EVIDENCE OF DIACHRONIC SOUND CHANGE:

A COMPARATIVE ACOUSTIC STUDY OF SEOUL AND KYUNGSANG KOREAN

BY

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ABSTRACT

The phonetics and phonology of the Kyungsang dialect of Korean is distinct from those of the standard Seoul dialect with regard to segments and lexical pitch. However, whether the distinctive phonetics and phonology of Kyungsang Korean are maintained by younger speakers is questionable due to the increased exposure to Seoul Korean and the prevailing linguistic ideology that has lent Seoul Korean a strong normative bias. The current dissertation investigated diachronic sound change in Kyungsang Korean based on the acoustic data collected from forty female Korean speakers (10 younger and 10 older speakers each for Kyungsang and Seoul). Acoustic evidence for sound change is provided by showing generational differences in the phonetics of Kyungsang Korean, and comparison of the phonetics between Kyungsang and Seoul Korean addressed how a prestigious national standard language affects dialect re-formation.

In the acoustic study of vowels (Chapter 2), measures of formant frequencies showed that the merged /ʌ/ and /ɨ/ vowels for older Kyungsang speakers are split among younger speakers, resulting in the same vowel system between younger Kyungsang and Seoul speakers both of which have seven vowels. The study of stop consonants (Chapter 3) showed generational differences for the measures of VOT and F0 in distinguishing the three-way laryngeal contrast among voiceless stops for Kyungsang speakers. Younger Kyungsang speakers rely more on F0, but less on VOT to distinguish the stops than older speakers do. The increased role of F0 to the laryngeal contrast for the younger Kyungsang speakers corresponds with the diachronic change in Seoul Korean where the role of VOT is reduced, but that of F0 is increased for younger Seoul speakers. In the acoustic study of fricative (Chapter 4), measures of fricative duration and

center of gravity showed that while the two-way fricative contrast is less distinct for older Kyungsang speakers, younger Kyungsang speakers well distinguish the two fricatives similar to Seoul speakers. As a consequence of the generational change in the segments of Kyungsang Korean, younger Kyungsang speakers do not maintain the vowel and consonant features unique to Kyungsang Korean, but rather approximate to those of Seoul Korean.

The current dissertation showed evidence for the diachronic sound change in the lexical pitch accent of Kyungsang Korean for both surface and underlying forms (Chapters 5 and 6). F0 spectral and temporal properties characterizing contrastive lexical accents are less distinct for younger Kyungsang speakers than for older speakers. Notably, F0 peak shifted rightwards for younger Kyungsang speakers across all accent classes, resulting in the final rising accent pattern similar to Seoul Korean. The generational difference in the lexical accents of Kyungsang Korean was also observed for underlying forms (Chapter 6). Elicited accent patterns for monosyllabic and disyllabic nouns under suffixation showed that the accent system of younger Kyungsang speakers is simpler than that of older speakers and similar to that of Seoul speakers, which results from accent merger, loss of suffix tone, and weakened accent contrasts.

The direction of the sound change observed in the current dissertation suggested that the phonetics and phonology of Kyungsang Korean is re-formed to approximate Seoul Korean.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

INTRODUCTION

This dissertation investigates diachronic sound change in progress in the South Kyungsang dialect of Korean, and tests its linguistic homogeneity by exploring whether the phonetic uniqueness of Kyungsang Korean compared to Seoul (i.e., the national standard language) is maintained by younger speakers as well as older speakers. The current dissertation examines the phonetic characteristics of Kyungsang Korean spoken by older and younger generations, and covers generational variations in the phonetics and phonology of segments and lexical pitch. In addition, by comparing the phonetics of Kyungsang Korean with that of Seoul Korean, this dissertation addresses whether and how the phonetics of a regional dialect is re-formed to approximate a national standard. This chapter first states issues regarding sound change in Kyungsang Korean, relating them to a theory of language change and previous empirical studies about synchronic change. In what follows, I introduce the social and linguistic background of the Kyungsang dialect of Korean as compared to Seoul Korean. A subject description and an overview of the dissertation will be followed.

1. 1. Statement of the problem

The Northern and Southern Kyungsang dialects of Korean (spoken by approximately thirteen million people in the southeastern part of Korea) have distinctive phonetics and phonology with regard to segments, lexical pitch and intonation compared to Seoul Korean, which is considered as the 'standard' dialect. However, we have two reasons to question whether the distinctive phonetics and phonology of Kyungsang Korean are retained by both younger and older Kyungsang generations: 1) the exposure to Seoul Korean has increased among Kyungsang speakers; 2) Korean language ideology provides Seoul Korean with strong prestige.

