

Title: Variation of the word-initial liquid in North and South Korean dialects under contact

Suyeon Yun^{a*} and Yoonjung Kang^{b,c}

* corresponding author: suyeonyun@ewha.ac.kr, Tel: +81-10-5739-2281

^a Ewha Womans University, Seoul 03760 Korea

^b University of Toronto Scarborough, Toronto, M1C 1A4, Canada

^c University of Toronto, Toronto, M5S 3G3, Canada

Suyeon Yun

Department of English Education

Ewha Womans University

52, Ewhayeodae-gil, Seodaemun-gu, Seoul 03760 Republic of Korea

suyeonyun@ewha.ac.kr

Yoonjung Kang^{1,2}

¹Centre for French and Linguistics

University of Toronto Scarborough

1265 Military Trail, HW314

Toronto ON M1C 1A4

kang@utsc.utoronto.ca

²Department of Linguistics

University of Toronto

100 St. George Street, S5S4082

Toronto ON M5S 3G3

yunjung.kang@utoronto.ca

Abstract

This study examines the phonetic variation of the word-initial liquid in two dialects of Korean, Northern Hamkyeong Korean of North Korea and Seoul Korean of South Korea. The goals of the study are two-fold: to provide a thorough description of the phonetic variation in the word-initial liquid in these two dialects and to examine the acquisition of Seoul Korean features by North Koreans residing in Seoul. We found that in addition to tap, the presumed default variant in word-initial position, a variety of variants (nasal, lateral, approximant, obstruent, and trill) are attested in both North and South Korean speakers' speech, but the proportion of the variants differ by dialect; Northern Hamkyeong speakers produced more obstruent and trill variants than Seoul Korean speakers, while Seoul Korean speakers produced more lateral and approximant variants. We also found evidence for dialect-internal changes and dialect acquisition. The younger Seoul Korean speakers realized word-initial liquid as lateral more than older speakers, and the use of trill is declining in the North Korean dialect with younger speakers using it less than older speakers. The North Korean speakers who have been in South Korea longer and have the most contact with South Korean speakers tend to produce fewer obstruents.

Keywords: liquid, dialect variation, dialect contact, Korean

Variation of the word-initial liquid in North and South Korean dialects under contact

1.0 Introduction

This paper reports on a large-scale production study of phonetic variation in the word-initial liquid in two Korean dialects, the Northern Hamkyeong dialect in North Korea and the Seoul dialect in South Korea. It has been described that Korean does not allow a liquid to appear in word-initial position, and this description is true of native and Sino-Korean words in South Korean dialects, including the Seoul dialect. However, the ban on the word-initial liquid is relaxed in loanwords, as recent loanwords have been shown to retain word-initial liquids in Seoul Korean. In the Northern Hamkyeong dialect, on the other hand, it is reported that word-initial liquids are not prohibited regardless of the lexical stratum. Instrumental studies of linguistic features of North Korean dialects have been sparse and the phonetics and phonology of the word-initial liquid is no exception. This study seeks to provide a detailed description of the phonetic properties of the word-initial liquid in Northern Hamkyeong and Seoul Korean with a focus on dialect- and age-based variation. Beyond the goals of providing a thorough description of the Korean liquid, we examine how the liquid realization changes as North Korean speakers move to South Korea and interact with South Korean speakers, contributing to the literature on dialect contact and acquisition by adult speakers.

2.0 Background

2.1 Korean liquid

Korean has a single liquid phoneme, which we represent as /L/, and its allophones show complementary distribution; the liquid phoneme is realized as [r] in intervocalic onset position (e.g., /taL-i/ → [tari] ‘moon’ + nom) and as [l] in syllable-final position (e.g., /taL/ → [tal] ‘moon’) and in geminates (e.g., /taL-Lo/ [tallo] ‘moon’ + ‘to’). In word-initial position, the liquid is not allowed to surface in all South Korean dialects (‘the Initial Avoidance Law (*Dueum Law*)’), and Sino-Korean word-initial liquids are deleted before a high front vocoid /i, j/ or otherwise undergo nasalization, as exemplified in Table 1 (Iverson & Kim 1987, Iverson and Sohn 1994, a.o.).

Table 1. Initial liquid avoidance in Seoul Korean

context	process	example	
/#_{i, j}	deletion	/Li-ca/ → [ica] ‘interest’	cf. /ko-Li/ → [kori] ‘high interest’
/#_other V	nasalization	/Lo-ton/ → [noton] ‘work’	cf. /kwa-Lo/ → [kwaro] ‘overwork’

This phonotactic restriction is relaxed in more recent loanwords and the liquid may appear word-initially, mostly in loanwords from English. Chae (2002) pointed out that the number of liquid-initial words in Korean dictionaries has increased over time and the initial liquid appears not only in loanwords but in proper names (e.g., /Lina/ ‘Lina’ (personal name)) and newly-coined Sino-Korean words (e.g., /Lε-mi-an/ ‘future-oriented beautiful house’ (brand name)). Most previous studies (Martin 1992, Sohn 1999, Kim 2000, Lee 2001, Chae 2002, Iverson and Lee 2006) described word-initial /l/ and /ɾ/ in English words to be rendered with the tap [r] in loanwords (e.g., ‘lobby’ → [ropi], ‘radio’ → [ratio]), while Lee (1996) claimed that they can be realized as either [l] or [r] (e.g., ‘lilac’ → [laillak] or [raillak], ‘radio’ → [latio] or [ratio]), although he also assumed that the default form of the word-initial /L/ is [r]. Choi (2001) examined the pronunciation of 170 loanwords, including 12 /L/-initial loanwords, produced by

401 Seoul speakers and found that the most frequent /L/ variant was [r] (over 80%), while the lateral [l] and the nasal [n] were sparsely observed as well. These reports were based on impressionistic descriptions, and no phonetic evidence was provided.

There have been a few instrumental phonetic studies on the word-initial /L/ in Seoul Korean. Lee (1999) investigated phonetic realizations of /L/ in several prosodic positions: utterance-initial, Intonational Phrase initial, Accentual Phrase initial, and Accentual Phrase medial. Out of the three test words used, however, only one word began with /L/, and it was actually located in the intervocalic position except when the word was in the utterance-initial position. In the utterance-initial position, the word-initial /L/ was realized as a tap ('short stop' in her term), including a single occurrence of a fricated tap ('fricative' in her term). In another study, Seo (2004) conducted a production experiment with ten Seoul speakers. The stimuli included 20 liquid-initial loanwords put in sentence- and utterance-initial position. Unlike the production results from Lee (1999) and the other previous descriptions mentioned above, the most frequent realization of the word-initial /L/ was the lateral [l], followed by the approximant [ɹ] and stops [t, d].¹ More recently, Cho (2014) examined 15 female Seoul speakers' production of 38 /L/-initial words located at the beginning of a short frame sentence. His results showed that the word-initial /L/ was realized as one of three allophones, [l], [r] and [ɹ]; the majority variants were [l] and [r], however, the study did not report which of the two allophones was more frequent.²

In North Korean dialects, it is generally assumed that the word-initial /L/ is retained even in Sino-Korean words. In *Munhwaeo*, the standard language of North Korea, /L/ is written and produced in word-initial position (Martin 1992, Sohn 1999), and this is specified in the rules of spelling and pronunciation of *Munhwaeo* (*Joseonmal Gyubeomjip*, 2010).³ Jung and Shin (2017) found that more than 80% of the word-initial liquid was produced in the speech of the anchors on Chosun Central TV news program from 2104 to 2017. Recent studies also reported that North Korean refugees who reside in South Korea may retain the initial /L/. For example, Lee et al. (2009) stated that North Korean speakers produce the initial /L/ as written in a reading task, but the type of liquid was not described. Bae (2011) found lexical and speaker-dependent variation in the production of word-initial /L/ when the North Korean speakers were asked to choose a pronunciation they would currently use out of options that did or did not include initial /L/. However, these were based on a limited number of lexical items (two words for Lee et al. 2009 and nine words for Bae 2011), and these studies did not examine the phonetic realization of the word-initial /L/.

To the best of our knowledge, there is no phonetic study on the word-initial /L/ in North Korean, but there exist two studies on the liquid of the Yanbian dialect of Korean, spoken in the Northeastern region of China bordering on Northern Hamkyeong province of North Korea. Kang (1999) described the syllable-initial /L/ in Yanbian Korean to be produced as a tap [r], based on the production of two /L/-

¹ It is surprising that no tokens were realized with initial [r] in Seo's (2004) experiment. We suspect that this is because Seo (2004) only analysed the tokens for which at least two out of the three transcriber phoneticians agree with the transcription. As will be discussed later, both the tap and the stop involve a release burst, and the distinction between the two is not clear, especially in word-initial position. So it is possible that the phoneticians disagreed more about the tokens involving a single release burst and such tokens were excluded in the final analysis. Also, since all three transcribers were native speakers of English, in which [r] is not attested word-initially, and the transcribers might have been more reluctant to transcribe the initial liquid as [r].

² Cho (2015) conducted a similar production experiment but placed the target /L/-initial words after a vowel-final word in the frame sentence, which may have confounded the results by having the target liquid in the intervocalic position.

³ While *Munhwaeo* is generally based on the speech of Pheongyang, the capital of North Korea, the non-application of the Initial Avoidance Law is not likely the trait of the Pheongyang dialect as the vernacular of the North-Western region, which Pheongyang is a part of, is reported to be subject to the same initial avoidance process as southern dialects (Kim 1998, Han 2006). Thus, to the extent that the North-Western dialects retain initial liquids in Sino-Korean words, it is likely a top-down change due to the normative orthography and the standard language.

initial Sino-Korean words, /LjoLi/ ‘cooking’ and /Ljaksɑ/ ‘history’. Kang and Han’s (2002) experiment on the production of the liquid in Yanbian Korean contained one /L/-initial word, /Lotoŋ/ ‘work’⁴, and they reported that the word-initial /L/ was realized as the tap [ɾ], as in Kang (1999). No variation was reported in these studies, possibly due to the small number of participants and test words. The methodology and the results of the previous studies relevant to the current purpose are summarized in Table 2 below.

