

The Adaptation of English Liquids in Contemporary Korean: a Diachronic Study*

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Abstract

This paper examines the diachronic development of English liquid adaptation in Contemporary Korean (1890-Present) based on a number of loanword lists from different time periods. The examination of initial liquids shows that contrary to common assumption, the initial liquids are often realized as [n], showing that the *Tuim rule* (a rule of initial liquid avoidance) is still active, although marginally. The adaptation of word-medial /l/ varies between singleton [r] and geminate [ll]. A quantitative study finds evidence for both of two competing explanations for the variation—(1) the singleton adaptation is a remnant of Japanese-mediated loans and (2) the variation is conditioned by the durational characteristics of English input—but the former turns out to be a more dominant factor and the latter plays only a minor role.

Keywords: loanwords; Korean; English; Japanese; diachrony.

Table of Contents

- | | |
|----------------------|---------------|
| 1. Introduction | 4. Conclusion |
| 2. Background | References |
| 3. Data and analysis | |

1. Introduction

While many recent studies on loanword adaptation have shown that perceptual factors play a major role in loanword adaptation (Silverman 1992, Y. Kang 2003, Kenstowicz 2003, 2007, Iverson and Lee 2006, Peperkamp et al. 2008, Boersma and Hamann 2009, Broselow 2009), we also find evidence that other factors such as orthography, the channel of borrowing, the level of bilingualism, and tendency toward regularization also affect the outcome of adaptation (See Kang 2011 for a

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recent review). Often these competing explanations predict similar outcomes and evaluating the contribution of each factor toward a particular adaptation pattern can be challenging. In Korean, the pervasive influence of Japanese-mediated loanwords, i.e. Western loanwords borrowed into Korean through Japanese (Tranter 1997, Kang et al. 2008) complicates the matter further. Also, the interpretation of written data from time periods when no spoken data are available requires some amount of detective work that takes into account the orthographic conventions of the time.

The current paper examines the adaptation of English liquids /l/ and /ɹ/ and their diachronic development in Contemporary Korean (1890-Present), in particular the adaptation of initial /l/ and /ɹ/ and medial /l/. Various aspects of liquid adaption and their implications for the phonology of the Present Day Korean have been widely discussed in the literature (B. Lee 2001, Y. Lee 2001, H. Kang 2003, Seo 2004, Heo and Lee 2004, J. Lee 2005, Kenstowicz 2005, Iverson and Lee 2006, A. Lee 2009). Also, the transcription of liquids in Western words in publications from the Enlightenment period (1890-1910) has been studied by many (Chung 1999, Y.-S. Shin 2000, Han 2007, 2009, 2010). The goals of the current study are to reexamine the phenomena from a quantitative and diachronic point of view subjecting various assumptions found in the literature to the test of quantitative verification, and as a result also to contribute to our understanding of loanword phonology in general.

The study examines English loanwords from three time periods in Contemporary Korean: the Enlightenment Period Korean (EPK 1890-1910) when substantial contact between English and Korean began, the 1930s, the height of the Japanese occupation of Korea (1910-1945) and right before the establishment of detailed spelling convention on loanwords in 1941, and Present Day Korean (PDK, 1990s-now). The data discussed in this study are drawn from loanword lists compiled from various published sources. A list of data sources examined in this paper is provided in (1).

- (1) a. EPK (The Enlightenment Period Korean: 1880-1910)
 - Y.-H. Kang (1971): a list of Western sound-based loanwords compiled from 37 textbooks from EPK.
 - Y.-S. Park (1997): a book-length list of loanwords compiled from textbooks, newspapers and novels from EPK.
- b. The 1930s
 - J.-K. Lee (1937): a compilation of over 18,000 loanwords in publications from the 1930s.
- c. PDK (Present Day Korean: 1990-now)
 - NIKL (1991): a compilation of about 5,000 loanwords used in newspapers and magazines published in 1990.
 - H.-W. Choi (2001): a survey of pronunciation of 170 loanwords by 367 Seoul Korean speakers and 34 professional broadcasters.

2. Background

Korean has a single liquid phoneme, represented as /L/ in this paper (cf. Iverson and Sohn 1994). The liquid phoneme is realized as a tap [ɾ] intervocalically and as a lateral [l] in coda or when geminated, as the examples in (2) demonstrate.

- (2) a. /muL/ [mul] ‘water’
 b. /muL-i/ [muri] ‘water-Nom.’
 c. /muL-Lo/ [mullo] ‘water-Inst.’

In South Korean dialects, liquids cannot occur in word-initial position in native and Sino-Korean vocabulary.¹ The restriction is static in native vocabulary as there is no native word that has an underlying initial liquid. In Sino-Korean words, alternations are found as shown in (3). Underlying /L/ in Sino-Korean morphemes is realized as [n] or is deleted word-initially, the deletion occurring when the liquid is followed by [i] or [j], due to a restriction against initial [ni] and [nj].² The term *Tuim rule* (‘initial sound rule’) refers to both the general restriction against initial liquids and the restriction against initial [ni] and [nj] sequences. In this paper, our main focus is on the restriction against the initial liquid.

- (3) /Lo-tong/ [no-tong] *[ro-tong] ‘labor’ cf. [kwa-ro] ‘overwork’
 /Ljæk-sa/ [jæk-sa] *[rjæk-sa], *[njæk-sa] ‘history’ cf. [i-rjæk] ‘resume’

In Present Day Korean, the general pattern of loanword adaptation is as follows (Y. Lee 2001, B. Lee 2001, Kenstowicz 2005, Iverson and Lee 2006, A. Lee 2009). In word-initial position, both liquids of English, /l/ and /ɹ/, are adapted as a tap [ɾ], in violation of *Tuim rule*, as shown in (4a). In intervocalic position, the contrast of /ɹ/ and /l/ is retained as a singleton-geminate contrast, as shown in (4b). A liquid in obstruent-liquid clusters is adapted with vowel epenthesis and the English liquid contrast is retained as a singleton-geminate contrast similar to the adaptation of intervocalic liquids. Examples are provided in (4c). In coda, English /l/ is adapted as [l] and English coda /ɹ/ is realized as a zero, as shown in (4d) presumably due to their vowel-like quality. This is in contrast to coda rhotics from other European languages which are generally more consonant-like (trill or tap) in their quality and tend to be adapted as a liquid with an epenthetic vowel as in Italian *largo* → /LaLiko/ and French *bourgeois* → /puLicuəl/. The examples in (4) are all from B. Lee (2001).

1. There are exceptions to this restriction: the name of the letter, /Liil/ and family names that have Chinese characters with original initial liquid as in /Li/, /Lim/, /Lju/, /La/, and /Lo/ (Martin 1992). These are the exceptions allowed by the normative orthographic convention but the actual pronunciation of these names likely varies.
2. H. Kang (2003) proposes that these words are lexicalized as underlyingly /n/-initial or vowel-initial and the [ɾ] ~ [n]/∅ alternation is no longer synchronically active.

