^h/, /k’/. In this thesis, Korean vowels are transcribed in IPA in the way they are pronounced. Therefore, plain obstruent is sometimes transcribed with voiced, sometimes with voiceless consonants. For example, 다 in 다리미 is transcribed as /ta/ in this thesis, since plain /t/ in this position is voiceless. However, 다 in 바다 is transcribed as /da/ in this thesis, since plain /t/ in intervocalic position becomes voiced.

¹⁵ The grapheme ‘ㅇ’ represents no sound in onset position, [ŋ] in coda position.

Table 14 Phonetic transcription of Korean plain consonants

<i>Hangul</i>	<i>Korean Standard Romanization</i>	<i>in this thesis</i>	<i>meaning</i>
다리미	darimi	tarimi	iron
바다	bada	pada	sea

In following 2.3., Korean perception of English vowels reviewed based on previous studies on this topic, with Korean phonetic transcription presented in Table 11 and 13.

2.3. How Korean perceives English vowels

2.3.1. Korean and English vowel system

This section summarizes Korean speakers' perception of English vowels with special attention to the difficulties Korean learners of English experience when acquiring English vowels. First of all let us have a look into Korean vowel inventory in comparison with the English vowel inventory. Figure 12 (from Kim C. W. 1999)¹⁶ displays Korean vowels in the vowel space using both phonetic symbols and Hangul vowel graphemes. As shown in the vowel chart, Korean has seven short vowels, which are distinguished by contrast in backness and vowel height. It is also important to note that while mid-close and mid-open front vowels have separate graphemes, ㅐ and ㅓ , the contrast has been neutralized into /e/ in contemporary Korean (See 2.4.2.). The vowel space in Figure 13 presents the English vowel inventory based on Ladefoged (2006).

In English there are 11 monophthongs, featuring a distinction between tense and lax vowels. Tense vowels differ from their lax counterparts both in quality and duration (Peterson & Barney 1952, Hillenbrand et al. 1995). For example, the high tense vowels, [i] and [u], are longer than the high lax vowels, [ɪ] and [ʊ]. There are strict constraints on the positions where short vowels can occur. For example, lax vowels cannot occur in word finally.

¹⁶ Kim C. W. 1999 used [ɛ] for Korean ㅐ . But we scrub it out for the merger of ㅐ and ㅓ , both contemporary pronounced as [e].

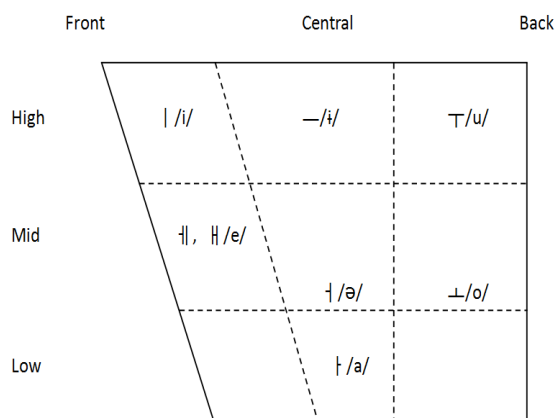
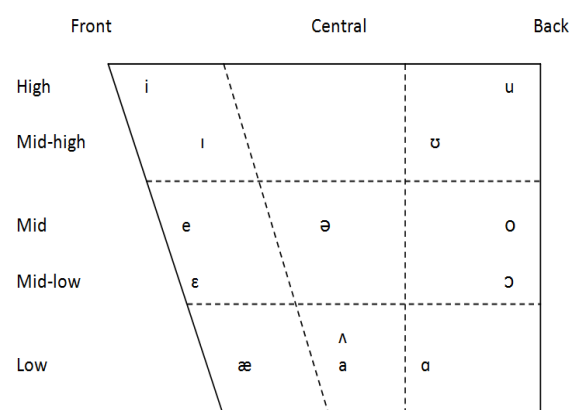


Figure 12 Korean vowel chart

Figure 13 English vowel chart¹⁷

Comparing the Korean and English vowel systems, it can be seen that the highest region of the vowel space is more crowded in the Korean system, while lower regions are more densely populated in the English inventory. As for high vowels, Korean has three high vowels /i ɨ u/ while English has only two [i] and [u]. In case of low vowels, Korean has one low vowel /a/ while English has four [æ, a, ʌ, ɑ]. These differences are illustrated in Figure 14 and Figure 15.

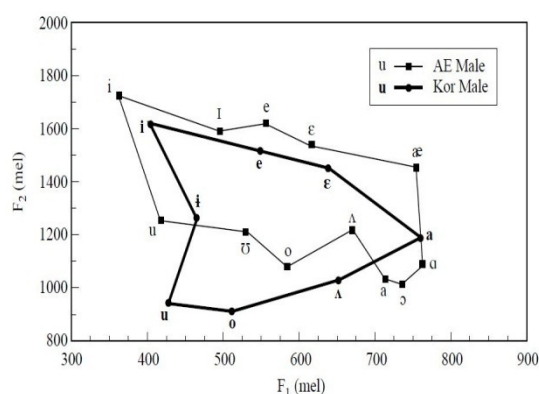


Figure 14 vowel spaces of American English and Korean male speakers

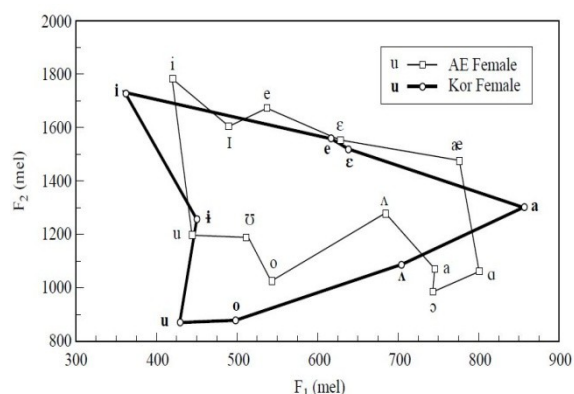


Figure 15 vowel spaces of American English and Korean female speakers

Yang (1996) carried out articulatory experiments upon which the analysis is based using both Korean and English participants. In these experiments, native English speakers pronounced American English vowels in the context of /h_d/. Thirteen vowels from American English /æ, a, ɔ, e, ɛ,

¹⁷ The vowels /e, a, o/ can occur only as first elements of diphthongs (Ladefoged 2006).

¹⁸ Superimposed F1/F2(in mel) vowel spaces of American English and Korean speakers normalized. Phonetic symbols are given near the formant position (From Yang 1996).

i, æ, ɪ, a, o, u, ʌ, ʊ/ were investigated through such target words as *had, hard, hawed, hayed, head, heed, herd, hid, hod, hoed, who'd, Hudd* and *hood*. As for Korean vowels, the eight vowels of Standard Korean, namely /a, ɛ, e, i, o, u, ʌ, ɨ/¹⁹, were pronounced by Korean speakers in a similar /h_d/ context: /hada/, /hɛda/, /hida/, /hoda/, /huda/, /hʌda/, and /hɨda/. Participants read each word from a printed word list at a normal speech rate. Formant values were automatically computed by a spectral analysis tool, and revised manually using audio and visual spectral information.

According to Yang (1996) Korean vowels were substantially shorter than American English vowels. Korean vowel space appears to have a wedge-shape with /i, a, u/ vowel at the corners. In contrast, the American English vowel space looks more rectangular with /i, u, æ, a/ at the corners.

Table 15 below summarizes English-Korean vowel correspondence rules based on phonetic proximity as proposed by Lee and An (1996). Lee and An (1996) is a handbook for the current spelling system of Hangul, which deals with Korean Romanization and explains Hangul orthography for loanwords with attention to the source languages.

Table 15 Correspondence between English and Korean vowels from Lee and An (1996)

English	[a],[ɑ],[ɒ]	[i], [ɪ]	[ɜ],[ʌ],[ə]	[e], [ɛ]	[æ]	[ʊ], [u]	[o],[ɔ]	
Korean	ㅏ /a/	ㅣ /i/	ㅓ /ə/	ㅔ /e/	ㅕ /e/	ㅗ /u/	ㅛ /o/	ㅡ /i/

Since English has more vowels in its inventory than Korean, as we can see from Table 15, English vowels are neutralized in Korean in many cases during the borrowing process. Table 16 represents a list of rough phonetic equivalencies between English and Korean vowels. The Table 16 is organized around the 11 monophthongs in English, and gives examples from both languages.

In English there are two front high vowels, the tense [i] as in *heat*, and the lax [ɪ] as in *hit*. Korean lacks the tense-lax contrast; it has only a single front high vowel /i/, as in 김치 /kimtʃʰi/. This Korean front high vowel corresponds to both tense and lax high front vowels in English. As for non-high front vowels, English has the mid vowel [ɛ] and close-open vowel [æ], as in *head* and *hat*, respectively. Contemporary Korean, has only one non-high front vowel, the mid vowel /e/, as in 찌개 /tʃʰige/. This Korean mid vowel corresponds to English [ɛ] and [æ]. Another case of neutralization takes place in the central low region of the vowel space. While English has [ɑ] as in *heart* and [ʌ] as in *hut* in this region, Korean has only a single low central vowel: /a/ (as in 삼계탕 /samgetʰaŋ/). A similar case for neutralization is the central mid region. While English has [ɜ] and the schwa, Korean has only /ə/ as in 서울 /səul/ here. The longer English [ɜ:] also converts into Korean

¹⁹ It is generally accepted among recent researches that standard Korean has as seven vowels: /a, e, i, o, u, ʌ, ɨ/ (Chung M. S. 2002, Pae J. C. 2006, Shin J. Y. 2006, Cha Jae Eun. 2007).

/ə/. As for the mid back vowels, English has [ɔ] in *haw*, while Korean has /o/ in *불고기* /pulɡogi/. For the central high vowel, Korean has /ɨ/ in *스시* /sɨsi/, but English has none. For the high back vowels, English has tense [u] and lax [ʊ] in *hoot* and *hood*. Since Korean has no tense and lax contrast, these vowels go to Korean /u/ as in *우동* /udon/.

Table 16 Short vowels of English and Korean with example words

	English words			Korean words			
	pronunciation	example words		/pronunciation/ & Hangul character	Hangul	pronunciation	meaning
high front vowel	i	heed	heat				
	ɪ	hid	hit	/i/ ㅣ	김치	kimtʃʰi	Kimchi
non high vowel	ɛ	head					
	æ	had	hat	/e/ 에 / 해	찌개	tʃʰige	Korean soup
low vowel	ɑ	hod	hard heart				
	ʌ	Hudd	hut	/a/ 아	삼계탕	samget ^h an	chicken soup
mid central vowel	ɜ	herd					
	ə	sofa	soda arise	/ə/ 어	서울	səul	Seoul
mid back vowel							
	ɔ	haw		/o/ 오	불고기	pulɡogi	grilled beef
high back vowel	u	who	hoot	/u/ 우	우동	udon	Udong
	ʊ	hood	could	/ɨ/ 으	스시	sɨʃi	Sushi

Later in this section along with other sections involved in this thesis will analyze vowel selection in Korean loanwords. The analysis will be brought on according to vowel height for referential convenience. In this subsection, literature on Korean perception of English also will be reviewed according to vowel height.

2.3.2. High vowels [i], [ɪ], [u], [ʊ]

English has a tense versus lax contrast in its vowel system. Two pairs of this contrast are [i] versus [ɪ] as in *beat* versus *bit*, and [u] versus [ʊ] as in *boot* versus *foot*. Tense and lax contrast in English was brought upon by the Great Vowel Shift. The contrast was historically a length difference, but now the differences involve the coloring of vowels as well. Tense vowels are longer, and higher in pitch than lax vowels (Fry 1955). Lax vowels, on the other hand, are relatively more centralized (Ladefoged 2006).

There are different constraints on the positions where tense and lax vowels can occur. Lax vowels, for example, can only occur in closed syllables (i.e., (C)VC). In contrast, tense vowels have a greater distribution, they can occur word-finally in both open syllables and in closed syllables (Celce-Murcia et al. 1996). Sometimes orthography provides hints about the tenseness of a vowel (Dickerson 1989). For example, tense vowels are often spelled with a silent letter ‘e’ at the end of the word. For example in the words: *hate*, *Pete*, *kite*, *hope*, all of the underlined vowels are tense. Lax vowels usually end on a consonant – hence, spelled without silent ‘e’ (e.g., *hat*, *pet*, *kit*, *hop*).

Korean lacks the tense versus lax contrast in its vowel system. Traditionally Korean used to have a distinction between phonemically long and short vowels (e.g., /kil/ ‘road’ vs. /ki:l/ ‘long’), with long vowels generally more peripheral in the vowel space (Lee H. B. & Zhi M. J. 1987). However, in contemporary Korean this vowel length contrast is lost (Magen & Blumstein 1993). According to Park (1993), many Koreans from the younger generation perceptually cannot distinguish between short and long vowels – despite the fact that they do tend to pronounce the two groups with a difference in vowel duration.

Many English-Korean dictionaries transcribe the contrast in the pronunciation of English tense and lax vowels as a difference in vowel duration (e.g., *heed* [hi:d] versus *hid* [hid]; *who’d* [hu:d] versus *hood* [hud]) (Lee JiYeon 2009, Kim D. W. 2003). In accordance with this phonetic description in dictionaries, Korean students are taught to produce vowel /ɪ/ by pronouncing it like a shorter /i/ sound. Likewise, they learn to produce lax /ʊ/ by pronouncing a short /u/ sound (Kim 2004, Kim D. W. 2003). However, the English tense versus lax contrast is not a mere durational difference. Furthermore, even if duration is involved, Koreans are in a process of losing vowel length contrast in their mother tongue. As a matter of the fact, it has been pointed out by several experiments that Korean speakers cannot make a clear quality distinction within English tense and lax high vowel pairs (i.e., /i/-/ɪ/ and /u/-/ʊ/) in pronunciation (Koo H. S. 2000, 2005, Yang 2008, Yun Y. 2005, 2009, 2011).

While Korean speakers do not utilize vowel duration to make distinctions in pronunciation; they do rely on vowel duration in the discrimination of tense and lax vowels. In perception

experiments, stimuli that had been manipulated in duration and in spectral features were presented to Korean and English native speakers (Yun Y. 2009, 2011, Lee J. Y. 2009). Native speaker of English distinguished tense vowels from lax vowels relying on spectral and duration differences. Korean listeners, however, categorized both English [i] and [ɪ] stimuli as Korean ㅣ /i/ when the duration was longer; and both of the stimuli as /ɪ/ when duration was shorter – regardless to the spectral characteristics. Additionally, it has been reported that Korean listeners perceive English [ɪ] as [i] or [ɛ], since English [ɪ] is close to [ɛ] in terms of formant values than other English vowels. Korean English learners tends to perceive [ɪ] as [ɛ] after training of distinguishing English [ɪ] to [i] (Yun Y. 2012).

Later in Chapter 3, we could found the resembling result of perception test performed originally in this thesis. The patterns are quite similar to the data from literatures on Korean perception of English vowels. Also, adaptation patterns in established loanwords of these vowels are analyzed in Chapter 5.

2.3.3. Mid vowels [ɛ], [ə], [ɔ]

English [ɛ] is very similar to Korean ㅔ /ɛ/ in terms of formant values (Jun S. A. & Cowie I. 1994, Yang 1996). However, since in contemporary Korean the front vowels ㅔ /e/ and ㅖ /ɛ/ has merged into /e/ (Hong Y. 1991, Ahn Byung Sup 2010, Pae J. C. 2006, Shin J. Y. 2006, Cha J. E. 2007), the differentiation between English [ɛ] and [e] is also difficult for Korean speakers.

As Robson (1982) reported, Koreans living in the U.S. seems to perceive English [æ] and [ɛ] as [ɛ] quality vowels – disregarding the differences within vowel groups. They conceptualize English [e] is pronounced as wider open mouthed [ɛ] like as Korean ㅔ /e/ and ㅖ /ɛ/. Similarly, Korean speakers conceptualize English [æ] as a version of [ɛ] with a more open pronunciation.

There is another case that reflects Korean perception of English [ɛ]. Kim (1972) in his experiments asked Koreans with little or no knowledge of English to write down the vowels in 60 aurally presented English words using the Korean writing system. English [ɛ] with Korean ㅔ /ɛ/ or ㅖ /e/; and English [æ] also with Korean ㅖ /ɛ/.

Experimental studies on Korean speakers confirm the difficulties associated with perception and production of English [ɛ]. In perceptual tests, Korean speakers could not differentiate between vowel [e] and [æ] (Yun Y. 2003), and between [ɛ] and [æ] (Kim, Ji-Eun 2010). Flege et al. (1997) performed a series of production experiments with native and non-native participants in order to investigate the accuracy of producing English front vowels (i.e., [i, ɪ, e, æ]). Table 17 shows error patterns in the production of front vowels in the pronunciation of Korean speakers.

Pronunciation accuracies were evaluated with respect to target vowels produced by native speakers of English.

Table 17 Patterns of misidentification of front vowels (Flege et al. 1997)

		English Target Vowels				
			/i/	/ɪ/	/ɛ/	/æ/
Korean	Experienced	correct	/i/-60	/ɪ/-92	/ɛ/-81	/æ/-43
		incorrect	/ɪ/-40	/i/-8	/æ/-19	/ɛ/-57
	Inexperienced	correct	/i/-75	/ɪ/-61	/ɛ/-81	/æ/-18
		incorrect	/ɪ/-25	/i/-39	/æ/-19	/ɛ/-82

The overall accuracy rate was the lowest for English [æ] in both experienced and inexperienced groups of Korean speakers. Interestingly, Table 17 shows that not only /æ/ but also English /i/ turns out to be a relatively difficult vowel to pronounce correctly even for the experienced group. This poor result of production of [i] can be assumed to be resulted from that Korean vowel duration is relatively shorter than English vowel (Park H. S. 1997).

As for a central vowel, the English vowel system has a single vowel, [ə]; while the Korean inventory has two vowels, ㅏ /ə/ and /ɪ/. English [ə] is considered to be a reduced vowel, the so called schwa. Partly because Korean is not a stress timed but a syllable-timed language, Korean speakers in general are expected to be bad at perceiving and producing English stress patterns. Interestingly, Korean speakers are relatively good at assigning stress to syllables within English words. However, they often fail to make a distinction in pronunciation between stressed and unstressed vowels in English (Lee O. H. and Kim J. M. 2005). It is a typical problem for Korean speakers that the level of vowel reduction in unstressed syllables is not as significant as with native speakers (Lee, O. H. and Kim J. M. 2005).

The reduced vowel schwa in English is phonetically an extremely variable vowel. Its acoustic realization depends highly on its context (Browman & Goldstein 1992b, Bergem 1994). While full stressed vowels in English seem to be resistant to contextual effects, the reduced vowels are extremely sensitive to phonetic context (Folwer 1981, Magen 1984, Kondo 1995, Bates 1995).

There are two types of reduced vowels in English (Flemming & Johnson 2007). One is the mid central vowel [ə] and the other one is the high central vowel [ɪ]. Vowel [ɪ] is relatively shorter and weaker than [ə], and it also has higher tongue position than [ə]. Native speakers of English make a clear distinction between [ə] and [ɪ] sounds (Shin et al 2011). Mid [ə] is mostly written as 'a' (e.g., soda, sodas), it is longer in duration than [ɪ], and its sound quality is maintained even when it is

followed by suffixes (e.g., *sofa*, *sofas*, *Rosa*, *Rosa's*: see Flemming and Johnson 2007). On the other hand, the high central vowel [ɪ] occurs in unstressed syllables such as in *suggest*, *suspend*, and *compare*, and can take up phonetic values varying across a wide region in the vowel space.

As opposed to English [ə] and [ɪ], Korean ㅏ /ə/ and ㅣ /i/ are two distinct, full-fledged vowels in the Korean vowel inventory. They can occur in any position in a word, and their vowel qualities are relatively invariable in any position (30).

From phonetic description English and Korean have two same mid central vowels in their inventory; [ɪ] and [ə]. However, English [ɪ] and [ə] and Korean /i/ and ㅏ /ə/ significantly differ in their formant values (Shin, Yoon, N. and Yoon, K 2011, Ahn S. W.2000). Thus are not the same in realization.

(30)

	Korean ㅏ /ə/	Korean ㅣ /i/
<i>word initial</i>	언니 /ənni/ 'sister'	음식 /imsik/ 'food'
<i>word medial</i>	무허가 /muhəga/ 'unlicensed'	나그네 /nagine/ 'traveler'
<i>word final</i>	문어 /munə/ 'octopus'	노트 /not ^h i/ 'note'

As for English [ɔ], it is a mid-low back rounded vowel; it does not have a direct Korean equivalent either. As for mid back rounded vowels, Korean has ㅓ /o/, which can be an acceptable substitute for English [ɔ]. It has reported by Cho B. E 2004 that Korean speakers tend to substitute the Korean ㅓ /o/ for English [ɔ]. Another Korean vowel that can be considered to be a phonetically close match for the English open [ɔ] is ㅏ /ə/, as Heo Y. and Kim S.J.(2008:102) that American speakers perceive Korean ㅏ /ə/ as English [ɔ].

Later in chapter 3, by examining the results of the audio perception test, we could confirm how Korean perceives English. Also, adaptation patterns in established loanwords of these vowels are analyzed in 5.3.3. The patterns are rather different to the data reported by previous research. Especially, English [ə] was adapted as Korean ㅏ /ə/ only in 45% of cases, despite that Korean ㅏ /ə/ is a phonetic approximate of English [ə].

2.3.4. Low vowels [æ], [ʌ], [ɑ]

For Korean learners of English, [ɪ] and [æ] are novel vowels which do not exist in Korean (Colhoun & Kim 1976). As already has mentioned above (2.3.2.), Korean learners struggle to perceive

and produce the distinctions between English [ɛ] and [æ] (Bohn & Flege 1990; Flege, Bohn & Jang 1997; Ingram & Park 1997; Koo H. S. 1998; Tsukada et al. 2005; Kang S. H. 2007; Yang 2008). Korean speakers tend to perceive this vowel as Korean ㅓ /e/ (Kim C. W. 1972, Robson 1982, Flege et al. 1997).

English [ʌ] is a low central vowel. Originally it does not have any direct counterpart in the Korean vowel inventory. Korean listeners tend to perceive this vowel as either ㅓ /a/ or ㅚ /ə/. Korean /a/ is a central vowel, but it is lower than English [ʌ]. The difference is not too salient in actual pronunciation, so Korean /a/ is a good candidate for English [ʌ]. Another candidate that is actually in the process of replacing of /a/ is ㅚ /ə/. The realization of the Korean ㅚ /ə/ varies across a wide range in the vowel space depending on dialects and generations. The realization of Korean ㅚ /ə/ includes central [ə], [ə:], high [i] and mid [ʌ]. Obviously, [i] – together with many other variants – is not an optimal substitute for English [ʌ], but younger generations tend to pronounce the Korean phoneme ㅚ /ə/ as [ʌ] making it a near perfect acoustic match for the English sound (Chung M. S. 2002). However, Korean substitution of ㅚ /ə/ for English [ʌ] causes difficulties to differentiate English [ə] from [ʌ] for Korean speakers (Koo H. S. 2000).

As another English low vowel, there is [ɑ]. Korean listeners tend to perceive English [ɑ] as a sound that is similar to Korean /a/. In an experiment carried out by Tsukada et al. (2005), the mean percentage for classifying English [ɑ] as Korean /a/ reached 98%. Nevertheless, English [ɑ] is not the only vowel that can be classified by Koreans as /a/. In Tsukada et al. (2005) English [æ], [ʌ] and [ɛ] were perceived as Korean /a/.

The audio perception experiment in chapter 3 confirms that Koreans are sensitive to perceptual cues during online adaptation of English low vowels. However, adaptation patterns in established loanwords of these vowels (5.3.4.) are rather different from the data reported by previous research and the result of perception test. Especially the vowel selection for English [ɑ] cannot be explained phonetically since Korean ㅓ /o/ is not a phonetic approximate of English [ɑ].

2.3.5. Summary

Korean perception of English vowels based on the results of previous studies is summarized in Table 18. We expect this pattern to be confirmed in the present audio experiment and to offer criteria for phonetic adaptation.

Table 18 Korean perception of English vowels, based on the previous studies

English	[ɑ]	[i]	[ɪ]	[ʌ]	[ə]	[ɔ]	[ɛ]	[æ]	[u]	[ʊ]
Korean	ㅏ /a/	ㅣ /i/	ㅓ /ə/	ㅗ /o/, ㅜ /ə/		ㅜ /e/, ㅡ /e/		ㅓ /u/		

It needs to be remembered that Korean orthographic recommendation (Table 19) can influence loanword adaptation into the Korean language, regardless of faithfulness to the actual perceptions of Korean listeners. Table 19 below, originally appearing as Table 15 in 2.3.1., is reproduced in order to compare it to Table 18. Tables 18 and 19 coincide, except that English [ɔ] is paired with Korean /o/ in Table 19 but with both Korean /o/ and /ə/ in Table 18.