Table 2. Summary of the previous phonetic production studies on the word-initial /L/ in Korean

	dialect	# of participants	participant age	# of /L/-initial words	/L/ realizations
Lee 1999	Seoul	4 (2M 2F)	20s-30s	1 (loanword)	[ɾ]
Seo 2004	Seoul	10 (5M 5F)	20s-30s? (students at OSU)	20 (loanword)	[l], [ɾ], stops
Cho 2014	Seoul	15 (15F)	20s-40s	38 (31 loan + 7 nonword)	[l], [ɾ], [ɹ]
Kang 1999	Yanbian	3 (no gender info)	20s? (undergraduate students at Handong U)	2? (Sino-Korean)	[ɾ]
Kang & Han 2002	Yanbian	2 (1M 1F)	not reported	1 (Sino-Korean)	[ɾ]

In summary, the previous studies on word-initial /L/ realization in Seoul Korean have focused on younger speakers and showed that younger Seoul speakers tend to produce the initial /L/ in loanwords as [ɾ] or [l], with [ɹ] and stops occurring as minor variants. In Northern dialects, it is described that the initial /L/ is retained, but no phonetic description exists. The current study explores the allophonic variation of the word-initial /L/ in both Northern and Southern dialects, involving a large number of words of Sino-Korean and loanword origins, and participants of different age groups.

2.2 Background on North Korean speakers in South Korea

The current study examines the speech of North Korean defectors residing in Seoul. North and South Korea have been separated since World War II, and for most of the second half of the 20th century, the two Koreas were isolated from each other, undergoing independent cultural and linguistic development. The economic hardship in the North in the 1990s led to a large influx of North Koreans to the South with the total number of North Koreans living in South Korea reaching 31,093 as of September 2017, according to the Ministry of Unification in Korea (<http://www.unikorea.go.kr/>). 64% of the North Korean settlers live in the Seoul Metropolitan Area, including 24% living in Seoul proper, as of September 2017.

While the languages of the two Koreas are mutually intelligible for the most part, there is a massive difference in the lexicon, to the extent that over 70% of North Korean speakers report having had some degree of difficulty understanding South Korean speech when they first moved to the South, especially due to many new Sino-Korean coinages and English loanwords (Jeong and Seo 2001). Besides the lexical differences, there are many phonological and phonetic differences, some of which

⁴ In Kang and Han (2002), the test words were read both in a frame sentence and in isolation. In the frame sentence, a vowel-final word ([ikʌsi] ‘this’-nom) precedes the target /L/-initial word, and this may have put the target liquid in intervocalic position.

are highly sociolinguistically salient such that many North Korean speakers report experience of embarrassment and discrimination due to their speech (cf. Shin et al. 2010, Yang 2013). So, there is a strong incentive for the speakers to adapt and learn to speak like South Koreans in order to be understood and to avoid discrimination.

North Korean speakers vary in their linguistic experience along with a number of other dimensions. Access to South Korean media is officially prohibited in the North, but many speakers, especially in recent years, have been exposed to the South Korean language through radio, dramas, or movies; Park et al.'s (2016) survey of North Korean defectors in South Korea showed that 69% of them came in contact with the South Korean language when they were in the North, through South Korean movies and dramas (62%) and TV, radio, newspaper or magazines (42%). After leaving North Korea, some defectors came more or less directly to the South, while many defectors resided in a third country, mainly China, for several years before they landed in the South. During their time in China, they were often exposed to additional varieties of Korean, including those spoken by ethnic Koreans in China, as well as those spoken by South Koreans, in addition to the South Korean dialects they were exposed to through the Korean media (Ko 2013). Speakers' level of exposure and adaptation to the South Korean language is also expected to vary as a function of the number of years since their arrival in the South as well as the level of everyday exposure to the South Korean language. Additionally, factors such as an individual's motivation to acclimate to the new culture, as well as individual variation in linguistic adaptability also play a role in speakers' adaptation to the South Korean language (Jeong 2002).

The North Korean refugees come from a number of different dialectal regions within North Korea. In our study, we chose to focus on the Northern Hamkyeong dialect for two reasons. First, it is known that the Northern Hamkyeong dialect maintains the word-initial liquid on the surface. To our knowledge, there is no report of the Initial Avoidance Law in this dialect. Also, as mentioned earlier, Northern Hamkyeong province is bordered on the north by Yanbian Autonomous Region of China with a high concentration of ethnic Koreans with their ancestral root in Hamkyeong, and the Yanbian dialect maintains the word-initial /L/ as the tap. Second, due to Northern Hamkyeong's proximity to the Chinese border, the largest proportion of the refugees are from that area (61.6%, as of September 2017 according to Ministry of Unification in Korea) and it was relatively easy to recruit people from Northern Hamkyeong.

2.3 Adult Dialect Acquisition

Recent studies show that adult speakers have the capacity to continue changing their speech throughout their lifespan, adapting to the changing linguistic environments; individuals may change their speech along the direction of community-level change (Harrington et al. 2000, Sankoff and Blondeau 2007, Kang and Han 2013), adopt an age-appropriate speech norm as speakers grow older (Sankoff 2005, Wagner 2012), or alter their speech due to the influence of second language acquisition (Flege 1995, Kang and Guion 2006, Chang 2012). Most relevant to our discussion is change due to dialect contact (Trudgill 1986, Chambers 1992, Nycz 2015). While the acquisition of certain dialectal features, especially ones involving complex linguistic conditioning, may be difficult beyond a certain age threshold (Payne 1976, Chamber 1992, Kerswill 1996), adult speakers that move to a different geographical area have been shown to take on linguistic features of the new dialect.

Shockey (1984) examined the speech of four American English speakers living in England and found that they frequently suppressed the flapping of intervocalic /t/ and /d/ in contexts where flapping is generally expected in American English. Munro, Derwing, and Flege (1999) examined the speech of Canadians that moved to Alabama and found their speech changed as a result of contact with the

Southern American dialect and were consistently judged to be intermediate between the Canadian and the Alabaman comparison groups by native judges of both dialects. Evans and Iverson (2007) tracked the speech of young adult Northern British English speakers over the first two years of their university studies, during which they were exposed to Standard Southern British English (SSBE) and found that the majority of speakers shifted their speech toward the southern norm, as evidenced by accent ratings and acoustic analyses of vowels in words like *bud*, *cud*, *bath*, and *could*. The results of the studies mentioned above provide evidence that adult speakers who have moved to a different geographical area take on specific linguistic features of the new dialect. However, adult acquisition of a new dialectal feature is constrained by various linguistic, sociolinguistic, and attitudinal factors, and speakers in a new dialect region do not take on all features of the new dialect.

Bowie (2000) compared the speech of lifelong residents of Waldorf, Maryland, with those who were born in Waldorf but moved away later in life and observed a tendency that features undergoing change in the native dialect, such as the decline in the monophthongization of /aj/, are more susceptible to change due to dialect contact, while features that are stable in the native dialect tend to remain stable in the exiles' speech. Walker (2014) examined the adoption of new dialect features—t-flapping/aspiration, rhoticity, and TRAP-BATH split—by Americans living in the UK and English living in the US and found that the adoption patterns were asymmetrical between the two dialects and not consistent across the variables; while Americans showed evidence of adoption of all three British English features, the English only adopted t-flapping. In light of these results, Walker (2014) entertains two possible explanations, linguistic and attitudinal; a linguistic explanation posits that a new dialect variant is more likely to be adopted when it is already available in the native dialect, even as a minor variant, than when it is completely new. An attitudinal explanation attributes the dialectal asymmetry in adaptation to the relative prestige of the British dialect with Americans more likely to take on the prestige dialect feature than the other way around. In a similar study, Evans (2004) examined the speech of Appalachian migrants in Ypsilanti, Michigan and also found evidence for the role of attitudinal factors; participation in the Appalachian social network along with sex were prominent factors in determining their participation in Northern Cities Shift while speaker age and socioeconomic status were not.

Nycz (2011) examined the speech of Canadians living in New York City and found a significant effect of word frequency, with more frequently used words showing a greater shift away from the Canadian features – low back vowel 'cot/caught' merger and Canadian raising. Nycz (2011) also found a surprising negative correlation between the degrees of change in the two Canadian features across individuals; speakers who produced a clearer distinction in cot/caught vowels (i.e., loss of Canadian merger) also retained the raised vowels in Canadian raising better, the latter being one of the most salient markers of Canadian English. Nycz (2011) attributes the individual variation to their difference in cognitive style, namely linguistic sensitivity; linguistically sensitive individuals are more likely to adopt new dialect features while retaining sociolinguistically salient features of the dialect they identify with. Along the same lines, Ziliak (2012) examined Northern Cities Shift vowel production, a Chicago feature, by speakers who grew up in Southern Indiana and then moved to Chicago as adults and found that their vowels were intermediate between the two dialect comparison groups. The age of arrival in Chicago had no discernible effect while the years spent in Chicago or the percentage of life spent in Chicago sometimes had an effect in the expected direction. The lack of age of arrival effect suggests that the age of dialect acquisition is a significant factor only up to a certain threshold of childhood and adolescence (Payne 1976, Chamber 1992, Kerswill 1996), but in adult acquisition, the attitudinal factor and the amount of contact are better predictors of dialect acquisition.

To summarize, indeed the evidence is overwhelming that adult speakers can and do change their speech due to contact, but not all features are acquired by all speakers under all circumstances. The

findings are complex and nuanced, and a multitude of linguistic and extra-linguistic factors are implicated, such as the complexity of linguistic conditioning, the extent of variation in the native dialect, word frequency, sex or gender identity, age of acquisition, length of dialect contact, and speakers' attitude toward the dialects, among others.