First, over the past several decades, Kyungsang speakers have had more exposure to the standard Seoul dialect through increased contact with Seoul speakers and media based in Seoul (H.-S. Lee 2008; Gu 2009). According to the notion that *"dialect differences are the result of isolation and the lack of communication"* (Labov 1974: 234), it is reasonable to speculate that the direct contact with Seoul speakers and exposure to the Seoul dialect may have an influence in re-formation of the Kyungsang dialect. Particularly, if the interaction with Seoul speakers plays a role in the potential sound change of Kyungsang Korean, it seems plausible to expect that the phonetics and phonology of Kyungsang Korean become more similar to those of Seoul Korean through phonetic imitation between the two varieties. Research on phonetic accommodation has demonstrated that interaction among talkers increases phonetic similarity in their speech, and has suggested that this phonetic accommodation may be an important mechanism in diachronic sound change (Pardo 2006; Babel 2009). In models of language change, the role of accommodation due to contact among talkers is also considered as a major factor in language change. Trudgill (1986) argues:

"In face-to-face interaction, speakers accommodate to each other linguistically by reducing the dissimilarities between their speech patterns and adopting features from each other's speech. If a speaker accommodates frequently enough to a particular accent or dialect, I would go on to argue, then the accommodation may in time become permanent, particularly if attitudinal factors are favorable (Trudgill 1986: 39)."

Similar to the notion by Trudgill (1986), Auer and Hinskens (1996) claimed that the face-to-face communication between speakers forms a short-term accommodation, and if the permanently occurring short-term accommodation becomes a long-term accommodation, this might affect the language community, leading to language change.

Several empirical studies on phonetic accommodation have demonstrated that long-term exposure to a target dialect results in acquiring speech characteristics of that dialect (Munro, Derwing & Flege 1999; Evans & Iverson 2007). Munro, Derwing and Flege (1999) tested the hypothesis that adults who move from one dialect area to another acquire speech characteristics of the second dialect. Munro et al. (1999) examined whether Canadians who have moved to Alabama acquire some local dialectal features through accent ratings. The researchers revealed that both native Canadian and Alabama listeners rated the speech of Canadian emigrants to Alabama as having an American accent, suggesting that phonetic features of the second dialect can be acquired to a perceptible degree. A longitudinal study by Evans and Iverson (2007) also tested if college students change their vowel perception and production during a two-year of a college attending period. Evans and Iverson (2007) examined whether college students from the north of England adapt acoustic qualities of the vowels in Standard Southern British English (SSBE), which is considered prestigious. The results of accentedness ratings and formant measurements in Evans and Iverson (2007) showed that speakers of northern English change their accent to be more similar to southern English accent after attending university.

The hypothetical model of language change by Trudgill (1986) and the empirical findings in the synchronic phonetic studies indicate that a speaker exposed to a different dialect is likely to acquire certain linguistic features of that dialect, and this may in the long run result in dialect change. In this sense, we can reasonably ask whether the diachronic change occurs in Kyungsang Korean because the regional variety has been increasingly in contact with the standard Seoul dialect over the past three decades, which leads us to doubt the extent of linguistic homogeneity across older and younger generations.

The second reason to doubt the homogeneity of Kyungsang Korean is the language ideology in Korean. In sociolinguistics, language either prestige or stigma is considered an important factor in language change (Heffernan, Borden, Erath & Yang 2010; Armstrong 2012). Armstrong (2012) noted the importance of the dominant language ideology in a threatened language, claiming that a counter-ideology that promotes the value of the language can play a role in revitalizing the language. Heffernan et al. (2010) shows how negative attitude toward the United States affects spelling in Canadian English, reporting decreased American spelling variants during the Vietnam War era (e.g., the American variant *honor* is used less compared to the British variant *honour*).

By defining 'standard Korean' as "*the modern speech of Seoul widely used by the well-cultivated*" (1977, National Institute of the Korean Language), the Korean government's language policy has given Seoul Korean a strong normative bias. As indicated by the definition, this ideology not only provides Seoul Korean with prestige, but also stigmatizes regional varieties. Two possible scenarios under this ideology might be considered regarding the dialect change of Kyungsang: 1) younger Kyungsang speakers may try to imitate speech characteristics of prestigious Seoul Korean; 2) they may try to avoid any marked property in their stigmatized Kyungsang speech. Whichever scenario is right, it can be reasonably assumed that the prevailing Korean ideology might play another critical role in increasing the phonetic and phonological similarity between Seoul and Kyungsang Korean in favor of Seoul Korean. In this sense, the increased exposure to Seoul Korean might provide an optimal linguistic setting for younger Kyungsang speakers who favorably imitate the phonetic property of the standard Seoul dialect.