(4)	English /l/	English /ɹ/
a.	/Lɛmp ^h i/ [ɾɛmp ^h i] ‘lamp’	/Lɛmp ^h i/ [ɾɛmp ^h i] ‘ramp’
b.	/k ^h əLLə/ [k ^h əllə] ‘color’	/miLə/ [mirə] ‘mirror’
c.	/piLLɛk/ [pillek] ‘black’	/piLok ^h ə/ [pirok ^h ə] ‘broker’
d.	/seiL/ [seil] ‘sale’	/pət ^h ə/ [pət ^h ə] ‘butter’

The current paper will examine the adaptation of initial liquids (4a) and intervocalic /l/ (4b, c).³ While (4) is a fair description of the general pattern of adaptation, as we will see below, there is a considerable amount of variability in the actual data, particularly in earlier periods of Contemporary Korean and also in PDK. This presents us with a challenge but also an opportunity to evaluate competing explanations about the adaptation patterns.

3. Data and analysis

I begin with the (non)-adaptation of word-initial liquids in section 3.1. I will then discuss the adaptation of intervocalic /l/ in section 3.2.

3.1. Word-initial liquids

It is sometimes mentioned in the literature that initial liquids in loanwords used to be realized as [n] in earlier periods as in (5) but in PDK the *Tuim rule* is no longer active and the English initial liquids are realized as some type of liquid in recent loanwords (Martin 1992, Sohn 1999).

(5)	/nacio/	‘radio’
	/namp ^h o/	‘lamp’
	/nuka/	‘Luke’
	/nak ^h et/	‘racket’
	/not ^h aLi/	‘rotary’

First, we start with the written data sources and we find evidence for a diachronic shift in the expected direction, i.e., from less to more violation of *Tuim rule*. Figure 1. summarizes how these initial consonants are transcribed in the written data.

3. The current paper does not deal with the adaptation of the liquid in sonorant-liquid clusters. See H. Kang (2003), and Seo (2004) among others for discussion of adaptation of these sequences.

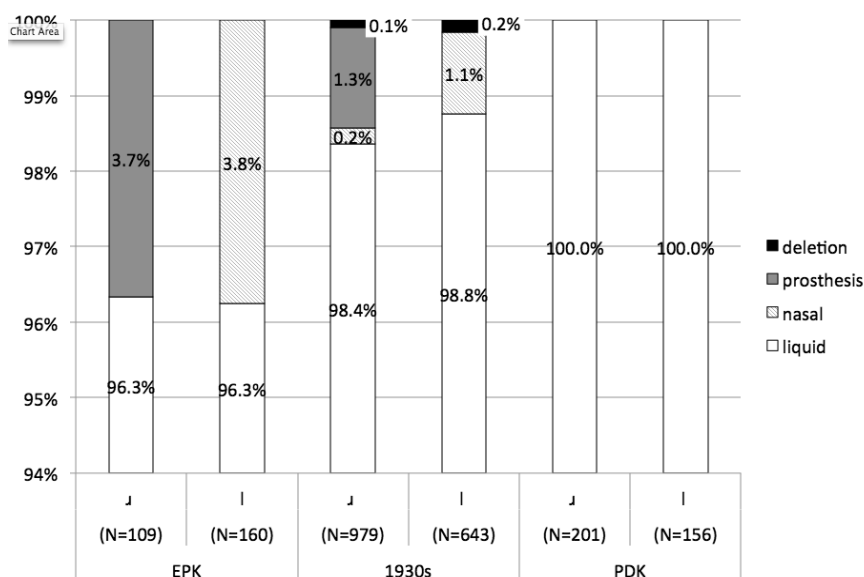


Figure 1. Transcription of initial liquids in loanwords in Contemporary Korean.

The PDK data are drawn from NIKL (1991) where the initial liquids are categorically transcribed as <L> without a single exception. In EPK and the 1930s, unlike PDK, alternative transcriptions are attested which avoid an initial liquid in accordance with the *Tuim rule*. The rate of liquid retention increases through the three time periods (96.3% (EPK) < 98.5% (the 1930s) < 100% (PDK)). A comprehensive list of initial liquid modification from the corpora is provided in (6) and (7).

(6) Repair for the *Tuim rule* in EPK. < > represents orthographic forms.

- a. /l/ → <n>: <nimuL> ‘lemur’
 <nopiLnia> ‘lobelia’
 <nəntən>, <nonton> ‘London’
 <nakkij> ‘lucky’
 <nuka> ‘Luke’
- b. /ɹ/ → <VL>: <iLaisp^hiLti> ‘rightfielder’
 <aLasa>, <aLasja> ‘Russia’
 <uLip> ‘Ryp’

(7) Repair for the *Tuim* rule in the 1930s

a.	/l/ → <n>:	<namune>, <nemonate>	‘lemonade’
		<namp ^h o>	‘lamp’
		<net ^h i>	‘let’ ⁴
		<net ^h i in>	‘let in’
		<nisol>	‘lysol’
	/l/ → null:	<imp ^h a>	‘lymph’
b.	/ɭ/ → <n>:	<nak ^h et ^h i>	‘racket’
		<ne:Lu>	‘rail’
	/ɭ/ → <iL>:	<iLapinson k ^h iLuso>	‘Robinson Crusoe’
		<iLaunti>	‘round’
		<iLait ^h i>~<iLait ^h >	‘right’
		<iLait ^h i>~<iLait ^h >	‘right’
		<iLep ^h o:t ^h ə>	‘reporter’
		<iLis’ait ^h il>	‘recital’
		<iLip ^h əpuLLik ^h >	‘republic’
		<iLiLLei>	‘relay’
		<iLiLLe ^h i>	‘relief’
		<iLiŋ>	‘ring, rink’
	/ɭ/ → null:	<icimik ^h aL>	‘rhythmical’

It is notable that the /l/ tends to be repaired with [n] but /ɭ/ tends to be repaired with prosthesis. It is not clear, however, whether the initial vowel was actually pronounced as such or whether it is merely a device to ensure that the liquid is pronounced as such without undergoing nasalization. The deletion repair is found only before the vowel [i], as expected from the native process.

A striking fact about Figure 1 is that liquid transcription is the overwhelming majority pattern even in the earliest time periods, seemingly contra the assertion that the *Tuim* rule used to be more pervasively applied in earlier loans (Martin 1992, Sohn 1999). But we need to interpret the written data in the context of the spelling conventions of the time and there are reasons to believe that the rate of liquid retention was probably lower in actual pronunciation in EPK than is suggested by Figure 1.