2.4 Hypotheses

With this background, three hypotheses on speaker variation in the word-initial /L/ realization will be tested in the current study. First, we hypothesize that types of allophones will differ by the speaker dialect, i.e., Northern Hamkyeong Korean and Seoul Korean (NK and SK, henceforth). In particular, it is predicted from the aforementioned previous studies that in SK, [l] and [ɾ] will frequently occur, while another allophone [ɺ] and nasalization or deletion of the initial /L/ that obey the Initial Avoidance Law may also appear. On the other hand, we predict that the tap [ɾ] will be the majority variant of the word-initial /L/ in NK. This is because [ɾ] is supposed to be the default for Korean /L/ (Iverson and Kim 1987), based on its realization in the intervocalic onset position and, as stated earlier, [ɾ] is reported to occur word-initially in Yanbian Korean, a closely related cognate dialect of Northern Hamkyeong Korean. The word-initial lateral [l] is not predicted to appear commonly in NK, which is far less affected by English loanwords compared to SK, given that the [l] realization in liquid-initial loanwords in SK is attributed to the influence of English (Seo 2004).

The next hypothesis is about speaker age. For SK, we expect that younger SK speakers will use [l] more frequently than older SK speakers. In previous studies, the SK speakers who were reported to produce [l] often for the initial /L/ were all young speakers in their 20s-30s (Seo 2004, Cho 2014). Also, in Choi's (2001) large-scale production study, the [l] realization was more frequent in the speakers in their 20s-30s (8-10%) than the speakers in their 40s-60s (2-4%). Assuming that the production of [l] is related to English proficiency, it is likely that we will see the age effect in the [l] realization in the current study, as younger SK speakers have more exposure to English than older speakers in part due to the introduction of English to the elementary school curriculum in 1997.

In contrast, we expect that the [n] variant will be more frequent in older SK speakers than in younger SK speakers. As previously mentioned, the word-initial /L/ is nasalized before non-high-front vocoids in Sino-Korean words in SK, according to the Initial Avoidance Law. Chae (2002) and Kang (2012) pointed out that the word-initial liquid in older English loanwords was often realized as [n] while recent pronunciations generally retain the liquid. In particular, based on loanword data published in three time periods (1880s-1910s, 1930s and 1990s-present), Kang (2012) argued that the [n] realization of word-initial liquid in loanwords has declined over time. For example, 'London' and 'lemonade' were adapted as /nʌntʌn/ in the 1880s-1910s and /nemonate/ in the 1930s, while in Present Day Korean, both words maintain the initial liquid as /Lʌntʌn/ and /Lemoneiti/. Also, in Choi (2001)'s survey, the [n] realizations were rare and observed mostly in speakers older than 40 (2.2% in 40s, 9.9% in 50s, and 4.2% in 60s).

Given the lack of available data, we do not have a specific hypothesis regarding the age effect in NK speakers. One may expect that younger NK speakers are more successful with acquiring SK features and pattern more like SK speakers than older NK speakers. It is generally argued that speakers acquire features of a second dialect better when the age of acquisition is early, but the critical inflection point in the age of phonological acquisition is lower than that of morphological or syntactic acquisition and is said to be around age seven for near-native fluency in the second dialect phonology (cf. Kerswill 1994, Ivars 1994, and Omdal 1994) or phonetics (Ziliak 2012). Since only adult speakers of NK are included in our study, we will be cautious in interpreting any age effect related to the acquisition of SK. Instead,

any age effect we find—after controlling for the length of residence or the degree of contact with SK speakers—could instead be interpreted as evidence for NK-internal sound change in progress, based on the apparent time construct (Bailey et al. 1991).

The third hypothesis focuses on the relationship between NK settlers’ length of residence (LOR) in South Korea and their acquisition of the SK dialect. Based on the previous studies on dialect acquisition as well as ample anecdotal observations, we expect that many NK speakers in Seoul will have acquired aspects of SK speech, although the extent of the approximation of the Seoul norm is expected to vary depending on a multitude of linguistic, cognitive, and attitudinal factors. It is even possible that NK speakers acquire features of the SK dialect better, compared to the cases of other dialect acquisitions, considering NK speakers’ strong motivation to learn SK; according to Park et al. (2016), 86% of NK settlers in South Korea think that they have to change their language to Seoul Korean and 83% actually try to speak like South Koreans. Therefore, other things being equal, we hypothesize that the speakers who arrived earlier and have been in Seoul for a longer period will show a greater shift toward the Southern norm compared to those who arrived in the South more recently. In particular, NK speakers may learn the nasalization and deletion of the word-initial /L/ in SK after coming to the South, and the longer they have lived in the South, the more frequently they will nasalize or delete the /L/. Also, if the lateral [l] realization in younger SK speakers is salient enough to incur adaptation in the NK speakers’ speech, we also expect that NK speakers with a long LOR will produce [l] more frequently than NK speakers with a short LOR. The three hypotheses laid out so far are summarized as follows.

Table 3. Summary of the hypotheses

hypothesis	predictions	
	NK	SK
1. dialect	[r]	[r]~[l] (~[ɾ]~[n]~ ø)
2. age	-	Younger speakers produce [l] more frequently and [n] less frequently than older speakers.
3. LOR	Speakers with longer LOR pattern more with SK speakers (produce [l], [n] and ø more) than speakers with short LOR.	not applicable

Based on these hypotheses, we designed and conducted a production experiment. The next section describes the methodology of the current experiment, and Section 3 reports the results. Section 4 ends the paper with a summary of the findings and discussion.

3.0 Methods

3.1. Participants

Participants included 35 North Korean defectors residing in the Seoul Metropolitan Area who speak the Northern Hamkyeong dialect⁵ and 20 speakers of Seoul Korean. Participants were paid for their time,

⁵ The Yukjin dialect, spoken near Duman River including Hweryeong, Onseong and Kyeongwon, is classified as a dialect related to but distinct from Northern Hamkyeong dialect (Kwak 1998). Sixteen out of our 35 NK participants were from the Yukjin area, but there was no significant difference observed between Yukjin and non-Yukjin dialects in the realizations of the word-initial /L/ in the current study.

and informed consent was obtained prior to data collection. All participants reported no speech or hearing problems. Table 4 below summarizes the demographic information of the participants.

Table 4. Participant demographic information (Mean, Range)

Dialect	Age group (years)	Length of residence in Seoul (months)	number of speakers
Northern Hamkyeong Korean (NK)	older (Mean=52.2, Range=41-78)	short (Mean=16.3, Range=3-32)	9 (1M 8F)
		long (Mean=95.3, Range=57-164)	9 (1M 8F)
	younger (Mean=30.8, Range=21-40)	short (Mean=14.1, Range=2-30)	7 (0M, 7F)
		long (Mean=77.4, Range=36-146)	10 (3M 7F)
Seoul Korean (SK)	older (Mean=55.8, Range=41-66)	-	10 (5M 5F)
	younger (Mean=24.2, Range=19-28)	-	10 (5M 5F)

NK participants consisted of 18 speakers older than 40 as of December 2016 when the experiment was conducted (born in or before 1975; 2 male, 16 female) and 17 speakers younger than 40 (born after 1975; 2 male, 15 female). SK participants consisted of 10 older speakers and ten younger speakers, and each age group consisted of 5 male and 5 female speakers. It should be noted that while the gender factor was balanced for the SK speakers, the number of NK female speakers was far greater than the number of NK male speakers. This is because female NK refugees outnumber male refugees; according to the Ministry of Unification (<http://www.unikorea.go.kr/>), 71% of NK refugees who came to South Korea are female, as of September 2017. In addition, many male speakers worked during the day and were harder to recruit for the experiment.

Time spent in South Korea for the NK speakers (LOR) is one of the main factors we controlled for, and information about when they arrived in South Korea was collected. Speakers who had lived in the South for more than three years were classified as having a long LOR and those who had lived there for less than three years were classified as having a short LOR. Three years was set as a cut-off for long vs. short LORs, as it is argued that it takes two to three years for North Korean settlers to no longer experience substantial difficulties with SK dialects (Jeong and Seo 2001, Lee et al. 2003, Moon et al. 2006). The LOR ranged from two months to 13 years and three months in the current NK participants.

Another factor we need to consider is how much contact NK settlers have with SK speakers. For example, if some NK settlers do not work outside of the home and interact mostly with his or her family from North Korea, and others came to the South alone and have everyday contact with SK speakers in the workplace, we expect that the latter will have acquired the SK dialect much better than the former. In the post-experiment survey, we asked the NK participants to self-report their degree of contact with NK and SK speakers. To be specific, they were asked to report the proportions of time they spend with NK vs. SK speakers among (i) family members, (ii) friends, and (iii) co-workers. For example, one NK participant's NK-SK proportion in family members, friends, and co-workers were 100-0, 70-30, and 10-90, respectively. We calculated the average of NK-SK proportions, and assigned 'more' to participants whose SK proportion average was higher than the NK proportion average and 'less' to participants whose NK proportion average was higher than the SK proportion average for the variable SK contact. In the above-mentioned case, the NK proportion average was 60, and the SK proportion average was 40, and thus the participant was coded as 'more' for SK contact. As a result, out of the 19 NK participants with long LOR, ten were classified as 'less,' and nine were classified as 'more' for SK contact.