A recent dissertation by H.-S. Lee (2008) provides a piece of evidence of sound change in Kyungsang Korean. In the phonetic study, H.-S. Lee (2008) reported age variations in

sentence intonation of Northern Kyungsang Korean. Unlike the Seoul dialect or many other languages, Kyungsang dialects of Korean mark an interrogative sentence with final-falling declarative intonation. Instead of intonation, North Kyungsang speakers use sentence-final particles to mark sentence types. H.-S. Lee (2008) showed that in contrast to the older Kyungsang generation, the younger Kyungsang generation does not preserve the final-falling intonation for a question sentence. Instead, the younger generation used final-rising intonation for a question sentence, similar to Seoul Korean. H.-S. Lee (2008) suggested that this generational difference possibly indicates ongoing sound change that may be attributed to increased exposure to prestigious Seoul Korean.

Although H.-S. Lee (2008) provided evidence of sound change in Kyungsang Korean, it was limited to sentence intonation. In addition, H.-S. Lee (2008) raised the possibility that the observed age difference in sentence intonation might be due to younger Kyungsang speakers' self-conscious efforts to avoid certain Kyungsang features. That is, although the current linguistic environment in Kyungsang Korean suggests the existence of a sound change in progress, no phonetic studies have systematically investigated the potential dialect change in contemporary Kyungsang Korean. Therefore, the major goal of this dissertation is to investigate sound change in progress in Kyungsang Korean in apparent time[1] where different age groups are observed at the same point in time (Bailey et al. 1991). The current dissertation will test the

[1] The assumption here is that differences among generations of similar adults mirror actual diachronic developments in a language: the speech of each generation is assumed to reflect the language more or less as it existed at the time when that generation learned the language (Bailey et al. 1991: 241). A counterpart of the apparent time is a *real-time* study where a researcher compares data from similar speakers at each of two or more time periods.

internal homogeneity of Kyungsang Korean by exploring whether the phonetic uniqueness of Kyungsang Korean relative to Seoul Korean is still maintained by younger speakers. Acoustic studies will compare the phonetic characteristics of Kyungsang Korean spoken by two different generations, and will form the basis for an analysis of the phonetics and phonology of segments and lexical pitch. A comparison with Seoul Korean will establish whether the phonetics of contemporary Kyungsang Korean is changing toward Seoul Korean, which makes it possible to test the influence of Seoul Korean.

The significance of this dissertation includes its advancement of our understanding of language change, particularly with respect to whether and how interaction between dialects influences the formation of phonetics and phonology in a dialect. Investigating the sound change in Kyungsang Korean through a comparison with Seoul Korean will result not only in a greater understanding of the phonetics and phonology of Kyungsang and Seoul Korean, but also in knowledge of how a prestigious dialect can affect language re-formation. Moreover, the quantitative analysis of a large set of acoustic data will contribute to resolving ongoing debates about the phonology of Kyungsang Korean. As a pioneering sociolinguistic study of Kyungsang Korean, it is hoped that the phonetic examination in this dissertation will be able to build a bridge between past research and future work that traces the process of diachronic sound change in Kyungsang Korean.

1. 2. Background

1. 2. 1. Social background of the Kyungsang region

The Kyungsang province is located in the southeastern part of Korea as seen in Figure 1.1.

Figure 1. 1. Korean dialectal map.

Among five major dialect communities in South Korea[2], the Kyungsang province forms the second largest dialect community after the standard Seoul dialect. The North and South Kyungsang provinces might be considered separately regarding their geographical locations and dialects: Daegu and Pusan are major cities for North and South Kyungsang provinces, respectively. The North and South Kyungsang dialects of Korean are spoken approximately by thirteen million speakers, and the populations of Pusan, where the current data were collected, is around 3.6 million. In 1970s when industrialization began in South Korea, population in the Seoul/Kyunggi capital area started to increase most drastically among other regions. Notably, the population in the South Kyungsang region has also increased, and this is different from other regions that have undergone the decrease in population (see Figure 1. 2). The increased population in the South Kyungsang area may be because large factories such as Hyundai are located in the area. Presumably, people from other regions moved to this region for labor.