Table 19 Korean loanword orthographic recommendation

English	[a],[ɑ],[ɒ]	[i], [ɪ]	[ɜ],[ʌ],[ə]	[e], [ɛ]	[æ]	[ʊ], [u]	[o],[ɔ]
Korean	ㅏ /a/	ㅣ /i/	ㅓ /ə/	ㅜ /e/ ㅡ /e/	ㅓ /u/	ㅗ /o/	

In the following chapter, Chapter 3, a perception experiment will be executed with audio stimuli. The results will be compared with the patterns in previous studies and in established loanwords as given in Chapter 5. The results of the experiment will also lead us to be able to elaborate criteria for audio adaptation. We will compare these results to those of the visual experiment in Chapter 4 and will discuss which experiment is a better estimator of patterns in established loanwords.

3. Audio experiment

One widely accepted way to explain loanword adaptation, or at least some aspects of it, is to rely on phonetic characteristics of the involved languages. In order to testify the phonetic nature of the adaptation process a perceptual test with a Korean listener was carried out by the author, explained in details in the chapter below. The result of this online adaptation process provides good approximation about how Korean speakers perceive and process the phonetics of English. Interestingly to the current research, the resulting patterns are somewhat different from what we find in established Korean loanwords, implying importance of orthographic factors in the formation of loanwords.

3.1. The participant

There was a single participant in the experiment, a Korean male speaker in his thirties who was born and raised in Seoul. He had no notable experience in a foreign language except regular English course in school. Therefore, it can be presumed that the phonological systems, which the participant had access to, were restricted to his mother tongue and the Universal Grammar.

3.2. Materials

The words used in the experiment are presented in Table 20. Stimuli in Table 20 consisted of English words, which are extracted from “the Investigation of Frequency of Using Modern Korean Words “(2002). The words are selected to include 10 English vowels ([æ], [a], [ə], [i], [ɪ], [ɛ], [ʌ], [ɔ], [u], [ʊ], [aɪ], [aʊ], [eɪ], and [oʊ]) and their orthographic variations (e.g. a, e, i, o, u) in the stimuli. For instance, The English vowel [ə] is written with various kinds of spelling conventions; ‘a’ as in academic, ‘e’ as in academy, ‘i’ as communication, ‘o’ as in curator and so on. Therefore, in this experiment, six English words were used as the stimuli that represent English [ə]; *academic*, *academy*, *communication*, *accordion*, *curator*, *adventure*, and *dribble*.

23 words are used in this experiment, and they are recorded by an American English speaker. He is in his thirties, and he is from California. He has lived in Japan for 1 year at the time of recording, and he was not proficient at Japanese.

Table 20 Exhaustive list of recorded words²⁰

recorded word	extracted CVC	pronunciation	target vowel
ba <u>r</u>	bar	'bæ̃	ɑ
go <u>l</u> f	golf	'gɑ:l̩f	ɑ
alcoho <u>l</u>	hol	ˌhɑ:l̩	ɑ
a <u>cc</u> ent	ac	'æk	æ
a <u>m</u> ateur	am	'æm	æ
aca <u>d</u> emic	cad	kə	ə
acade <u>m</u> y	dem	də	ə
acco <u>r</u> dion	on	jən	ə
commu <u>n</u> ication	nic	nə	ə
dribb <u>l</u> e	ble	bəl	ə
adventu <u>r</u> e	ture	tʃə	ə
acad <u>e</u> mic	dem	'dɛ	ɛ
acc <u>e</u> nt	cen	ˌsɛnt	ɛ
curat <u>o</u> r	tor	tə̃,	ə
academ <u>i</u> c	mic	mɪk	ɪ
a <u>cc</u> elerator	ac	ɪk	ɪ
access <u>o</u> ry	ry	ri	i
barbe <u>q</u> ue	be	bɪ̃,	ɪ
benze <u>n</u> e	zene	ˌzi:n	i
pu <u>s</u> h	push	'pʊʃ	ʊ
loo <u>p</u>	loop	'lu:p	u
commu <u>n</u> ication	mun	ˌmju:	u
dug <u>o</u> ut	dug	'dʌg	ʌ

After recording stimuli were made by extracting CVC from recorded words. For example, from English word *alcohol*, [æɪ], [cəh], [həl] were extracted. As shown in Figure 16, the extracting

²⁰ In the actual experiment, four diphthongs were included as dummies; [aɪ] *advice*, [aʊ] *announce*, [eɪ] *acacia*, [oʊ] *manhole*.

process was executed by referring to spectrogram of the recorded words. This extraction was carried out in order to clarify the pattern between Korean and English vowels in adaptation. If Korean listeners can recognize the stimuli as a whole word, it is possible that not only bottom-up, that is perceptual, but also top-down processes are also triggered. If the auditory stimulus reaches the mental lexicon the responses can be affected by both English and Korean words. The extraction of CVC chunks was carried out in order to avoid such interference with established loanwords and L2 words.

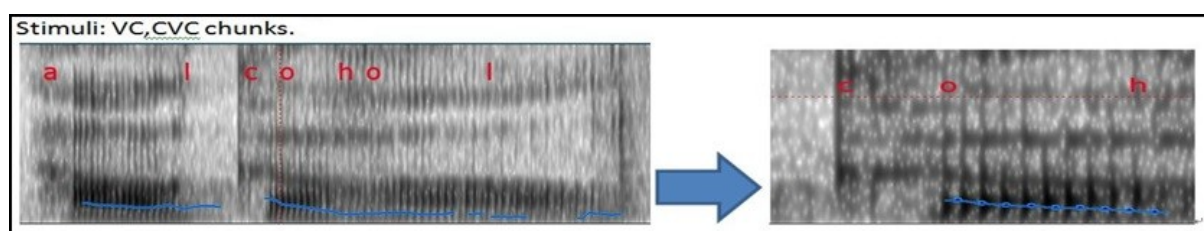


Figure 16 Extracting (C)V(C) from recorded words

Undoubtedly, the extracted audio chunks are not clear in a sense that they carry over characteristics of the surrounding sounds. For example, due to coarticulation, the vowel quality may spread across preceding and following consonants (Liberman 1970: 309). Regarding the experimental conditions, it has been reported that stimuli are perceived more correctly in CVC condition than as isolated vowel stimuli (Strange, Verbrugge, Shankweiler, & Edman 1976, Macchi 1980, Diehl, McCusker, & Cahpman 1981). Also, English vowels have dynamic transitions even in monophthong vowels which are proved to help listeners to collect the correct information about the color of these vowels (Strange, Jenkins, & Johnson 1983, Strange 1987). The current experiment followed this strategy and used CVC as opposed to single V stimuli in order to preserve more vowel cues.

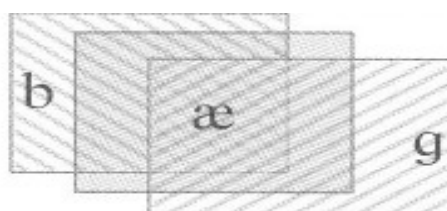


Figure 17 Coarticulation effects in speech signal

Table 20 presents the exhaustive list of words used in the experiment. The target syllables are underlined (see the leftmost column). Some of the polysyllabic words are used multiple times in

the experiments. For example, the word ‘*accent*’ was used twice, once the vowel [æ] was presented as the first syllable of *ac*cent, and once [ɛ] from the second syllable: accent.

The third column of Table 20 displays the spelling of the target syllables. In the word ‘dribble’, the second syllable comprises a syllabic consonant with no vowel letter. These cases were planted in the set in order to investigate how vowels with no corresponding letters are perceived.

3.3. Method

The experiment is performed with a computer program. The participant was directed to listen and choose the phonetic approximate of the audio stimuli among five distracters. A play button was presented in the center of the window, and five distracters were listed in the lower part of the window. Those distracters were Korean vowel characters. The participant could play and listen to the stimuli as many times as he could be sure about his decision. When he still could not be sure about his decision, he could choose NA from the distracters.



Figure 18 User interface used in the experiment

Audio stimuli were presented in VC, CVC or CV forms. For dummy purposes English diphthongs, such as [ai], [au], [ei] and [ou], were included in the experiment. One set of experiment included 23 stimuli, which was repeated twice in random order. The same set of sounds in randomized order was played 13 times, providing 598 responses in total.

3.4. Results

The summary of the responses from the audio experiment is presented in Table 21. The overall tendency by-and-large confirm previous studies (cf. figures in boldface). Out of 598 replies there are 349 replies (58%) that coincide with predictions of previous orthographically oriented studies (Table 18). The difference between the experiment results and previous studies is from the

responses to vowel [ɪ], [u], [ə], [ɔ], and [ɑ]. Those vowels will be discussed in detail, in later subsections. Another difference comes from the existence of NA in the audio experiment. In sum there are 31 NA responses they sharing 5% of all responses. It is suspected that the number of NA responses corresponds to the perceptual difficulties associated with the English vowel. The NA judgments, consequently the perceptual difficulties, follow the order of [ɪ], [ɛ], [ə], [u], and [ʊ].

Table 21 Responses obtained in audio experiment

		ㅏ /a/	ㅣ /i/	ㅓ /u/	ㅗ /ə/	ㅜ /e/	ㅛ /o/	ㅝ /e/	ㅞ /ei/	ㅟ /i/	NA	total
<i>high vowel</i>	ɪ									52 (100%)		52
	ɪ	2 (3%)	6 (8%)					30 (38%)		21 (27%)	19 (24%)	78
	u		8 (15%)	22 (42%)			2 (4%)			18 (35%)	2 (4%)	52
	ʊ			24 (92%)							2 (8%)	26
<i>mid vowel</i>	ɛ			1 (2%)				46 (88%)	1 (2%)	0 (0%)	4 (8%)	52
	ə		48 (26%)	24 (13%)	79 (43%)			6 (3%)		22 (12%)	3 (2%)	182
	ɔ	24 (92%)			2 (8%)							26
<i>low vowel</i>	æ					52 (100%)						52
	ʌ				25 (96%)						1 (4%)	26
	ɑ	26 (50%)			26 (50%)							52
		52	62	71	132	52	2	82	1	113	31	598

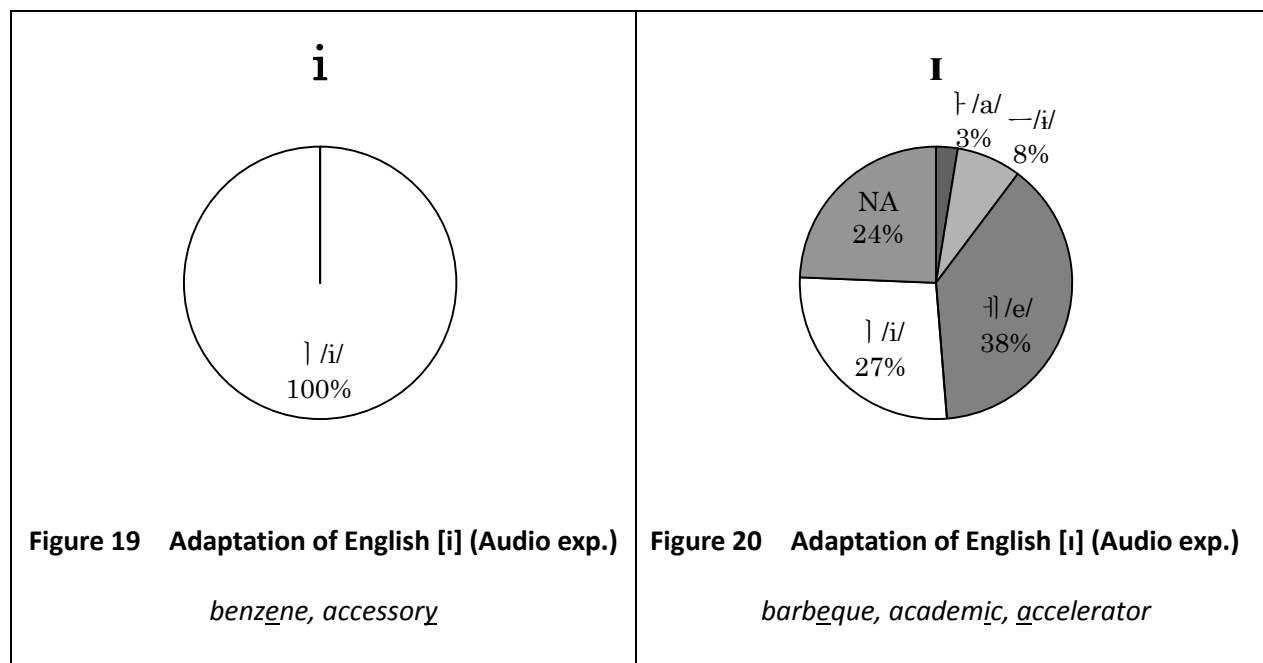
Also, there is notable variation in the type of responses in the audio experiment. In Table 22, the numbers of possible response types are summarized. In average there are 2.2 types of responses for an English vowel. The greatest variations are caused by English [ɪ], [u], and [ə]. All of these vowels are associated with four four kinds of Korean vowels.

Table 22 Numbers of Vowel variations in established loanwords

	<i>high vowel</i>				<i>mid vowel</i>			<i>low vowel</i>			<i>average number</i>
	i	ɪ	u	ʊ	ɛ	ə	ɔ	æ	ʌ	ɑ	
<i>perception test</i>	1	4	4	1	2	4	2	1	1	2	2.2

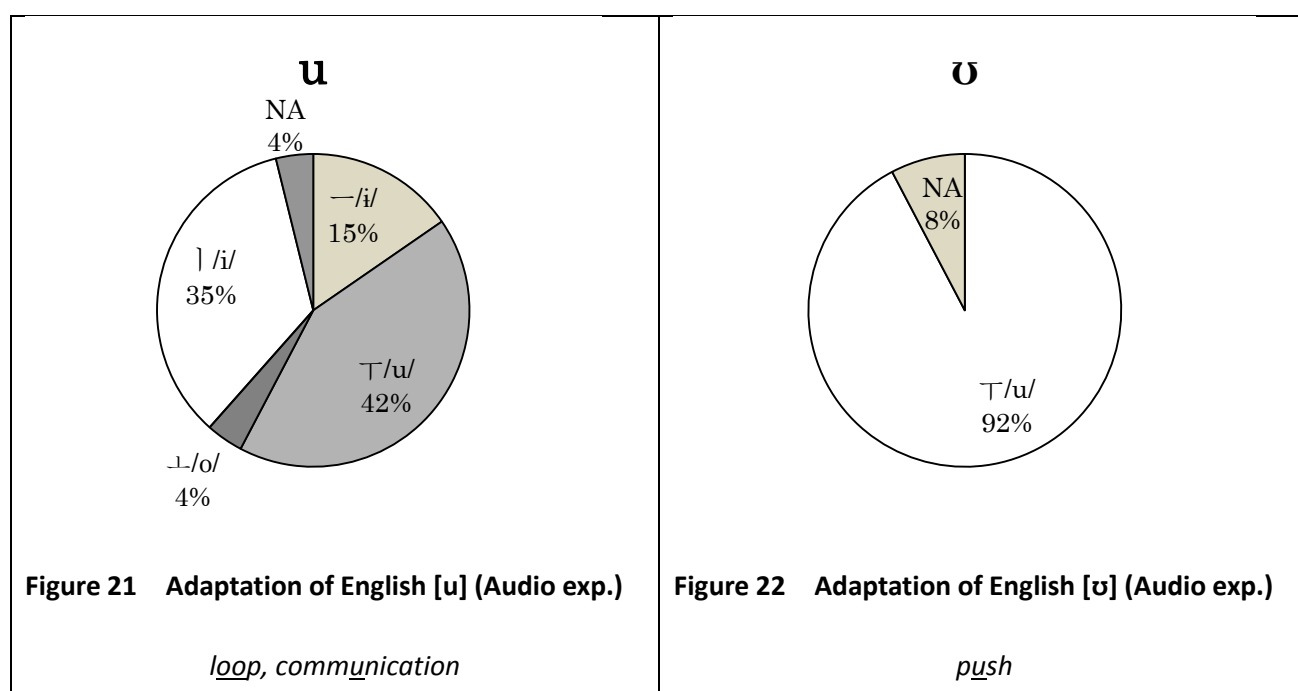
3.4.1. High vowels

Figure 19 and 20 show how English high vowel [i] and [ɪ] were adapted in the perception test. All tense [i] vowels were adapted as Korean ㅣ /i/. This result coincides with the observation done in previous studies claiming that Korean ㅣ /i/ is a phonetic approximate of English [i] (see chapter 2.3.2). On the other hand, responses for English lax [ɪ] varied across four Korean vowels. Despite that the most previous studies confirmed that English /ɪ/ is phonetically similar to Korean ㅣ /i/, the most frequent response for English [ɪ] was /e/ rather than ㅣ /i/. This result coincides with findings of Yun (2012). The second most frequent response was ㅣ /i/ (27%). Note that 24% of the cases correspond to NA responses. For the variations and high rate of NA responses, we can conclude that English /ɪ/ may be a difficult vowel for Koreans to perceptually identify.



There is more variation in response with tense [u] than lax [ʊ] (Figure 21 and 22). According to the previous comparison studies on Korean and English vowels, tense [u] is phonetically similar to

Korean vowel /u/. The result concurred with the literature, which the most frequent response was /u/ (42%). The second frequent response was ㅣ /i/ which shares 35% of the cases. The perceptions of ㅣ /i/ for stimuli [u] were possibly caused by the pronunciation of “*communication*”. The CVC part of the target “*mun*” is pronounced as [mju]. For the acoustics of the stimuli, the participant may be captured by [j] part of [mju] and choose ㅣ /i/ for the responses. The following response was /ɪ/ (15%). Taken together, we can conclude that Korean perceives English /u/ as one of Korean high vowels. However, English lax /ʊ/ was consistently adapted as Korean /u/ (92%), and this result confirms the previous literature.



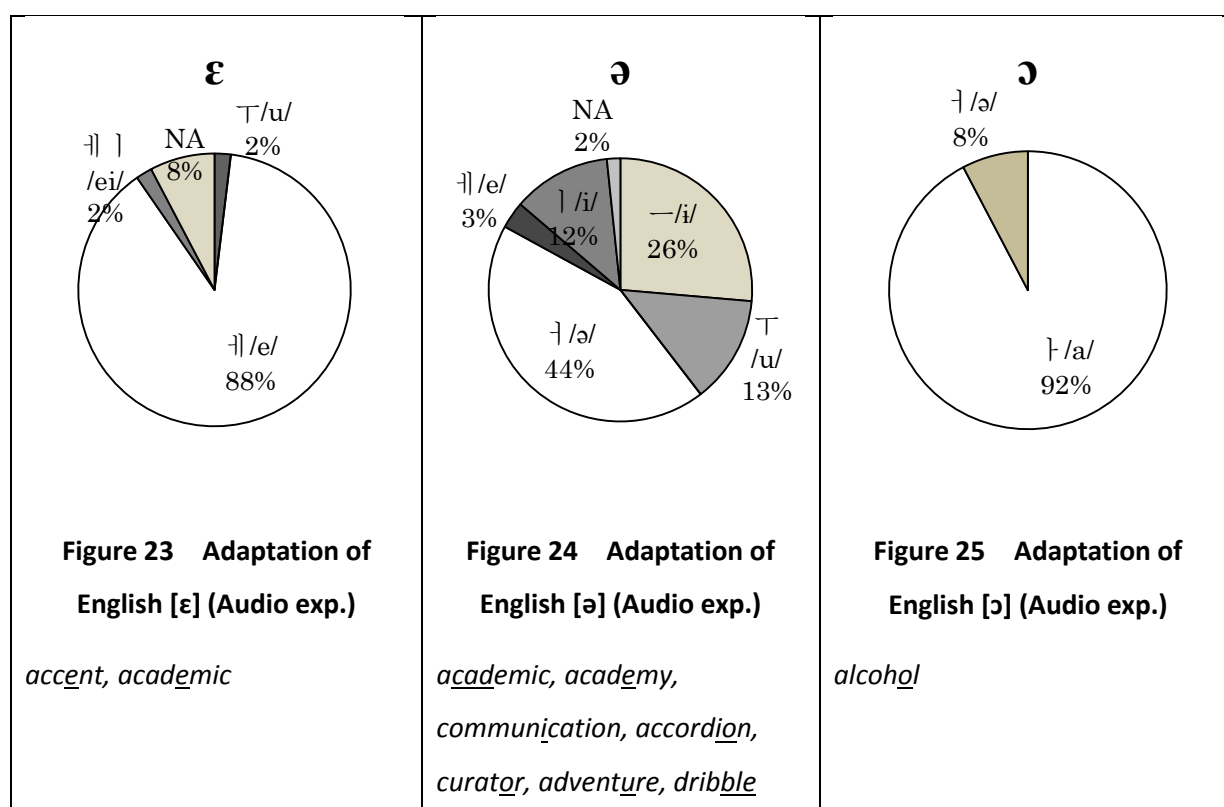
3.4.2. Mid vowels

As stimuli for mid vowels of English, front vowel [ɛ], center vowel [ə] and back vowel [ɔ] were presented in this experiment. As for front mid vowel [ɛ], Korean ㅓ /e/ was the most frequent responses (88%), for that we can see the correspondence between English [ɛ] and Korean ㅓ /e/ as previous studies have already pointed out (See chapter 2.3.3).

On the other hand, responses to the stimuli with vowel [ə] varied in plural vowels in Korean. Although, NA responses were relatively small (2%) in number, we can see that English [ə] is difficult vowel for Korean to distinguish from other vowels. The most frequent vowel is ㅓ /ə/ (44%) which is a phonetic equivalent of English [ə] according to previous studies (See chapter 2.3.3). The second most frequent vowel was /ɪ/ (26%). Adaptation of /ɪ/ is expectable since English [ə] is sometimes

realized as [i] (Flemming & Johnson 2007). For other responses, there were /u/, ɪ /i/ and ɛ /e/ which shares 13%, 12% and 3% of all the cases respectively. This tendency of high vowel responses to English ɪ /ə/ is reasonable because English non-final schwa has dispersed formant value around [i] (Flemming & Johnson 2007).

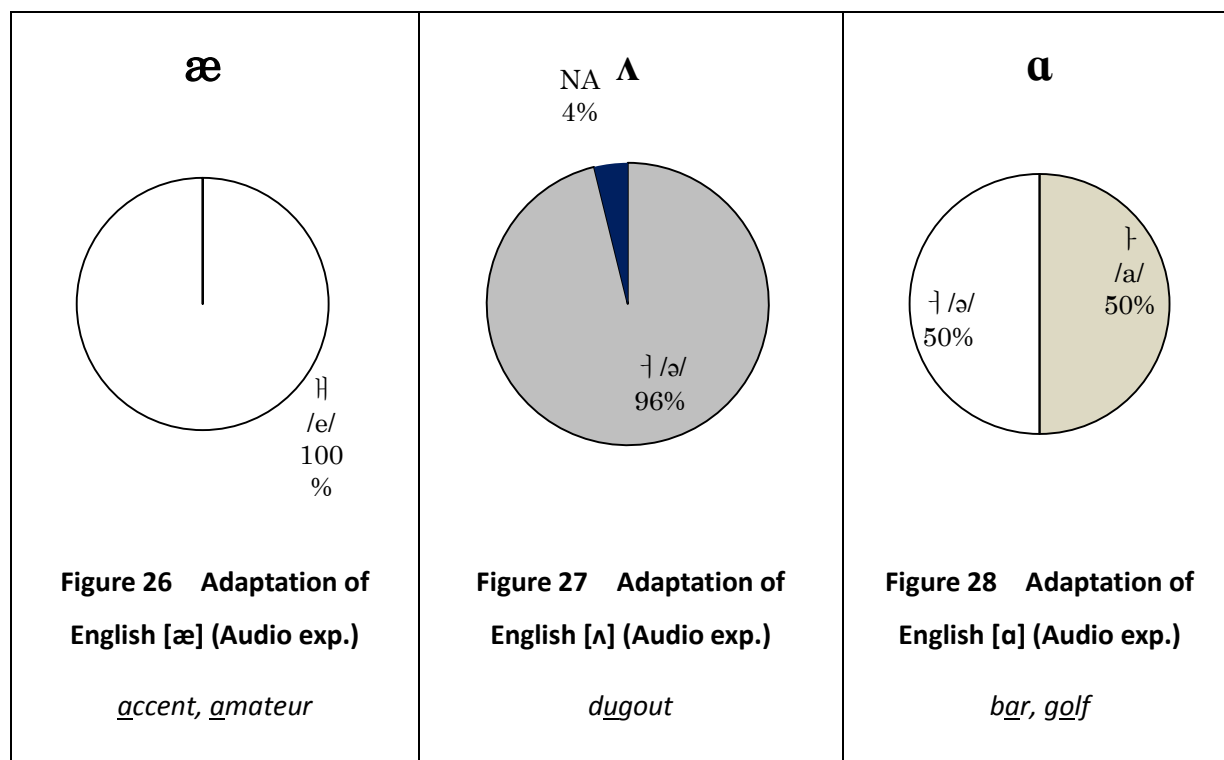
Finally, the responses for back mid vowel [ɔ], there was no NA responses. The most frequent response was /a/ (92%), which has not been reported as a phonetic approximate of English [ɔ] by previous literatures. According to previous studies, phonetic approximate of English [ɔ] in Korean is ㅓ /o/ or ㅓ /ə/. However, in this experiment, there were no /o/ responses and only two responses of ㅓ /ə/ out of all 26 responses (8%).