Most participants had learned at least one foreign language at school, although the language they learned differed by the dialect and by the age at which they began learning the language. In 1986, North

Korea changed the foreign language education policy, introducing English education at school and fully switched from Russian to English as the primary foreign language in 1995 (Jeong 2002). Thus, while many older NK speakers learned Russian, most of our younger NK speakers learned English at school. No NK participants, however, reported that they were fluent in Russian or English, and even younger speakers reported difficulties with English loanwords used in South Korea.⁶ On the other hand, the second language for all SK participants was English. The old age group of SK speakers did not use English after graduating from high school and were not fluent in English at all. In contrast, the younger SK speakers were undergraduate or graduate students at Seoul National University and were all somewhat fluent in English. Another piece of information we collected from the participants was the amount of exposure to SK language through the media. In contrast to the previous study, the survey of the current NK participants showed that only three people often had access to South Korean TV shows, radios, or newspapers when they were in North Korea or China.⁷

Both NK and SK speakers seemed well aware of the initial /L/ avoidance as a clear difference between the North and South Korean dialects. This may be because the difference is reflected in orthography. One of the questions in our post-experiment survey for NK speakers asked what the participant thought was the difference between SK and NK. Four participants answered that it is the initial liquid avoidance, and this is the only segmental property that the participants ever noticed.⁸

3.2 Stimuli

The stimuli comprise 41 words that begin with /L/. Table 5

Table 5. Examples of target words summarizes the breakdown of the stimuli with examples, and the entire list of the test words appears in the Appendix. A few speakers missed a couple of tokens or made pronunciation errors, or the recording quality was suboptimal. After excluding these cases, a total of 2,207 tokens (41 words * 55 participants – 48 omissions) were analysed.

Table 5. Examples of target words

origin	Sino-Korean (n=24)			loanword (n=17)	
following vowel	/i/ (n=2)	/j/ (n=8)	others (n=14)	/i/ (n=3)	others (n=14)
e.g.	/Lipjʌl/ 'parting'	/Ljʌhɛŋ/ 'travel'	/Lotoŋ/ 'labor'	/Litim/ 'rhythm'	/Lait ^h a/ 'lighter'
cf.	([ipjʌl] in SK)	([jʌhɛŋ] in SK)	([notoŋ] in SK)		

Notice that the current stimuli involve both Sino-Korean words and loanwords that are mostly adopted from English. The Sino-Korean words are used with the initial /L/ only in North Korea. The corresponding Sino-Korean forms in SK replace the /L/ with a nasal or delete the /L/, as mentioned

⁶ NK defectors pass through one or more third countries, such as China, Thailand, and Myanmar, before they settle in South Korea. Most of our participants stayed in those countries only for a short time and rarely had contact with the local people with the exception of four female NK participants who had lived in China longer than a year and identified themselves as fluent in Mandarin Chinese.

⁷ This difference might originate from the difference in the regional distribution of the participants. Whereas the regions where NK defectors come from were well balanced in the previous study including relatively more affluent Western region of NK (Park et al. 2016), we limited our participants to people from Northern Hamkyeong area. The degree of SK contact by the region is beyond the scope of this study.

⁸ Frequent answers for the salient difference of SK from NK comprise of lots of loanwords, no pitch accent, and friendly tone.

earlier, and this phonological difference is reflected in the orthography. In this task, the Sino-Korean words were presented in the NK spelling, i.e., with initial /L/, to elicit /L/-initial pronunciation from both SK and NK speakers.

3.3 Procedure

The recording took place either in the phonetics lab of the Department of Linguistics at Seoul National University or a quiet room in downtown Seoul. The participants were fitted with a high-quality lapel condenser microphone (Audio-Technica AT831B) suspended on a tabletop mic stand, and their speech was recorded mono at 44,100 Hz on a Zoom H4n recorder.

The material was presented using Psychopy (Pierce 2007) on a Microsoft Surface 3, and the participants read the material at their own pace. The device first presented the target word embedded in a contextually appropriate carrier sentence along with a picture depicting the target word (e.g., /ikʌs-in Lopot^hi-ipnita/ ‘This is a robot.’). When the participant read the sentence and then touched a button on the screen, the target word (i.e., /Lopot^hi/ ‘robot’) was presented in isolation for the participants to read. Only the isolation reading was analyzed for the current study. The stimuli were embedded in a larger word list that includes non-/L/-initial words, and the order of presentation was randomized for each participant. After the recording, the participants filled out a questionnaire on their demographic information and language background.

3.4 Acoustic analysis

The produced words were examined acoustically using Praat (Boersma and Weenink 2017). Acoustic cues for the initial consonant, such as prevoicing, closure, release burst, and aspiration, were coded by the first author.

We found several variants of the initial liquid, including both sonorants and obstruents. First, there were three types of sonorant realizations: rhotics, lateral [l], and nasal [n]. The rhotics were again divided into three subtypes: tap [ɾ], approximant [ɹ], and trill [r]. Taps are produced by a brief contact between the tongue tip and the alveolar ridge. When this contact is complete, albeit brief, the tap involves a stop-like release burst, possibly preceded by prevoicing, as illustrated in Figure 1. When this contact is incomplete, it may be realized as a fricated tap involving some frication or aspiration instead of the burst at the point of release, as in Figure 2. Tokens with these acoustic properties were included in the category of tap. Approximant [ɹ] features a long transition into the following vowel with a gradual increase in amplitude, compared to the abrupt amplitude increase in the tap. It may involve relatively low F3 values, compared to those of laterals. When there was no signal for tap release and the transition into the vowel was long and gradual as in Figure 3, it was annotated as approximant [ɹ]. Trills involve multiple contacts between the tongue tip and the alveolar ridge, as shown in Figure 4. When there existed more than one release and one or more closures, the sonorant was labeled as trill.

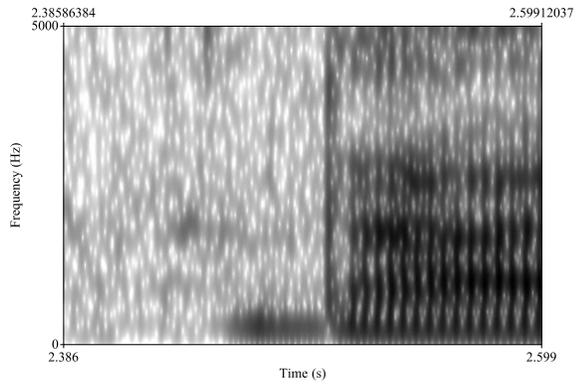


Figure 1. Tap [ɾ] with a release burst and prevoicing in /Lait^ha/, produced by a female NK speaker

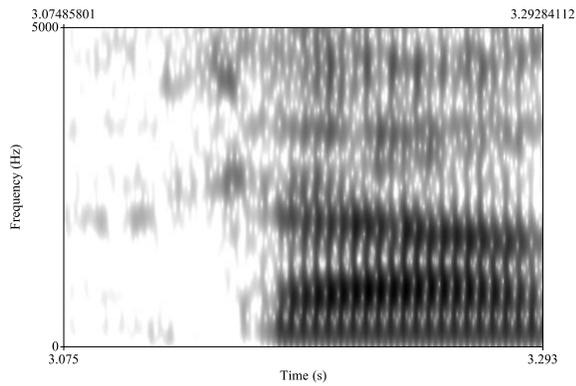


Figure 2. Fricated tap [ɾ] in /Lakjʌp/, produced by a female NK speaker

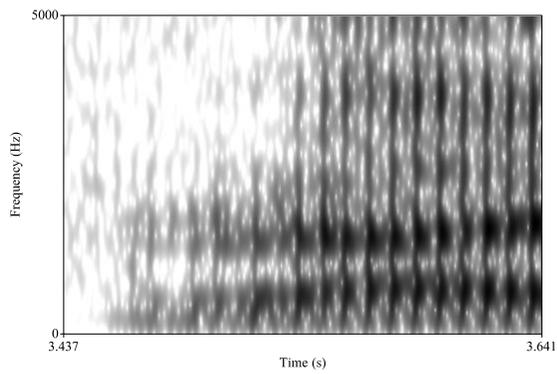


Figure 3. Approximant [ɹ] in /Lain/, produced by a male SK speaker

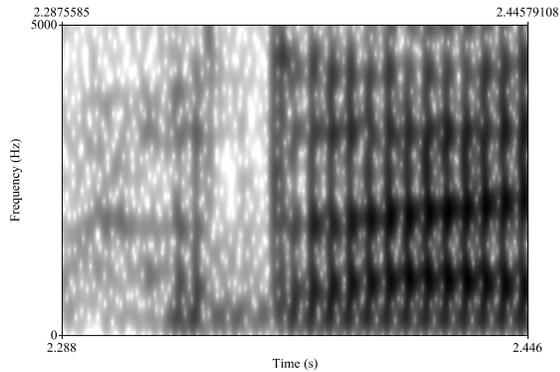


Figure 4. Trill [r] in /Lait^ha/, produced by a female NK speaker

The lateral [l] has a longer steady state and a shorter transition into the following vowel than the approximant [ɭ]. Also, the F2 and F3 values of [l] are higher than those of [ɭ]. The sonorants with these properties, as in Figure 5, were annotated as [l].

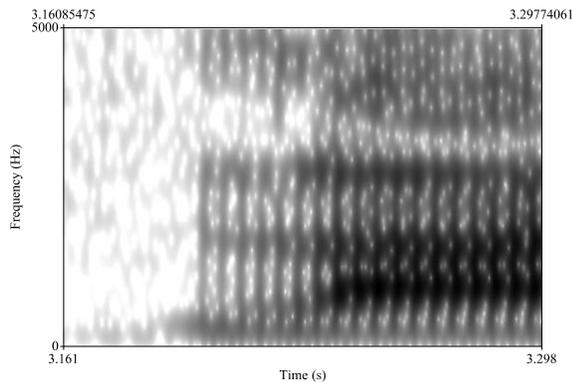


Figure 5. Lateral [l] in /Lain/, produced by a female NK speaker

The nasal [n] also involves a relatively long steady state like [l] but involves a more abrupt transition into the vowel than [l], as well as nasal murmur. Tokens with those properties, as shown in Figure 6, were classified as [n].⁹

⁹ One of the acoustic features that distinguish [n] from [l] is that the ratio of energies between the low and high frequency regions is higher in [n] than in [l] (cf. Pruthi and Espy-Wilson 2004), which means that the energy of [n] is more centered in the low frequency region than that of [l]. We conducted a post-hoc analysis of the ratio between low- and high-frequency energy by subtracting the intensity (dB) of the low frequency signal (0-320 Hz) from the intensity (dB) of the high frequency signal (320-5360 Hz) measured at the midpoint of the intervals annotated as [n] or [l]. It is shown that the [l]-tokens show significantly stronger upper-frequency energy than the [n]-tokens, as illustrated in the following plot. This difference is found to be statistically significant ($b = -3.8361$, $t = -5.782$, $p < 0.001$), based on a linear mixed-effects model with allophone type as a predictor variable and a random effect of participant (intercept and slope) and word.