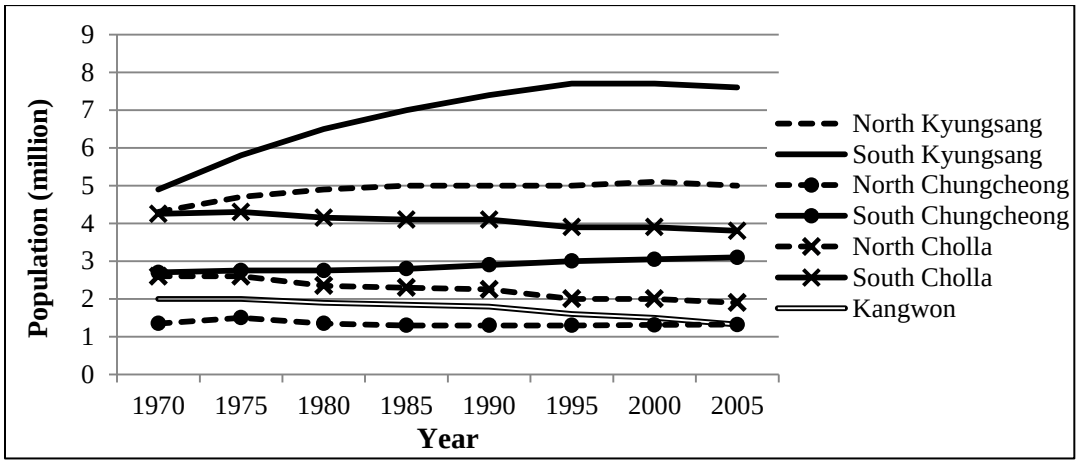

Figure 1. 2. Change in population by regions from 1970 to 2005 (adapted from http://blog.naver.com/mystericolor?Redirect=Log&logNo=105481248)

[2] The five major regional dialects spoken in South Korea are Seoul/Kyunggi, Chungcheong (central), Kangwon (east coast), Cholla (southwestern), and Kyungsang dialects.

Regarding the current linguistic environment of the Kyungsang dialect, H.-S. Lee (2008) noted that younger Kyungsang speakers have been exposed to Seoul Korean from an early age through various sources such as television and movies. In addition, compared to older speakers, more younger Kyungsang people have had higher education, which also exposed them more to the Seoul dialect than older people. H.-S. Lee (2008) hypothesizes that the exposure to Seoul Korean among younger Kyungsang speakers might play a role in prompting a negative attitude towards regional dialects compared to the standard Seoul dialect. As stated by H.-S. Lee (2008), while the Kyungsang dialect is described as masculine and aggressive, the Seoul dialect is described as feminine and soft. These descriptions about the Kyungsang and Seoul dialects are reflected in Korean movies and dramas. Moreover, in his survey about college students' attitudes toward their dialects, Min (1997) also noted that while none of the Seoul speakers indicated that their dialect sounds bad, 4% of male and 10% of female Kyungsang participants indicated that their dialect sounds bad.

1. 2. 2. Linguistic background of Kyungsang Korean

This section briefly describes the phonetic and phonological characteristics of segments and lexical pitch accents of Kyungsang Korean in comparison to those of Seoul Korean. Individual chapters of this dissertation provide more detailed background information and literature reviews regarding vowels, stops, fricatives and the phonetics and phonology of Kyungsang's lexical pitch accent.

1. 2. 2. 1. Segments

The phonetic properties of segments in Northern and Southern Kyungsang Korean are quite different from those of Seoul Korean. Previous studies (e.g., Y.-H. Chung 1991; N.-J. Kim

1997) agree that there are no differences in segments between the two Kyungsang dialects. I briefly describe the characteristics of vowels and consonants of Kyungsang Korean, and compare them to those in Seoul Korean.

Seoul Korean has been reported as having up to ten vowels, while Kyungsang Korean has six vowels. H.-M. Sohn (1999) stated that the difference in the number of vowels between the two dialects is because Kyungsang Korean has undergone many simplifications in the course of its evolution (Sohn 1999: 17). The difference in vowels between Seoul and Kyungsang Korean derives from the absence in Kyungsang Korean of two front rounded monophthongs (/y/ and /ø/)[3], the lack of a distinction between the central high and back mid vowels (/ɨ/ and /ʌ/), and between the two front mid vowels (/e/ and /ɛ/)[4]. Figure 1. 3 presents the vowel inventories of Seoul and Kyungsang Korean.