3.4.3. Low vowels

Now let us look into the group of low vowels. There are three low vowels in English. Firstly, [æ] does not exist in Korean. The responses for the English [æ] were all ㅓ /e/ (100%). As we already seen in the previous section, our Korean participant responded to English [ɛ] with Korean ㅓ /e/. Although Korean orthography distinguishes these two vowels, in reality, these vowels are not differentiated in contemporary Korean pronunciation (see chapter 2.2.). It seems that our participant may not able to identify [æ] from [ɛ].

Secondly, for English [ʌ], most of the adaptation were ㅏ /ə/ (96%) which is a phonetic approximate of English [ʌ] (Chung M. S. 2002). Finally, English back low vowel /ɑ/ also does not exist in Korean. The result shows that the participant heard this vowel as ㅏ /ə/ or /a/. All together, there were three English vowels that can be perceived as Korean /a/ by Korean speakers; [æ], [ʌ], and [ɑ].



3.5. Conclusion

In this chapter, an audio experiment was executed, with a Korean listener as participant. The result shows how this Korean perceives ten English vowels. More than half of the responses (58%) coincide with those of previous studies (Table 18), predominantly those for the five vowels [i], [ʊ], [ʌ], [ɛ] and [æ]. For [i] and [ə], the responses coincide with the previous studies to a lesser degree. Stimuli of [i] were perceived as ㅏ or /e/ in 38% of responses, aligning with the results of Yun Y. (2012). Stimuli of [ə] were generally perceived as high vowels, including —/i/. This result can be explained with reference to Flemming & Johnson (2007).

The remaining three vowels, [ɑ], [ɔ] and [u], showed disagreement with previous studies, with no clear explanation. These discrepancies may be due to the idiosyncratic characteristics of the acoustic stimuli in this experiment. Stimuli for [u] were perceived as /i/ in 35% of cases, stimuli for [ɑ] as ㅏ /ə/ in 50% of cases, and stimuli for [ɔ] as ㅏ /a/ in 92%

Table 23 Korean perception of English vowels: result of audio experiment

English	[i]	[ɪ]		[u]	[ʊ]	[ɛ]
Korean	ㅣ /i/	ㅓ /e/	ㅣ /i/	ㅓ /u/	ㅓ /u/	ㅓ /e/
	100%	38%	27%	42%	92%	88%
[ə]		[ɔ]	[æ]	[ʌ]	[ɑ]	
ㅓ /ə/	ㅡ /ɪ/	ㅓ /a/	ㅓ /e/	ㅓ /ə/	ㅓ /a/	ㅓ /ə/
43%	26%	92%	100%	96%	50%	50%

The vowel correspondences obtained from the audio experiment are summarized in Table 23. This data forms the base for judging adaptation patterns as phonetic in the investigations in later chapters.

4. Visual experiment

A possible, but somewhat less explored cue that can influence the loanword adaptation process is orthographic representation. That is, the spelling of borrowed words. This chapter investigates how our Korean participant adapts English words through written forms. The overall result shows discrepancies with the outcome of the audio experiments. However, interestingly, the results of the visual experiment greatly coincide with the patterns observed in established loanwords. An important difference compared to established loanwords, which is explained in details in chapter 5, is that vowel adaptation patterns show considerably less variation in the visual experiment. The vowel letters are adapted consistently, sometimes even disagreeing with the corresponding phonetic value.

4.1. Participants

The participant in this visual experiment is the same person as in the previous audio experiment in chapter 3. He is a Korean male speaker in his thirties who was born and raised in Seoul. He had no special experience in learning foreign languages except from regular English courses in school.

4.2. Materials

The 23 words used in the experiment are presented in Table 24. These words are identical to the ones that were used in the audio experiment in chapter 3. The target syllables are underlined in the central column of Table 24. Some of the polysyllabic words are used multiple times targeting different syllables within the word. For example, the word ‘*accent*’ was used twice, once targeting the first vowel [æ] (i.e., accent), and once targeting the second vowel [ɛ] in the same word (i.e., accent). Four words with diphthongs were included as dummies in each set. These words are excluded from the final analysis.

The third column of Table 24 displays the spelling of the target syllable. In the word ‘dribble’, the second syllable is made up of a syllabic consonant with no corresponding vowel letter. The final ‘e’ is silent. The presence of this word in the stimuli set is not accidental. It is expected that the response to this syllable will show how a vowel with no corresponding letter is adapted.

Table 24 Words list of visual stimuli

pronunciation of the target syllable	carrier word	target syllable spelling
[æ]	<i><u>a</u>ccent, <u>a</u>mateur</i>	a
[ɑ]	<i><u>b</u>ar</i>	a
	<i><u>g</u>olf</i>	o
[ə]	<i><u>a</u>cademic</i>	a
	<i>acad<u>e</u>my</i>	e
	<i>commu<u>n</u>ication</i>	i
	<i>accor<u>d</u>ion, curat<u>o</u>r</i>	o
	<i>advent<u>u</u>re</i>	u
	<i>dr<u>i</u>bble</i>	no corresponding letter
[i]	<i>benz<u>e</u>ne</i>	e
	<i>accessor<u>y</u></i>	y
[ɪ]	<i>barbe<u>q</u>ue</i>	e
	<i>academ<u>i</u>c</i>	i
	<i><u>a</u>ccelerator</i>	a
[ɛ]	<i>acc<u>e</u>nt, acad<u>e</u>mic</i>	e
[ʌ]	<i><u>d</u>ugout</i>	u
[ɔ]	<i>alcoh<u>o</u>l</i>	o
[u]	<i><u>l</u>oop</i>	oo
	<i>commu<u>n</u>ication</i>	u
[ʊ]	<i><u>p</u>ush</i>	u

4.3. Method

A labeling task was carried out using a computer program (see *figure 29*). The program was initiated by the participant by clicking on its icon on his computer after downloading it. The program sent the responses to a server. The above explained 26 stimuli words – with the target syllables underlined – were presented in a random fashion in the center of the screen. The participant was directed to choose the most similar Korean vowel to the target syllable by clicking on one of the

labeled button in the bottom part of the program window. There were five labeled buttons presented in the bottom. Four of them displayed Korean vowels, and there was one for NA responses. The participant was directed to choose NA when he was in doubt. After selecting a response label, the arrow on the top-right of the window had to be clicked to proceed to the next word.

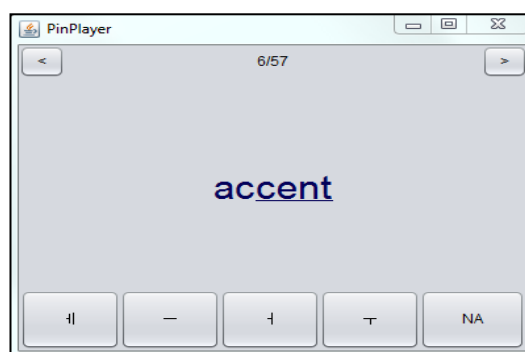


Figure 29 Window display for the visual experiment

One set of the experimental trials consisted of 23 stimuli, presented two times each. In total 13 sets were run resulting in 598 response tokens. In order to prevent saturation effects and automatic memorization of responses, there were 2 or more days left out between experiment runs.

4.4. Results

4.4.1. Overall analysis

The result of the experiment is summarized in Table 25. The table shows the Korean vowels that the participant selected in response to the English vowels. The header row on the top of table displays the response labels of Korean vowels with their pronunciation notated below (e.g. ㅏ /a/). The left-most column represents the vowel of the target syllable (e.g. [æ]). In the right-most column the total number of the stimuli for a single English vowel is showed. Every cell represents the number of Korean vowels given as response to the English vowel stimuli. For example, the English vowel [æ], which is represented right below the header row, invoked the response of Korean vowel ㅏ /a/ 28 times out of 52 trials (54%).

It can be seen in Table 25 that the Korean vowel responses for a single English vowel may vary across several vowels. Monophthongs such as [æ], [a], [ə], [i], and [ɪ] – displayed in the first five rows in Table 25 – show a variety in their responses across two or more Korean vowels. For example, the weak vowel [ə] showed the greatest number variants in terms of of Korean vowels ranging through ㅏ /a/ in 14%, ㅓ /o/ in 1%, ㅗ /e/ in 15%, ㅣ /i/ in 14%, ㅓ /ə/ in 42%, and ㅡ /ɪ/ in 14%.

target vowel	response label (Korean vowel)								total number of the stimuli
	ㅏ /a/	ㅓ /e/	ㅗ /o/	ㅕ /e/	ㅣ /i/	ㅑ /ə/	ㅡ /ɨ/	ㅜ /u/	
[æ]	28 (54%)	24 (46%)							52
[a]	26 (50%)		26 (50%)						52
[ə]	25 (14%)		1 (1%)	28 (15%)	25 (14%)	77 (42%)	26 (14%)		182
[i]				25 (48%)	27 (52%)				52
[ɪ]	26 (33%)			26 (33%)	26 (33%)				78
[ɛ]				26 (100%)					26
[ʌ]						26 (100%)			26
[ɔ]			26 (100%)						26
[u]								52 (100%)	52
[ʊ]								26 (100%)	26

Interestingly, in the visual experiment, unlike in the audio experiment, there were no NA responses. Also, as it can be seen in Table 25, there were fewer variations in the vowel types compared to the audio experiment (cf., 3.5. Table 23). A closer look at the responses reveals that the participant consistently gave the same response for the same stimulus. For example, ‘a’ in *amateur* was always answered as Korean /a/ and ‘a’ in *bar* was always answered as Korean /a/. In the following subsections, the results of the visual experiment are analyzed according to vowel height.

4.4.2. High vowels

There are four high vowels in English: [i], [ɪ], [u], and [ʊ]. Table 26 displays those stimuli words which had high vowels.

Table 26 Stimuli words for high vowels (Visual exp.)

target vowel pronunciation	English Word	Spelling of the target syllable
[i]	ben <u>z</u> ene	e
	ac <u>ce</u> ssory	y
[ɪ]	bar <u>b</u> eque	e
	acade <u>m</u> ic	i
	ac <u>ce</u> lerator	a
[u]	<u>l</u> oop	oo
	commu <u>n</u> ication	u
[ʊ]	p <u>u</u> sh	u

The responses to each stimulus are summarized in Table 27. The high back lax vowel [ʊ] in the words *loop*, *communication*, and *push* is adapted uniformly as Korean /u/. In contrast with [ʊ], responses for English [i] showed variation depending on the carrier word. The word *benzene* invoked Korean ㅏ /e/, the word *accessory* Korean ㅣ /i/ as response. The high front lax English vowel [ɪ] also triggered different vowels. The underlined vowel in the word *barbeque* was associated with Korean ㅏ /e/, the word *academic* invoked Korean ㅣ /i/, and *accelerator* was adapted as Korean /a/.

Table 27 gives a numerical summary of the responses. Results coinciding with the outcomes of the audio experiment are indicated in boldface. In total 87% of the responses coincide with the results of the audio experiment (cf. 3.5. Table 23). Discrepancies between the two modalities are attested with high front English vowels of [i] and [ɪ]. English [i] is associated with ㅏ /e/ in stimulus *benzene* in the visual experiment. This appears to be triggered by the spelling of the vowel, which is ‘e’. Another discrepancy occurs in the responses for [ɪ]. When the stimulus word with [ɪ] was *accelerator*, the responses were /a/ instead of the phonetically grounded ㅣ /i/. This result is also

attributable to orthography as the vowel in question is spelled with ‘a’. Phonetic motivation can be ruled out, as no perceptual confusion is reported between [i]/[ɪ] and [a] with Korean listeners in the literature.

Table 27 Responses for high vowels (Visual exp.)

		response label (Korean vowel)				total number of stimuli
		ㅏ /a/	ㅓ /e/	ㅣ /i/	ㅜ /u/	
target vowel	[i]		25 (48%)	27 (52%)		52
	[ɪ]	26 (33%)	26 (33%)	26 (33%)		78
	[u]				52 (100%)	52
	[ʊ]				26 (100%)	26

4.4.3. Mid vowels

There are three mid vowels in English: [ɛ], [ə], and [ɔ]. The carrier words with mid vowels in the visual experiment are enlisted in Table 28.

Table 28 Stimuli words for mid vowels (visual exp.)

target vowel pronunciation	Word	target vowel spelling
[ɛ]	Accent acad <u>e</u> mic	e
[ə]	ac <u>a</u> ademic	a
	ac <u>a</u> demy	e
	communi <u>c</u> ation	i
	accord <u>i</u> on, curat <u>o</u> r	o
	advent <u>u</u> re	u
	dribbl <u>e</u>	no corresponding letter
[ɔ]	alcohol	o

Responses for the mid vowels are shown in Table 29. The English vowel [ɛ] and [ɔ] were adapted as ㅓ /e/ and ㅜ /o/ respectively with no variation in both cases. In sharp contrast to this uniformity, the mid central vowel [ə] invoked variation across six Korean vowels. The variation was a function of target words. The underlined vowel in the word *academic* was adapted as Korean /a/, the schwa in *academy* was adapted as Korean ㅓ /e/. Korean ㅣ /i/ was selected for the vowel in the

word *communication*. The most frequent response was Korean ㅏ /ə/. This response was triggered by words of *accordion*, *curator*, and *adventure*. The special target of *dribble* was associated with /i/.

Table 29 Responses for mid vowels (visual exp.)

		response label (Korean vowel)						total number of stimuli
		ㅏ /a/	ㅓ /o/	ㅕ /e/	ㅣ /i/	ㅑ /ə/	ㅡ /ɪ/	
target vowel	[ɛ]			26 (100%)				26
	[ə]	25 (14%)	1 (1%)	28 (15%)	25 (14%)	77 (42%)	26 (14%)	182
	[ɔ]		26 (100%)					26

In case of English mid vowels, the correspondence rate between the audio and visual experiments (in boldface) falls down to 55% (cf. 3.5. Table 23). While the vowel [ɛ] invoked responses identical to audio experiment, the other two mid vowels, [ə] and [ɔ] are in discord with results of the audio experiment. The disagreeing results appear to be affected by orthography. In case of [ə] the responses correspond to the spelling of the target vowel. Korean /a/ was selected for spelling ‘a’ in the word *academic*. The response ㅕ /e/ corresponds to letter ‘e’ in *academy*; Korean ㅣ /i/ to letter ‘i’ in the word *communication*; Korean ㅕ /e/ in the word *academy*. Responses motivated by orthography also occur with English mid back vowel [ɔ]. The word *accordion* was once adapted as ㅓ /o/ in accordance with the spelling of the vowel. The letter ‘o’ in the word *alcohol* is most likely the trigger for response ㅓ /o/.

4.4.4. Low vowels

There are three low vowels in English; [æ], [ʌ], and [ɑ]. The target words for the visual experiment are listed in Table 30.

Table 30 Stimuli words for low vowels (Visual exp.)

target vowel pronunciation	Word	target vowel spelling
[æ]	accent, amateur	a
[ʌ]	dugout	u
[ɑ]	Bar	a
	Golf	o

Responses for the low vowels are summarized in Table 31. English [æ] in *accent* was taken as Korean ㅏ /e/, whereas in *amateur* it was adapted as Korean /a/. English [ʌ] in *dugout* is answered by Korean ㅓ /ə/. Finally, English [ɑ] in *bar* was associated with /a/, but in *golf* it was borrowed as ㅗ /o/.

Table 31 Responses for low vowels (Visual exp.)

		response label (Korean vowel)				total number of stimuli
		ㅏ /a/	ㅓ /e/	ㅗ /o/	ㅓ /ə/	
target vowel	[æ]	28 (54%)	24 (46%)			52
	[ʌ]				26 (100%)	26
	[ɑ]	26 (50%)		26 (50%)		52

The results coinciding with results of the audio experiment is indicated by boldface figures in Table 31. In sum 58% of the responses coincide with the results of the audio experiment (cf. 3.5. Table 23). This value is even lower than for mid vowels. The discrepancies occur mainly in the responses for [æ] and [ɑ]. Unlike the responses in the audio experiment, [æ] in the visual experiment is adapted as /a/ in 54%. Also, [ɑ] was associated with ㅗ /o/ in 50% of the cases. These responses are for the stimuli of 'a' in *accent* and 'o' in *golf*. They appear to be triggered by visual representation of the English stimuli.

4.5. Conclusion

Altogether, the correspondence rate between the audio and visual experiments is 60%. For those visual instances that do not coincide with the results of the audio experiment, orthographic explanations appear to be possible. This result supports the argument that orthographic cues are used under conditions when there is no audio input present.

The goal of the following chapter is to give an analysis of Korean loanwords from English. After investigating the characteristics of vowel correspondence in English source words and Korean loanwords, we will analyze which can be explained phonetically account and which cannot. The current chapter, with the results of the audio experiment (cf. 3.5. Table 23), will be used as criteria to judge the orthographic nature of the adaptations. For those cases that cannot be explained phonetically, an analysis based on The English orthography will be provided

5. Adaptation patterns of Korean established loanwords

5.1. Introduction of the chapter and the research Predictions

5.1.1. Introduction and construction of this chapter

This chapter analyzes Korean loanwords from English and evaluates how English words are adapted into Korean by focusing on the relation between Korean established loanwords and the source words in English. The analytical focus is laid on clarifying whether Korean loanwords are related to The English pronunciation rather than to the English orthography.

English orthography, or as it is often referred to as “deep orthography” (Besner and Smith 1992), does not offer consistent help or direct guidance for the pronunciation of words. By focusing on the vowel correspondence between English and Korean loanwords, we may observe how phonetic and orthographic information affects the process of loanwords adaptation.

The structure of this section is as follows. The first subsection lays down the main predictions of the results. The second subsection, 5.2 introduces and describes the corpus used for the investigations. This section explains the characteristics of the corpus and how words in the corpus were processed for the analysis. 5.3 established loanwords are analyzed in terms of phonetic and orthographic factors. Following an overall description of the data, an analysis of English vowels in established loanwords will be presented. The next subsection, 5.4 investigates the currently observable variation in the forms of the established loanwords.

5.1.2. Prediction-phonetic account

In analyzing the established loanwords in Korean, the results of the audio experiment in chapter 3 will be the criteria for determining phonetic adaptation.

Table 32 Vowel adaptations based on pronunciation²¹

English	[i]	[ɪ]	[u]	[ʊ]	[ɛ]
Korean	ㅣ /i/ 100%	ㅓ /e/ 38% ㅣ /i/ 27%	ㅜ /u/ 42%	ㅜ /u/ 92%	ㅓ /e/ 88%
	[ə]	[ɔ]	[æ]	[ʌ]	[ɑ]
	ㅓ /ə/ 43% ㅡ /i/ 26%	ㅓ /a/ 92%	ㅓ /e/ 100%	ㅓ /ə/ 96%	ㅓ /a/ 50% ㅓ /ə/ 50%

²¹ Table 23 in 3.5.

For example, if English [æ] is adapted as ㅏ /e/ it is considered to be a phonetic adaptation. If English [æ] is adapted as other Korean vowels than ㅏ /e/, it is considered to be a non-phonetic adaptation.

5.1.3. Prediction- orthographic account

Since, this thesis aims to investigate the role of orthography in loanword adaptations, it needs to use or develop criteria that identify orthographic factors in adaptations. As orthographic adaptation, English words read as Korean Romanization will be accused.

In English, there are six letters that can represent vowels; ‘a’, ‘e’, ‘i’, ‘o’, ‘u’, and ‘y’. These letters read as [ei], [i:], [oʊ], [u], and [wai] respectively. However, in the Korean Romanization system these letters are pronounced as [a], [e], [i], [o], [u] and [i]. For example, ‘bang’ is [bæŋ] in English, but in Korean Romanization, the same arrangement of letters, is read as [paŋ]. Table 33 represents how characters in the Roman alphabet are rendered phonetically in the Korean Romanization system. Note that letter ‘e’ is always read as ㅏ /e/. Although Korean ㅏ and ㅓ are both often pronounced as [e] in contemporary Korean, historically ㅓ was a lower vowel ([ɛ]) than ㅏ ([e]).

Table 33 Korean pronunciation of Roman letters

<i>English alphabet</i>	a	e	i / y	o	u	no letter
<i>corresponding pronunciation in Korean Romanization</i>	ㅏ /a/	ㅏ /e/	ㅣ /i/	ㅓ /o/	ㅜ /u/	ㅡ /ɨ/

On the orthographic account, we will look at how we will treat the situation in that there is no corresponding vowel letter in L2 orthography. It is the cases with epenthetic vowels, which exist in English, as well as in Korean. In English, between non-native word-initial consonant clusters (Davidson 2008) or before intervocalic /l/ (Wells 1982), schwa can be inserted. For example, African instrument ‘mbira’ is pronounced as English [əmbi:rə] with word initial epenthetic vowel [ə]. For another example, English word *real* is often pronounced as [rɪ(ə)l]. In these cases, for the sound [ə], there are no corresponding letters in the written forms of English.

In Korean, on the other hand, vowel /ɨ/ is often used as epenthetic vowel. Instances of epenthetic vowel /ɨ/ can be found in Korean native inflection and also in Korean loanword adaptation. For example, Korean nouns can be derived from verbs using the suffix /m/. If the verb root ends in consonant, an epenthetic vowel /ɨ/ is inserted between the verb root and the suffix /m/.

Another example can be found in loanwords. Since Korean does not allow for consonant clusters in onset positions, consonant cluster in this position are adapted into Korean with epenthetic

vowels. For example, the oft-cited English word *strike* is adapted into Korean as /sɪtʰɪraikʰɪ/. Similarly, after word final coda, epenthetic vowel /i/ is usually inserted when the consonants are not allowed in Korean as coda consonants (English ‘mug’ → Korean /mægi/). Consequently, Korean use epenthetic vowel /i/ when there is no corresponding vowel letter in the source word spelling (e. g., consonant cluster in onset position, word final consonant cluster) can be considered as orthographic adaptation.

(1)	verb	verb root + derivational suffix /m/	meaning
	자다/tjada/	잠/tjam/	‘sleep’, ‘sleeping’
	먹다/mækta/	먹음/mægim/	‘eat’, ‘eating’

To sum up, input of source word can be interpreted according to Table 23 and 33. For instance, we will think about the case of The English vowel [æ] spelled with ‘a’ as in the word *fax*. If it is adapted into Korean as Korean /a/, it can be interpreted as orthographic adaptation resulted from the letter ‘a’ which is read in Korean as ㅏ /a/. Since English [æ] is phonetically similar to Korean ㅓ /e/ than /a/, this case cannot be interpreted as phonetic adaptation. If otherwise, when English ‘a’ spelled [æ] is adapted into Korean as Korean ㅓ /e/, this case will be interpreted as phonetic adaptation. For another example, let us consider the case of English [ɑ] spelled with ‘a’. When this vowel is adapted into Korean as ㅏ /a/, both phonetic and orthographic interpretation can be considered, since English [ɑ] is phonetically similar to Korean ㅏ /a/, and the letter ‘a’ is read as ㅏ /a/ in Korean Romanization.

5.2. Method

5.2.1. Corpus

The loanword data for this thesis were extracted from a corpus compiled by The National institute of the Korean language. The corpus released by the title “The Investigation of Frequency of Using Contemporary Korean Words” (2002) contains 58437 words with frequency and syntactic categories. This corpus was compiled in order to provide frequency data for graded vocabulary oriented text in Korean language education. Words in this corpus were collected from written and spoken data including school text books. Translated writings were excluded from the selection. All the sources used in this corpus were created in the 1990s. Loanwords in the corpus are explicitly marked, and cognate forms from the originating language are also listed. Discussions in the following sections are based upon those 1846 loanwords from the corpus that are marked to have English origins.

5.2.2. Data processing

The present analysis aims to investigate the relation between Korean and English vowels. After extracting all loanwords from the corpus with English origins, a database was created focusing on the tripartite correspondences between English orthography, English pronunciation and Korean orthography. Only vowel correspondences were enumerated. For example, the English word *accent* is borrowed into Korean as /eksent/ in the corpus. The word *accent* in English has two syllables. The first syllable is written with the letter ‘a’ and its pronunciation is [æ], and the second syllable is written with letter ‘e’ and pronounced as [ə]. As a result, the word yields in two tripartite (English spelling-English sound-Korean sound) relations. One of them is ‘a’-[æ]-ㅏ /e/, and the other one is ‘e’-[ə]-ㅓ /e/.

(2) English orthography	English pronunciation	Korean
<u>a</u> cc	[<u>æ</u> k]	<u>액</u> / <u>ek</u> /
cc <u>e</u> nt	[s <u>ə</u> nt]	<u>센트</u> /s <u>ent</u> /

Some words in the corpus have more than one pronunciation. For example, English word *boss* has two pronunciations [bas] and [bɔs]. In this case, both [bas] and [bɔs] were considered as pronunciations in the source language. Therefore from *boss* and its adaptation in Korean-보스 /posi/, two vowel tripartite were gained; ‘o’-[a]-ㅓ /o/ from The English pronunciation [bas], and ‘o’-[ɔ]-ㅓ /o/ from The English pronunciation [bɔs].