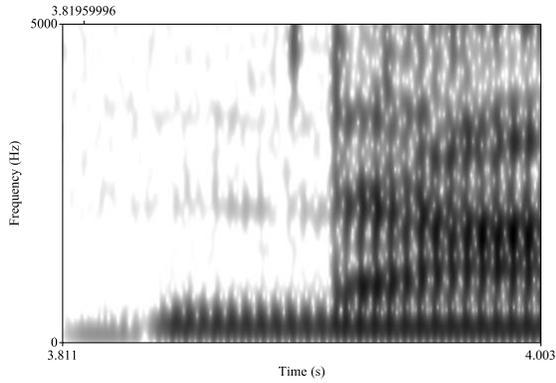


Figure 6. Nasal [n] in /Lain/, produced by a female NK speaker

It is observed that the word-initial /L/ is sometimes realized as an obstruent, mostly as a stop. Seo (2004) similarly reported stop realizations of word-initial /L/. There are two types of tokens that were classified as an obstruent. One involves a release burst followed by frication or aspiration (defined as a VOT over 10 ms), as shown in Figure 7. If frication follows the burst, the segment is an affricate, and if aspiration follows, it is an aspirated stop. The other involves multiple bursts, as in Figure 8. The difference between this stop with multiple bursts and the trill seen above is that there is no closure period between bursts in the stop. Although not frequent, there were also cases where the word-initial /L/ was completely deleted.

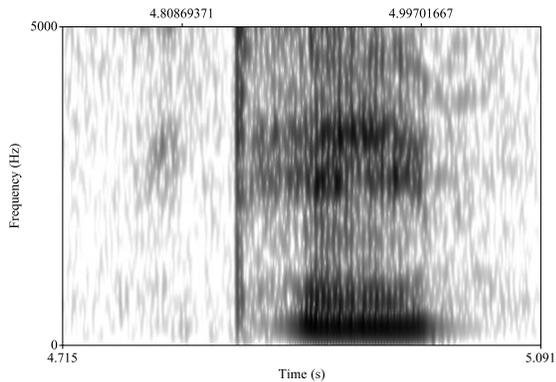
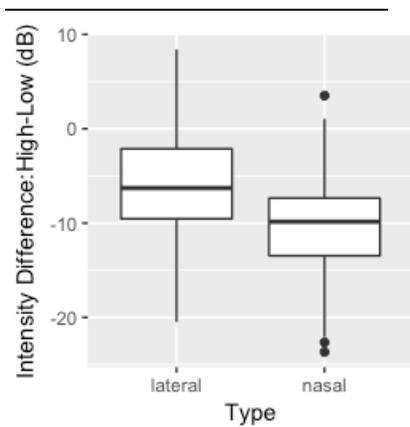


Figure 7. Stop with aspiration [tʰ] in /Lεp/, produced by a female NK speaker



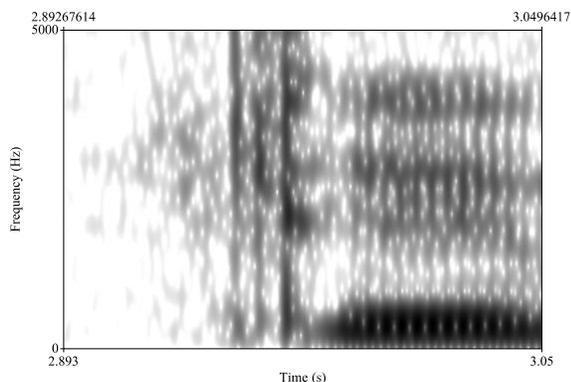


Figure 8. Stop with multiple bursts [tʰ] in /LiŋLato/, produced by a female NK speaker

Before closing the section, it should be noted that unaspirated stops ([t], [d]) are not included in the category of obstruent above. The acoustic cue for the word-initial unaspirated stop is the presence of a release burst, and the tokens annotated with a release burst may be a stop or a tap. Indeed, the distinction between the stop and the tap is not categorical but is gradual (de Jong 1998). Several factors have been used to differentiate the tap and stop in the literature, including closure duration, VOT, and F2 of the following vowel onset. Since our target segment is located word-initially, closure duration is not available in the current study. The VOT and F2 of the following vowel onset were measured, but it was hard to find a reliable acoustic distinction between the tap and the stop.¹⁰ To avoid making an arbitrary decision between the tap and the stop, we only distinguish the segments with a single burst only and the segments with multiple bursts or with a burst followed by frication or aspiration. The former is classified as the tap, and the latter is classified as the obstruent, as laid out above. According to this criterion, unfortunately, the tokens classified in the tap category may have included unaspirated stops too, but we consider it one of the phonetic variants of the tap, unlike the other obstruents involving frication or aspiration.¹¹

3.5 Statistical analysis

The data from the production experiment was statistically analyzed using R (R Core Team 2017). Using the *glmer* function from the *lme4* package (Bates et al. 2015), we fitted mixed-effects logistic regression models to predict the types of /L/ variants. Specifically, a model posited “lateral” as a dependent variable, which coded [l] variants as ‘1’ and all other variants as ‘0’. A total of six such models were built, one for each variant coded as a binary variable. No model was built for “deletion” as deletion was overall very rare. To test our hypotheses regarding speaker dialects, we first built univariate models with a single independent variable of DIALECT (SK = -0.5 vs. NK = 0.5). To examine other factors of interests, we built dialect specific models. For SK, we tested the effects of speaker GENDER (M = -0.5 vs. F = 0.5) and AGE (Old = -0.5 vs. Young = 0.5) and their interaction. The interaction was not significant in any

¹⁰ The tokens involving a release burst only were also auditorily examined by the first author and two additional native speakers of Seoul Korean. They listened to the initial consonant and the following vowel of the words and transcribed the initial sound they heard, i.e., whether it was a liquid, stop or others. The results, however, showed that the answers of the three listeners agreed in only about one third of the words. In addition, the perception results were not well lined up with the VOT and F2 measures. Hence the acoustic factors discussed above and the perception results do not successfully distinguish the tap and the unaspirated stop in word-initial position.

¹¹ There were two tokens of prosthesis and two tokens of glide realizations by NK speakers and these are excluded from further analysis.

of the SK models and likelihood ratio tests selected simpler models without the interaction term. So, we report the simple models with main effects of GENDER and AGE only for SK. For NK, we tested the effects of AGE, Length of Residence (LOR; Short = -0.5 vs. Long = 0.5), the degree of contact with SK speakers (CONTACT; Less = -0.5 vs. More = 0.5), and the dialect attitude index (SK-ORIENTATION: numeric and centered). Gender is not included in the NK model as gender is not balanced for this group. The initial model included all two-way and four-way interaction terms. With the exception of the “approximant” model, none of the full models survived the likelihood ratio tests, and we report the models with four main effect terms only. Random intercepts for speaker and word were included in all models.

4.0 Results

4.1 Dialect effect

We observed seven types of /L/ variants both in NK and in SK. Table 6 below shows the distribution of the variants in each dialect group, which is plotted in Figure 9, and Table 7 shows the full statistical model outputs.

Table 6. Distribution of allophonic variants for the word-initial /L/ in each dialect.

dialect		tap	nasal	lateral	approximant	obstruent	trill	deletion	total
SK	N	304	83	258	100	34	36	3	818
	%	37.2	10.1	31.5	12.2	4.2	4.4	0.4	100.0
NK	N	536	176	155	117	192	200	9	1385
	%	38.7	12.7	11.2	8.4	13.9	14.4	0.6	100.0

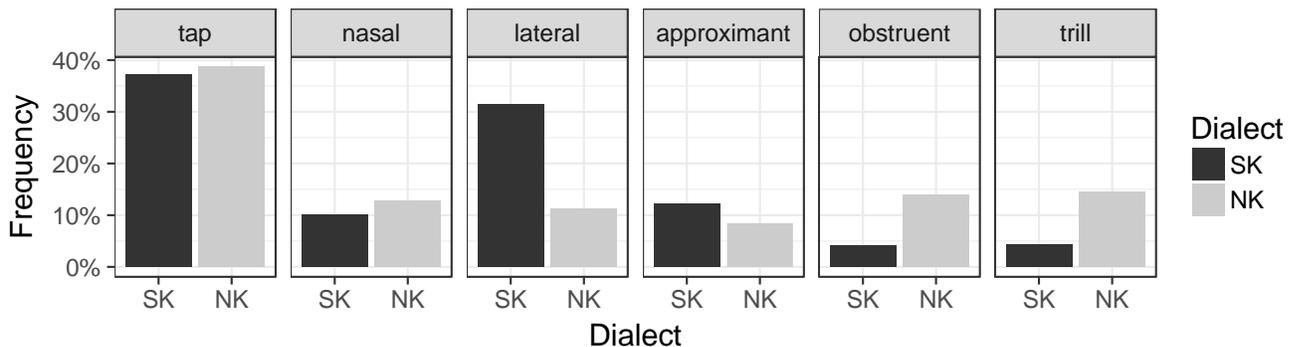


Figure 9. Distribution of /L/ variants (excluding “deletion”) by dialect

Table 7. Logistic mixed-effects model outputs for DIALECT effects. SK is the reference level. (Significance codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1)