In EPK, the transcription of Sino-Korean words that were subject to the *Tuim* rule varied between <n> and <L>, presumably reflecting different degrees of orthographic depth, <n> reflecting the surface realization and <L> reflecting the underlying representation of the morpheme, as in <nwemuL> ~ <LwemuL> ‘bribe’ and <notoŋca> ~ <Lotoŋca> ‘laborer’ (Song, et al. 2008, C.-S. Shin 2003). The indeterminacy of spelling is also evidenced by hypercorrective <L> spelling in words which are originally /n/-initial, as in <noŋəp> ~ <Lnoŋəp> ‘agriculture’ (Chung

4. As a reviewer pointed out, the word ‘let’, a technical term in tennis, is still often pronounced as [net] in PDK and this is likely because speakers misanalyse the word as ‘net’ which is semantically congruent in the context.

1999, p. 38).⁵ And such hypercorrective spelling is also attested in loanword transcription from this time as in <noLmanti> ~ <LoLumansi> ~ <LoLumanci> ‘Normandie’ (Y.-H. Kang 1971).⁶

Given this spelling practice of EPK, we cannot simply assume that the prevalent <L> spelling in the loanwords from this time period reflects the actual or intended pronunciation. Rather, probably the loanwords written with initial <L> were pronounced as a nasal a good proportion of the time.

At the same time, it seems that the initial liquids in loanwords did not always obey the *Tuim rule* even at this early stage of contact. While the <n> ~ <L> spelling variation was common in Sino-Korean words, the rate of initial <L> spelling was far lower for Sino-Korean words than for loanwords. I examined the rate of <n> vs. <L> spelling variation in Sino-Korean words in Song, et al. (2008). Song, et al. (2008) is a compilation of words, mostly Sino-Korean, commonly used in newspapers, journals, novels, textbooks, and grammar books published between 1901 and 1910 and the book provides spelling variants for the words attested in their corpus. In Song, et al. (2008) there are 10 words that begin with an underlying initial liquid and when the count is summed over all 10 words, the rate of <L> spelling is only 48.8% (20 out of 41), compared to 96.3% in the loanwords in our data (259 out of 269).⁷ This suggests that the initial liquid in loanwords had

5. The consensus in the literature is that the avoidance of initial liquids is already established in Middle Korean (/Lomo/ [nomo] ‘old mother’, /LeiL/ [neil] ‘tomorrow’ Y.-B. Kim 2000). The variation in spelling of words subject to *Tuim rule* in (i) and the hypercorrective spelling of originally /n/-initial native words as <L> in (ii) date back to as early as the 15th century (Y. B. Kim 2000, Ci 2006).
 - i. 16th Century: <Ljankos> ~ <njankos> ‘lotus flower’
 <Lɔɔnjən> ~ <nɔɔnjən> ‘next year’
 - ii. 16th Century: <LaL-mata> ‘everyday (day-each)’
 17th Century: <LoLiL> ‘to descend’
6. The transcription of English word-initial liquids in A-hak-phyen (1908) is also instructive in showing the indeterminacy of initial <L> transcription in EPK. A-hak-phyen (1908) is a textbook for children, originally published in 1804 for teaching Chinese characters, and revised a century later to include information about English, Chinese, and Japanese. The transcription of English words in A-hak-phyen is intended to provide a faithful description of the English sounds, not a transcription of the words as used as loanwords. A-hak-phyen (1908) transcribes both liquids of English with a vowel prosthesis maintaining the distinction between the two liquids as a singleton vs. geminate contrast, as in <iLən> ‘run’ vs. <iL.Lən> ‘learn’ (Chung 1999, Y.-S. Shin 2000, Han 2009, 2010). This transcription suggests that the editors found that neither sound was similar to sounds transcribed as word-initial <L> in existing Korean words (i.e., Sino-Korean words), which was actually pronounced as [n] or null. It is plausible that the transcription in A-hak-phyen (1908) is an attempt to indicate that the initial liquid should be pronounced as a liquid, not as [n].
7. 3 of the 10 words occurred with <L> only, 3 occurred with <n> only, and the other 4 were attested with both spellings. There were also 30 words which have an underlying initial liquid followed by [j] and one word followed by [i]. It is assumed that the initial liquids in these words are pronounced as null due to the restriction against [nj/i], introduced around the 17th century (Chung 1999, Wee 2004). Interestingly, in these words, the spelling with <L> was overwhelmingly favored at 96.7% (118 out of 122). It is not clear why the <L> spelling is so systematically retained in these words. When these words are combined to the total count, the rate of <L> spelling increases to 84.7% (138 out of 163) but this rate is still lower than the rate found in loanwords (96.3%) and the difference is statistically significant ($\chi^2=18.407$, $df=1$, $p<0.001$).

a different status from the initial liquid in Sino-Korean words with respect to the initial liquid restriction.⁸

By the 1930s, various spelling reforms culminating in *The Unified Rules of Hangul Spelling* of 1933 had a significant effect on how loanwords are transcribed. The following three rules related to liquids are particularly relevant to our discussion.⁹

- (8) a. Rule #4: Where lateral 'L' used to be written as <Ln>, write <LL>.
 e.g. <kəLLe> *<kəLne> 'washcloth'
 <naLLinta> *<naLninta> 'let fly'
- b. Rule #43: When the consonant of <Lja Ljə Ljo Lju Li Lje> appears word-initially, write <ja jə jo ju i je>.¹⁰
 e.g. <jaŋsim> *<Ljaŋsim> 'conscience'
 <jək̚sa> *<Ljək̚sa> 'history'
- c. Rule #44: When the consonant of <La Lo Lu Li Lɛ Lø> appears word-initially, write <na no nu ni nɛ nø> as actually pronounced.
 e.g. <nakwən> *<Lakwən> 'paradise'
 <noin> *<Loin> 'elder'

(translation by YK)

In EPK, spelling variation between <n> and <L> was also rampant in word-medial position (Y.-B. Kim 2000, Ci 2006) and geminate [ll], both in loanwords and in native and Sino-Korean words, was commonly spelled as <Ln>, which should surface as [ll] in pronunciation by the regular process of lateralization (ln → ll) (Han 2007). The effect of Rule #4 on the transcription of medial [ll] in loanwords is clear; in EPK loanwords, a medial geminate [ll] was transcribed as <Ln> in 50.1% of the cases (182 out of 363) with the rest being transcribed as <LL> but in the 1930s, the rate of <Ln> transcription dropped to 2.4% (32 out of 1352). In contrast, Rules #43 and #44 on the transcription of initial liquids had practically no effect of lowering the rate of word-initial <L> transcription in loanwords. If anything, the <L> transcription increased from EPK to the 1930s as we saw in Figure 1.