(3) English orthography	English pronunciation	Korean
<u>b</u> oss	b <u>a</u> s	<u>보스</u> / <u>posi</u> /
b <u>o</u> ss	b <u>ɔ</u> s	<u>보스</u> / <u>posi</u> /

The corpus also contained words that are heteronyms. That is, words that share spelling but have different pronunciations and meanings. For instance, the word *sauce* can be read as [sɔs] in which case it means ‘a fluid dressing’. With the pronunciation [sæs], however, it has the meaning of ‘impudent language or action’. In case of heteronyms only one pronunciation was chosen, namely the one that corresponds to the Korean loanwords in its meaning. Therefore, only [sɔs] was considered as the English pronunciation for the word *sauce* because Korean 소스 /sosi/ refers to this meaning²².

By these above-mentioned methods 4650 vowel correspondences were extracted from 1846 English loanwords. Among those, 3918 cases of vowel correspondences were analyzed in this chapter, excluding the cases including diphthongs.

²² The other meaning of *sauce* (impudent) was not in the corpus.

5.2.3. The reference of English pronunciation

As for the variety of The English pronunciation, the current research relies on the phonetic description displayed in the Online Merriam-Webster dictionary. The Merriam-Webster dictionary represents the American Standard dialect, along with the pronunciations of other, most often UK English dialects– which are neglected in this analysis. In Korea, American English is dominating both in English language education of regular schools (Cho B. E. 2004) and in the popular culture. Therefore, American English was referred for the pronunciation of the words.

5.3. Results

Previous studies draw a conclusion on loanword adaptation in Korean that they are mostly phonetic in nature, and the influence of orthography is weak in most cases. However, the data presented in this chapter will show different aspects of loanword adaptation.

5.3.1. Overall analysis

Overall, the majority of adaptation patterns showed either phonetic or orthographic adaptation. Below in Table 34, the vowel correspondences in established loans are summarized in detail. Table 34 is modeled after English vowel chart. Patterns are grouped by the pronunciation of English vowels. Korean vowels are listed below English vowels with their ratio of adaptation in descending order. Korean vowel variants that have less than 2% of all occurrences for a single English vowel are not presented.

In each cell, an example is also given for the adaptation pattern. For example, in the first cell, we can see that English [i] is adapted into Korean as ㅣ /i/ in 90% of cases (e.g. English: *appeal*→Korean: /əp^hil/), and as ㅔ /e/ in 9% of cases (e.g. English *benzene*→Korean: /penjen/).

Along with English [ɑ], English [æ], and [ə] also show considerable variation in their borrowing patterns. In the last cell, we can see that English [a] is adapted into Korean as ㅏ /o/ in 50% of cases (e.g. English: *bond*→ Korean: /pondi/), and as ㅑ /a/ in 45% of cases (e.g. English: *box*→Korean: /paksi/), whereas English [æ] is adapted into Korean as ㅔ /e/ in 61% and ㅑ /a/ in 45% of the times. The most inconsistent adaptation pattern is produced by English [ə]. This vowel is adapted into Korean as ㅓ /ə/ in 45%, as ㅑ /a/ in 15% of the times.

As opposed to the group of vowels that show considerable variation in their borrowing patterns, there is another group of vowels whose adaptation patterns are consistent. In most of the cases the adaptation patterns tends to converge towards a single Korean vowel. In cases of English [i],

[i], [ɛ], [ʌ], [ɔ], [u], [ʊ], a single Korean vowel is selected in around 90% of the times. The most consistent adaptation pattern is produced by English [u] which was to Korean ㅓ /u/ in 98% of the times. The second most consistent vowel is English [i] which was to Korean ㅣ /i/ in 94% of the cases. The least consistent vowel within this group is English [ʌ] with 86%, which corresponds to Korean ㅓ /ə/.

Table 34 Overall result of vowel adaptation in Korean

	<i>front</i>	<i>central</i>	<i>back</i>
<i>high</i>	English[i] : 395		English[u] : 125
	ㅣ /i/ : 357 (90%) <i>ape<u>a</u>l</i>		ㅓ /u/ : 125 (100%) <i>loo<u>p</u></i>
	ㅓ /e/ : 35 (9%) <i>benze<u>n</u>e</i>		
	English[i] : 548		English[ʊ] : 44
	ㅣ /i/ : 512 (93%) <i>academ<u>i</u>c</i>		ㅓ /u/ : 42 (95%) <i>pu<u>s</u>h</i>
	ㅓ /e/ : 26 (5%) <i>barbe<u>q</u>ue</i>		ㅓ /ə/ : 2 (5%) <i>bu<u>l</u>k, caricatu<u>r</u>e</i>
<i>mid</i>	English[ɛ] : 382	English[ə] : 1310	English[ɔ] : 177
	ㅓ /e/ : 346 (91%) <i>accen<u>t</u></i>	ㅓ /ə/ : 599 (46%) <i>a<u>w</u>ay</i>	ㅓ /o/ : 157 (89%) <i>alcoh<u>o</u>l</i>
	ㅓ /a/ : 14 (4%) ㅓ /e/ : 14 (4%) <i>academ<u>i</u>c</i>	ㅓ /a/ : 211 (16%) <i>academ<u>i</u>c</i> ㅣ /i/ : 147 (11%) ㅓ /o/ : 132 (11%)	ㅓ /ə/ : 12 (7%) <i>coff<u>e</u>e</i>
<i>low</i>	English[æ] : 430	English[ʌ] : 115	English[ɑ] : 347
	ㅓ /e/ : 263 (61%) <i>accen<u>t</u></i>	ㅓ /ə/ : 100 (87%) <i>du<u>g</u>out</i>	ㅓ /o/ : 174 (50%) <i>bo<u>n</u>d</i>
	ㅓ /a/ : 153 (36%) <i>amateu<u>r</u></i>	ㅓ /u/ : 5 (4%) <i>mo<u>t</u>her</i>	ㅓ /a/ : 153 (44%) <i>bo<u>x</u>, ba<u>r</u></i>

To one degree or another, every adaptation pattern shows variations. These variations cannot be simply explained by phonetic or phonological principles. An analysis taking phonetic and

orthographic factors into consideration will enable us to reveal a detailed picture of the adaptation process. The following sections (5.3.2.- 5.3.4) will analyze each vowel correspondence in detail according to vowel height.

5.3.2. High vowels: Tense versus Lax

There are four high vowel sounds in English: [i], [ɪ], [u], [ʊ]. Vowel [i] and [ɪ] are front vowels, whereas [u] and [ʊ] are back vowels. As for tenseness, [i] and [u] are tense vowels, and [ɪ] and [ʊ] are their lax counterparts. Tense-lax contrasts do not exist in Korean. By looking at the adaptation patterns of high vowels, we hope to see how loanwords to Korean deal with the English tense-lax contrast.

5.3.2.1. English [i]

Phonetically, the English front high vowel [i] is very similar to Korean ㅣ /i/ in terms of formant values (Jun S. A. and Cowie I. 1994, Yang 1996). Therefore, Korean ㅣ /i/ would be a phonetic approximation of English [i]. The top row in Table 35 shows that English [i] can be adapted into Korean as ㅐ ㅣ /ei/, ㅓ /e/, ㅑ /e/, ㅣ /i/, or ㅓ ㅣ /ai/.

Table 35 Adaptation of English [i]

English [i]		Korean				
		ㅐ ㅣ /ei/	ㅓ /e/	ㅑ /e/	ㅣ /i/	ㅓ ㅣ /ai/
English spelling	e		1	31	42	74
	i				117	1
	y			2	114	116
	ea				26	26
	ee				35	35
	ei	1		1	2	4
	ey				7	7
	ie				14	14
	oe			1		1
		1	1	35	357	1

Out of the 395 syllables in the corpus with The English pronunciation [i], 357 (90% of all [i] cases) are adapted as Korean ㅣ /i/, which is the most adequate candidate in terms of phonetic factors (shaded cells in Table 35). As displayed in the left column of Table 35, vowel [i] in the English target words can be spelled as ‘e, i, y, ea, ee, ei, ey, ie’ or ‘oi’. More than half of the English [i] in the corpus are spelled with either ‘i’ or ‘y’ (234 cases, 59% of the cases).

For the English letters ‘i’, ‘y’ and ‘e’, we can find orthographic influences on adaptation (figures in boldface). English letters ‘i’ and ‘y’ encourage adaptation into Korean as ㅣ /i/ (see Table

32). Also, in the corpus, there are 74 English [i] words whose target syllables are spelled with ‘e’. Among those, 31 words are adapted as Korean /e/, which isn’t considered to be a phonetic approximation of English [i] (Table 23). The Korean /e/ appears to be triggered by the English letter ‘e’. That is, at least 8% (31/395) of all cases have to be explained by this orthographic factor. In total, there are 262 cases (66%; 262/395) that can be explained by other orthographic factors.

Table 36 below summarizes how orthographic and phonetic factors work on the adaptation of English [i]. In case of words, where the target syllables are denoted by ‘i’ or ‘y’, both phonetic and orthographic factors encourage easy adaptation into Korean as ㅣ /i/. Cases of these, which are both phonetic and orthographic, amount to 231 out of 395 cases (58%, top left cell in Table 36). Yet, Interestingly, Korean ㅣ /i/ is preferred even in the cases when English [i] is not spelled with ‘i’ or ‘y’. Of the cases which have only phonetic but no orthographic motivation 32% (126/395). All together 90% of the adaptations can be explained by phonetic factors alone.

Table 36 Summary of adaptation factors in English [i]

	Phonetic	Non-Phonetic	
Orthographic	231 (58%)	31 (8%)	262 (66%)
Non-Orthographic	126 (32%)	7 (2%)	133 (34%)
	357 (90%)	38 (10%)	395 (100%)

(df=1, $\chi^2=4.37$, $p<0.01$)

Additionally, adaptations that cannot be explained by either phonetic or orthographic factors are less than 2% (7/368) of all cases. In conclusion, in the case of English [i], more cases are explained by phonetic factors (90%) than by orthographic factors (66%).

5.3.2.2. English [i]

English mid high vowel [i] does not exist in the Korean vowel inventory. According to the audio experiment in Chapter 3, Korean perceives English [i] as Korean ㅣ /i/ or ㅓ /e/. The top row in Table 37 shows that English [i] can be adapted into Korean as ㅏ /a/, ㅓ /e/, ㅣ /i/, ㅗ /u/, or ㅜ /o/. Out of the 548 syllables in the corpus with the pronunciation of [i], 538 are adapted as Korean ㅣ /i/ and ㅓ /e/, which are phonetic approximates of English [i] (98%).

Table 37 Adaptation of English [ɪ]

English [ɪ]	Korean					
	ㅏ /a/	ㅓ /e/	ㅣ /i/	ㅑ /ai/	ㅕ /e/	
English spelling	a	4	13		3	21
	e	24	31			55
	i	1	419	3		423
	y		33			33
	ea		2			2
	ee		6			6
	ie		2			2
	u		1			1
	ui		5			5
	4	26	512	3	3	548

As displayed in the left column of Table 37, English [ɪ] in the Korean corpus is spelled in English as ‘a, e, i, y, ea, ee, ua’, or ‘ui’. Most English lax vowel [ɪ] in the corpus are spelled with either ‘i’ (423/548) or ‘e’ (55/548). For the English letters ‘a, e, i’ and ‘y’, the influence of orthography can be considered. Adaptation patterns leading to Korean ㅏ /a/ can be explained only as orthographic reflection of the English letter ‘a’. In a similar fashion, the adaptation pattern leading to Korean ㅓ /e/ can also be explained as orthographic reflection of The English letter ‘e’. In total, there are 480 (88%) out of 548 which can be explained by orthographic analysis.

Table 37 below summarizes how orthographic and phonetic factors affect adaptation of English [ɪ]. In the phonetic factors, Korean ㅣ /i/ and ㅓ /e/ are included. Adaptations of these two Korean vowels were founded in 98% (538/548) of all cases. As for orthographic factors, The English letters ‘a, e, i’ and ‘y’ triggered adaptation into Korean as ㅏ, ㅓ, ㅣ /a, e, i/ and ㅣ /i/. This was true in 88% of the cases (480/542).

Table 38 Summary of adaptation factors in English [ɪ]

	Phonetic	Non-Phonetic	
Orthographic	476 (87%)	4 (1%)	480 (88%)
Non-Orthographic	62 (11%)	6 (1%)	68 (12%)
	538 (98%)	10 (2%)	548 (100%)

(df=1, $\chi^2=21.23$, $p<0.01$)

In the case of English [ɪ] spelled with ‘i’ or ‘y’ adaptation into Korean used ㅣ /i/ (See Table 32). Therefore, in the case of the adaptation of English [ɪ] which is spelled with either ‘i’ or ‘y’, both

phonetic and orthographic factors encourage adaptation into Korean as | /i/. 476 cases of letter ‘i’ and ‘y’ were adapted into Korean as | /i/, in 87% of the cases. In conclusion, in the case of English [i], there are more cases that can be explained by phonetic factors (98%) than by orthographic factors (88%).

5.3.2.3. English [u]

English high back vowel [u] mostly provoked a response with ㅓ/u/ in the audio experiment (Table 23). Therefore, an adequate approximate of this vowel in Korean will be ㅓ/u/. As we can see in Table 39, all cases of English [u] were adapted as Korean ㅓ/u/.

We will now look into the spelling of English [u]. English [u] is spelled as ‘o, u, eu, ew, oo, ou, ue, ui, uo,’ or ‘wo’. Among those, ‘u’ is the most frequent letter (73/125). In cases of the target syllables which are spelled with ‘u’, orthographic factors can be considered as well as phonetic factors.

Table 39 Adaptation of English [u]

English [u]		Korean ㅓ /u/
English spelling	o	2
	u	73
	eu	1
	ew	6
	oo	29
	ou	7
	ue	1
	ui	3
	uo	1
	wo	2
		125

The influences of phonetic and orthographic factors are analyzed in the contingency Table 40. In the case of English [u], all cases can be explained by phonetic factors. However, there are 73 cases out of 125 that can be explained both phonetic and orthographic analysis. On the other hand, there are 52 cases that can be explained by only phonetic analysis. There are no cases that cannot be explained by either phonetic or orthographic factors.

In conclusion, in the case of English [u], there are more cases that can be explained by phonetic factors (100%) than by orthographic factors (58%).

Table 40 Summary of adaptation factors in English [u]

	Phonetic	Non-Phonetic	
Orthographic	73 (58%)		73 (58%)
Non-Orthographic	52 (42%)		52 (42%)
	125 (100%)		125 (100%)

5.3.2.4. English [ʊ]

Lax vowel [ʊ] does not exist in Korean. This vowel is perceived in Korean as ㅓ/u/ by Korean listeners (Table 23). Table 41 below summarizes the adaptation patterns of English [ʊ] in Korean. From the top row of Table we can see that English [ʊ] is adapted as Korean ㅓ /ə/ or ㅓ/u/. ㅓ/u/ adaptation, the phonetic approximate of English [u], were 44 cases (95%; 42/44). There were two cases of [ʊ] adaptation into Korean as ㅓ /ə/; *bulk* and *caricature*. These target syllables have two kinds of pronunciation in the Merriam-Webster dictionary; [ʊ] and [ʌ], [ʊ] and [ə]. Since we cannot specify which pronunciation is the phonetic input of the target syllables, two pairs of tripartite were extracted from each the target syllable (*bulk*: [ʊ]-“u”- ㅓ /ə/, [ʌ]-“u”- ㅓ /ə/; *caricature*: [ʊ]-“u”- ㅓ /ə/, [ʊ]-“u”- ㅓ /ə/).

The left column enlist all of the variations how English [ʊ] in the target words are spelled. English [ʊ] can be spelled as any of ‘u, o, eu, oo, ou,’ or ‘ue’. Most frequently, English [ʊ] is spelled with ‘u’ and it counts 25 out of 44 cases. This letter ‘u’ triggers the adaptation as Korean ㅓ/u/. Therefore, for ㅓ/u/ adaptation both phonetic and orthographic influence can be considered.

Table 41 Adaptation of English [ʊ]

English [ʊ]		Korean		
		ㅓ /ə/	ㅓ/u/	
English spelling	u	2	23	25
	o		1	1
	eu		2	2
	oo		13	13
	ou		2	2
	ue		1	1
		2	42	44

The influences of orthographic and phonetic factors are summarized in Table 42. First of all, there are 23 cases that are stimulated by both orthographic and phonetic factors. There are no cases that only can be explained by orthographic account. On the other hand, there are 19 cases that can

only be explained by phonetic account.

Table 42 Summary of adaptation factors in English [ʊ]

	Phonetic	Non-Phonetic	
Orthographic	23 (52%)		23 (52%)
Non-Orthographic	19 (48%)	2 (5%)	21 (48%)
	42 (95%)	2 (5%)	44 (100%)

In conclusion, in the case of English [ʊ], there are more cases that can be explained by phonetic factors (95%) than by orthographic factors (52%).

5.3.3. Mid vowels

In English, there are six kinds of mid vowels; [e], [ɛ], [ɜ], [ə], [o], [ɔ]. Among those [e] and [o] only occur as a component of diphthong. Therefore, they are not discussed in this thesis. [ɜ] also is excluded, since this thesis based on the pronunciation of American English. [ɜ] occurs typically in British English and some of American dialect, which does not have [ɜ].

Remaining [ɛ], [ə], and [ɔ] do not exist in Korean as phoneme. Therefore, they frequently mispronounced by Korean learners of English. Through their adaptation patterns, we can see how foreign sounds, which exist as an allophone in L1, are managed.

5.3.3.1. English [ɛ]

Historically Korean had two front mid vowels, /e/ and /ɛ/. Although these vowels distinguished in written form as ㅓ and ㅕ , in contemporary Korean, the pronunciation of these two vowels are merged into ㅓ /e/ (Lee Jin Ho 2012 : 132). For this diachronic reason, Korean learners of English are in difficulties of production and comprehension of this vowel.

Table 43 shows how English [ɛ] is adapted into Korean. First of all, English [ɛ] is adapted into Korean as ㅏ /a/, ㅓ /e/, ㅑ /ə/, ㅓ /e/, ㅡ /i/, or ㅣ /i/. Among those, the most frequent vowel is ㅓ /e/, which is phonetic approximate of English [ɛ] in Korean (See Table 23).

As for the orthography, English [ɛ] is written as 'a, ua, e, ae, ai, ea, ei', or 'ue' in English. Among those, most frequent spelling is 'e', which consist 85% of the cases (325/382). This spelling 'e' appears to provoke the adaptation of the Korean ㅓ /e/. In cases of The English orthography 'a' and 'e' can be considered as orthographic adaptation. There are 14 cases of ㅏ /a/ adaptation, which could be resulted from orthography 'a', and 318 cases of ㅓ /e/ adaptation, which could be resulted

from orthography 'e'. All together, 87% of the cases can be interpreted as orthographic adaptation.

On the other hand, there are 346 cases which can be interpreted as phonetic adaptation of [e] (91%). In case of spelling of 'e', both phonetic and orthographic interpretation can be raised. 318 out of 382 cases (83%) can be seen to be provoked by both phonetic and orthographic factors.

Table 43 Adaptation of English [ε]

English [ε]		Korean					
		ㅏ /a/	ㅓ /e/	ㅑ /ə/	ㅕ /e/	ㅡ /i/	ㅣ /i/
English spelling	a	14	13	1	6		34
	ua		1				1
	e			3	318	1	325
	ae				2		2
	ai				7		7
	ea				11		11
	ei				1		1
	ue				1		1
		14	14	4	346	1	382

Table 44 below shows how orthographic and phonetic factors are interacting on adaptation of English /ε/. There are cases which are only considered as either phonetic or orthographic adaptation. 14 (3%) cases of ㅏ /a/ adaptations are only can be explained by orthographic approach while 28 (7%) cases of ㅕ /e/ adaptation that do not spell as 'e', can be explained by phonetic approach. There are 22 (6%) cases that can explain by neither orthographic nor phonetic interpretation.

Table 44 Summary of adaptation factors in English [ε]

	Phonetic	Non-Phonetic	
Orthographic	318 (83%)	14 (4%)	332 (87%)
Non-Orthographic	28 (7%)	22 (6%)	50 (13%)
	346 (91%)	36 (9%)	382 (100%)

(df=1, $\chi^2=80.57$, $p<0.01$)

In conclusion, in the case of English [ε], there are more cases that can be explained by phonetic factors (91%) than by orthographic factors (87%).

5.3.3.2. English [ə]

Schwa is a reduced vowel, which can be conceptualized as a weak version of a full vowel. This weakness is expressed by phonetic characteristics, as well. Schwa is much shorter in duration

than full vowels (Ladefoged 2006). Since, schwa never occurs in monosyllabic words, or in stressed syllables. Therefore, traditionally schwa is regarded as an allophone of a full vowel.

In Korean, there are no reduced vowels in the phonological sense of the word. As for phonetic equivalent of English schwa, the Korean mid central vowel ㅏ /ə/ may be the closest phonetic approximate. However, on the contrary to English [ə], Korean ㅏ /ə/ can occur in any syllable and any syllable position. According to the audio experiment in Chapter 3, phonetic approximates of English [ə] are Korean ㅏ /ə/ and ㅡ /i/.

Adaptations of English [ə] in Korean are summarized in Table 45. The left column enlists of the variations how English [ə] in the target words are spelled in English. English [ə] can be spelled ‘a, e, i, o, u, y, ai, ui, oa, ia, io, ou, ea’, or ‘eu’. Additionally, schwa can occur as a vocalic variant of a syllabic consonant (e.g., dribble [dribl] or [dribəl]). In this case, since the word final ‘e’ is silent, there is no corresponding letter in the target word (indicated by English spelling ‘0’ in Table 45). Most frequently, English [ə] is spelled with ‘e’. Out of the 1310 English syllables in the corpus with the [ə], there are 361 (28%) syllables spelled with ‘e’. The second most frequent vowel letter for schwa is ‘a’, reaching 347 (26%) count.

Table 45 Adaptation of English [ə]

English [ə]	Korean											
	ㅏ /a/	ㅓ /e/	ㅣ /i/	ㅗ /o/	ㅜ /u/	ㅓ /ə/	ㅡ /i/	ㅓ /e/	ㅏ ㅣ /ai/	ㅣ ㅓ /ia/	ㅗ ㅏ /oa/	
a	198	1	6			129	4	9				347
e	5	81	21			246	8					361
i	1		110			11	1		2			125
o	4			132		91	3					230
u	3				39	59						101
y			4									4
ai		1					1					2
ui			5						1			6
oa											1	1
ia						5				1		6
io						51						51
ou						4						4
ea						3						3
eu					1							1
0			1				67					68
	211	83	147	132	40	599	84	9	3	1	1	1310

The top row of Table 45 shows that English [ə] can be adapted into Korean as any of ㅏ /a/, ㅓ /e/, ㅣ /i/, ㅗ /o/, ㅜ /u/, ㅓ /ə/, ㅡ /i/, ㅓ /e/, ㅏ ㅣ /ai/, ㅣ ㅓ /ia/, or ㅗ ㅏ /oa/. Out of these 1310 English syllables in the corpus, English [ə] is adapted as Korean ㅓ /ə/ and ㅡ /i/ in 52% of the

cases (683/1310). In terms of phonetic proximity, Korean ㅏ /ə/ and ㅓ /i/ are the optimal vowel selections, so the 52% share of the Korean ㅏ /ə/ and ㅓ /i/ strikes as a little bit low. The second most frequently used Korean vowel during the adaptation of schwa is ㅑ /a/ with 16% (211/1310).

Interestingly, a good portion of the remaining 48%, which cannot be explained by phonetic account, can be explained by orthographic reasons. Adaptation patterns leading to Korean ㅑ /a/ are most often coincide with English spelling 'a'. So it can be stated that Korean ㅑ /a/ is an orthographic reflection of the English letter 'a' (15%; 198/1310). In a similar fashion, adaptation patterns leading to Korean ㅓ /o/ can be explained as orthographic reflections of The English letter 'o' (10%; 132/1310). Although small in number, the marginal cases of the Korean ㅏ /i/, ㅓ /e/, and ㅑ /u/ adaptations can be explained by the orthography of the source word (110, 81, 39 cases, respectively). Note that there are [ə] syllables that have no corresponding letters in their words (e.g., dribble). Korean epenthetic vowel is ㅓ /i/ (See 5.1.3.). Therefore, in the case of English [ə] with no corresponding letter, adaptation as Korean ㅓ /i/ is an orthographic reflection of the source word (5%; 67/1310).

Table 46 Summary of adaptation factors in English [ə]

	Phonetic	Non-Phonetic	
Orthographic	67 (5%)	564 (43%)	631 (48%)
Non-Orthographic	616 (47%)	63 (5%)	679 (52%)
	683 (52%)	627 (48%)	1310 (100%)

(df=1, $\chi^2=840.98$, $p<0.01$)

Table 46 provides a summary of the data. The sum of vowel tokens that can be explained by phonetic factors is 683 out of 1310, which is 52% of the cases. Adaptation that can be explained by orthographic factors is 631 out of 1310 which is 48% of the cases. In English, there is no letter that triggers adaptation into Korean as ㅏ /ə/ or ㅓ /i/ which is phonetic approximates of English [ə]. However, adaptation as Korean ㅓ /i/ with no corresponding letter in source word spelling will be the case in which the phonetic and orthographic factors work together (5%; 67/1310). Finally, there are 63 cases of 1310 (5%) that cannot be explained by either phonetic or orthographic factors.