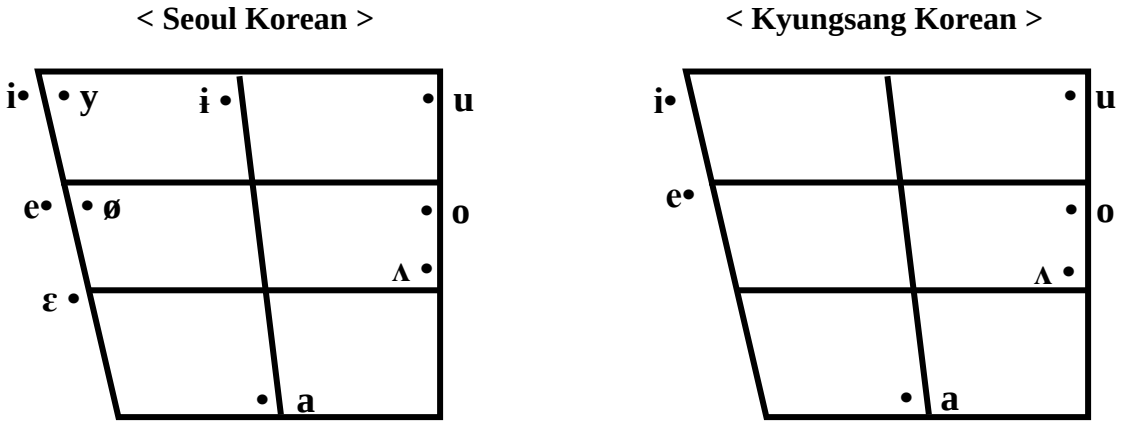

Figure 1. 3. Vowels in Seoul and Kyungsang Korean (adapted from Sohn 1999)

[3] The two front rounded monophthongs have also disappeared from Seoul Korean, and these rounded vowels are now considered as parts of an 'ideal' vowel system (e.g., Hong 1991; Lee & Ramsey 2011).

[4] An on-going merger between /e/ and /ɛ/ is also observed for Seoul Korean (e.g., Hong 1991).

Previous studies (e.g., Y.-H. Chung 1991; N.-J. Kim 1997; H.-M. Sohn 1999) noted the neutralization between /ɨ/ and /ʌ/, and between /ɛ/ and /e/ in Kyungsang Korean. Chung (1991) mentioned that /ʌ/ is a little bit higher in the Kyungsang dialect compared to the Seoul dialect, having a quality in between /ɨ/ and /ʌ/. N.-J. Kim (1997) also proposed that /ɨ/ and /ɛ/ are missing in Kyungsang Korean. As for the two front rounded monophthongs /y/ and /ø/, H.-M. Sohn 1999 mentioned that /ø/ is pronounced as /e/, and /y/ is pronounced as /i/ (see Chapter 2 for vowels).

The consonant inventory of Kyungsang Korean consists of 18 segments (e.g., Y.-H. Chung 1991; N.-J.Kim 1997; H.-M. Sohn 1999; S.-E.Chang 2007). Consonants in Kyungsang Korean are not different from Seoul except that the fricatives /s/ and /s'/ are not phonemically distinct in Kyungsang Korean. Table 1. 1 presents the consonant inventory in Kyungsang Korean.

	Labial	Alveolar	Post-alveolar	Velar	Glottal
Stop	p, p^h, p'	t, t^h, t'	ʧ, $ʧ^h$, ʧ'	k, k^h, k'	
Fricative		s			h
Nasal	m	n		ŋ	
Liquid		l			

Table 1. 1. Consonants of Kyungsang Korean (adapted from N.-J. Kim 1997)