The fact that these initial sounds were mostly transcribed with initial <L>, despite the new spelling rule which specifically prohibits a surface [n] from being transcribed as <L>, suggests that the initial liquids were actually pronounced as a liquid a good proportion of the time. Also, an examination of the 1935 recording

8. It is also possible that the spelling reflects the lexical representation (or UR) not the surface pronunciation. In other words, the Sino-Korean words may have been reanalyzed as underlyingly /n/-initial at least by some of the speakers (See H. Kang 2003 for a related proposal on Present Day Korean) while English loans were more consistently analyzed as having an underlying liquid. Under this interpretation it is still possible that the actual pronunciation was all [n] for both Sino-Korean words and the loanwords, the former due to the underlying representation and the latter due to the application of the *Tuim* rule.

9. The spelling rules of 1933 are available on-line at <http://www.hangeul.or.kr/html/25.htm>

10. It is notable that unlike Rule #44, Rule #43 does not have the phrase «as actually pronounced».

of *Korean Reader for Primary School Students* shows that the speakers were able to pronounce word-initial liquids as a tap [ɾ] (cf. Han 2005). At the same time, we also continue to find hypercorrective spelling where English word-initial /n/ is transcribed with <L>, as in <neon> ~ <Leon> ‘neon’, <nopillitʰi> ~ <Lopillitʰi> ‘nobility’ (J.-K. Lee 1937) indicating that despite the spelling reform, the confusion in spelling remained. In short, we can surmise that similar to EPK, in the 1930s, the word-initial liquids in loanwords were sporadically repaired and there was likely a wide range of variation in actual pronunciation but it is also likely that these liquids were pronounced as some type of liquid in many or most cases.

Finally, in PDK, despite the categorical transcription of initial liquids as <L> in written data, we find evidence that the supposed liquids are actually pronounced as a nasal by a substantial proportion of speakers. First, I examined the pronunciation of ‘radio’ in sentence-initial position in the *NIKL Read Speech Corpus* (2005), recordings of novels and essays read by 120 Seoul Korean speakers of various age groups. The text included a single sentence that begins with a liquid-initial loanword, ‘radio’, read by 80 of the speakers, in their 20s, 30s, and 40s, and there are several instances of clear [n] realization. The spectrogram in Figure 2 provides an example of ‘radio’ pronounced as [n] by a male speaker in his 20s (file code: mv06 t1 s2).

Further evidence for the [n] realization of these liquids comes from Choi (2001), which reports the pronunciation of 170 loanwords, including 12 liquid-initial words, by 367 Seoul Korean speakers and 34 professional broadcasters. The target loanwords were embedded in a sentence providing an appropriate context and the pronunciation of the loanwords was transcribed by fieldworkers. In Figure 3, I tabulate the initial consonant realization of these words reported in Choi (2001).

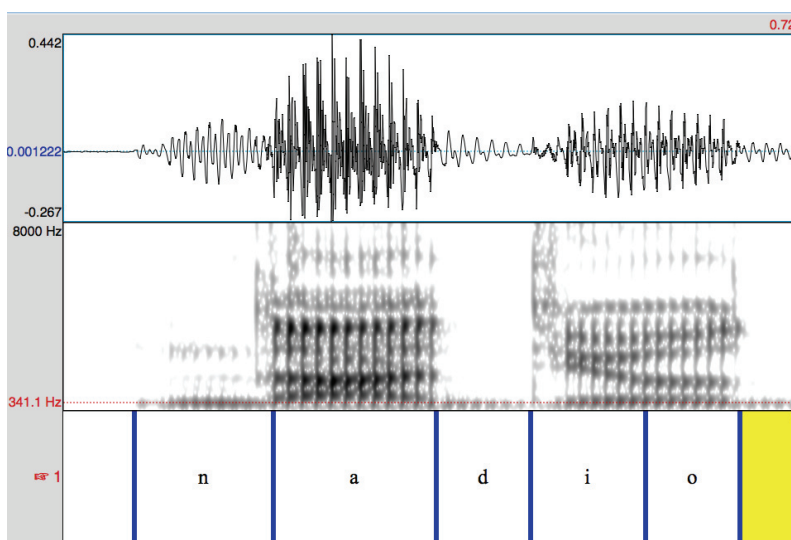


Figure 2. Spectrogram of 'radio' as produced by a male Seoul speaker in his 20s (NIKL 2005).

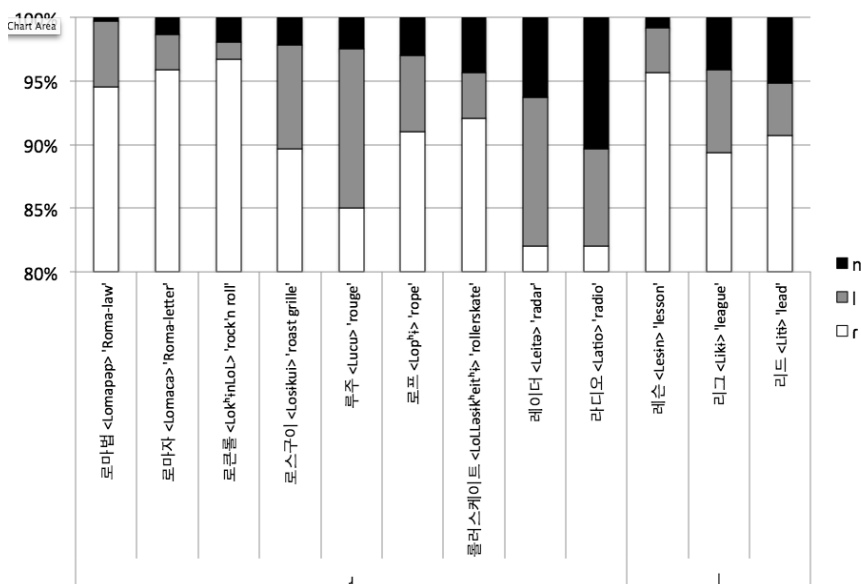


Figure 3. Realization of initial liquids in PDK loanwords in Choi (2001) (N=367).

In line with the standard assumption (Iverson and Kim 1987, Suh 1993, Y. Lee 2001, Ahn 2001, 2006, among others), these initial consonants are mostly realized as a tap, by over 80% of the speakers for all words, but, [n] and [l] are also attested.¹¹ The rate of [l] realization was not significantly different between English /l/-initial words (4.7%) and English /ɹ/-initial words (6.5%).

Figure 4 tabulates the results by age group and we can see that the [n] realization is more common among older speakers (40s, 50s, and 60s) than among younger speakers (20s and 30s). This age effect is consistent with the general diachronic trend that the [n] realization of these words is declining over time. We also observe that there is a substantial number of lateral realizations and that the [l] realization is more common with younger speakers than with older speakers. Assuming that younger speakers have more direct exposure to English than older speakers, this is in line with Seo (2004)'s suggestion that the lateral realization is likely an innovation by speakers with more exposure to English. Seo (2004)'s study found that a lateral realization is the majority pattern for word-initial liquids and her data were collected from Korean speakers residing in Ohio. A possible explanation for such a correlation between exposure to English and the increased [l] realization of initial liquids is as follows.