Dependent Variable	Fixed effects	Estimate	Std. Error	z value	Pr(> z)	
tap	Intercept	-0.5131	0.1471	-3.487	<.001	**
	dialect (NK vs. <u>SK</u>)	-0.1135	0.2333	-0.4866	0.6266	
nasal	Intercept	-3.0806	0.378	-8.1506	<0.001	***
	dialect (NK vs. <u>SK</u>)	-0.6661	0.5018	-1.3274	0.1844	
lateral	Intercept	-2.5014	0.224	-11.1658	<0.001	***
	dialect (NK vs. <u>SK</u>)	1.4523	0.3002	4.8371	<0.001	***
approximant	Intercept	-3.02	0.2545	-11.8679	<0.001	***
	dialect (NK vs. <u>SK</u>)	0.5679	0.3134	1.8119	0.07	.
obstruent	Intercept	-3.0517	0.4066	-7.5055	<0.001	***
	dialect (NK vs. <u>SK</u>)	-1.767	0.6496	-2.7204	0.0065	**
trill	Intercept	-2.623	0.3187	-8.2313	<0.001	***
	dialect (NK vs. <u>SK</u>)	-1.5346	0.5302	-2.8943	0.0038	**

Recall that in section 2.4 we hypothesized that the types of word-initial /L/ allophones in SK are more diverse than those in NK due to the exposure to English and the existence of the Initial Avoidance Law. The results, however, show that both dialects exhibit the same seven /L/ allophones. While the tap is the most common variant in NK, we observe the same range of variants as SK. The occurrence of trill was unexpected in both dialects.

Although the set of attested allophones is identical across NK and SK, the relative frequency of allophones differs by the dialect. A significant main effect of DIALECT was found for lateral, obstruent and trill and a marginal effect was found for approximant. First, it was confirmed that the lateral [l] realization was significantly more frequent in SK than in NK ($p < .001$). SK speakers also produced the approximant [ɹ] more frequently than NK speakers ($p = .07$). On the other hand, NK speakers produced the obstruent and the trill more frequently than SK speakers ($p < .01$ for both) and these were unexpected results.

4.2 SK: Age and gender effects

Let us now consider whether speakers’ age and gender have an impact on the realization of word-initial /L/ in SK. Table 8 and Figure 10 summarize the results by speaker age and gender in SK and Table 9 provides the statistical model outputs.

Table 8. Distribution of allophonic variants for the word-initial /L/ by speaker AGE (a) and GENDER (b) in SK.

(a) AGE

Age		tap	nasal	lateral	approximant	obstruent	trill	deletion	total
Old	N	177	62	86	47	16	20	2	410
	%	43.2	15.1	21.0	11.5	3.9	4.9	0.5	100.0
Young	N	127	21	172	53	18	16	1	408
	%	31.1	5.1	42.2	13.0	4.4	3.9	0.2	100.0

(b) GENDER

Gender		tap	nasal	lateral	approximant	obstruent	trill	deletion	total
Female	N	187	25	116	43	27	7	3	408
	%	45.8	6.1	28.4	10.5	6.6	1.7	0.7	100.0
Male	N	117	58	142	57	7	29	0	410
	%	28.5	14.1	34.6	13.9	1.7	7.1	0.0	100.0

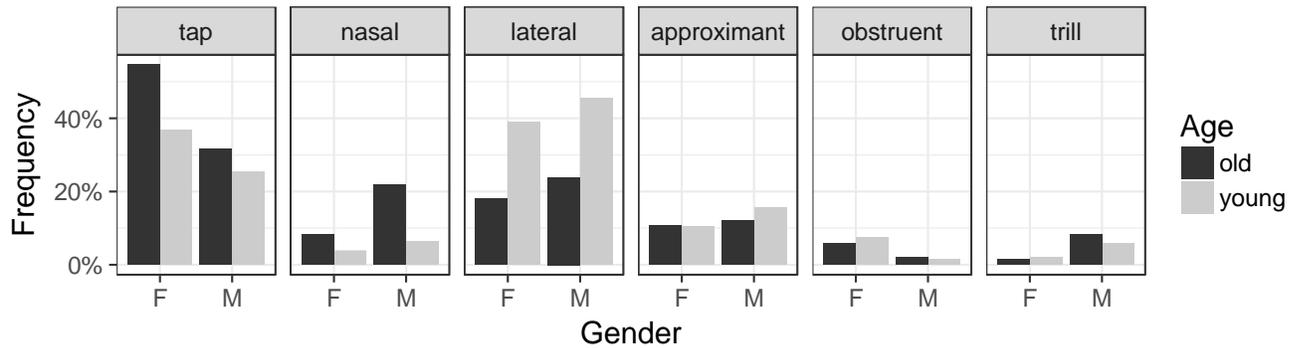


Figure 10. Distribution of /L/ variants (excluding “deletion”) in SK as a function of speaker age and gender

Table 9. Logistic mixed-effects model outputs for AGE and GENDER effects in SK. Old and Male are the reference levels

Dependent Variable	Fixed effects	Estimate	Std. Error	z value	Pr(> z)	
tap	Intercept	0.0798	0.3623	0.2204	0.8256	
	Age (young vs. <u>old</u>)	-0.5471	0.4127	-1.3258	0.1849	
	Gender (F vs. <u>M</u>)	-0.942	0.4134	-2.2786	0.0227	*
nasal	Intercept	-3.5634	0.8444	-4.2199	<0.001	***
	Age (young vs. <u>old</u>)	-1.3323	0.8911	-1.4951	0.1349	
	Gender (F vs. <u>M</u>)	0.9338	0.8913	1.0478	0.2947	
lateral	Intercept	-1.8047	0.4501	-4.0098	<0.001	***
	Age (young vs. <u>old</u>)	1.1848	0.5002	2.3687	0.0179	*
	Gender (F vs. <u>M</u>)	0.3405	0.4994	0.6818	0.4953	
approximant	Intercept	-2.637	0.3738	-7.0543	<0.001	***
	Age (young vs. <u>old</u>)	0.1841	0.3801	0.4843	0.6282	
	Gender (F vs. <u>M</u>)	0.3176	0.3801	0.8356	0.4034	
obstruent	Intercept	-5.3603	1.2685	-4.2258	<0.001	***
	Age (young vs. <u>old</u>)	-0.2172	1.1534	-0.1883	0.8506	
	Gender (F vs. <u>M</u>)	-1.6837	1.1619	-1.4491	0.1473	
trill	Intercept	-4.4782	0.6996	-6.4011	<0.001	***
	Age (young vs. <u>old</u>)	-0.0784	0.6867	-0.1141	0.9091	
	Gender (F vs. <u>M</u>)	1.2986	0.7023	1.8489	0.0645	.

(Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1)

We had two hypotheses on the age effect in SK speakers' speech: (i) younger speakers produce [l] more frequently than older speakers; and (ii) older speakers produce [n] more frequently than younger speakers. First, it was confirmed that the [l] realizations were significantly more frequent in younger than older SK speakers ($p < .05$). However, the second hypothesis about age and [n] realization was not confirmed. Although older SK speakers produced [n] more frequently (15.1%) than younger SK speakers (5.1%), this difference is driven by one older male speaker who produced the initial liquid as [n] for 29 out of 41 words. No other variant showed a significant AGE effect in SK.

As for the effect of GENDER in SK, Seo (2004) reported that male Seoul speakers produced [l] more frequently than female Seoul speakers. We see the same tendency for [l] (male 34.6% vs. female 28.4%), but this difference was not statistically significant ($p = .495$). Somewhat unexpectedly, there was a significant GENDER effect for tap realization ($p < .05$) and a marginally significant effect for trill realization ($p < .1$); male speakers produced more tap variants and fewer trill variants than female speakers.

4.3 NK: Age, length of residence and dialect contact effect

The third hypothesis on the realization of the word-initial /L/ is about the dialect acquisition of NK speakers in South Korea, and the results reported in this section concern NK participants only. We predict that other things being equal, the longer the NK speakers have lived in Seoul, the more likely they use SK variants of the word-initial /L/. Also, we hypothesize that the NK speakers who have had more contact with SK speakers produce SK variants of the word-initial /L/ more than the NK speakers

who have had less contact with SK speakers. In section 4.1, we found that SK speakers produce [l] and [ɫ] more frequently and [r] and obstruent less frequently than NK speakers. Hence, the specific hypotheses to test here are that (i) NK speakers with longer length of residence (LOR) use [l] and [ɫ] more frequently and [r] and obstruent less frequently than NK speakers with shorter LOR, and (ii) NK speakers with relatively more contact with SK speakers (SK-CONTACT) use [l] and [ɫ] more frequently and [r] and obstruent less frequently than NK speakers with less SK contact. We also consider the effect of AGE for any indication of NK-internal sound change or age-conditioned variation, independent of contact with SK. Table 10 and Figure 11 below show the distribution of each allophone of the word-initial /L/ by AGE, LOR, and SK-CONTACT and Table 11 provides the statistical model output.

Table 10. Distribution of allophonic variants for the word-initial /L/ by speaker LOR (a), SK-CONTACT (b), and AGE (c).