Cho, Jun and Ladefoged (2002) compared acoustic properties of obstruents between Seoul and Cheju dialects of Korean. Distinct acoustic characteristics between the fricatives /s/ and /s'/ led Cho et al. (2002) to categorize /s/ as lenis and /s'/ as fortis fricatives, respectively, in Seoul Korean. Cho et al. (2002) classified /s/ as lenis based on the lower F0 for vowels

following /s/ than for those following /s'/ and on its tendency to be voiced intervocalically which is similar to that found for the lenis stop. Kenstowicz and Park (2006) examined fricatives produced by seven Kyungsang speakers who ranged in age from their 20s to their 40s. Kenstowicz and Park (2006) noted that Kyungsang speakers also acoustically retain the two fricatives, but the acoustic cues to distinguish the two fricatives are different from Seoul Korean. Specifically, Kenstowicz and Park (2006) reported that F0 in the vowel after /s/ is as high as that after /s'/, while H1-H2 values were consistent with those in Cho et al. (2002): higher H1-H2 for /s/ than /s'/. Consequently, Kenstowicz and Park (2006) suggested the category of aspirated fricative for the plain /s/, which is different from Cho et al. (2002) in which lenis /s/ was suggested. However, although Kenstowicz and Park (2006) suggested two distinct fricatives /s/ and /s'/, categorizing /s/ as aspirated and /s'/ as tense in Kyungsang Korean, we cannot determine whether the distinction is from the younger or older speakers without considering age factors. See K. Lee (2002) and Holliday (2012) for more discussion about Kyungsang fricatives summarized in Chapter 4.

Regarding stop consonants, while both Seoul and Kyungsang Korean share the same three-way laryngeal distinction among voiceless stops, the two dialects distinguish the stops differently. Lee and Jongman (2012) demonstrated that non-tonal Seoul Korean speakers use a combination of VOT and F0, while tonal Kyungsang speakers primarily use VOT to cue the three-way distinction among voiceless stops. Lee and Jongman (2012) concluded that the different tonal system between the two dialects is responsible for the dialectal variation. In addition to the dialectal variation in stops, a reduction in VOT difference between the lenis and aspirated stops in Seoul Korean was noted in previous studies (e.g., Silva 2006; Wright 2007; Kang & Guion 2008; Kuang & Oh 2011) as an on-going diachronic change. The current

linguistic situation in Kyungsang Korean raises the question whether older and younger generations of Kyungsang speakers cue the three-way distinction among voiceless stops in a similar way. In addition, regarding the on-going diachronic change in VOT in Seoul Korean, this dissertation explores whether VOT in younger Kyungsang speakers patterns closely to younger Seoul speakers, which would reflect a simultaneous ongoing diachronic change in VOT (see Chapter 3 for stops).

1. 2. 2. 2. Lexical pitch

Unlike Seoul or any other regional dialects of Korean that have lost their pitch accent from Middle Korean (15th century), the Northern and Southern Kyungsang dialects of Korean have preserved lexical pitch accent (Ramsey 1975). While the Northern and Southern dialects of Kyungsang share most of their phonetic properties such as segment inventory and the presence of lexical pitch, the difference between the two Kyungsang dialects is in their pitch accent systems. While South Kyungsang Korean has maintained the rising pitch accent in monosyllabic words, North Kyungsang Korean lost the rising tone and developed a vowel length contrast as in example (1).

(1) mál (High) 'horse'
mǎl (Rising) 'speech' (South Kyungsang)

mál (High-short vowel) 'horse'
má:l (High-long vowel) 'speech' (North Kyungsang)

The current dissertation will focus on South Kyungsang Korean whose pitch system is close to Middle Korean. Therefore, the description of the lexical pitch accent below concentrates on South Kyungsang Korean.

South Kyungsang Korean has High and Rising lexical pitch in monosyllabic words in isolation, and HH (high-high), HL (high-low) and LH (low-high) lexical pitch patterns in disyllabic words in isolation. Previous phonetic studies (e.g., S.-E. Chang 2007; H.-S. Lee 2008) showed that the lexical pitch accent contrast can be distinguished in terms of F0 alignment (ms) and F0 scaling (Hz). Figure 1. 4 presents an example of the measurement for F0 alignment and F0 scaling.

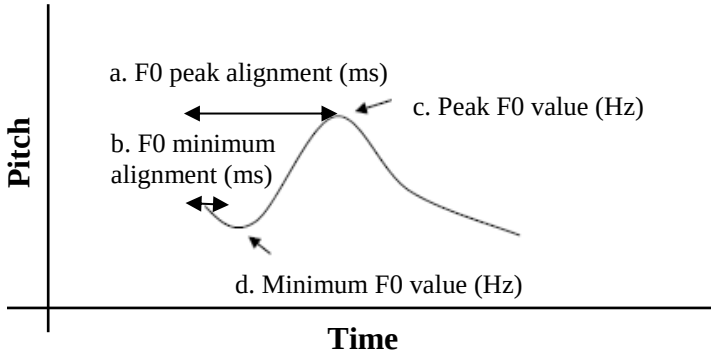

Figure 1. 4. Example of F0 alignment and F0 scaling measures (adapted from H.-S. Lee 2008)