11. A similar pattern is found for 34 professional broadcasters. The rate of [n] realization is slightly higher for general Seoul speakers (3.5%) than for broadcasters (2.3%) and the rate of [l] realization is slightly lower for general Seoul speakers (6.1%) than for broadcasters (9.2%). But, these differences are not statistically significant (Fisher's exact test: $p=0.2953$).

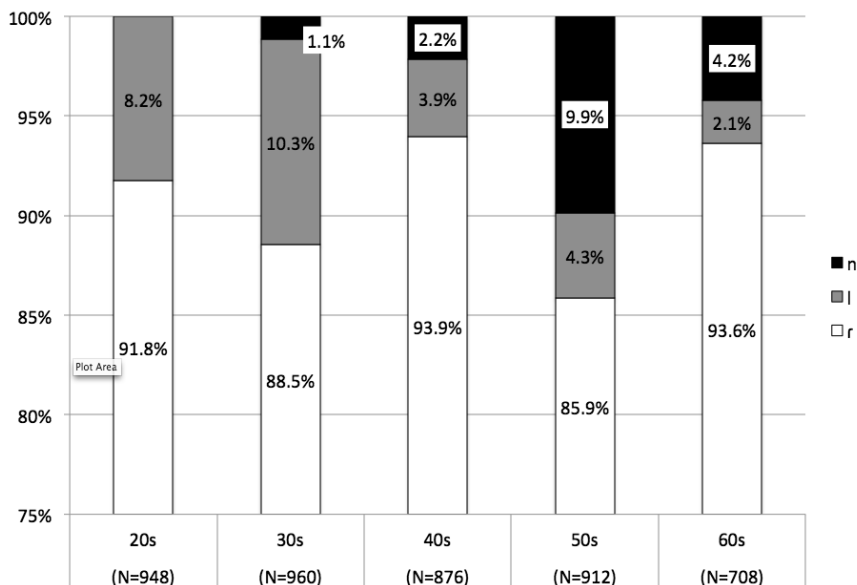


Figure 4. Realization of initial liquids in PDK loanwords in Choi (2001) by age group.

There being no contrast between the two types of liquids in word-initial position in Korean, naïve Korean speakers with little knowledge of English are expected to have difficulty distinguishing the two liquids of English (Ingram and Park 1998, H. Kang 1999, Kim and Kaiser 2010) and map the two liquids to a single liquid category in Korean and this single liquid phoneme is realized as a tap, presumably in analogy to the onset liquid realization in word-medial position. As Korean speakers gain more exposure to English, the speakers accumulate exemplars of the initial lateral, shifting the makeup of the initial allophone of the native liquid phoneme, and their word-initial liquid allophones end up showing free variation between a lateral and a tap. This account finds support in Borden et al. (1983)'s study on the production and perception of English liquids by Korean speakers. The study found that while low proficiency speakers tend to make errors of mispronouncing /l/ as /ɾ/, high proficiency speakers' errors, overall fewer in number, are found in both directions.¹²

To summarize the discussion on initial liquids, based on the corpus data we demonstrated that there is more variability in the realization of initial liquids in loanwords than is suggested in the literature and the *Tuim rule* is marginally active throughout Contemporary Korean, even in PDK. Also, we found evidence that there is a diachronic trend whereby the effect of the *Tuim rule* diminished over time in Contemporary Korean. This presents an example whereby a native restric-

12. But, the proficiency effect is not replicated in H. Kang (1999).

tion is more strictly abided by in earlier loans but gradually becomes more relaxed through sustained contact with the source language, leading to an importation of new structures (cf. Crawford 2009).

3.2. Word-medial /l/

Variation in the adaptation of medial /l/ has also attracted a lot of attention in the literature (Oh 2004, Oh and Steriade 2004, Kenstowicz 2005, Iverson and Lee 2006, A. Lee 2009, among others). In PDK, English /l/ is mostly adapted as a geminate [ll] but a singleton adaptation is also commonly attested. There are different explanations as to the source of the singleton variant.

Oh and Steriade (2004) and Kenstowicz (2005) account for this variation as a conflict between two faithfulness constraints, one that requires faithfulness in laterality or continuancy (violated by singleton adaptation) and one that requires faithfulness in duration (violated by geminate adaptation). Oh (2004) conducted a *Google* search and found that when the English input /l/ is spelled with a double liquid <ll>, the lateral is spelled as a geminate almost categorically in the Korean adaptation (99.999%) but when /l/ is spelled with a single <l> in the English input word, the geminate transcription rate drops to around 84%. A similar finding is reported in Heo and Lee (2004). Steriade and Oh (2004) interpret this as a case where spelling breaks the tie in cases of phonetic indeterminacy.¹³ Perception studies show, however, that laterality is the main cue that Korean speakers are sensitive to in their perception of the contrast between the singleton liquid [ɾ] and the geminate liquid [ll] and duration plays only a marginal role, if at all (J. E. Kim 2007, Broselow et al. 2009, Broselow 2011). So, one would like to see more evidence of duration of input liquid as a relevant factor in singleton adaptation.

Heo and Lee (2004), Kang et al. (2008) and A. Lee (2009), on the other hand, propose that the singleton adaptation is a remnant of Japanese-mediated loans. In Japanese, the English lateral is adapted as a singleton liquid of Japanese, regardless of position and the Japanese liquid in turn is adapted as a singleton liquid in Korean (E. *salad* → J. [sarada] → K. [sarata]). As these factors are often confounded in particular examples, we need to examine the contribution of various effects in a large database using a quantitative approach to test their validity.

In this paper, we examine the adaptation of intervocalic /l/ and also the adaptation of /l/ in obstruent + /l/ clusters in the three time periods of Contemporary Korean. As for the /l/ in clusters, the view that duration of input liquid plays a role predicts a higher rate of singleton adaptation in clusters compared to intervocalic position as the consonants tend to be shorter in duration when they occur in clusters in English (Klatt 1973, Haggard 1973). On the other hand, given the fact that in these clusters, the vowel preceding the liquid is always an epenthetic vowel, closed-syllable shortening (Lim 2000) expected in geminate adaptation (i.e., [i]

13. A. Lee (2009) proposes further constraints such as esthetics of spelling and advertisement and avoidance of sequences of geminate [ll].

is shorter in [pɪl.lu] than in [pɪ.ru]) and the preference for epenthetic vowels to be short and to avoid prominence (Steriade 2001, Kenstowicz 2003) may favor the geminate adaptation.