(a) LOR

LOR		tap	nasal	lateral	approximant	obstruent	trill	deletion	total
Short	N	232	74	72	45	140	63	5	631
	%	36.8	11.7	11.4	7.1	22.2	10	0.8	100
Long	N	304	102	83	72	52	137	4	754
	%	40.3	13.5	11.0	9.5	6.9	18.2	0.5	100

(b) SK-CONTACT

Contact		tap	nasal	lateral	approximant	obstruent	trill	deletion	total
Less	N	305	95	94	45	170	116	6	831
	%	36.7	11.4	11.3	5.4	20.5	14	0.7	100
More	N	231	81	61	72	22	84	3	554
	%	41.7	14.6	11.0	13.0	4.0	15.2	0.5	100

(c) AGE

Age		tap	nasal	lateral	approximant	obstruent	trill	deletion	total
Old	N	221	104	89	62	66	169	4	715
	%	30.9	14.5	12.4	8.7	9.2	23.6	0.6	100
Young	N	315	72	66	55	126	31	5	670
	%	47.0	10.7	9.9	8.2	18.8	4.6	0.7	100

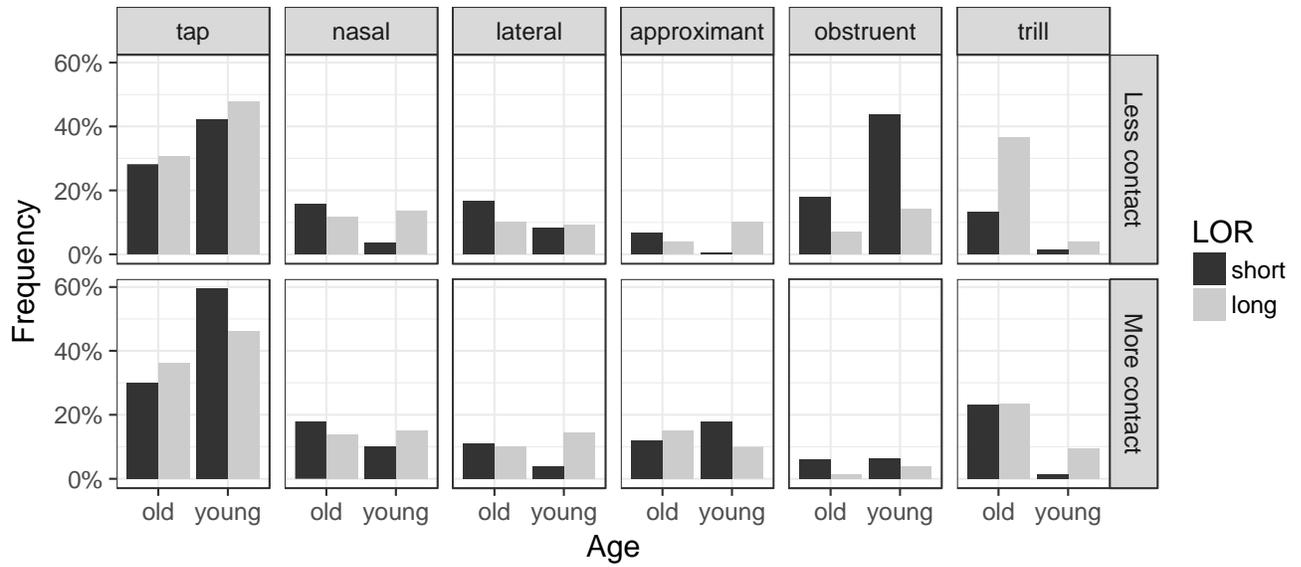


Figure 11. Distributions of /L/ variants (excluding “deletion”) as a function of LOR, SK-CONTACT, and AGE in NK

Table 11. Logistic mixed-effects model outputs for LOR, SK-CONTACT, and AGE effects in NK. Old, Short, and Less are the reference levels

Dependent variable	Fixed effects	Estimate	Std. Error	z value	Pr(> z)	
tap	Intercept	-0.8438	0.1522	-5.5453	<0.001	***
	LOR (long vs. <u>short</u>)	0.0592	0.2026	0.2923	0.77	
	Contact (more vs. <u>less</u>)	0.209	0.2049	1.0201	0.3077	
	Age (young vs. <u>old</u>)	0.7238	0.1994	3.6304	<0.001	***
nasal	Intercept	-2.0145	0.2691	-7.4866	<0.001	***
	LOR (long vs. <u>short</u>)	0.2345	0.3962	0.5918	0.554	
	Contact (more vs. <u>less</u>)	0.4628	0.3969	1.1662	0.2435	
	Age (young vs. <u>old</u>)	-0.5208	0.3917	-1.3295	0.1837	
lateral	Intercept	-2.9136	0.3636	-8.0125	<0.001	***
	LOR (long vs. <u>short</u>)	0.018	0.3524	0.0511	0.9593	
	Contact (more vs. <u>less</u>)	-0.0587	0.3566	-0.1646	0.8692	
	Age (young vs. <u>old</u>)	-0.3579	0.3459	-1.0346	0.3009	
approximant	Intercept	-2.7882	0.3187	-8.7477	<0.001	***
	LOR (long vs. <u>short</u>)	0.2831	0.4221	0.6706	0.5025	
	Contact (more vs. <u>less</u>) ¹²	1.304	0.429	3.0397	0.0024	**
	Age (young vs. <u>old</u>)	-0.2835	0.4181	-0.678	0.4978	
obstruent	Intercept	-3.5619	0.4024	-8.8526	<0.001	***
	LOR (long vs. <u>short</u>)	-1.626	0.4895	-3.3216	<0.001	***
	Contact (more vs. <u>less</u>)	-1.8602	0.5217	-3.5655	<0.001	***
	Age (young vs. <u>old</u>)	1.0907	0.4801	2.2719	0.0231	*
trill	Intercept	-1.5642	0.3087	-5.0664	<0.001	***
	LOR (long vs. <u>short</u>)	1.2146	0.467	2.6008	0.0093	**
	Contact (more vs. <u>less</u>)	0.3536	0.4578	0.7724	0.4399	
	Age (young vs. <u>old</u>)	-2.424	0.4746	-5.1077	<0.001	***

(Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1)

As for LOR, the hypothesis was confirmed only for the obstruent; NK speakers with long LOR produced the obstruent variant more frequently than speakers with short LOR ($p < .001$). For the trill, we found a pattern in the opposite direction from our hypothesis; the NK participants with a long LOR produced the trill *more frequently* than the NK participants with a short LOR ($p < .01$). There was no statistically significant difference in the realizations of the approximant and the lateral.

On the other hand, part of the results on the SK contact turned out to support our hypothesis. First, the effect of SK contact in the approximant realization was significant ($p < .01$, but see footnote 15); the NK participants with SK-CONTACT used [ɹ] more frequently than the participants without SK-CONTACT. Also, the obstruent realization was less frequent in the speech of NK participants with more SK-CONTACT than with less SK-CONTACT ($p < .001$). There was no significant difference by SK-CONTACT in the realization of the trill and the lateral.

¹² Three-way interaction of SK-CONTACT with AGE and LOR was significant and the SK-CONTACT effect is significant for older speakers with a long LOR and younger speakers with a short LOR. We do not have any principled reason to expect this interaction and we do not interpret it. We simply note that the SK-CONTACT effect is found for approximant pronunciation but not consistently across the subgroups.

AGE played a role in the realizations of trill, tap, and obstruents. First, the trill realization was more frequent in the speech of older than younger NK speakers ($p < .001$). The tap was used by younger speakers more frequently than older speakers in NK ($p < .001$). The obstruent was also used by younger speakers more frequently ($p < .05$) but this effect is less reliable, driven by one subgroup (speakers with a short LOR and less SK-CONTACT) and we are cautious in interpreting this age effect. For all other variants, no significant age effects were observed.

Summing up, the dialect acquisition hypothesis was only partially supported. It turned out that LOR did not make a considerable impact on learning /L/ allophones that SK speakers use, showing a significant effect only on the obstruent realization. The relative amount of contact with SK was more influential; NK participants who had contact with SK speakers produced the approximant more frequently and obstruents less frequently than those who had less contact with SK speakers. However, we did not see the effect of SK-CONTACT in the realizations of lateral and trill. We also found some age-dependent variation in NK speakers' production of initial liquid with younger speakers producing less trill but more taps and obstruents.

5.0 Discussion

The analysis of the data from our production experiment revealed that speakers' dialect, age, and LOR/SK contact all played a role in the variation of the word-initial /L/. Table 12 summarizes the findings.

Table 12. Summary of major findings in word-initial /L/ realization: shaded cells indicate no statistically significant effects and parentheses indicate marginally significant effects.

	Dialect	SK		NK		
		Age	Gender	Age	LOR	SK contact
tap			M < F	O < Y		
nasal						
lateral	SK > NK	O < Y				
approximant	(SK > NK)					(Less < More) ¹³
obstruent	SK < NK			O < Y	Short > Long	Less > More
trill	SK < NK		(M > F)	O > Y	Short < Long	

Our first hypothesis concerned the dialectal difference. We hypothesized that SK would show a variety of non-tap variants, especially the lateral [l] and the approximant [ɭ], as well as the nasal [n] and the deletion. We confirmed that the lateral and the approximant were indeed more commonly found in SK than in NK. The dialect effect in the lateral [l] and approximant [ɭ] realization may be attributable to the second language contact. SK speakers, who are either fluent in English or are at least relatively more exposed to English, produced [l] and [ɭ] more frequently than NK speakers, who have had far less contact with English. We also confirmed our second hypothesis regarding the age effect on the realization of the lateral in SK; younger speakers produced more laterals than older speakers, and this effect is consistent with the hypothesis that the increase in [l] realization is driven by the increased contact with English.¹⁴

¹³ See footnote 15.

¹⁴ Recall that there were four NK speakers who had lived in China for more than a year and self-reported that they spoke Mandarin. It turned out, however, that their second language experience with Mandarin did not have a significant effect on

The nasal [n] and deletion were not quite as frequent, and there was no dialect effect nor LOR/SK-CONTACT effect in the realization of the nasal [n] and deletion, even though it is a clear phonological difference between NK and SK. As mentioned earlier, most of the NK participants were aware of the Initial Avoidance Law in SK but did not apply it to the reading task. This is likely because the initial /L/ avoidance is reflected in orthography. Since our task was reading words and sentences written on the screen, the NK participants would have chosen to produce the initial /L/ as it is, regardless of the Initial Avoidance Law.