In Figure 1. 4, F0 peak alignment (a) indicates the duration from the onset of the prevocalic consonant to the point of the highest F0 value, while F0 minimum alignment (b) measures the duration from the onset of the prevocalic consonant to the point of the lowest F0 value before the highest F0 point. In terms of the F0 scaling (Hz), peak F0 value (c) measures the highest F0 value within a target syllable, and minimum F0 value (d) measures the point where F0 value is the lowest before the peak F0 point. Regarding F0 alignment, or the timing of

pitch contours (ms), H.-S. Lee (2008) showed that the accentual peak varies in accordance to the lexical pitch contrast: the F0 peak of HL comes earliest and that of LH last. The F0 minimum alignment also varies according to lexical pitch contrast: the F0 peak of HL comes earliest and that of LH last. In terms of F0 scaling (Hz), H.-S. Lee (2008) reported that the minimum F0 value in LH was lower than for the other two patterns, but the peak F0 values were not significantly different across pitch contrasts.

S.-E. Chang (2007) also examined the difference in F0 alignment and F0 scaling for monosyllabic High and Rising lexical pitch. S.-E. Chang (2007) noted that the timing of F0 peak (ms) is different across lexical tones; the F0 peak of High pitch accent comes earlier than that of Rising pitch accent. In addition, S.-E. Chang (2007) stated that the entire duration is longer for Rising than High pitch accent. In terms of F0 scaling (Hz), S.-E. Chang (2007) reported that the low F0 value is lower for the Rising than High pitch accent, and peak F0 is also lower for Rising than High pitch accent (see Chapter 5 for the phonetics of Kyungsang's lexical pitch accent).

Regarding the phonology of the lexical pitch accent in Kyungsang Korean, previous research (e.g., Ramsey 1975; Schuh & Kim 2007; S.-E. Chang 2007) noted that a phonological word consisting of less than three syllables should be expanded with suffixes in order to determine the underlying tonal classes. Adding suffixes reveals that monosyllabic H and disyllabic LH pitch patterns should actually belong to two separate underlying representations, respectively, indicating the importance of suffixation in determining underlying accents in Kyungsang Korean. Two different Hs and LHs are neutralized in word isolation form. That is, there are two types of High tones in monosyllabic nouns: one shows a consistent accent pattern of H-H(L) across suffix types, but the other shows accent variations depending on suffix types.

A similar situation is observed for the disyllabic LH accent classes: one with a consistent accent pattern of LH-H(L) across suffixes, but the other with accent variations by suffix types.

Lee and Zhang (in press) empirically observed this tonal variation by suffixes, and proposed a formal analysis for the lexical pitch accent based on the phonetic observations. According to four tonal parallels between monosyllabic and disyllabic nouns, Lee and Zhang (in press) suggested four underlying representations to account for the pitch system of nouns in South Kyungsang Korean. Specifically, the first pattern is the disyllabic HL accent where a high tone is located on the first syllable across suffixes (e.g., *kéwul-pota* (HL-LL) 'than a mirror'). The second pattern is monosyllabic H and disyllabic HH accents where the high peaks always occur on the first and the available second syllables (e.g., *nwún-póta* (H-HL) 'than eyes'; *kúlím-pota* (HH-LL) 'than painting'). The third is the monosyllabic R and disyllabic LH patterns where the high peaks occur on the second and the following adjacent available syllable (e.g., *nwun-pótá* (L-HH) 'than snow'; *salám-póta* (LH-HL) 'than a person'). The fourth is monosyllabic H and disyllabic LH patterns that are neutralized with the former H and LH in isolation. Unlike the previous H and LH which have consistent accent patterns regardless of suffix types, the fourth H and LH accent classes have tonal variations depending on suffixes. For example, when the words in these tone classes are suffixed with *-i* (nominative case marker) or *-imyen* 'if', the H tone occurs only on the last syllable of the root and the rest of the syllables take low tones, which is true for both monosyllabic and disyllabic noun stems (e.g., *mún-imyen* (H-LL) 'a door-nom; *palám-imyen* (LH-LL) 'than wind'). However, with the suffix *-pota* 'than', the H tone always occurs on the first syllable of the suffix *-pota*; the H tone does not occur in the root for the monosyllabic word with the suffix *-pota*, while it does occur on the second syllable of the root for the disyllabic words as well as the first syllable of the suffix (e.g., *mun-póta* (L-

HL) ‘a door-nom; *palám-póta* (LH-HL) ‘than wind’). The tonal variation by suffixation indicates that any examination of the pith accent system for nouns in Kyungsang Korean should consider how the tonal pattern interacts with suffixes (see Chapter 6 for the phonology of Kyungsang’s lexical pitch accent).