We start with the data from PDK. NIKL (1991) is not very informative for this purpose due to the normative nature of the data and /l/ in intervocalic and cluster positions is almost categorically transcribed as a geminate and the singleton rate is only 2.3% (7 out of 308). Choi (2001)'s survey of loanword pronunciation by 367 Seoul speakers includes 7 words with intervocalic /l/ and 3 words with /l/ in obstruent + /l/ clusters and in the data, the rate of singleton adaptation is 9.1% (335 out of 3670). The data for individual words are summarized in Figure 5. Due to the small number of words examined, it is difficult to draw any definitive conclusion but we can make a few observations, summarized in (9).

- (9) The rate of singleton [ɾ] realization in word-medial /l/ in PDK loanwords (based on Choi 2001)

a. spelling	<ll>	<l>
	2.4%(N=1468)	13.6%(N=2202)
b. segmental context	intervocalic	cluster
	8.0% (N=2569)	11.8% (N=1101)
c. position	initial	non-initial
	4.3% (N=2936)	28.3% (N=743)
d. Japanese influence	no influence	influence
	5.4% (N=3329)	45.7% (N=341)

First of all, we find a spelling effect in the direction expected under the duration-based account and in line with Oh (2004), i.e., the rate of singleton realization [ɾ] is higher for /l/ spelled with <l> (13.6%) than with <ll> (2.4%). The segmental context also has an effect expected under the duration-based account with /l/ in clusters realized as a singleton at a higher rate (11.8%) than in intervocalic condition (8.0%). It is also notable that in the two words that show the highest rate of singleton pronunciation in Figure 5, *pamphlet* and *ambulance*, the liquid occurs in non-initial syllables (28.3%), while in all the other words, the geminated liquid straddles the coda of the initial syllable as in [tʰjul.lip] (4.3%). This is a factor I did not consider going into the study but added to the study after examining the data. Also, I examined the effect of Japanese influence on the rate of singleton realization by examining if the singleton realization occurs more frequently in variants that contain other known characteristics of Japanese influence (Kang et al. 2008) such as the quality of epenthetic vowels (*pamphlet* → [pʰampʰuɾet] vs. [pʰampʰiɾet]), adaptation of mid central vowels as /a/ (*ambulance* → [empurans'i] vs. [empjulləns'i]), and affrication of coronal stops before a high vowel (*tulip* → [cʰuɾip] vs. [tʰjullip]). It turns out the variants which contain other characteristics

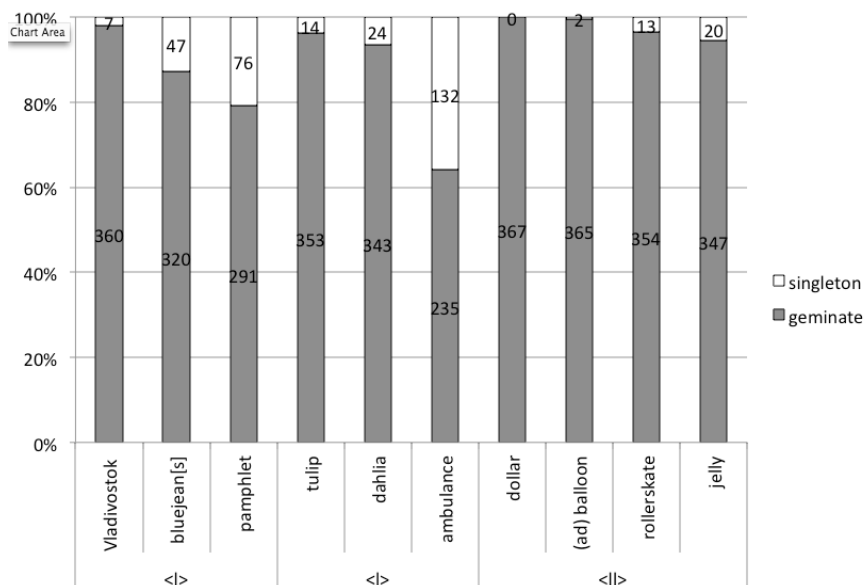


Figure 5. Realization of medial /r/ by Seoul Korean speakers in Choi (2001) (N=367).

of Japanese influence had a far higher rate of singleton realization (45.7%) than those without (5.4%).¹⁴

A mixed-effects logistic regression model is built with presence of Japanese influence (influence vs. no influence), the position in word (initial vs. non-initial), the segmental context (cluster vs. intervocalic) and the spelling (<l> vs. <ll>) as fixed effects and singleton vs. geminate realization in Korean adaptation as a

14. The table below summarizes the comparison between the realization of medial liquids in variants with and without traits of Japanese influence.

	Variants with Japanese influence			Variants without Japanese influence		
	[ll]	[r]	Percentage of [r]	[ll]	[r]	Percentage of [r]
Vladivostok	2	0	0.0%	358	7	1.9%
blue jean[s]	103	33	24.7%	217	14	6.1%
pamphlet	0	18	100.0%	291	58	16.6%
tulip	14	3	17.6%	339	11	3.1%
dahlia	0	0	NA	343	24	6.5%
ambulance	36	100	73.5%	199	32	13.9%
dollar	15	0	0.0%	352	0	0.0%
(ad) balloon	0	0	NA	365	2	0.5%
roller skate	15	2	11.8%	339	11	3.1%
jelly	0	0	NA	347	20	5.4%
Total	185	156	45.7%	3150	179	5.4%

response variable (geminate as the reference category). The by-word adjustment to intercept was entered as a random effect. The statistical analysis was conducted using the *lmer* function in the *lme4* package (Bates, Maechler, & Bolker, 2011) of R (R Development Core Team 2011). The results are summarized in (10).

- (10) A mixed-effects logistic regression model of medial /l/ adaptation in PDK based on the data from (Choi 2011)

	Estimate	Std. Error	z value	Pr(> z)
(intercept)	-3.2391	0.4911	-6.596	<0.0001***
position in word=noninitial	1.8142	0.6439	2.817	0.0048**
segmental context=cluster	-0.3157	0.6160	-0.513	0.6083
spelling=singleton	-1.0481	0.6475	-1.619	0.1055
Japanese influence=yes	2.4731	0.1810	13.667	<0.0001***

Significance codes: '***' 0.001 '**' 0.01 '*' 0.05.

The coefficients show the direction and the size of each effect. The factors are contrast-coded so that the condition that favors geminate adaptation (i.e., Japanese influence, non-initial position, cluster context, and singleton spelling) is coded as a reference category (=0) for each factor and the other category is coded as 1. So, the intercept represents the probability of singleton adaptation (transformed to logit values) when all factors are set to 0, i.e., the condition that favors geminate adaptation. The estimated probability of singleton adaptation in such condition is 3.8% ($=\exp(-3.2391)/(1+\exp(-3.2391))$). The estimate of each factor represents the increase in the probability of singleton adaptation when the factor is set to 1, i.e., the condition that favors singleton adaptation. The results show that only the Japanese influence ($b=2.4731$, $SE=0.1810$, $z=13.667$, $p<0.0001$) and the position in the word ($b=1.8142$, $SE=0.6439$, $z=2.817$, $p=0.0048$) are significant. Japanese influence has the largest coefficient value indicating that it has the strongest effect of raising the likelihood of singleton adaptation; the estimated probability of singleton adaptation rises from 3.8% to 31.7% ($=\exp(-3.2391+2.4731)/(1+\exp(-3.2391+2.4731))$) when a word contains traits of Japanese-mediated loans. The position in the word also has a substantial effect and the estimated probability rises from 3.8% to 19.4% when /l/ occurs in a non-initial syllable.