Perhaps the most surprising finding of our study is that the trill [r] appears in Korean, mostly in NK. To our knowledge, no literature has reported the occurrence of trill in Korean. NK speakers produced more trill and obstruent variants than SK speakers. One possible explanation of the trill realization in NK is that it is triggered by second language experience. North Korea was provisionally under the rule of the Soviet Union after the end of the World War II and had close political and economic relationships afterwards. A number of Russian words were borrowed into NK vocabulary, and as mentioned earlier, Russian was taught as a second language at school until the mid-1980s in North Korea. Therefore, we speculate that NK speakers were exposed to Russian [r] and adopted it in word-initial /L/ in their native language. The age effect in the realization of the trill can also be explained by this second language hypothesis; older NK speakers who learned Russian at school used the trill more frequently than younger NK speakers who did not. Younger speakers instead produced more tap and obstruent variants in place of the trill.

The trill, however, was also observed in the speech of the SK participants, who had never learned Russian or other languages with a trill, although much less frequent. 12 of the 20 SK speakers produced one or more tokens of trill and trill is not an idiosyncrasy of a few speakers. Notably, however, 27 of the 35 trill tokens SK speakers produced are found in words of NK origin – i.e., words that are only found in Sino-Korean words presented in NK spelling or loanwords primarily used in NK. This lexical conditioning suggests that SK speakers' trill realization is likely a case of hyperarticulation, resulting from too much articulatory effort. Tap [ɾ] is generally assumed to be the default form of the word-initial /L/, and we found it to be the most frequent variant in our study as well. SK speakers, who are unfamiliar with these Sino-Korean words written in North Korean orthography, attempt to produce the tap with a brief contact to the alveolar ridge, and may overshoot it, sometimes ending up with the trill with repeated contact. The fact that there are languages, such as Anyula and Tagalog, in which the tap may become the trill in emphatic contexts (Inouye 1995) may also support this hypothesis. Alternatively, SK speakers themselves may implicitly be aware of trill as an NK trait and adopt this variant in their production of NK words. We do not have evidence to tease apart these two possibilities and leave this question for future research.

With these dialectal differences in mind, we turn to the effects of dialect contact on NK speakers' production. Other things being equal, we predict that the speakers who lived longer in South Korea and have more contact with SK speakers produce SK-dominant variants (lateral and approximant) more and NK-dominant variants (obstruent and trill) less. The double-lined box in Table 12 highlights the relevant findings. We found a significant effect of SK-CONTACT for the approximant and the obstruent in the expected direction – speakers with more SK contact used the approximant more but the obstruent less – but no SK-contact was found for the lateral or trill variants. Similarly, we found a significant effect of LOR for the obstruent; speakers who have been in South Korea longer produce the obstruent less – but no LOR effect was found for the lateral or the approximant, and a significant effect of LOR was found for the trill in the opposite direction.

the selection of initial /L/ allophone. It could either be because the retroflex approximant [ɻ] in Mandarin was hard to acquire for them or the period they stayed in China was not long enough to learn Mandarin [ɻ].

These findings are quite surprising given that the most striking dialectal variants – lateral and trill – exhibited no contact effects. Particularly puzzling is the LOR effect in the opposite direction found for the trill; NK speakers who have been in South Korea longer produce the trill *more* frequently than NK speakers with a short LOR. We conjecture that this is an epiphenomenon of the NK-internal sound change of less use of the trill. NK speakers who left the North early may maintain the former trend with more occurrences of the trill. Since then the trill became less frequently used within the dialect, and so NK speakers who left the North recently reflect the recent trend with the reduced use of the trill. Therefore, the LOR effect in the trill realization may be confounded with the dialect-internal sound change, and it would not be counter-evidence to the LOR hypothesis. Nevertheless, the lack of dialect contact effect for these two salient variants, lateral and trill, is unexpected.

The only allophone that showed a consistent effect of both LOR and SK-CONTACT was the obstruent; the obstruent realization was less frequent in the NK speakers with long LOR and more SK-CONTACT than in the speakers with short LOR and less SK-CONTACT. This can be explained by the NK speakers' impression of the Seoul dialect. Many of the NK participants responded in the post-experiment questionnaire that the difference of the Seoul dialect from their native dialect was the soft and friendly tone. Thus, it seems likely that the NK speakers who lived in Seoul for more than three years and had more contact with SK speakers tried to speak mildly and used the obstruent variant less frequently with a shift to more sonorous variants. While not reaching statistical significance in most cases, the tap [ɾ], the nasal [n], the approximant [ɻ], and the trill [r] are all used more frequently by NK speakers with longer LOR and more SK-CONTACT. Then why are NK speakers sensitive to the dialectal difference along the use of obstruent vs. sonorant variants but not to the difference in lateral or trill usage? One possible explanation is the difference in the contrastive status of the relevant phonetic features involved; [sonorant] is a major class feature that is robustly manifested in Korean phonology, and the distinction along this featural dimension is more easily acquired by NK adult learners. In contrast, the contrasts among the sonorant variants, such as [lateral] and [trill], are not contrastive in Korean phonology and are more difficult to notice and acquire.¹⁵ Another possible explanation is the dialect-internal variation. While the lateral is overall more frequently used by the SK than the NK speakers, this difference is driven by the younger SK speakers, and older SK speakers do not use the lateral substantially more than the NK speakers. So, NK speakers may not have associated the lateral as the salient SK dialectal feature. A similar explanation is applicable to the lack of contact effect in trill realization. If our interpretation of the AGE and LOR effects on the NK trill usage is on the right track, the use of trill is declining within NK, and to NK speakers, the trill usage may be more salient as a marker of NK speaker's AGE than a marker of NK dialect. Note that this explanation may seem to contradict the suggestion in the literature (Bowie 2000, Walker 2014) that features which exhibit internal variation in the native dialect are more susceptible to change under dialect contact. We do not have relevant evidence to choose between these two explanations.

A future study can investigate the NK speakers' perceptual awareness of the sociolinguistic indexation of the liquid variants; according to the feature-based account, NK speakers may not be able to perceive the difference between sonorant variants of the initial liquid while associating the obstruent variants to the NK dialect. The internal variation account, on the other hand, predicts that the NK speakers will be able to perceive the difference amongst different sonorant variants (trill, lateral, and others) but will not associate these variants with dialectal differences.

To conclude, we have provided a detailed description of the allophonic variation in the word-initial /L/ in the Northern Hamkyeong dialect of NK and the Seoul dialect of SK. We have shown that

¹⁵ See Hancin-Bhatt (1994) and Brown (2000) for a similar proposal regarding the role of native language featural contrast on second language sound acquisition.

in both Korean dialects, the word-initial /L/ is subject to great allophonic variation and may be realized as seven different allophones. There are apparent dialectal differences between NK and SK in the /L/ variation, and we found evidence for sound change in each dialect, namely, the decline of [r] in NK and the rise of [l] in SK. The current results also contribute to the literature on the dialectal acquisition of allophonic variants. We found some evidence of contact-induced acquisition of dialectal features, but in keeping with the previous literature, the effect of contact was complex and did not affect all variants equally.

Appendix: the list of /L/-initial stimulus words

word	Korean transcription	gloss	origin
/Lait ^h a/	라이타	‘lighter’	loan
/Lʌnniŋ/	런닝	‘sleeveless undershirt’	loan
/Lopot ^h i/	로봇	‘robot’	loan
/Litiŋ/	리듬	‘rhythm’	loan
/LaktoŋLi/	락동리	‘Laktong-li’	Sino-Korean
/Lakjʌp/	낙엽	‘falling leaves’	Sino-Korean
/LanLi/	란리	‘fuss’	Sino-Korean
/LeiL/	래일	‘tomorrow’	Sino-Korean
/LɛŋLɛŋhata/	랭랭하다	‘chilly’	Sino-Korean
/Lɛŋmjʌn/	랭면	‘cold noodles’	Sino-Korean
/Ljaŋsik/	양식	‘food’	Sino-Korean
/Ljaŋkaŋto/	양강도	‘Ryangkang-do’	Sino-Korean
/LeLu/	레루	‘rail’	loan
/LesiLiŋ/	레슬링	‘wrestling’	loan
/Ljʌhɛŋ/	여행	‘travel’	Sino-Korean
/Ljʌksa/	력사	‘history’	Sino-Korean
/Ljʌlc ^h a/	열차	‘train’	Sino-Korean
/Lotoŋ/	로동	‘labor’	Sino-Korean
/LoLjʌk/	로력	‘effort’	Sino-Korean
/Lossija/	로씨야	‘Russia’	loan
/Loʌ/	로어	‘Russian language’	Sino-Korean
/LonLi/	론리	‘logic’	Sino-Korean

/Ljokim/	요금	‘fare’	Sino-Korean
/LjoLi/	료리	‘cooking’	Sino-Korean
/LuLak/	루락	‘omission’	Sino-Korean
/LusΛL/	루설	‘leakage’	Sino-Korean
/LjutaLLi/	류달리	‘particularly’	Sino-Korean
/LimLimhata/	름름하다	‘manly’	Sino-Korean
/LiŋLato/	릉라도	‘Reungla-island’	Sino-Korean
/LiLon/	리론	‘theory’	Sino-Korean
/LipjΛL/	리별	‘parting’	Sino-Korean
/Liponŋ/	리봉	‘ribbon’	loan
/Lijakka/	리야까	‘handcart’	loan
/LamjΛn/	라면	‘Ramen’	loan
/Lapokki/	라볶이	‘Topokki with ramen’	loan
/Lain/	라인	‘line’	loan
/Lɛp/	랩	‘wrap’	loan
/Lɛp ^h Λ/	래퍼	‘rapper’	loan
/Lesin/	레슨	‘lesson’	loan
/Lesit ^h oLaŋ/	레스토랑	‘restaurant’	loan
/Lummeit ^h i/	룸메이트	‘roommate’	loan

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