In conclusion, in the case of adaptation of English [ə], orthographic factors (48%) are working on adaptation in about the same strength as phonetic factors (52%).

5.3.3.3. English [ɔ]

English [ɔ] does not exist in Korean. Korean ㅏ /ə/ is often pronounced as [ɔ:] by English

native speakers (Heo and Kim 2008 :102). However, Korean ㅏ /ə/ is not same as English [ɔ]. Since English [ɔ] is a rounded back vowel whereas Korean ㅏ /ə/ is a unrounded central vowel. English [ɔ] can be described as the vowel, which is lower vowel than Korean /o/ and backer vowel than Korean ㅏ /ə/. According to the audio experiment in Chapter 3, phonetic approximate of English [ɔ] is ㅏ /a/ in Korean.

Table 47 summarizes how English [ɔ] adapted into Korean. As we seen the top low of Table, English [ɔ] is adapted into Korean as ㅏ /a/, ㅏㅓ /au/, ㅓ /e/, ㅏ /ə/, ㅓ /o/, or ㅓ /u/. Among those, ㅓ /o/ adaptation is most frequent (124/177), this pattern does not coincides with vowel correspondence appeared in the audio experiment.

On orthographic aspect, English [ɔ] is written as any of ‘a, o, au, aw, oa, oo, ou, ua’, or ‘uo’. Among those, ‘o’ is the most frequent spelling of English [ɔ] (130/177). About adaptation of spelling ‘a’ and ‘o’, we can consider orthographic adaptation (figures in bold face). There are five cases in which ‘a’ spelling adapted as ㅏ /a/, and there are 124 cases where ‘o’ spelling adapted as ㅓ /o/.

Table 47 Adaptation of English [ɔ]

English [ɔ]		Korean					
		ㅏ /a/	ㅏㅓ /au/	ㅓ /e/	ㅏ /ə/	ㅓ /o/	ㅓ /u/
English spelling	a	5		1	5	9	20
	o				6	124	130
	au		1		1	10	12
	aw					4	4
	oa					4	4
	oo					1	1
	ou					3	3
	ua					2	2
	uo						1
		5	1	1	12	157	177

Table 48 below summarizes how orthographic and phonetic factors are interacting. Adaptation as ㅓ /o/ can be considered as of phonetic motivations (See Table 23), which occupy only five cases (3%). As for an orthographic account, on the other hand, spelling of ‘a’ and ‘o’ can be considered. They share 5 and 124 cases respectively. Altogether, there are 129 cases that can be explained by orthographic approaches (73%).

As for English spelling of ‘o’ for [ɔ], it can be said that both orthography and the pronunciation are supporting the adaptation of ㅏ /a/. Besides the phonetically of orthographically motivated cases, there are 48 instances that can be explained neither orthographically nor by phonetics (27%).

Table 48 Summary of adaptation factors in English [ɔ]

English [ɔ]	Phonetic	Non-Phonetic	
Orthographic	5 (3%)	124 (70%)	129 (73%)
Non-Orthographic		48 (27%)	48 (27%)
	5 (3%)	172 (97%)	177 (100%)

In conclusion, in the case of English [ɔ], there are more cases that can be explained by orthographic factors (73%) than by phonetic factors (3%).

5.3.4. Low vowels

Korean vowel inventory lacks in low vowels. Korean has only one low vowel, ㅏ /a/. Therefore, by looking at the adaptation patterns of low vowels, we can see that how Korean deals with adaptation of foreign vowels, which do not exist in Korean.

5.3.4.1. English [æ]

All together 430 syllables with English [æ] pronunciation were found in the corpus. According to the audio experiment in Chapter 3, phonetic approximate of English [æ] in Korean is vowel ㅓ /e/.

Table 49 below gives a detailed description of English spelling and Korean vowel relations in establish loanwords. The left column enlists all the variations how English [æ] in the target words are spelled in English. There are three ways how English [æ] can be spelled, namely: it can be spelled 'a', 'e' or 'au'. As it can be seen from the summary Table, the English [æ] is almost always spelled as 'a' (99.5%; 429/431). The top row in Table 49 shows that English [æ] is adapted into Korean as any of ㅓ /e/, ㅏ /a/, ㅓ /e/, ㅗ /o/, ㅓ /ə/, or ㅓ /ei/. Out of these 431 English syllables in the corpus, 264 is adapted as ㅓ /e/ which is more than half of all cases (264/431; 61%).

It should be noted that English [æ] is always adapted into Korean as ㅓ /e/ and never as ㅓ /e/. Historically, Korean ㅓ /e/ and ㅓ /ε/ were distinct phonemes, but the opposition merged in contemporary Korean into ㅓ /e/ (Lee Jin Ho 2012: 132). Even though the phonetic argument is not present anymore, English [æ] is invariably adapted into Korean as ㅓ /e/.

Table 49 Adaptation of English [æ]

English [æ]		Korean				
		ㅏ /e/	ㅏ /a/	ㅓ /e/	ㅓ /ə/	ㅓ ㅣ /ei/
English spelling	a	266	153	1	5	3
	e			2		
		266	153	3	5	3
						430

The high number of cases leading to Korean ㅏ /e/ (62%; 266/430) can be explained by perceptual proximity. However, considering this phonetic evidence it is hard to explain why English [æ] was to Korean ㅏ /a/ in around more than one third of the cases (36%; 153/430). Given the fact that English [æ] is normally spelled with letter 'a' the conclusion should be made that the adaptation of English [æ] as Korean ㅏ / a / is a result of orthographic influence. In some marginal cases, English [æ] is not spelled with 'a'. The two cases when it is spelled with letter 'e' are *wrestling* and *ketchup*. In these cases, orthographic phonetic factors support an adaptation into Korean as ㅓ /e/.

Since English [æ] is at 99.5% written as 'a' (Table49), and Korean perceptually adapts English [æ] as Korean ㅏ /e/, where the phonetic and orthographic factors worked together, a case of the top left cell remain 0%. On the other hand, adaptation as Korean ㅏ /a/ and ㅓ /e/ that is only explained as orthographic factor reached 36% (155/430), and adaptation as Korean ㅏ /e/ that is only explained as phonetic factor reached 62% (266/430). Interestingly adaptation that cannot be explained either phonetically or orthographically remained only 2% (9/430).

Table 50 Summary of adaptation factors in English [æ]

	Phonetic	Non-Phonetic	
Orthographic		155 (36%)	155 (36%)
Non-Orthographic	266 (62%)	9 (2%)	275 (64%)
	266 (62%)	164 (38%)	430 (100%)

In conclusion, in the case of English [æ], there are more cases that can be explained by phonetic factors (62%) than by orthographic factors (36%).

5.3.4.2. English [ʌ]

Phonetic approximate of English [ʌ] in Korean is ㅓ /ə/ according to the audio experiment in Chapter 3. As we can see in top low of Table 51, English [ʌ] is adapted into Korean as ㅏ /a/, ㅓ /ə/, ㅓ /e/, ㅓ /o/, ㅓ /u/, or ㅏ /e/. Among those, in most of adaptation, ㅓ /ə/ is selected (100/115).

Orthographically, English [ʌ] is spelled as ‘a, e, ea, o, ou, u’, or ‘ue’. In cases of spelling of ‘a, e, o, u’, we can consider orthographic interpretation. These letters, ‘a, e, o, u’ trigger the adaptation of ㅏ /a/, ㅓ /e/, ㅗ /o/, ㅜ /u/, respectively. However, these cases only reach 8% of the cases (9/115).

Table 51 Adaptation of English [ʌ]

English [ʌ]		Korean					
		ㅏ /a/	ㅓ /ə/	ㅓ /e/	ㅗ /o/	ㅜ /u/	ㅓ /e/
English spelling	a	1					2
	e		5	1			6
	o	1	11		3		15
	ou		7				7
	u	2	77			4	83
	ue					1	1
		4	100	1	3	5	2
							115

Table 52 below shows how orthographic and phonetic factors interacting. There are 9 cases that can be explained orthographically. However, there is no orthography that triggers adaptation of ㅓ /ə/, which is phonetic approximate of English [ʌ]. Therefore, for English [ʌ], there is no case that is forced by both orthographic and phonetic account.

Table 52 Summary of adaptation factors in English [ʌ]

	Phonetic	Non-Phonetic	
Orthographic		9 (8%)	9 (8%)
Non-Orthographic	100 (87%)	6 (5%)	106 (92%)
	100 (87%)	15 (13%)	115 (100%)

In conclusion, in the case of English [ʌ], there are more cases that can be explained by phonetic factors (87%) than by orthographic factors (8%).

5.3.4.3. English [ɑ]

The audio experiment showed that the phonetic approximate of English [ɑ] in Korean is ㅏ /a/ and ㅓ /ə/. Table 53 shows adaptations of English [ɑ] in Korean in detail, emphasizing the orthographic correlation between Korean and English. The top row in Table shows that English [ɑ] can be adapted into Korean as any of ㅏ /a/, ㅗ /o/, ㅓ /e/, or ㅓ /ə/. Out of the 347 English syllables in the corpus with the pronunciation of [ɑ], 174 is adapted as Korean ㅗ /o/. The second most vowel

in adaptation is Korean ㅏ /a/, which counts 123 out of 347. Since Korean ㅏ /a/ and ㅓ /ə/ are the candidates expected by phonetic proximity, adaptation as Korean /o/ in Table 53 is unexpected.

Table 53 Adaptation of English [ɑ]

English [a]		Korean				
		ㅏ /a/	ㅓ /o/	ㅕ /e/	ㅗ /ə/	
English spelling	a	123	1	6	3	133
	o	23	172		9	204
	oi	2				2
	e	2				2
	ea	1				1
	ua	2		1		3
	au		1			1
	uo				1	1
		153	174	7	13	347

The left column enlists all of the variations how English [ɑ] in the target words are spelled in English. English [ɑ] can be spelled as any of ‘a, o, oi, e, ea, ua, au’, or ‘uo’. Most frequently, English [ɑ] is spelled with ‘o’ (59%; 204/347) and ‘a’ (38%; 133/347). Interestingly, English [ɑ] vowels that are spelled with ‘o’ are adapted as Korean ㅓ /o/ (84%; 172/204) rather than the phonetically closer ㅏ /a/ 11%; 23/204).

Adaptation patterns leading to Korean ㅏ /a/ and ㅗ /ə/ (48%; 166/347) can be explained as results of a phonetic adaptation. As for orthographic factors, Korean ㅏ /a/ can be considered as an orthographic reflection of The English letter ‘a’ (35%; 123/347), Korean ㅓ /o/ for The English letter ‘o’ (50%; 172/347). The case of English [ɑ] with spelling ‘a’ is special in a sense that both phonetic and orthographic factors encourage an adaptation into Korean as ㅏ /a/ (35%; 123/347).

Table 54 Summary of adaptation factors in English [ɑ]

	Phonetic	Non-Phonetic	
Orthographic	123 (35%)	172 (50%)	295 (85%)
Non-Orthographic	43 (12%)	9 (3%)	52 (15%)
	166 (48%)	181 (52%)	347 (100%)

(df=1, $\chi^2=29.78$, $p<0.01$)

Table 54 provides a summary of the data. The sum of tokens of adaptation that can be explained by phonetic factors is 166 out of 347(48%). Adaptation that can be explained by orthographic factors is 295 out of 347; 85%. Surprisingly, where the phonetic and orthographic

factors worked on together, the case of English [ɑ] spelled as 'a', reached 35% (123/347). Yet, adaptation that is only explained as orthographic factor reached 50% (172/347). The cases that cannot be explained either phonetically or orthographically reached less than 3% (9/347).

In summary, in the case of adaptation of English [ɑ], orthographic factor (85%) outweighs phonetic factors (48%).

5.3.5. English [0]: Adapted as Korean vowel with no corresponding vowel in English word

Sometimes, English orthography has vowel letter in written form, but the English pronunciation has no vowel sound in spoken form. For example, schwas in words like *mineral*, *gallery*, *memory* are not pronounced sometimes. In this case, their pronunciation could become ['min-rəl], ['gal-rē], and ['mem-rē].

(4)	Korean loanword	English word	English pron.	Korean vowel	English Alphabet
	갤러리	<i>gallery</i>	'gæl-ri	ㅏ	e
	미네랄	<i>mineral</i>	'min-rəl	ㅏ	e
	카메라	<i>camera</i>	'kæm-rə	ㅏ	e
	카메라맨	<i>cameraman</i>	'kæm-rə,mən	ㅏ	e
	캐비닛	<i>cabinet</i>	'kæb-nit	ㅣ	i
	터미널	<i>terminal</i>	'tərm-nəl	ㅣ	i
	패밀리	<i>family</i>	'fæm-li	ㅣ	i
	가톨릭	<i>Catholic</i>	'kæθ-lɪk	ㅓ	o
	메모리	<i>memory</i>	'mem-ri	ㅓ	o
	브로콜리	<i>broccoli</i>	'bra-kli	ㅓ	o
	액세서리	<i>accessory</i>	ɪk-'ses-ri	ㅏ	o
	칼로리	<i>calorie</i>	'kæl-ri	ㅓ	o
	내추럴	<i>natural</i>	'næch-rəl	ㅓ	u

If Korean loanword adaptation is based only on the source words pronunciation, then these three words would be adapted into Korean as *민렐/minrəl/, *갤리/kelli/, and *멤리/memri/. Although *민렐/minrəl/, *갤리/kelli/, and *멤리/memri/ are all possible words in Korean in terms of Korean phonology, the established loanwords are 미네랄/minerəl/, 갤러리/kelləri/ and 메모리/memori/. In the corpus of this research, there were 45 syllables that has pronunciation

varies in two, either schwa or no vowel. Table 55 below is summarizing the result of analysis on account of orthography and Korean vowel used in adaptation.

Table 55 Summary of adaptation patterns with zero vowels in English

		Korean						
		ㅏ /a/	ㅓ /e/	ㅣ /i/	ㅜ /o/	ㅡ /u/	ㅗ /ə/	ㅡ /ɪ/
English spelling	a	1					2	3
	e	1	6				8	15
	i			4			1	5
	o	3			9		6	19
	u					1		1
	io						2	2
		5	6	4	9	1	18	45

In fact, Korean /i/ is phonetic approximate for this case since Korean /i/ is epenthetic vowel which usually be applied both loanword and Korean native words. However, there were only 2 cases of adaptation of the Korean /i/. Interestingly, there seems apparent relation between the orthography of English and Korean vowel. For example, English orthography 'e' is adapted as Korean /e/ and English orthography 'i' is adapted as Korean ㅣ /i/. In an analogous way, we can interpret that there is 21 cases of orthographic adaptations.

Table 56 Summary of adaptation when no orthographic factor is present

	Phonetic	Non-Phonetic	
Orthographic		21 (47%)	21 (47%)
Non-Orthographic	20 (44%)	4 (9%)	24 (53%)
	20 (44%)	25 (56%)	45 (100%)

Table 56 analyzes adaptation pattern in loanword in terms of phonetic and orthographic factors. In this case, there is no adaptation that both orthographic and phonetic factors trigger. Adaptation as /i/ and ㅏ /ə/ can be interpreted as phonetic adaptation (44%; 20/45). Overall, 21 cases (47% of the cases) can be interpreted as orthographic adaptation. In conclusion, there are about the same amount of cases that can be explained by orthographic factors (47%) and phonetic factors (44%).

5.4. Discussion

Through 5.3.2 - 5.3.5., the influence of pronunciation and orthography were analyzed as a function of English vowel. In this subsection, we will simplify the Table using four abstract symbols;

◎, ○, △, and X. In each cell, instead of the numbers of percentage indicating the frequency of a given adaptation pattern, one of the following symbols is displayed. The double circle ◎ stands for cases that reach over 75%; single circle ○ indicates percentage over 50%; the triangle △ is used if the figure is over 25%; finally the capital X is displayed if the given condition does not reach 25% of cases. For example, Table 36 could be simplified as below.

(5) Summary of adaptation factors in English [i] (Table 36)

	<i>Phonetic</i>	<i>Non Phonetic</i>	
<i>Orthographic</i>	58%	31%	66%
<i>Non orthographic</i>	32%	2%	34%
	90%	10%	100%



Simplified summary of adaptation factors for English [i]

i	○	△
	△	x

From simplified Table, it can be read that adaptation of English [i] is mostly attributable to phonetic factors. The X marks under the non-phonetic conditions imply that non-phonetic effects are weak. The triangle in the combination of *non-orthographic* and *phonetic* shows underlies the strength of the phonetic factor – even in the lack of orthographic motivation.

All the investigated English vowel adaptation data can be summarized in an analogous way (see Table 57).

Table 57 Summary of adaptation factors over all English vowels

i	○	△
	△	x
ɪ	◎	x
	x	x
ε	◎	x
	x	x
æ	x	△
	○	x

no sound	x	△
	△	x
ə	x	△
	△	x
ɑ	△	○
	x	x

u	○	x
	△	x
ʊ	○	x
	△	x
ɔ	x	○
	x	△
ʌ	x	x
	◎	x

The following discussions on adaptation patterns rely on these simplified Tables.

5.4.1. English vowels borrowed into Korean under strong phonetic influence

The most typical case is when phonetic factors have a strong impact on loanword adaptation. The interaction of phonetic and orthographic effects is schemed as in type 1. The first

column is filled with double circles because of the phonetic influence. The spelling of words may or may not coincide with the pronunciation of words so the numbers are distributed over the cells covering *orthographic* and *non-orthographic* cases. The important point is that the division line between *phonetic* versus *non-phonetic* cases is vitally important, expressed through a sharp difference in numbers. At the same time the line between *orthographic* versus *non-orthographic* motivation do not mark a border in the distribution. Also, the presence orthographic factors do not have a boosting effect.

Type 1 Typical phonetic adaptation with no orthographic influence

	<i>phonetic</i>	<i>non-phonetic</i>
<i>orthographic</i>	◎	×
<i>non-orthographic</i>	◎	×

Type1 allows for two interpretations. One is that the majority of adaptations are driven by phonetic factors. The other interpretation acknowledges the effect of orthography hiding under phonetic cases. This scenario is possible if orthography suggests those target forms that are also motivated phonetically. In this case it is virtually impossible to tell the phonetic and orthographic factors apart. Of course it is possible that the influence of orthography is very weak, and there is almost the same amount of adaptations that can be explained both phonetically and orthographically, or that can be explained by phonetically but not orthographically.

Now we will look into the types actually existed in Korean established loanwords. In established loanwords, English [u], [ʊ] and [ʌ] showed similar adaptation patterns to Type 1. Let us put an adaptation pattern of English [u], and [ʊ] as Type 1-1, and an adaptation pattern of English [ʌ] as Type 1-2.

Type 1-1 Adaptation pattern of English [u], and [ʊ]

u/ʊ	○	×
	△	×

Type 1-2 Adaptation pattern of English [ʌ]

ʌ	×	×
	◎	×

Type 1-1 and Type 1-2 are different to Type1 since there is quantitative difference between the top cell and the bottom cell of the first column. Type 1-1 implies that there were more adaptation patterns that can be explained both phonetically and orthographically than that can be explained only phonetically. On the contrary, Type 1-2 implies that there were more adaptation patterns that can be explained only phonetically than that can be explained both phonetically and orthographically.

5.4.2. English vowels borrowed into Korean under strong orthographic influence

The second case is when orthographic factors have a strong impact on loanword adaptation. The interaction of phonetic and orthographic effects is schemed as in type 2. The first row is filled with double circles because of the orthographic influence. The pronunciation of words may or may not coincide with the orthography of words, so the numbers are distributed over the cells covering phonetic and non-phonetic cases. The important point is that the division line between *orthographic* versus *non-orthographic* cases is vitally important, expressed through a sharp difference in numbers. At the same time, the line between *phonetic* versus *non-phonetic* motivation does not mark a border in the distribution. Also, the presence phonetic factors do not have a boosting effect.

Type 2 Typical orthographic adaptation

	<i>phonetic</i>	<i>non-phonetic</i>
<i>orthographic</i>	◎	◎
<i>non-orthographic</i>	×	×

Then, we will look into the types actually existed in Korean established loanwords. In established loanwords, English [a] and [ɔ] showed similar adaptation patterns to Type 2.

Type 2-1 Adaptation pattern of English [a]

a	Δ	○
	×	×

Type 2-1 is different to Type 2 since there is a quantitative difference between the left cell and the right cell in the top row. Type2-1 implies that there were more adaptation patterns that can be explained only orthographically than that can be explained both phonetically and orthographically. Type 2-2 along with Type 2-1 can be considered as counter examples of phonetic adaptation. This type cannot be explained without orthographical accounts since the numbers of adaptation are distributed on the part where it cannot be explained by phonetic account.

Type 2-2 Adaptation pattern of English [ɔ]

ɔ	×	○
	×	△

5.4.3. English vowels borrowed into Korean under about the same strength of phonetic and orthographic influences.

The third case is when phonetic and orthographic factors have an impact on loanword adaptation with about the same strength. The interaction of phonetic and orthographic effects is schemed as in type 3. Only the top cell in the first column is filled with a double circle because pronunciation and orthography are working together on the adaptation. Two cells, which can be explained by either phonetic account or orthographic account, are filled with a circle. The rest of cells which can be explained by neither phonetically nor orthographically filled with X.

Type 3 Typical phonetic and orthographic adaptation

typical phonetic/ orthographic adaptation	◎	○
	○	×

In Korean established loanwords, five English vowels are comprised in this type3; [i], [ɪ], [ɛ], [ə], no sound, and [æ].

Type 3-1 Adaptation pattern of English [i]

i	○	△
	△	×

Type 3-1 is very similar to Type 3 and the difference is only in its numbers.

Type 3-2 Adaptation pattern of English [ɪ] and [ɛ]

ɪ/ɛ	⊙	×
	×	×

Type 3-2 is different from Type 3 since adaptation is concentrated on the top cell in the first column. Other than that cell, a few adaptations are distributed across the Table. Following Type 3-3 and Type 3-4 are similar to Type 3. However, there is a quantitative difference in concentration to the top cell in the first column which can be explained both phonetically and orthographically.

Type 3-3 Adaptation pattern of English [ə] and no sound

ə/ ∅	×	Δ
	Δ	×

Type 3-4 Adaptation pattern of English [æ]

æ	×	Δ
	○	×

Type 3-3 and 3-4 are different to type 3-1 and 3-2. In type 3-3 and 3-4 there are a few adaptations that can be explained both phonetically and orthographically. Many of adaptations in Type 3-3 and 3-4 are explained either phonetically or orthographically. The difference between Type 3-3 and 3-4 is numerical, there is more adaptation in Type 3-4 that can be only explained by phonetic account.

5.5. Conclusion

In all types, there were a few adaptations that cannot be explained by phonetically or orthographically. Through the analysis, we could see that orthographic interpretation is valid in many cases. However, phonetic factors tend to be stronger than orthographic factors.

Type 1 displays patterns that are under strong phonetic influence with [u], [ʊ] and [ʌ]. All of these vowels are showing consistency with their orthography. For example, English [u] is mostly written as ‘u’ in nearly two third of the time (See 5.3.2.1.). These vowels and their most frequent written forms are summarized in Table 58. Except for English [ʌ], Korean vowels promoted by these most frequent written forms coincide with Korean vowels promoted by their English pronunciations. For this characteristic of English [ʌ], there was more adaptation that can be explained only phonetically than that of others.

Table 58 English vowels displaying strong phonetic influence (Type 1)

English pronunciation	[u]	[ʊ]	[ʌ]
most frequent written form	‘u’	‘u’	‘u’
Korean vowels promoted by English pronunciation	ㅓ /u/	ㅓ /u/	ㅓ /ə/
Korean vowels promoted by written form	ㅓ /u/	ㅓ /u/	ㅓ /u/
most frequent vowel adaptation in Korean	ㅓ /u/	ㅓ /u/	ㅓ /ə/

Type 2 patterns that were under strong influence of orthography were [ɑ] and [ɔ]. These cases cannot be explained without orthographic approach. The characteristic of these vowels are that their English pronunciation and their written form work on a different direction. The pronunciation of English [ɑ] triggers Korean vowel ㅓ /a/ or ㅓ /ə/ adaptation. On the other hand, its orthography triggers Korean vowel /o/ adaptation since three fifth of the time English [ɑ] is written as ‘o’. In cases of English [ɔ], pronunciation triggers Korean vowel ㅓ /a/ adaptation. However, its orthography triggers Korean vowel /o/ adaptation since less than three quarters of the time English [ɔ] is written as ‘o’. In sum, we can conclude that when the orthography and the pronunciation of source words provoke different adaptation the dependency to orthographic adaptation increases.

Table 59 English vowels displaying clear orthographic influence (Type 2)

English pronunciation	[ɑ]	[ɔ]
most frequent written form	‘o’	‘o’
Korean vowels promoted by English pronunciation	ㅓ /a/, /ə/	ㅓ /a/
Korean vowels promoted by written form	/o/	/o/
most frequent vowel adaptation in Korean	/o/	/o/

Type 3 is a pattern that is under about the same strength of phonetic and orthographic factors ([i], [ɪ], [ɛ], [ə], no sound, and [æ]). In cases of [i], [ɪ], and [ɛ], the orthography and the pronunciation are working on the same direction. On the contrary in cases of [ə], no sound and [æ], the candidate of orthographic adaptation and that of phonetic adaptation are different. English

orthography for [ə] and [Ø] are not fixed in one written form. English [æ], on the other hand, is almost always written as ‘a’. The English letter ‘a’ provokes the adaptation of the Korean ㅏ /a/, which does not coincide with phonetic adaptation /e/.