Data from EPK and the 1930s also shows that presence of a Japanese trait is the dominant factor that favors singleton adaptation. The overall proportion of singleton vs. geminate adaptation of medial /l/ in different time periods is summarized in Figure 6. In EPK and the 1930s, the singleton adaptation is much more frequent than in Choi (2001)'s PDK data, at 18.7% (83 out of 445) for EPK and 37.4% (802 out of 2144) for the 1930s, compared to 9.1% for PDK. The higher rate of singleton adaptation in EPK and the 1930s, in particular at the height of the Japanese occupation, is in line with the view that the main source of singleton adaptation is the Japanese-influenced adaptation.

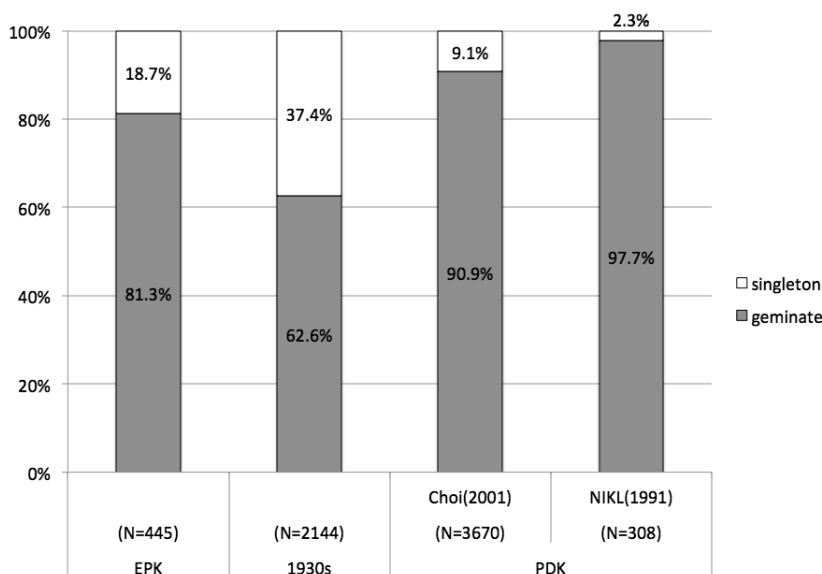


Figure 6. Realization of medial /l/ by Seoul Korean speakers in Choi (2001) (N=367).

The tables in (11) and (12) summarize the breakdown of the singleton transcription rate for word-medial /l/ in EPK and 1930s loanwords for different conditions. As for the Japanese influence, it is too time-consuming to code the entire data for the presence of Japanese influence and an approximation is made by examining the adaptation of word-initial voiceless stops only.¹⁵ In direct English to Korean adaptation, English voiceless stops are consistently adapted as aspirated stops but in Japanese-mediated loans, word-initial voiceless stops are adapted as lenis stops of Korean because English voiceless stops are adapted as voiceless stops of Japanese which are in turn adapted as lenis stops in Korean as in *Columbus* → EPK <koLomposi> vs. <k^hoLLəmpəs'i> (Ito et al. 2006, Kang et al. 2008).¹⁶ Therefore, words that do not contain a word-initial voiceless stop are not coded for the Japanese influence factor.

15. In the 1930s data, words that contained more than one medial /l/, which were small in number, were also excluded from the analysis.
16. According to Kang et al. (2008), voiceless stop adaptation is the most identifiable trait of Japanese-mediated loans. In hybrid loans, i.e., in loan forms where a subset of Japanese traits is replaced by the traits of direct English-to-Korean loans, the voiceless stop adaptation pattern is one of the first to be eliminated. Therefore, it is expected that even in words that do not have the Japanese-type voiceless stop adaptation pattern there may be other Japanese traits. In other words, some of the loans that are classified as not containing a Japanese trait in this table may still contain some Japanese traits. More systematic examination of the Japanese traits in the data will likely allow us to account for further variance by the Japanese influence.

(11) The rate of singleton <L> transcription by different conditions in EPK

a. spelling	<ll>	<l>	
	11.5%(N=52)	19.6%(N=393)	
b. segmental context	intervocalic	cluster	
	19.6%(N=346)	15.2% (N=99)	
c. position	initial	non-initial	
	17.9%(N=234)	19.4%(N=211)	
d. Japanese influence	no influence	influence	not coded
	7.2%(N=69)	32.0% (N=25)	19.9% (N=351)

(12) The rate of singleton <L> transcription by different conditions in the 1930s

a. spelling	<ll>	<l>	
	33.6%(N=378)	38.2%(N=1766)	
b. segmental context	intervocalic	cluster	
	40.1%(N=739)	32.3% (N=1405)	
c. position	initial	non-initial	
	33.8%(N=1344)	43.5%(N=800)	
d. Japanese influence	no influence	influence	not coded
	31.9%(N=382)	94.9% (N=79)	35.9%(N=1683)

The general pattern in (11) and (12) is similar to that found in PDK. In EPK and the 1930s, even in raw proportions, singleton transcription is more frequent intervocalically than in clusters, contra the prediction of the liquid duration-based account and in support of the account based on preference for shorter epenthetic vowels. Two logistic regression models are built to test the validity of each factor in accounting for the likelihood of singleton adaptation in EPK and the 1930s. The *lrm* function of R was used. The results of EPK and the 1930s are summarized in (13) and (14), respectively.

(13) A logistic regression model of medial /l/ adaptation in EPK

	Coefficient	Std. Error	Wald Z	P
(intercept)	-1.98992	0.4616	-4.31	< 0.0001 ***
position in word=noninitial	0.04831	0.2545	0.19	0.8494
segmental context=cluster	-0.36666	0.3218	-1.14	0.2545
spelling=singleton	0.78781	0.4606	1.71	0.0872
Japanese influence=no	-1.20072	0.4890	-2.46	0.0141 *
Japanese influence=yes	0.56605	0.4578	1.24	0.2163

Significance codes: '***' 0.001 '**' 0.01 '*' 0.05.

(14) A logistic regression model of medial /l/ adaptation in the 1930s

	Coefficient	Std. Error	Wald Z	P
(intercept)	-0.4441	0.13209	-3.36	0.0008 ***
position in word=noninitial	0.3873	0.09601	4.03	0.0001 ***
segmental context=cluster	-0.3625	0.10527	-3.44	0.0006 ***
spelling=singleton	0.2667	0.13096	2.04	0.0417 *
Japanese influence=no	-0.1539	0.12234	-1.26	0.2084
Japanese influence=yes	3.5345	0.51678	6.84	<0.0001 ***

Significance codes: '***' 0.001 '**' 0.01 '*' 0.05.