Table 60 English vowels displaying both phonetic and orthographic influence (Type 3)

English pronunciation	[i]	[ɪ]	[ε]	[ə]	[Ø]	[æ]
most frequent written form	‘i, y’	‘i’	‘e’	‘e’	‘o’	‘a’
Korean vowels promoted by English pronunciation	/i/	/i/	/e/	ㅏ /ə/	ㅡ /i/	/e/
Korean vowels promoted by written form	/i/	/i/	/e/	/e/	/o/	ㅏ /a/
most frequent vowel adaptation in Korean	/i/	/i/	/e/	ㅏ /ə/	ㅏ /ə/	/e/

Additionally, the numbers of possible orthographic notations in English for each vowel are summarized in Table 61.

Table 61 Number of possible spellings for English vowels

	<i>high vowel</i>				<i>mid vowel</i>			<i>low vowel</i>			∅	<i>average number</i>
	i	ɪ	u	ʊ	ε	ə	ɔ	æ	ʌ	ɑ		
<i>number of possible spellings</i>	9	9	10	6	8	15	9	2	6	8	6	8

On average, there were 8 kinds of orthography for each vowel. Type1 vowels, [u], [ʊ] and [ʌ] have 10, 6, and 6 kinds of orthography, respectively. Some of these numbers larger than the average number of orthography. Type 2 vowels, [a], and [ɔ] have 8 and 9 kinds of orthography each. Type 3 vowels, [i], [ɪ], [ε], [ə], [Ø] and [æ] have 9, 9, 8, 15, 6, 2 kinds of orthography.

Conclusively, we could not find any relation between adaptation pattern and kinds of orthography. As already mentioned above, the existence of vowel adaptation, which is provoked by both phonetically and orthographically, is the key for determining phonetic or orthographic adaptation.

Altogether we could obtain following contingency Table 62 from the data of the Korean established loanwords. In this contingency Table, we see some evidence that phonetic adaptation is more frequent than non phonetic adaptation. Out of the 3818 adaptations, 2648 (68%) were phonetic adaptation. However, for non-phonetic adaptation, there are 1270 (32%) cases. Table 62 can be simplified into Type 3-5 which is variation of Type 3.

Table 62 Summary of adaptation strategies in Korean loanwords with English origins

	phonetic	non-phonetic	
orthographic	1316 (34%)	1094 (28%)	2410 (62%)
non orthographic	1332 (34%)	176 (4%)	1508 (38%)
	2648 (68%)	1270 (32%)	3918 (100%)

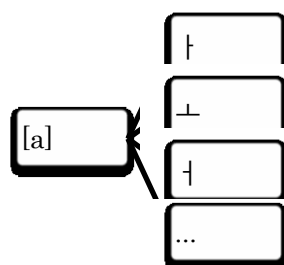
(df=1, $\chi^2=481.52$, $p<0.01$)**Type 3-5** Summary of adaptation strategies

vowel adaptations in Korean	△	△
established loanwords	△	×

Hence, we can conclude that phonetic and orthographic factors are working together on loanword adaptation at about the same strength. Later in chapter 6, we will discuss this pattern of the established loanwords in comparison with the results of the audio and visual experiments.

5.6. Analysis on variation

According to five rules and correspondence between IPA and Korean, one English vowel should be adapted as one Korean corresponding vowel, but the reality is not that simple. For example, the English vowel [a] is adapted as ㅏ /a/ or ㅑ /o/ in most of the cases, but other Korean vowels like ㅓ /ə/ or ㅜ /i/ are also found as a adapted form of English [a] (Figure 30).

Figure 30 Various adaptations for English vowel [a]

In some cases, Korean adaptation of English vowel results in variations. In this corpus, variations exist in eight pairs ((1)-(16)). First, let us have a look at the English word *shot* ((1), (2)). This word is adapted into Korean as either /sja/ or /sjot/. A simple explanation can be offered concerning the color of the vowel in the word /sja/ as the phonetic correspondence between Korean ㅏ /a/ and

the English vowel [a] is straightforward. As for /sjot/, however, neither phonetic nor phonological explanations seem reasonable. The most plausible explanation would be to rely on the orthography of the input, 'o'.

(1)	shot	'shat	샷 /sjat/
(2)	shot	'shat	쏷 /sjot/

Another interesting case is shown in (3) and (4). The English words *canon* and *cannon* have the same pronunciation, ['kæ-nən]. However, they are adapted into Korean as [k^henən] and [k^hanon], respectively. If one assumes that the adaptation process is based on pronunciation, there is no reason to expect any variation for the output as the English pronunciation of this word.

(3)	cannon	'kæ-nən	캐년 /k ^h enən/
(4)	canon	'kæ-nən	카논 /k ^h anon/

(5) and (6) show loanword variations in Korean which in English has no pronunciation variation. These are not variations of vowel adaptations, however. Through them, we can see the loanword phonology is not all about phonology of the source language.

English word *type* is adapted as 타이프/t^haip^hi/ and 타입/t^haip/ in Korean. Korean coda condition rule does not allow aspirated consonant. Therefore For (5) 타이프/t^haip^hi/, an epenthetic vowel —/i/ is used after coda /p^h/. For (6) 타입/t^haip/, on the other hand, English coda [p] is adapted as unreleased plain /p/. Once the adaptation is completed, coda /p/ undergoes the other Korean phonological rule. When coda plain /p/ in Korean used with case markers, it realized as /b/: e.g. 타입이/t^haibi/ with nominative /i/, 타입을/t^haibil/ with objective /il/, 타입은/t^haibin/ with topic marker /in/).

(5)	type	'tīp	타이프/t ^h aip ^h i/
(6)	type	'tīp	타입/t ^h aip/
(7)	cut	'kʌt	커트 /k ^h ət ^h i/
(8)	cut	'kʌt	컷 /k ^h ət/

English word *cut* is adapted as (7)커트 /k^hət^hi/ or (8)컷 /k^hət/. As mentioned above, Korean coda condition rule does not allow aspirated consonant. Therefore, for (7) 커트 /k^hət^hi/, an epenthetic vowel —/i/ is used after coda /t^h/. In (8), on the other hand, English coda /t/ is adapted as unreleased plain /t/. Once the adaptation is completed, /t/ undergoes the other the Korean

phonological rule. In Korean, coda /t/ is merged into /s/ which represents all oral alveolar sounds in coda position. Thus, when coda plain /t/ in Korean used with case markers, it realized as /s/ (e.g. 컵이/kʰəsi/ with nominative /i/, 컵을/kʰəsɪl/ with objective /ɪl/, 컵은/kʰəsɪn/ with topic marker /ɪn/).

(9) and (10) show Korean loanwords for English word *jumper*. In (10) 점프 /tʃəmpʰə/, we can see vowel correspondence based on the English pronunciation, Korean ㅏ /ə/ for English [ʌ] and Korean ㅓ /a/ for English [ə]. However, we cannot find any phonological or phonetic reasons for the adaptation of *jumper* as in (9) 잠바 /tʃamba/.

(9)	jumper	'jʌm-pər	잠바 /tʃamba/
(10)	jumper	'jʌm-pər	점프 /tʃəmpʰə/
(11)	machine	mə-'ʃɪn	미싱/misiŋ/
(12)	machine	mə-'ʃɪn	머신/məsin/

Both (11) and (12) are adapted from English word *machine*. However, in Korean they are used as separate meaning, 미싱/misiŋ/ is only for a sewing machine, and 머신/məsin/ is for all mechanic machines. Apart from its meaning, since both of them are from the same English word *machine*, if the adaptation is based on the English pronunciation, they must appear as the same in Korean. However, only (12) are faithful to the English pronunciation. For the (11) we cannot find phonetic resemblance between first vowel of Korean 미싱/misiŋ/ and English [mə-'ʃɪn].

In fact, it is natural that (9) and (11) are unexplainable with their English pronunciation, because (9) and (11) are English loanwords in Korean arrived via Japanese. Therefore, for (9) and (11), we can easily find the pronunciation resemblance between Korean forms and Japanese forms.

Table 63 Korean loanword via Japanese

Japanese	Korean
ジャンパー [jamba-]	잠바 /tʃamba/
ミシン [mɪʃɪn]	미싱/misiŋ/

(13) and (14) show another example words that have the same pronunciation but different meaning. Loanwords in (13) and (14) have different meaning both in Korean and in English. (14) is German currency *Mark* and (13) is English noun that is synonym of *brand or label*. (14) is classified English loanword, but it is from German. Thus we can classify (13) as a loanword from German via

English.

(13)	mark	'mark	마크	makhɪ
(14)	Mark	'mark	마르크	marɪkɪ

(15) and (16) show Korean loanwords for the English word *accessory*. In Korean this word is adapted either as 악세사리 /aksəsari/ or as 엑세서리 /eksesəri/. As the underlined parts show there is variation in the first vowels between Korean ㅏ /a/ and ㅓ /ə/, and another variation for the third vowels between ㅏ /a/ and ㅓ /ə/. In fact, the Merriam Webster Dictionary provides two pronunciations for this word: one with a schwa for letter 'o' and another one with no pronunciation for that letter at all. The initial vowel of the word is pronounced as [æ] in English, and it is adapted as either ㅏ /a/ or ㅓ /ə/ in Korean. According to Lee H. S. and Ahn B. H. (1994), English [æ] corresponds to Korean /e/. However, Korean vowel selection ㅏ /a/ in (15) for English [æ] cannot be explained with phonetic explanation.

(15)	accessory	æk-'sɛs-ri	악세사리 /aksəsari/
(16)	accessory	æk-'sɛ-sə-ri	엑세서리 /eksesəri/

And in the third syllable of *accessory*, where the English pronunciation varies between [ə] and zero, the Korean vowel ㅏ /a/ and ㅓ /ə/ is used for the adaptation. In terms of the English pronunciation, it must be ㅓ /ə/ for pronunciation (15), or ㅓ /ə/ for pronunciation (16). Thus 엑세서리 /eksesəri/, Korean loanword in (16), coincides with pronunciation. If the English pronunciation variants triggers the loanword variation in Korean, for the English pronunciation of [ə] or no sound should result in ㅓ /ə/, like as (16), or no sound in Korean, like as *엑셋리/eksesri/. Considering Korean coda condition rule, epenthetic vowel ㅓ /ə/ can be inserted after /s/, like as *엑세스리/eksesiri/. However, as seen in (15), vowel selection of the Korean ㅏ /a/ is unexplainable.

6. Discussion

In this section we will look at the input of the lexical borrowing process from the aspects of psychology and language education which is apart from the field of phonology. Through this we confirm that it is natural for loanwords to have different forms depending on the modality of the source – being the written form or the spoken form. Although previous studies on loanword phonology consider the influence of orthography on loanwords to be marginal, this chapter confirms what is an established fact in psychology, namely that visual information dominates audio.

6.1. Visual experiment in comparison with established loanwords

The results of the visual experiment formed a subset of the adaptation patterns found in established loanwords. In the visual experiment the Korean participant alphabet reading was found to be more similar to Korean loanword reading than reading English itself. However, the participant sometimes chose other vowels that established loanwords do not have. For example, for the word *benzene*, he adapted this vowel as /i/ once in 26 trials. In English [ə] words which are *academic*, *accordian*, were adapted in Korean /e/ and /o/ once out of 26 trials. We cannot evaluate these variations since they were too few in number in this experiment. In order to confirm these deviations further experiments should be conducted with more participants, trials and stimuli including words which have variations in established loanwords.

6.2. Visual experiment in comparison with audio experiment

In this subsection, the results of the audio and visual experiments are compared with respect to how well they predict patterns in established loanwords in Korean. From the results, we can calculate the probabilities and the expected frequencies in established loanwords. The result will be analyzed according to the vowel height.

6.2.1. High vowels

First, the responses from visual and audio experiment given to English [i] will be compared. In the audio experiment, this English vowel was adapted into Korean /i/ in 100% of the cases. Therefore, the probability of adapting English [i] as Korean /i/ based on audio source is 1.0. In the visual experiment, on the other hand, English [i] was adapted as /i/ in only 52% of the cases and as

/e/ in 48%. Thus, the probability of adapting to these vowels are 0.52 and 0.48 respectively (cf. Table 64).

Table 64 Probabilities based on audio and visual exp. [i]

Korean Vowel	Probability	
	Based on audio exp.	Based on visual exp.
ㅣ /i/	1.0	0.52
ㅔ /e/	0.0	0.48
Total	1.00	1.00

By applying the probability to the total count of [i] vowels in established loanwords (395), we can calculate the expected frequencies for the adaptation patterns. The calculation follows in Table 65.

Table 65 Expected frequencies based on audio and visual exp. [i]

Korean Vowel	Audio exp.		Visual exp.	
	Probability	Expected frequency	Probability	Expected frequency
ㅣ /i/	1.0	395	0.52	205
ㅔ /e/	0.0	0	0.48	190
Total	1.0	395	1.0	395

Since the probability of adapting English [i] as /i/ calculated from the results of the audio experiment was 1.0, the expected frequency of this pattern in loanwords can be calculated by multiplying this probability with the total count of English [i] vowels in the corpus: $395 \times 1.0 = 395$. The expected frequencies based on the visual experiment yield in different numbers. The probability of adapting into Korean /i/ was 0.52, so the expected count for this pattern – based on visual input – is only $395 \times 0.52 = 205$. The other visually motivated pattern into Korean /e/ is expected to occur 48% of the cases, that is $395 \times 0.48 = 190$ times. These predictions can be numerically evaluated against the actual frequencies observed in loanwords. The results are summarized in Table 66.

Table 66 Expected and actual frequencies for English [i]

Korean Vowel	Frequency of established loanwords	Expected frequency	
		Based on audio exp.	Based on visual exp.
ㅣ /i/	357	395	205
ㅓ /e/	35	0	190
ㅓㅣ /ei/	1	0	0
ㅓㅣ /ai/	1	0	0
ㅡ /i/	1	0	0
Total	395		

Although the audio experiment predicted only Korean /i/, the observed frequency was 357 which reached 90% in the cases of English [i]. In 38 cases Korean /i/ was predicted wrongly. The visual experiment, on the other hand, provided two Korean vowels: /i/ and /e/. The number of predictions found correct is 205 (for /i/) + 35 (for /e/) = 240, which is around 61% of the cases. Based on the visual experiment more /e/ vowels are expected to occur in response to English [i]. The number of mispredictions is 155 = 39% of the cases. In comparison of the predictions of the two modalities it can be claimed that the audio experiment provide better prediction than the visual experiment about the distribution of adaptation patterns in loanwords. Nevertheless it should be added, that the visual modality deserves more credit, as the audio input alone cannot say anything about alternative adaptation pattern. The visual experiment correctly predicts /e/ as an alternative output for input English [i].

Table 67 displays data for English lax vowel [ɪ] which was created in an analogous way to that of vowel [i]. Since 24% of all responses were NAs in the audio experiment, the sum of probability values is 0.76. For further calculations, the probabilities were normalized to have the sum of 1.0. There were no NA responses in the visual experiment. The probability of each Korean vowel was 0.33 because there were three kinds of vowel responses obtained in equal portions in the visual experiment.

Table 67 Probability calculated based on audio and visual experiment with English [ɪ]

Korean Vowel	Probability	
	Based on audio exp.	Based on visual exp.
ㅓ /e/	0.38 →0.50	0.33
ㅣ /i/	0.27 →0.36	0.33
ㅡ /i/	0.08 →0.11	
ㅓㅣ /a/	0.03 →0.04	0.33
Total	0.76 →1.00	1.00

Based on the probability which was calculated from the results of the audio and visual

experiments, the expected frequencies were calculated by multiplying the expected frequencies with the observed number of English [ɪ] vowels in established loanwords, that is 548.

Table 68 Expected frequencies based on audio and visual exp. [ɪ]

Korean Vowel	Audio exp.		Visual exp.	
	Probability	Expected frequency	Probability	Expected frequency
ㅏ /e/	0.50	208→274	0.33	183
ㅣ /i/	0.36	148→194	0.33	183
ㅡ /ɪ/	0.11	44→57		
ㅏ /a/	0.04	16→21	0.33	183
Total	1.0		1.0	

These calculated frequencies are compared in Table 69 with the actual frequencies in established loanwords.

The established loanwords showed more variation than what was found in the results of the experiments (6 Korean vowels; ㅏ /e/ ㅣ /i/ ㅡ /ɪ/ ㅏ /a/ ㅏ ㅣ /ai/ ㅏ /e/). Moreover, the Korean ㅏ ㅣ /ai/ and ㅏ /e/, were not chosen by the participant and so neither the audio nor the visual experiment could have expected them. The results of the audio experiment predicted ㅏ /e/(26), ㅣ /i/(194), and ㅏ /a/(4). Altogether, 168 (31%) of the established loanwords could be explained by the audio experiment. The results of the visual experiment predicted ㅏ /e/(26), ㅣ /i/(183), and ㅏ /a/(4). Altogether, 213 (39%) of the established loanwords could be explained by the visual experiment.

Table 69 Expected and actual frequencies for English [ɪ]

Korean Vowel	Frequency of established loanwords	Expected frequency	
		Based on audio exp.	Based on visual exp.
ㅏ /e/	26	274	183
ㅣ /i/	512	194	183
ㅡ /ɪ/	0	57	
ㅏ /a/	4	21	183
ㅏ ㅣ /ai/	3		
ㅏ /e/	3		
Total	548		

In an analogous way, Table 70 was created to display the expected probabilities of Korean vowels for the input English [u] vowel.

Table 70 Probability calculated based on audio and visual experiment with English [u]

Korean Vowel	Probability	
	Based on audio exp.	Based on visual exp.
ㅏ /u/	0.44	1.0
ㅣ /i/	0.36	0.0
ㅡ /ɨ/	0.16	0.0
ㅜ /o/	0.04	0.0
Total	1.00	1.00

Approximately 4% of the results from the audio experiment were NAs. The expectation probabilities based on the audio experiment were calculated leaving out these NA responses. There were no NA responses in the visual experiment; all stimuli were adapted uniformly as Korean ㅏ /u/. Thus, the probability of this pattern is 1.0. Based on these results, by applying the actual number of the established loanwords, we found the expected frequencies shown in Table 71.

Table 71 Expected frequencies based on audio and visual exp. [u]

Korean Vowel	Audio exp.		Visual exp.	
	Probability	Expected frequency	Probability	Expected frequency
ㅏ /u/	0.42	53	1.0	125
ㅣ /i/	0.35	44		
ㅡ /ɨ/	0.15	19		
ㅜ /o/	0.04	5		
Total	1.0		1.0	

There were cases of 125 of English [u] in established loanwords. The results of the audio experiment predicted ㅏ /u/(53), ㅣ /i/(44), ㅡ /ɨ/(19), and ㅜ /o/(5). 53 of cases (42% of all cases) were predicted by the results of the audio experiment. On the other hand, since the probability of ㅏ /u/ in the results of the visual experiment was 1.0, the expected frequency was 125. Overall, for cases of English [u] the visual experiment was much better at predicting established loanwords.

Table 72 Expected and actual frequencies [u]

Korean Vowel	Frequency of established loanwords	Expected frequency	
		Based on audio exp.	Based on visual exp.
ㅏ /u/	125	53	125
ㅣ /i/	0	44	0
ㅡ /ɨ/	0	19	0
ㅜ /o/	0	5	0
Total	125		

The last vowel in the overview of high vowels is English [ʊ]. Based on the experiment, the probabilities are obtained and shown in Table 73.

Table 73 Probability calculated based on audio and visual experiment for English [ʊ]

Korean Vowel	Probability	
	Based on audio exp.	Based on visual exp.
ㅏ/u/	1.0	1.0
Total	1.00	1.00

In cases of English [ʊ], both visual and audio experiments predicted adaptation as Korean ㅏ/u/. Although the expected probability in case of audio experiment is 1.0, approximately 8% of the responses were NAs. Ignoring these responses, there is no numerical difference between the two modalities. For sake of completeness Table 74 summarizes the expected counts calculated the by using the 43 occurrences of [ʊ] in established loanwords.

Table 74 Expected frequencies based on audio and visual experiment for English [ʊ]

Korean Vowel	Audio exp.		Visual exp.	
	Probability	Expected frequency	Probability	Expected frequency
ㅏ/u/	1.0	44	1.0	44
Total	1.0	44	1.0	44

Of course there is no need to go further, because the expectations are identical. Nevertheless, it is interesting to see how the observed data follows these expectations. As it can be seen in Table 75 English /ʊ/ is adapted mainly as Korean ㅏ/u/, with some cases of ㅣ/ə/. This latter pattern occur, which occur in a minority of cases, however, cannot be predicted neither based on audio nor based on visual experiment. In sum, it can be claimed that in cases of English [ʊ], the predictive performance is about the same for both audio and visual inputs.

Table 75 Expected and actual frequencies [ʊ]

Korean Vowel	Frequency of established loanwords	Expected frequency	
		Based on audio exp.	Based on visual exp.
ㅏ/u/	42	44	44
ㅣ/ə/	2		
Total	44	44	44

6.2.2. Mid vowels

The next vowel we will compare in predictive power between the audio and visual experiments is English [ɛ].

Table 76 Probability calculated based on audio and visual experiment for English [ɛ]

Korean Vowel	Probability	
	Based on audio exp.	Based on visual exp.
ㅓ /e/	0.96	1.0
ㅜ /u/	0.02	
ㅔ /ei/	0.02	
Total	1.00	1.00

In the audio experiment, excluding NA responses, the probability of /e/ in the responses is 0.96. For both /u/ and /ei/ the probability is 0.02. The results of the visual experiment showed 100% adaptation into /e/; hence the probability of /e/ adaptation is 1.0.

Expected frequencies are summarized in Table 77. These values were obtained by multiplying the probabilities by total number of English [ɛ] vowels in established loanwords, of which is 382. The expected frequencies are calculated based on audio experiment were 366 of /e/, 8 of /u/, and 8 of /ei/. The expected frequencies calculated based on the visual experiment were 382 of /e/ since the adaptation was 1.0.

Table 77 Expected frequencies based on audio and visual experiment for English [ɛ]

Korean Vowel	Audio exp.		Visual exp.	
	Probability	Expected frequency	Probability	Expected frequency
ㅓ /e/	0.88	366	1.0	382
ㅜ /u/	0.02	8		
ㅔ /ei/	0.02	8		
Total	1.0	382	1.0	382

The observed frequencies in established loanwords are summarized in Table 78 in comparison with expected frequencies. Again the established loanwords showed more variation in vowel selection. The audio experiment predicted 336 (88%) of /e/, and the visual experiment predicted 346 (91%) of /e/. In cases of English [ɛ], the predictive performance turned out to be about the same for both the audio and visual experiments.

Table 78 Expected and actual frequencies [ɛ]

Korean vowel	Frequency of established loanwords	Expected frequency	
		Based on audio exp.	Based on visual exp.
ㅏ /e/	346	365	382
ㅓ /u/	0	8	
ㅗ ㅣ /ei/	0	8	
ㅑ /a/	14		
ㅓ /e/	14		
ㅓ /ə/	4		
ㅣ /i/	3		
ㅡ /ɪ/	1		
Total	382		

The next mid vowel is English [ə]. This vowel showed by far the most interesting adaptation pattern in loanwords presumably because its lack of conventionalized spelling. The probabilities calculated from the results of the experiments are summarized in Table 79. Korean ㅓ /ə/ adaptation is the most frequent adaptation in both the audio and visual experiments. Their probabilities were 0.44 in the audio experiment and 0.42 in the visual experiment.

Table 79 Probability calculated based on audio and visual experiment for English [ə]

Korean Vowel	Probability	
	Based on audio exp.	Based on visual exp.
ㅓ /ə/	0.44	0.42
ㅡ /ɪ/	0.27	0.14
ㅓ /u/	0.13	
ㅣ /i/	0.12	0.14
ㅏ /e/	0.03	0.15
ㅑ /a/		0.14
ㅜ /o/		0.01
Total	1.00	1.00

Applying the actual total frequency of English [ə] in established loanwords gives us the expected frequencies shown in Table 80.

Table 80 Expected frequencies based on audio and visual experiment for English [ə]

Korean Vowel	Audio exp.		Visual exp.	
	Probability	Expected frequency	Probability	Expected frequency
ㅏ /ə/	0.44	581	0.42	550
ㅡ /i/	0.27	351	0.14	183
ㅓ /u/	0.13	176		
ㅣ /i/	0.12	162	0.14	183
ㅓ /e/	0.03	40	0.15	197
ㅏ /a/			0.14	183
ㅓ /o/			0.01	13
Total	1.0	1310	1.0	1310

Data from Table 80 is compared in Table 81 with the actual frequencies in established loanwords. The results of the audio experiment predicted 67% of the established loanwords; the result predicted 563 of ㅏ /ə/, 84 of ㅡ /i/, 40 of ㅓ /u/, 147 of ㅣ /i/, and 39 of ㅓ /e/. In sum, 873 cases are predicted correctly. On the other hand, the results of the visual experiment predicted 81% of the established loanwords; the result predicted 550 of ㅏ /ə/, 84 of ㅡ /i/, 147 of ㅣ /i/, 83 of ㅓ /e/, 183 of ㅏ /a/ and 13 of ㅓ /o/. In sum, 1060 cases are predicted correctly. Conclusively, we can see that the results of the visual experiment can predict the established loanwords better than the results of the audio experiment.

Table 81 Expected and actual frequencies for English [ə]

Korean Vowel	Frequency of established loanwords	Expected frequency	
		Based on audio exp.	Based on visual exp.
ㅏ /ə/	599	563	550
ㅡ /i/	84	341	183
ㅓ /u/	40	170	
ㅣ /i/	147	157	183
ㅓ /e/	83	39	197
ㅏ /a/	211		183
ㅓ /o/	132		13
ㅓ /e/	9		
ㅏ ㅣ /ai/	3		
ㅣ ㅏ /ia/	1		
ㅓ ㅏ /oa/	1		
Total	1310		

The last member of the investigated English mid-vowels is [ɔ]. Table 82 displays the adaptation patterns observed in audio and visual modalities with their probability values.

Table 82 Probabilities based on audio and visual experiment for English [ɔ]

Korean Vowel	Probability	
	Based on audio exp.	Based on visual exp.
ㅏ /a/	0.92	
ㅓ /ə/	0.08	
ㅗ /o/		1.0
Total	1.00	1.00

The probabilities calculated from the audio experiment are 0.92 for ㅏ /a/ and 0.08 for ㅓ /ə/. In the visual experiment there is only one adaptation pattern, namely into Korean vowel /o/. Thus, the probability of vowel /o/ from visual experiment is 1.0. From these probabilities, we can obtain the expected frequencies by multiplying the probability values with the total number of English [ɔ] vowels in established loanwords (cf. Table 83).

Table 83 Expected frequencies based on audio and visual experiment for English [ɔ]

Korean Vowel	Audio exp.		Visual exp.	
	Probability	Expected frequency	Probability	Expected frequency
ㅏ /a/	0.92	163		
ㅓ /ə/	0.08	14		
ㅗ /o/			1.0	177
Total	1.0		1.0	

The results of the audio experiment predicted a frequency of 163 for ㅏ /a/ and 14 for ㅓ /ə/. The results of the visual experiment predicted /o/ adaptation in all cases, resulting in the expected frequency of 177. Now we will compare these calculated frequencies with the actual frequencies of the established loanwords in Table 84.

Table 84 Expected and actual frequencies for English [ɔ]

Korean Vowel	Frequency of established loanwords	Expected frequency	
		Based on audio exp.	Based on visual exp.
ㅏ /a/	5	163	
ㅓ /ə/	12	14	
ㅗ /o/	157		177
ㅜ /u/	1		
ㅟ /au/	1		
ㅚ /e/	1		
Total	163		

Again the established loanwords showed more variations than the results of the experiments imply. On account of the predictive performance, the visual experiment is better than

the audio experiment. The audio experiment predicted a frequency of 5 for ㅏ /a/, and 12 for ㅑ /æ/. In sum, 17 cases (10%) were predicted correctly by the audio experiment. On the other hand, the visual experiment predicted a frequency of 157 for /o/ which is 89% of the cases.

6.2.3. Low vowels

Table 85 below summarizes the probabilities obtained based on experiments with English vowel [æ].

Table 85 Probability calculated based on audio and visual exp. [æ]

Korean Vowel	Probability	
	Based on audio exp.	Based on visual exp.
ㅏ /e/	1.0	0.46
ㅑ /a/		0.54
Total	1.00	1.00

In the audio experiment, all [æ] stimuli are adapted as Korean /e/, so the probability for this vowel is 1.0 for /e/. In the visual experiment, on the other hand, English [æ] was adapted as /e/ only in 46% of the times. Korean ㅑ /a/ was preferred in 54% of the cases. Hence, the probabilities based on the visual experiment are 0.46 for /e/ and 0.54 for ㅑ /a/. Table 86 below was obtained by multiplying these frequencies with the number of English [æ] vowels attested in established loanwords.

Table 86 Expected frequencies based on audio and visual experiment for English [æ]

Korean Vowel	Audio exp.		Visual exp.	
	Probability	Expected frequency	Probability	Expected frequency
ㅏ /e/	1.0	430	0.46	198
ㅑ /a/			0.54	232
Total	1.0	430	1.0	430

There are 430 /e/ adaptations expected based on the audio experiment. The expected frequencies of 198 and 232 were calculated for /e/ and ㅑ /a/ respectively based on the results of the visual experiment. In Table 87, we can see how predictions of the audio and visual experiments carry out in the light of established loanwords.

Table 87 Expected and actual frequencies for English [æ]

Korean Vowel	Frequency of established loanwords	Expected frequency	
		Based on audio exp.	Based on visual exp.
ㅏ /e/	266	430	198
ㅓ /a/	153	0	232
ㅕ /ə/	5	0	0
ㅗ /e/	3	0	0
ㅛ /ei/	3	0	0
Total	430		

The prediction of the audio experiment (i.e., Korean /e/) was correct in 266 of the cases out of 430, which is 62% of all cases. The visual experiment predicted correctly two directions for adaptation in the form of Korean /e/ and /a/. In total there were 351 correct predictions: 198 for ㅏ /e/ and 153 for ㅓ /a/, which is 82% of all cases. In sum, the established loanwords are better represented by the results of the visual experiment (354; 82%) than by those of the audio experiment (266; 62%)

The next member of English low vowels is [ʌ]. The probabilities were calculated from the visual and audio experiments are summarized into Table 88.

Table 88 Probability calculated based on audio and visual experiment for English [ʌ]

Korean Vowel	Probability	
	Based on audio exp.	Based on visual exp.
ㅕ /ə/	1.0	1.0
Total	1.00	1.00

Similar to English [u], English [ʌ] also gave identical patterns for adaptation in both modalities. In both the audio and the visual experiments uniformly Korean ㅕ /ə/ was selected as the Korean counterpart of English [ʌ]. This claim ignores the approximately 4% of NA responses in the audio experiment. Since there were 115 occurrences of English [ʌ] in established loanwords, both experiment types predict adaptation into Korean /e/ in all 115 of the cases. The data is summarized in Table 89.

Table 89 Expected frequencies based on audio and visual experiment for English [ʌ]

Korean Vowel	Audio exp.		Visual exp.	
	Probability	Expected frequency	Probability	Expected frequency
ㅕ /ə/	1.0	115	1.0	115
Total	1.0		1.0	

The comparison of observed and expected frequencies is presented in Table 90 below. As it can be seen in the data, almost all occurrences of English [ʌ] are adapted as Korean /ə/.

Table 90 Expected and observed frequencies for English [ʌ]

Korean Vowel	Frequency of established loanwords	Expected frequency	
		Based on audio exp.	Based on visual exp.
ㅏ /ə/	100	115	115
ㅓ /a/	4	0	0
ㅕ /e/	1	0	0
ㅗ /u/	5	0	0
ㅜ /o/	3	0	0
ㅡ /e/	2	0	0
Total	115		

Since both experiments predicted the same amount of ㅏ /ə/ adaptation, in case of English [ʌ] it is impossible to rank the two modalities. It can be concluded that the predictions of both the audio and visual experiments are equally correct.

The last English vowel to investigate is low back vowel [ɑ]. Table 91 summarizes the probabilities obtained from the audio and the visual experiments. Based on the results of the audio experiment English [ɑ] is expected to be adapted either as Korean ㅓ /a/ or as Korean ㅏ /ə/ at equal probabilities. Based on the results of the visual experiment, the expected vowels are divided between Korean ㅓ /a/ and /o/ in 50-50% of the times. Interestingly the ratios are similar, but the vowel qualities are different.

Table 91 Probability calculated based on audio and visual experiment with English [ɑ]

Korean Vowel	Probability	
	Based on audio exp.	Based on visual exp.
ㅓ /a/	0.5	0.5
ㅏ /ə/	0.5	
ㅜ /o/		0.5
Total	1.00	1.00

In total there are the English vowel [ɑ] is attested in 347 cases in the established loanwords. The expected frequencies are calculated by multiplying this count with the probabilities of the audio and visual experiments. The expected frequencies are summarized in Table 91.

Table 92 Expected frequencies based on audio and visual experiment for English [a]

Korean Vowel	Audio exp.		Visual exp.	
	Probability	Expected frequency	Probability	Expected frequency
ㅏ /a/	0.5	173	0.5	173
ㅓ /ə/	0.5	173		
ㅗ /o/			0.5	173
Total	1.0		1.0	

Adaptation patterns found in both the audio and visual experiments are bifurcated in two kinds of vowels. Each vowel anticipates 173 of adaptations. These expected frequencies are compared with the frequencies of the established loanwords in Table 93.

Table 93 Expected and actual frequencies for English [a]

Korean Vowel	Frequency of established loanwords	Expected frequency	
		Based on audio exp.	Based on visual exp.
ㅏ /a/	153	173	173
ㅓ /ə/	13	173	
ㅗ /o/	174		173
ㅜ /e/	7		
Total	347		

The results of the audio experiment predicted correctly 153 cases for vowel ㅏ /a/ and 13 cases for ㅓ /ə/; which is 166 cases in total (48%). The results of the visual experiment predicted correctly 153 cases for ㅏ /a/ and 173 cases for /o/; which is 326 cases in total (94%). It is apparent that the established loanwords can be better represented by the results of the visual experiment (326; 94%) than by the results of the audio experiment (166; 48%)

6.2.4. Summary

Overall, predictive performance varies according to the source vowel. In the case of English borrowings into Korean, with regard to the vowel [i], the audio experiments represent established loanwords better. In the cases of [ʊ], [ɛ], and [ʌ], in contrast, predictive performance is about the same between the audio and visual experiments, and in the cases of [ɪ], [u], [ə], [ɔ], [æ], and [ɑ], visual representations were more effective.

In contrast to established loanwords, in the present audio experiment there were no cases of letters without sounds (aural representations). Therefore, English letters with no pronunciation, which were analyzed in section 5.3.5., were not analyzed in this section. Thus, 3918 individual tokens were analyzed in this section, excluding 45 cases of letters without sounds. Table 94 below summarizes the predicted frequencies based on the perception experiments.

Table 94 Summary of predicted frequencies based on experiments

	High vowel				Mid vowel			Low vowel			sum of correct predictions
	i	ɪ	u	ʊ	ɛ	ə	ɔ	æ	ʌ	ɑ	
correct prediction based on audio exp.	357	168	53	40	336	873	17	266	110	166	2386
correct prediction based on visual exp.	240	213	125	42	346	1060	157	351	115	326	2975

Overall, the results of the audio experiment predicted 2386 cases (61%) and the results of the visual experiment, 2975 cases (76%). Hence, we can conclude that actual established loanwords are better represented by the visual experiment than by the audio experiment.

6.3. Audio experiment in comparison with established Korean loanwords

In this subsection, we compare the results of the perception test with adaptation pattern in established loanwords. Through this comparison the similarity between two groups will be shown. Also, discrepancies in the intended correspondences will argue for the consideration of orthographic factors in the borrowing process.

6.3.1. Vowels with strong correspondence to Korean vowels

The results of perception test with English [i], [ʊ], [ɛ], [ɔ], [æ], and [ʌ] showed strong relation with Korean vowels. For example, all stimuli with English [i] were adapted as /i/ in Korean; English [æ] were adapted as Korean /e/. Although the adaptation patterns for English [ʊ], [ɛ], [ɔ], and [ʌ] vowels are not 100% unanimous, their correlations with Korean vowels are rather strong. Namely, they all are adapted as certain Korean vowels in more than 85% of the each case (cf. Table 95).

Table 95 Vowels with strong correspondence with Korean vowels (audio experiment)

English	[i]	[ʊ]	[ɛ]	[ɔ]	[æ]	[ʌ]
Korean	ㅣ /i/	ㅓ /u/	ㅓ /e/	ㅓ /a/	ㅓ /e/	ㅓ /ə/
	100%	92%	88%	92%	100%	96%

A comparison with patterns observed in established loanwords reveal an interesting pattern. As for English [i], [ʊ], [ɛ], and [ʌ], the selections for Korean vowel equivalents are identical across the loanwords and the audio experiment. Even the adaptation rates converge significantly. For example, English [i], which was adapted as Korean ㅣ /i/ in the perception test 100% of the time

is adapted as /i/ in established loanwords in 90% of the cases. Or, English [ʊ], which was adapted as Korean ㅜ/u/ in the perception test at 92% of regularity, is adapted as ㅜ/u/ in established loanwords in 95% of the times.

Table 96 Vowels with strong correspondence to Korean vowels (established loanwords)

English	[i]	[ʊ]	[ɛ]	[ɔ]	[æ]	[ʌ]
Korean	ㅣ /i/	ㅜ /u/	ㅔ /e/	ㅓ /o/	ㅐ /e/	ㅑ /ə/
	90%	95%	91%	89%	62%	87%

However, not all vowels are in harmony. There are some discrepancies between the results of the perception test and the adaptation pattern in established loanwords. The two most obvious cases are [ɔ] and [æ]. The English open [ɔ] was predominantly adapted as Korean ㅓ /a/ in the perception (92%), it is usually adapted as a different vowel in established loanwords. Approximately 89% of English [ɔ] is associated with Korean /o/ in loanwords. In case of English [æ], both loanwords and the audio experiment provide /e/ as its Korean equivalent, however, at rather different adaptation rates. While in perception Korean /e/ was chosen with no exception, in established loanwords this pattern is preferred only 62% of the cases.

The interpretation of these discrepancies with the two vowels should refer to the influence of orthography. The majority of English [ɔ] is written as ‘o’ (73%), which explains the choice for /o/ in established loanwords. Similarly, the large majority of English [æ] is written as ‘a’ (99%; see chapter 5 for further details), which triggers Korean ㅓ /a/ – lowering the number of the phonetically grounded adaptation into /e/.

6.3.2. Vowels with no strong correspondence to Korean vowels

Next we will look at the English vowels that do not exhibit any strong tendencies toward being adapted as particular Korean vowels. In the perception test the majority of responses for English [ɪ], [ʊ], [ə], and [ɑ] were divided between two or more Korean vowels. The proportion of even the most frequent responses typically did not reach 50% compared to all possible adaptation patterns. For example, English [ɪ] was adapted as Korean /e/, /i/ and /i/ with proportions of 38%, 27% and 8%, respectively (Table 97). There is no clear preference for a single Korean vowel, and the ratios of the best candidates do not reach 50%.

Table 97 Vowels with no strong correspondence to Korean vowels (audio experiment)

English	[ɪ]	[u]	[ə]	[ɑ]
Korean	ㅓ /e/ 38%	ㅜ /u/ 42%	ㅓ /ə/ 44%	ㅓ /a/ 50%
	ㅣ /i/ 27%	ㅣ /i/ 35%	ㅡ /ɪ/ 26%	ㅓ /ə/ 50%
	NA 24%	ㅡ /ɪ/ 15%	ㅜ /u/ 13%	
	ㅡ /ɪ/ 8%	ㅓ /o/ 4%	ㅣ /i/ 12%	

As a comparison, the adaptation patterns of these unstable vowels in establish loanwords are presented in Table 98.

Table 98 Vowels with no strong correspondence to Korean vowels (established loanwords)

English	[ɪ]	[u]	[ə]	[ɑ]
Korean	ㅣ /i/ 93%	ㅜ /u/ 100%	ㅓ /ə/ 46%	ㅓ /o/ 50%
	ㅓ /e/ 5%		ㅓ /a/ 16%	ㅓ /a/ 35%
			ㅣ /i/ 11%	
			ㅓ /o/ 10%	

There are some obvious differences. For example, in perception test, English [ɪ] was adapted as Korean /e/ in 38% of the times, but the large majority of English [ɪ] in established loanword is adapted as /i/ (93%, Table 98). Also, in the perception test English [u] was adapted as Korean ㅜ /u/ in 42% of the time, but in established loanwords all English [u] is adapted as Korean ㅜ /u/.

As for the English weak vowel [ə], both in the perception test and in established loanwords Korean ㅓ /ə/ is chosen as a counterpart with the proportions somewhat below 50% (44% in the experiment; 46% in loanwords). In contrast with this similarity, the non-winning candidates for English [ə] are rather different in the audio experiment from the established patterns. While in the audio experiment English [ə] can be adapted as /i/ or /u/, these patterns are not supported by existing loanwords. Conversely, adaptation into /a/ or /o/ is not uncommon in loanwords, but it is not supported by the audio experiment.

The final English vowel in this line of discussions is [ɑ]. In the perceptual experiment English [ɑ] is commonly borrowed either as /a/ or /ə/ with the same 50% probability. Among these two choices, only /a/ exists in established loanwords. Even this preference for /a/ shows a smaller proportion in borrowings than in the audio experiment (35% versus 50%). The most preferred Korean vowel for English [ɑ] in established words is /o/, which is actually absent from candidates of the perceptual experiment.

The overall results of the perception test coincided with adaptation patterns in established loanwords. However, in the case of English [ɔ], [æ], [ɪ], [u], [ə], and [ɑ], discrepancies were registered between results of perception test and the patterns observed in established loanwords. The discrepancies imply that other factors are at stake with established loanwords which do not exist in the audio test. Orthography is a natural candidate to solve this problem.

6.4. Two forms of input in language comprehension

6.4.1. Previous studies on loanword phonology

One of the most intriguing problems in loanword research is about the nature of input forms in the process of loanword adaptation. There are two opposing views, one of them positing phonemic forms, the other one assuming phonetic forms as inputs to the borrowing process. The current chapter, while admitting the influence of both phonemic and phonetic factors, argues that the orthographic representation of the lexical items should also be taken into equal consideration when discussing the formation of loanwords. Orthography is often an overlooked factor in the current literature, as visual representation of language is not considered to be an inherent part of our linguistic knowledge. Through a logical line of argument this chapter arrives to the conclusion that orthographic information, if present, must be involved in the analysis of loanwords.

6.4.2. Means of language: sign, spoken, and written languages

Although under normal circumstances most of us use spoken language for communication, language can be expressed by other means as well. Deaf children can learn sign language; linguistic communication can take place using written forms; messages can be exchanged using Morse codes. It is needless to say, these forms of language have different characteristics and attract different branches of linguistics. Theoretical linguistics, and phonology in particular, aims to understand linguistic knowledge, and it chooses to investigate it through its most natural and intuitive form of expression: via spoken language. Written language with its incidental nature and its social and anthropological relevancies lies outside of the interest of theoretical linguistics. Under these circumstances it follows logically that studies on loanword adaptation tend to focus on spoken representation of words, let them be phonetic or phonological in nature, and either marginalize or simply ignore effects of orthography.

6.4.3. Language comprehension model

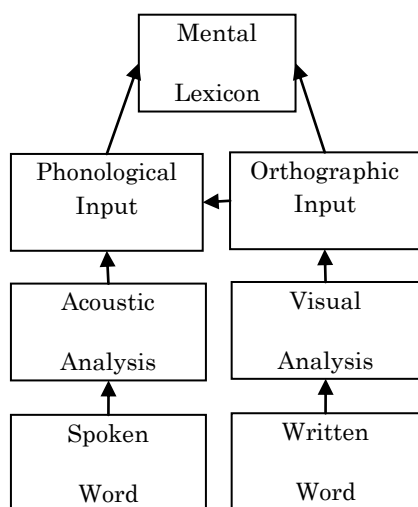


Figure 31 Language comprehension model (Gazzaniga et al. 2002)

Moving away from the constraints of competence-oriented linguistics, the role of written language receives greater appreciation. For example, in psychological models of language comprehension both spoken and written inputs are present, and they are treated of equal importance (Gazzaniga et al. 2002). A schematic representation of components of language comprehension is demonstrated in Figure 1. It is clear in this flow chart that both spoken and written words can constitute as inputs. It is also important to note that the model features an orthography-to-phonology mapping process. Written forms usually access the mental lexicon through the phonology of the language. Also orthographic input can access straight the mental lexicon

when the reading skill is matured.

Although a comparison of phonological and psychological models in relation to loanword phonology is a promising research topic, the current paper cannot pursue this route. Nevertheless, if we accept the – otherwise justified – psychological model as our working model, several implications for loanword phonology can be claimed. First of all it can be presumed that written forms are

full-fledged members of the system; their role in the borrowing process is not marginal anymore. Second, the psychological model offers several points where the L2→L1 process can take place, allowing for both phonetic and phonemic inputs. Third, the orthography-phonology mapping part of the model can explain the phenomenon of reading adaptation. Reading adaptation is when L1 spelling-to-pronunciation rules are applied to L2 words.

6.5. Orthography and phonology

6.5.1. *Orthography reflects the phonology of the language*

6.5.1.1. Syllable structure in languages

The writing system of a language reflects its phonology. For example, in case of Japanese, it is not a mere coincidence that the kana writing systems (katakana and hiragana) consist of symbols representing units of morae, as Japanese language itself is a mora-based language. Due to phonotactic constraints in Japanese, the possible number of syllables is rather limited, thus CV syllables can be used as basic units in its writing systems. Similar syllabic alphabets are not possible in either Korean or English. The number of grammatical syllables is too high to be easily memorized. According to “The Investigation of Frequency of Using Modern Korean Words” (2002) there are 1989 types of syllables in contemporary Korean, and the theoretically possible number of syllables is even higher. Korean with its maximal CCVC syllable template is still restrictive compared to the maximal CCCVCCCC template of English. In order to constrain the number of symbols to be memorized, syllables are decomposed into phonemes in the writing system of languages with complex syllable structures. The building blocks of writing systems (i.e., graphemes) in these so called phonemic languages correspond roughly to the phonemic units of the language.

6.5.1.2. Letter differences in languages

The close relation between the writing system and phonology of a language is particularly apparent in languages with phonemic orthography. Speech sounds engaging in phonemic contrasts are expressed by different graphemes. For example, for English speakers /r/ and /l/ are distinct phonemes, thus they are expressed in writing by different letters (Table 99). The pair of [r] and [l] sounds also exists in Korean, but they are consciously not distinguished by Korean speakers. These sounds occur in complementary distribution and associated with a single phoneme. Unsurprisingly the Korean writing system, Hangul, uses a single symbol to notate these two sounds.

Table 99 Contrastive phonemes in English and Korean (From Fernandez et al. 2011)

	English	Korean
Contrastive distribution	/r/ → [r]: river, peer, sprint /l/ → [l]: liver, peel, splint	/p ^h / → [ph]: [p ^h ul]; 'grass' /p/ → [p]: [pul]; 'fire'
Complementary distribution	/p/ → [p ^h]: pin, apart [p]: spin, apple	/l/ → [r]: [rupi], 'ruby' [l]: [p ^h ul], 'grass'

An inverse pattern is observable with simple and aspirated stops, which form an allophonic relation in English and phonemic relation in Korean. For example, [p] and [p^h] belong to a phonemic contrast in Korean, but they are difficult to distinguish for English speakers. The writing system reflects these relations. In English both [p] and [p^h] are spelled with 'p'; in Korean they are written by different graphemes: the plain /p/ with 'ㅍ', its aspirated pair /p^h/ with 'ㅍ'.

6.5.2. Orthography is related to phonological awareness

6.5.2.1. Necessity of phonology on learning to read

Learning to read requires phonological awareness. Every human being who was born and raised in a language community, acquire her language by being exposed to it. While learning the first spoken language takes place unconsciously, learning to read requires considerable conscious efforts. Learning to read involves training a skill that is responsible for matching graphemes to phonemes (Ehri 1997). In order to match graphemes to phonemes one should be aware of both letters and phonemes. To memorize phonemes, one should be able to understand the sound system of the language - that is its phonology.

The acquisition of reading skills requires phonological awareness which is a tool of analyzing a spoken word into its phonological components (Shankweiler and Lundquist 1992). As Frost and Ziegler (2007) points out, phonology plays a crucial role in decoding words while reading. Practical evidence has been reported among others by Liberman (1992) that a child's success in learning to read is connected to the child's ability to analyze the phonological structure of his or her language. The involvement of phonology during reading is irrespective even of such differences as the one exists between the writing systems of English and Chinese (Perfetti et al. 1992). The connection between phonological awareness and reading skills is further supported by experiments which report that training phonological awareness is helpful for the children with reading difficulties (Scarborough 1998). These findings were found to be also for the logographic writing system of Chinese (Perfetti et al. 2005). The implication of these experiments is that phonological awareness

precedes orthographic knowledge. That is, phonological awareness is a precondition for reading (Liberman, Shankweiler, Liberman, Fowler & Fischer 1977).

6.5.2.2. Literacy affects phonological awareness

Once we have learned to read, the reading ability affects our ability to consciously manipulate phonemes (Morais et al. 1979). By the time reading skills are acquired, orthographic knowledge is closely intertwined with phonological awareness (Mattingly 1972). In literate societies, people spend much of their time on decoding written forms of their languages. Meanwhile their phonological awareness is brought upon the experience of reading (Liberman, Shankweiler, Liberman, Fowler & Fischer 1977). “The beginning reader must have some degree of awareness, but this awareness is increased and diversifies in appropriate directions as a result of his encounter with the orthography” (Morais, Alegria & Content 1987). That is literacy itself can be a stimulus for linguistic awareness (Morais et al. 1979).