The factors were coded the same way as the mixed-effects logistic regression model for the PDK data except that for the Japanese influence, the factor has three levels, «Japanese influence», «no Japanese influence», and «not coded for Japanese influence» and the last level was coded as the reference. So, the row «Japanese influence=no» summarizes the comparison between the reference category and the loanforms where the initial voiceless stop is adapted without a Japanese influence (i.e., as aspirated) while the row «Japanese=yes» summarizes the comparison between the reference category and the loanforms where the initial voiceless stop is adapted in «Japanese style» (i.e., as lenis or fortis).

In EPK, the only factor that came out as significant is the non-Japanese adaptation of initial voiceless stop ($p=0.0141$); in words where initial voiceless stops are adapted as aspirated, the singleton adaptation was far less likely than otherwise. The position in the word (initial vs. non-initial) was not a significant factor but the correlation is in the expected direction based on the PDK data, i.e., singleton adaptation is more likely in non-initial position.

In the 1930s, all four factors are statistically significant, presumably due to the larger data size. Particularly notable is the large coefficient value of the «Japanese influence=yes» factor ($b=3.5345$) which translates to a 56.6% increase in the percentage of singleton adaptation in comparison to the baseline, i.e., the words that are not coded for Japanese traits (39.1%).¹⁷ In comparison, the singleton spelling ($b=0.2667$) increases the percentage of singleton adaptation by 6.5% only.

The segmental context has a significant effect and the estimated rate of singleton adaptation is *lower* in clusters than in intervocalic position by 8.2%. This is contrary to the prediction of the view that adapters are sensitive to the duration of English /l/ in adaptation. Instead, the observed pattern indicates that preference for shorter epenthetic vowel trumps the preference for matching the duration of the English input [l].

At this point, we return to the effect of position in word (initial vs. non-initial). Recall that in Choi (2001)'s data we noticed that in the two words that have the

17. The baseline probability of singleton adaptation is calculated as $39.1\% = \exp(-0.4441) / \{1 + \exp(-0.4441)\}$. When words contain Japanese influence, the rate changes to $95.6\% = \exp(-0.4441 + 3.5345) / \{1 + \exp(-0.4441 + 3.5345)\}$.

highest rate of singleton adaptation, *pamphlet* and *ambulance*, the (geminated) liquid does not straddle the first syllable in the Korean adaptation. A possible rationale behind such an effect may be that the Korean initial syllable has a privileged status that favors a closed heavy syllable more so than non-initial syllables. The fact that in Korean dialects where the vowel length contrast is retained, long vowels occur only in initial syllables provides some support for this privileged status of initial syllables (Sohn 1999).

But, there are a few other possible hypotheses regarding the factor that affects the rate of singleton adaptation in *pamphlet* and *ambulance* vs. other words. The first possibility is that it is the position of the consonant in the English input, not the Korean output. In other words, it is possible that laterals in the initial syllable of English may have a privileged status and possibly the duration of consonants may be longer other things being equal. Note that, the /l/ in *trolley* straddles the first syllable of English (assuming ambisyllabicity of /l/ in English) but not in the Korean rendition of the word [tʰi.rol.li]. Another possibility is that it is the stress of English that is relevant, i.e., /l/ occurring in post-tonic (*dóllar*) or immediately pre-tonic (*ballóon*, *blúe*) may be longer in duration and favor a geminate adaptation. These different hypotheses cannot be examined in the PDK data because all three hypotheses converge on more or less the same classification of the 10 words. The 1930s data, on the other hand, is large in size and allows us to quantitatively examine these competing hypotheses. I coded each word in the 1930s data according to whether /l/ straddles the initial syllable in Korean or in English (InitialK and InitialE), and whether /l/ occurs in the pre-tonic or post-tonic position with respect to the main stress in English (PreTonic and PostTonic). So, in addition to the Japanese influence, segmental context, and spelling, four additional factors are entered into the logistic regression model. As expected, not all factors turned out to be significant and after applying a fast backward elimination algorithm (Baayen 2008, p.204), only four factors remain in the model, Japanese influence, PostTonic, InitialE, and segmental context. In this trimmed model, Japanese influence still has the strongest effect of raising the rate of singleton adaptation. Spelling is no longer a significant factor and the cluster condition continues to favor the geminate adaptation. Both the post-tonic position and the initial syllable position in English lower the rate of singleton adaptation and these are all positions where we may expect English liquids to be longer than otherwise. This seems to indicate that Korean adapters are sensitive to the durational cues of the English input lateral after all, although the effect is very small. In clusters, however, the preference for a shorter epenthetic vowel overrides the consideration for liquid duration. So, liquid duration may have some effects but the effects seem very minor compared to the other two factors, Japanese influence and the preference for a shorter epenthetic vowel duration.

(15) A revised logistic regression model of medial /l/ adaptation in the 1930s

	Coefficient	Std. Error	Wald Z	P
(Intercept)	−0.4441	0.13209	−3.36	0.0008 ***
PostTonic=yes	−0.36997	0.12179	−3.04	0.0024 **
InitialE=yes	−0.32529	0.10583	−3.07	0.0021 **
segmental context=cluster	−0.51029	0.11855	−4.30	< 0.0001 ***
Japanese=no	−0.08028	0.12300	−0.65	0.5140
Japanese influence=yes	3.57227	0.51691	6.91	< 0.0001 ***

Significance codes: '***' 0.001 '**' 0.01 '*' 0.05.

4. Conclusion

In this paper, we examined the diachronic development of liquid adaptation in Contemporary Korean. The examination of initial liquids shows that contrary to the common assumption, the initial liquids are often realized as [n], showing that the *Tuim rule* is still active although marginally. Also, we could get a glimpse of diachronic trends whereby the effect of *Tuim rule* is weakened over time and the lateral allophone of the initial liquid is on the rise.

As for the adaptation of word-medial /l/, the different proposals regarding the source of singleton adaptation have been evaluated. Throughout Contemporary Korean, Japanese influence seems to be the dominant factor that increases the likelihood of singleton adaptation. The quantitative study also finds evidence for sensitivity to input liquid duration, preference for shorter epenthetic vowels and some marginal evidence of spelling but these effects are dwarfed by the Japanese influence.

The paper's contribution to the field of loanword phonology in general comes from its methodology. Given the fact that loanword adaptation tends to be governed by a multitude of factors and tends to show high variability, a quantitative study of the type presented in the paper can lead to a clearer picture of various factors in play in loanword adaptation leading to a more solid empirical foundation for the theory of loanword phonology.

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