Orthography and phonology mediate access to our mental lexicon. The bidirectional interaction between the orthographic and phonemic representation evolves simultaneously to the development of literacy skills (Frost and Ziegler 2007, Castles & Coltheart 2004, Perfetti et al. 1987). Whether they are native speakers or learners of a language, phonological knowledge is affected by the orthography of the language. The evidence can be found in phonological manipulation tests. For example, for French learners of English, the phoneme /p/ in the English word *lapse* is easier to be noticed than in the English word *absurd*, because /p/ in *lapse* is written as ‘p’ while /p/ in *absurd* is not written with ‘b’ (Halle, Chereau, and Segui 2000).

Another example for the influence of orthography on phonology can be found in deletion tests carried out with English and Hebrew bilingual speakers (Ben-Dror, Frost, and Bentin 1995). The bilingual participants were asked to delete the first sound of the stimuli they heard. While English speakers more or less accurately deleted the first sounds, Hebrew speakers showed a tendency to delete the first two sounds in the word: the initial consonant and the following vowel. The difference between two groups may be linked to the writing systems in these two languages. For instance the word [gʌn] used in the experiment is a valid word in both English and Hebrew meaning “gun” in English and “garden” in Hebrew. However, there are orthographic differences, English [gʌn] is spelled as ‘g’ ‘u’ ‘n’, while Hebrew [gʌn] is spelled as ‘g’ ‘n’ with no letter representing the vowel between. For Hebrew speakers the deletion of the first sound was interpreted as deleting the first grapheme. The left single ‘n’ was pronounced without the vowel. For another instance, the word [bʌt] exists in both English and Hebrew. In Hebrew [bʌt] means “daughter”. However, [bʌt] is written in these languages differently, English [bʌt] is spelled as ‘b’ ‘u’ ‘t’, while Hebrew [bʌt] is spelled as ‘b’ ‘t’

with no letter representing the vowel between. During deletion task involving the first consonant, English speakers left [ʌt] while Hebrew speakers left [t].

Sometimes, even lost pronunciations recovered from the orthography. In case of /t/ in the word *often*, the sound was lost by eighteenth century and it is seldom pronounced in British English. However, the same /t/ in *often* has been reintroduced in American English based on its spelling and the word now often pronounced as [ɔftən] (Antilla 1972). Another example of orthography affecting spoken language can be found in the Korean initial law. In Korean, initial law prohibits word initial $\equiv$ /r/ sounds. For example, Chinese character 料 is pronounced in two ways depend on the context. When 料 is in a non-initial position, as in 資料 자료 /tʃaryo/ ‘document’, it read as /ryo/. However, when 料 is in word initial position as in 料理 요리 /yori/ ‘cousine’, it read as /yo/. *The Korean orthography Rule* (1933), which was released by the Association of Korean Language, acknowledged this variation in the pronunciation of r-initial morphemes and made Korean orthography comply with the initial law. After Korea was divided into North and South around the 1950s, North Korea reformed its orthography. The initial law was deliberately ignored in order to unify the pronunciation of morphemes, regardless of the positional variations in the spoken language (Ahn B. H. 2001). Consequently, in North Korean dialect both 資料(자료) /tʃaryo/ and 料理(료리)/ryori/ are written and pronounced with /r/s for the initial consonant in morpheme 料. The existence or absence of the initial law is one of the major differences between Northern and Southern Korean dialects. Interestingly this difference was brought upon by orthographic reformations in the North.

6.6. Reading adaptation

6.6.1. Visual dominance effect

People tend to rely more on the visual information than on auditory information. When auditory information and visual information is presented simultaneously, the effect of visual information tends to be more powerful than auditory information (Colavita and Weisberg 1979). This phenomenon is called the visual dominance effect. Visual stimuli get faster and more accurate responses than auditory stimuli (Kim and Min 2009). For example, Kim and Min 2009 presented their participants both visual stimuli (written numbers) and auditory stimuli (audio recordings of numbers) simultaneously. The result showed that the reaction time of correct answers were the fastest when the visual and auditory stimuli represented identical numbers. Under the condition of only one kind of stimuli – either visual or auditory –, the reaction time of correct answers were found to be shorter for visual only stimuli compared to audio only stimuli. As for error rates, the visual stimuli showed lower error rates compared to that of the auditory stimuli.

6.6.2. Mismatch between written and spoken form

English is apparently a good example for a language that has an irregular orthography (Carney 1994, Venezky 1970, 1999). Unlike Italian and Hungarian dictionaries, most English dictionaries note phonetic transcriptions. Language is changing, so in order to make written language fit well with the changing spoken forms, writing system has to undergo reformatations. For example, Korean underwent spelling reform in 1933 and in 1989, German has undergone writing reforms in 1901 and in 1996, Dutch also underwent several major spelling reforms between 1815 and 1996 (Borgwaldt 2003). As for English, however, spelling reforms have never been undertaken. Because of constant changes of the language, the correspondence between sounds and letters became rather loose. As a result, some of letters are not pronounced. For example, English word initial /kn-/ sequences were simplified to /n/, though the spelling preserved the lost /k/ (Antilla 1972). Another example is word initial 'wr' clusters, in which /r/ is absent from pronunciation. As a result [rait] can be spelled as *right*, *rite*, *wright* and *write*.

Another problem of spelling is that the correspondence between sound inventory and the often borrowed symbol set, that is the alphabet, is not ideal. For example, English phonemes outnumber the number of Roman characters. The Roman alphabet consists of five symbols that represent vowels: 'a, e, i, o' and 'u'. Even if letter 'y' and 'w' are considered to be an additional vowels (representing /i/ and ɪ/u/), the seven vowel symbols are not sufficient to represent the more than 13 distinctive English vowels.

Other languages using the Roman alphabet face similar issues. In the writing system of German this problem was resolved by introducing diacritics, thus vowels are written as follows: a, e, i, o, u, ä, ö, ü. In case of English digraphs have been introduced into the writing system. Vowel digraphs are sequences of two vowel letters that may or may not be identical (e.g., 'oo', 'ee', 'ea', 'ou,' as in *pool*, *seem*, *lead*, *soul*). Letter 'w' and 'y' can also be part of digraphs: V+y as in *day*, *boy*; V+w as in *row*, *pew*; or y+e as in *dye*, *rye*. Sometimes trigraphs are used with 'y' and 'w' being a letter in the middle, such as in *aye*, and *ewe*.

Although mismatches in the number of sounds and letters can be remedied by diacritics and digraphs, in the case of English the resulted system is not ideal. In an ideal system, a single letter or digraph represents a single sound and a single sound is represented by a single letter or digraph. English is rather far from this ideal one-to-one relation between letters and sounds. First of all, in English, one sound can be written in many different ways. For example, phoneme /f/ can be written as 'f' as in *five*, 'ph' as in *phone*, 'ff' as in *staff*, or 'gh' as in *laugh*. Another example, is English /i/ which can be written as 'e' as in *be*, 'ee' as in *fee*, 'ea' as in *sea*, 'ei' as in *receive*, 'eo' as in *people*, 'ey'

as in *key*, 'i' as in *machine*, 'ie' as in *belief*, 'ae' as in *formulae*, 'ay' as in *quay*, or 'oe' as in *poenology* (Lado 1957).

Second, English letters can represent more than one sound. For example, English words starting with the letter 'c' can be pronounced as [k] as in *cat*, or [s] as in *ceiling*. The digraph 'ch' can be pronounced as [tʃ] as in *chart*, or [ʃ] as in *chic* (Borgwaldt 2003). There are many similar cases with vowels as well. Letter 'a' is pronounced as [æ] in *fat*, and as [ei] in *fate*. Letter 'e' is pronounced as [ɛ] in *met*, and as [i] in *meat*. Letter 'i' and 'y' is pronounced as [ɪ] in *bit* and *tryst*, and as [ai] in *bite* and *type*. Letter 'o' is pronounced as [a] in *hop*, and [ow] in *mope*. Letter 'u' is pronounced as [ʌ] in *mutt*, and [u] in *mute* (Celce-Murcia et al. 1996). These pairs are also referred to as tense and lax pronunciations of the letters. Table 100 summarizes these correspondences.

In contrast to monographs, digraphs usually offer more reliable information about word pronunciation. For instance, digraph 'ee' mainly represents [i] (e.g., *tee*, *fee*, *see*, *bee*). Although the degree of variation is considerable less with digraphs, they do not always offer bullet proof information about the pronunciation of vowels. For example, the digraph 'ea' is read as [i] in *leaf*, but it is read as [ɛ] in *deaf*.

As mentioned above a considerable portion of the sound variation is due to the tense/lax distinction in the vowel system. The tense versus lax contrast in English emerged partly as a result of the Great Vowel Shift between the fifteenth and eighteenth century. In closed syllables, only lax vowels occurs ((C)VC). On the other hand, tense vowel could occur in both syllable final open syllables or in closed syllables (Celce-Murcia 1996). According to Dickerson (1989), the tense-lax vowel distinction can be explained by four orthographic rules. First, lax vowels are followed by one or more consonants at the end of the word (e.g., *at*, *add*, *tell*, *off*, *pend*, *felt*, *loft*), while tense vowels are followed by consonant and a word final silent e (e.g., *rate*, *mete*, *bite*).

Table 100 English pronunciation of vowel letters (Monosyllable words)

letter		lax vowel		tense vowel
a	rat	/æ/	rate	/ei/
e	met	/ɛ/	mete	/i/
i	bit	/ɪ/	bite	/ai/
o	rot	/a/	rote	/oo/
u	cut	/ʌ/	cute	/(y)u/

The second rule says that lax vowels are followed by double consonants in writing (see Table 101). The third rule says that in closed syllables, tense vowels before the final consonants are

spelled with digraphs (e.g., *eat, meet, boot, boat, bail, boil, bawl, bowl*). Finally, in open syllables, tense vowels are written as a vowel digraphs ending in 'w' or 'y' (e.g., *low, how, may, buy*). In closed syllables, digraphs of tense vowels end in 'w' (e.g., *howl, dawn, sewn*).

While these four rules greatly help speakers to guess the pronunciation of words based on the written forms, they are mainly valid only for monosyllabic words. It is possible to extend the rules to polysyllabic words, but in order to do so the place of the stress has to be known. Since word stress in itself is hard to learn for foreign learners of English, the correct pronunciation of vowels are inherently difficult to master. It also does not help that there are several exceptions to these rules (e.g., *Canada, banana*).

Table 101 English pronunciation of vowel letters (Two syllable words)

<i>letter</i>	<i>lax vowel</i>		<i>tense vowel</i>	
a	latter	/æ/	later	/eɪ/
e	Eddie	/ɛ/	Edie	/i/
i	pinning	/ɪ/	pining	/aɪ/
o	mopping	/ɑ/	moping	/oʊ/
u	rubble	/ʌ/	ruble	/u/

6.6.3. Reading pronunciation

The contemporary English writing system is so inconsistent that even well educated native speakers of English needs to consult a dictionary to get the spelling of a word right (Lado 1957). Table 102 below displays a list of common spelling errors made by native speakers and learners of English. The errors of English learners are most likely due to their lack of phonological knowledge of English. Native speakers of English, who are fully aware of English, made these errors presumably because English sound-to-letter relations in English are far from being obvious, on the contrary, they can be really confusing (Besner and Smith 1992).

Table 102 Spelling errors in English (Celce-Murcia et al. 1996)

native speaks of English		learners of English	
correct form	error	correct form	error
<i>photograph</i>	<i>photagraph</i>	<i>green</i>	<i>grin</i>
<i>writing</i>	<i>writting</i>	<i>writing</i>	<i>writting</i>
<i>grammar</i>	<i>grammer</i>	<i>light</i>	<i>right</i>

Reading adaptation is the process when words from the target language are pronounced using the grapheme-to-phoneme rules of the source language (Vendeline & Peperkamp 2006). For example, Spanish learners of English often pronounce the English letters 'u' as /u/ or /ʊ/ bringing in the Spanish pronunciation of the letter. In this setting the English word *but* may be pronounced as [bʊt] as in *boot*. Similarly, English speakers who are learning Spanish often pronounce Spanish letter u as [ʌ] like as in the English word *bus*. Likewise, English speakers tend to pronounce the letter 'i' in Spanish words *vine*, *dime*, *dile*, *dice* as [ai] instead of the correct [i], because this is how these CiCe forms in English are rendered to pronunciation.

Table 103 Pronunciation errors (from Lado 1957)

<i>correct English pronunciation</i>	<i>error by Spanish speakers</i>	<i>correct Spanish pronunciation</i>	<i>error by English speaker</i>
[ʌ]	[u] or [ʊ].	[i]	[ai]
bus, run, cup		bine, dime, dile, dice	

Reading pronunciation is especially common with brand names. Since brand names are present in the target language mainly in written forms, such as labels of goods, or sign boards, speakers of the target language are left with their grapheme-to-phoneme rules to derive pronunciation. Although it is expected that speakers would use grapheme-to-phoneme rules of the source language, their knowledge is often limited, and as a resort they fall back to rules of their native language. This can be the case even if the grapheme-to-phoneme rule of the source language involves phonemes that are present in the adopting language. For example, Haugen (1950) reports a case of pronunciation errors of American Norwegian immigrants who tend to render American the English letter 'a' as /a/. Despite the fact that the sound [æ] is present in the Norwegian vowel inventory, Norwegian immigrants used their native 'a' to /a/ mapping.

Table 104 Pronunciation errors by Norwegian immigrants

	<i>bran</i>	<i>alfalfa</i>	<i>saloon</i>	<i>battery</i>	<i>gallon</i>
<i>English model</i>	[bræn]	[æɫ'fæɪfə]	[sə'lun]	['bæt(ə)ri]	['gælən]
<i>oral reproduction</i>	bræn	æɫ'fæɪfa	sa'lun	bətri	gælən
<i>spelling pronunciation</i>	brann	alfalfa	salon	battəri	gallon gallan

6.6.4. Evidence for reading adaptation found in this thesis

In established loanwords, there were considerable cases of orthographic adaptations. Through analysis in chapter 3, we could find out that reading adaptation occurs regardless of the pronunciation of the target vowel. For example, out 1105 cases of the English letter 'a', 523 cases were adapted as Korean *ㅏ* /a/ independent of the actual pronunciation of the target vowel. In fact, out of 1105 cases of letter 'a', there were 137 cases whose pronunciation are [a] in English. Therefore, we can find phonetic reason of *ㅏ* /a/ adaptation for these 137 cases. Yet, this number (137) is a lot smaller than potential reading adaptation cases (523). In an analogous way, cases of reading adaptation in established loanwords are summarized in Table105. It is noteworthy that the figures for reading adaptation are always greater in number than the cases in which the English pronunciation actually coincides with the Korean reading of the English vowel letter.

Table 105 Reading adaptation and adaptation-faithful English pronunciation

<i>English letter</i>	<i>total number of instances</i>	<i>reading adaptation</i>	<i>English pronunciation coincides with reading adaptation</i>
<i>a</i>	1105	523	137
<i>e</i>	859	468	322
<i>i</i>	815	644	526
<i>o</i>	812	668	363
<i>u</i>	285	144	100
<i>y</i>	169	141	131

A comparative analysis in section 4.5 showed us that there were more variations in established loanwords than in the results of the audio experiment. About half of the vowel adaptation patterns that occur in established loanwords were not observed in the audio experiment. Among those 1964 cases, 733 cases (19% of the cases) can be interpreted as reading adaptation. In other words, phonetic approach alone can explain established loanwords in 49% of cases. However, if we take an orthographic approach into consideration, then we can cover adaptation outputs up to 68%. Considering the existence of the intersection between phonetic and orthographic adaptation, it is apparent that influence of orthography on loanword adaptation strategies is not at all marginal.

6.7. Summary

Loanword adaptation is a popular topic in phonology, with two main rival views. Phonemic views claim that phonological representations are the input for the adaptation process, while phonetic views emphasize the importance of surface, phonetic forms. While several arguments have been made for both views, orthography has been regarded as a marginal component by most of

these positions. The present thesis claims that this dismissive treatment of orthography is not justifiable. Although theoretical linguistics does not allow for a role of orthographic factors in linguistic analysis, psycholinguistic models of language comprehension do accommodate written forms (Gazzaniga et al. 2002). These models faithfully describe the bidirectional relation between phonology and orthography, and correctly predict an influence of orthography on loanword adaptation. This points the conclusion that loanword phonology can be complete only if orthography is treated as an inherent component of the borrowing mechanism.

7. Conclusion

This thesis has investigated loanword adaptation patterns through an analysis of established loanwords and perception tests. Specifically, Korean loanwords from English were analyzed. In Chapter 5, we analyzed established loanwords according to their orthographic and phonetic characteristics. A perception test (Chapter 3) demonstrated how vowels are borrowed when only audio input is available. Then, we compared the results of the auditory experiment with the patterns we found in established loanwords in Chapter 5. Following a visual perception test, we described how vowels are borrowed when only visual stimuli are present. The results were then compared to the outcome of the audio perception test.

The greater part of the data, that is, the findings of Chapters 3 to 5, could be explained by phonetic factors. Yet, in addition to phonetic motivations, the role of orthography is also undeniable. Furthermore, we found numerous cases that can only be explained by orthographic factors — with no reliance on phonetics. These cases clearly demonstrated that orthographic factors also have to be taken into consideration in the explanation of loanword adaptation. This conclusion is supported by the fact that outside phonology, orthographic effects are widely acknowledged. Chapter 6 gave a brief overview of the literature supporting the role of orthography outside phonology.

For the analysis of established loanwords, we used Korean loanwords from English. For our investigation, a tripartite system of Korean vowel–English pronunciation–English orthography was created. The data showed variations in the quality of Korean vowels compared to fixed English orthography. Of course, some of these variations seemed to result from variation in the English pronunciation. For others, we could not find phonetic motivations from the English pronunciation. These cases can be explained either by orthographic accounts or by Korean phonology.

As a next step, the data were classified according to English vowel pronunciation. Overall, the results showed that phonetic influence is strong in the case of seven vowels: [i], [ɪ], [u], [ʊ], [ɛ], [ɔ], and [ʌ]. However, orthographic interpretation was also possible for [ɪ], [ɛ], [ɔ], and [ʌ]. Further, a large number of Korean vowel selections can be explained on orthographic grounds in the case of English [ɑ] and [æ] (e.g., Korean /kɒlpʰi/ for English *golf* [gɔlf], Korean /kʌs/ for English *gas* [gæʃ]).

There were two obvious cases of orthographic adaptations in the established loanwords. One was with schwa, and the other was with a special case in which an English vowel letter is paired with no pronunciation. Although schwa can be a phoneme in English, its orthography is not fixed to one letter; it can be written with the character ‘a,’ ‘e,’ ‘i,’ ‘o,’ or ‘u.’ In established Korean loanwords, schwa is adapted as ㅏ /a/, ㅓ /e/, ㅣ /i/, ㅜ /o/, ㅡ /u/, ㅗ /ɨ/, or ㅛ /ə/. These latter

vowels are all distinctive phonemes in Korean. When an English word has a vowel in its orthography but the letter has no corresponding pronunciation, the vowel letter is adapted into Korean as one of the Korean vowels even though it is not pronounced in English. The selection of the vowel in established loanwords is greatly influenced by the English spelling of the word.

Under the supposition that factors other than ones related to phonetics or orthography may also be at work in loanword adaptation, a perception experiment was performed. It was an audio perception experiment in which Korean participants listened to acoustic stimuli of English vowels and selected one Korean vowel from a set of candidates that was the most similar to the English one. If the established loanwords are all borrowed based on the word pronunciation, the results of the audio experiment would coincide with the patterns found in established loanwords.

The overall patterns showed great similarity between the results of the audio experiment and established loanwords. However, there were also undeniable differences between the two. The results of the audio experiment showed considerably less variation in the possible ways of adaptation compared to the established loanwords. Also, in some cases, the perceptual selection of Korean vowels directly contradicted the selections found in established loanwords. For instance, English [ɔ] was adapted mostly as Korean ㅓ /a/ in the perceptual experiment, while it is adapted mostly as Korean ㅕ /o/ in established loanwords. In the audio experiment, English [ə] tended to be adapted as Korean ㅓ /ə/, and occasionally as a high vowel varying between ㅗ /i/, ㅜ /u/, and ㅣ /i/. However, this tendency could not be found in established loanwords where English [ə] is adapted as Korean ㅓ /ə/, ㅓ /a/, ㅣ /i/, or ㅕ /o/.

In addition to the audio test, another type of perceptual test was carried out in order to investigate loanword adaptation patterns under visual stimuli without audio stimuli. In the experiment, written English words were presented as the stimuli. In a sharp difference with the results of the audio experiment, the participant responded with the same reply to the same stimuli most of the time. For instance, English [u] tended to trigger Korean ㅜ /u/, ㅣ /i/, and ㅗ /i/ in the audio experiment, whereas in the visual experiment, the same English [u] (e.g., in stimuli words such as “loop” and “communication”) was paired exclusively with Korean ㅜ /u/. Interestingly, although the participants were allowed to choose “NA” as their response in both the audio and visual experiments, they never did so. The results of the visual experiment were a subset of the patterns found in established loanwords. Most of the written English words were adapted exactly in the form that the established loanwords had. Only a few cases showed different adaptation patterns. As explained in Chapter 6, the results of the visual experiment predict the pattern of established

loanwords better than the results of the audio experiment. This observation is supported by calculating the probabilities and expected frequencies based on the results of both experiments.

The evidence presented in Chapters 3 to 5 showed a clear influence of orthography on the adaptation of loanwords from English to Korean. Chapter 6 showed that this finding is supported widely in the literature outside phonology. Firstly, according to psychological experiments, visual input tends to win over auditory input during processing because visual information remains longer in the memory and is preserved more accurately than auditory information (Colavita and Weisberg 1979, Kim and Min 2009). Secondly, it is widely accepted that orthography itself is a type of manifestation of phonological knowledge. Therefore, the phonological interpretation of linguistic matters relies strongly on orthographic knowledge. Thirdly, the effects of reading adaptation, that is, the native reading of foreign words, can be easily found in errors made by language learners. Finally, early loanwords in Korean exhibit forms that are apparently formulated through reading adaptation. All together, the literature confirms that orthographic adaptation occurs regardless of the languages involved.

Previously, the majority of the literature on loanword adaptation ascribed adapted forms to variants of either phonetic or phonological adaptation. A recent research trend, however, takes orthography into account. Yet, there have been no clear statements or evidence of how orthographic adaptation is carried out, nor has there been an investigation into how strong the orthographic influence is in comparison to phonetic and phonological motivations.

This thesis confirmed that in Korean loanwords, orthographic factors also affect the adaptation process along with phonetic and phonological factors. In established loanwords, the presence of phonetically motivated patterns was — as expected — overwhelming high, around 68%. However, patterns that can be explained by orthography were found in a considerable portion, 62% of all cases. As the figures suggest, in many cases, adaptation patterns can be explained on both phonetic and orthographic grounds.

Despite the limitations of coverage and methodology, the findings presented in this thesis provide meaningful resources for further studies. First, at concrete levels, the data organized and analyzed in a tripartite format can form the basis of further studies, even for completely different frameworks. Data from the perceptual and visual experiments can also be a valuable resource not only for academic purposes but also in the field of education. Second, from a more abstract point of view, the general idea of weighting orthographic factors in comparison to other ones is an attractive idea that can easily be applied by other researchers.

Although there are a great number of studies on loanword phonology, the data presented in their research is not exhaustive, and arguments are often based on anecdotic or ad-hoc data. Only

a few studies offer a quantitative analysis in the field (Kang Y. 2003 among others). Yet, their data is usually restricted to a rather narrowly defined phenomenon, and thus, it is difficult to extract data from these datasets that are not directly related to the subject matter. This thesis presented a quantitative, holistic approach to the topic of vowel adaptation patterns in English loanwords of Korean. All possible adaptation strategies in ten monophthong English vowels were enumerated and discussed in detail using a database of established loanwords. Although diphthongs were not discussed here, their behavior can be easily placed in the framework of the study.

Besides scarcity of data, another characteristic of previous research is that arguments split along the debate of the phonetic versus phonological nature of adaptation. Although the possibility of an orthographic influence on loanwords is not denied in these papers, probably due to the so-called non-linguistic nature of written language, spelling effects are rarely discussed. The present research aims to fill this gap in the literature by focusing on the role and weight of orthography in adaptation strategies. Uniquely, it aims to quantify the weight of spelling in comparison with phonetic and phonemic influence.

An additional unique feature of this thesis is that perceptual tests are devised, and the results are compared with patterns extracted from established loanwords. Previous works have been limited to data of either established loanwords or the results of online adaptation processes. The present research combines the two by executing visual and audio perception tests in Chapters 3 and 4, respectively.

In sum, this thesis presents a valuable addition to the view that loanwords are formed by a combination of source word pronunciation and orthography. Through quantification of influencing factors on loanwords, the thesis proved that orthographic motivation in loanwords adaptation is comparable to phonetic and phonological factors. The results clearly mark a necessary correction for loanwords studies into a direction that pays more attention to the written form of words and incorporates orthographic factors at a more basic level into the analysis.

8. References

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