1. 3. Goals of the study

The overall goal of the current dissertation is to examine whether the phonetics and phonology of South Kyungsang Korean differ between younger and older Kyungsang generations, and thus to determine whether and how diachronic sound change occurs in South Kyungsang Korean. The acoustic study of segments tests whether the phonetically or phonologically distinct vowels, stops, and fricatives of Kyungsang Korean as compared to Seoul are still retained by younger Kyungsang speakers.

The goal of the acoustic study of vowels in Chapter 2 is to determine whether sound change occurs in the vowel system of Kyungsang Korean by testing the phonetic homogeneity of the vowel inventory between older and younger Kyungsang generations. The primary focus of the vowel chapter is on the vowel pairs for which dialectal variation has been reported (i.e., /ɨ/-/ʌ/, /ɛ/-/e/). Acoustic comparison between Kyungsang and Seoul Korean allows us to test if the vowel system of Kyungsang Korean becomes similar to that of Seoul Korean. Along with the primary focus, this chapter also aims to clarify the issue on the two front rounded vowels /y/ and /ø/ in the Korean vowel system by testing these two rounded vowels indeed disappear in Seoul Korean.

The goal of the acoustic study of stop consonants in Chapter 3 is to examine whether younger Kyungsang speakers cue the three-way distinction among the voiceless stops in the same way as the older Kyungsang generation. To address this, the stop chapter tests if the

acoustic properties of VOT, F0 and H1-H2 are homogeneous between older and younger Kyungsang generations for the three stops. Consistent with the vowel chapter, the dialectal comparison between Kyungsang and Seoul Korean allows us to test if younger Kyungsang speakers distinguish the stops in a similar way as younger Seoul speakers, and thereby provides us with an indirect indication of how non-tonal Seoul Korean affects the segmental distinction of tonal Kyungsang Korean. In addition, we will verify the reported ongoing sound change in the stops of Seoul Korean, examining whether and how the change in Seoul Korean stops affects the production of stops among younger Kyungsang speakers.

The acoustic study of fricatives in Chapter 4 aims to determine whether the fricatives /s/ and /s'/ are retained by younger Kyungsang speakers as well as older speakers. Although the two-way fricative distinction is known to be neutralized in Kyungsang Korean (Sohn 1999, Lee & Ramsey 2011), several experimental findings on Kyungsang fricatives have reported that the two fricatives /s/ and /s'/ are acoustically distinguished in terms of frication/aspiration duration (K. Lee 2002, Holliday 2012), center of gravity (Holliday 2012) and H1-H2 (Kenstowicz & Park 2006). Therefore, the fricative chapter in this dissertation tests if the acoustic properties of frication/aspiration duration, center of gravity, H1-H2, and F0 at the onset of the following vowel show the consistent pattern between older and younger Kyungsang generations for the two-way fricative distinction, and see if the inconsistent reports among studies are related to the age factor. In addition, the dialectal comparison between Kyungsang and Seoul Korean tests if younger Kyungsang speakers distinguish the fricatives in a similar way as younger Seoul speakers.

The acoustic study of lexical pitch accent examines whether older and younger Kyungsang speakers distinguish the monosyllabic and disyllabic accent contrasts in a similar

way, and whether the two generations have maintained the same underlying representations. These topics are examined in two separate chapters: 1) the phonetic property of the pitch accent (Chapter 5), and 2) a phonological analysis of the full range of nominal accent patterns (Chapter 6).

In Chapter 5, the phonetic study of the lexical pitch accent examines whether the monosyllabic Rising vs. High and disyllabic HH, HL and LH accent contrasts in isolation forms are maintained consistently by older and younger Kyungsang speakers. Temporal and spectral properties of contrastive lexical accents are measured to test if these acoustic properties show generational differences in contrasting the mono- and disyllabic nouns in isolation. In addition, the same acoustic measures for Seoul utterances are aimed to compare the accent pattern across Seoul and Kyungsang, and across older and younger generations. These generational and dialectal comparisons will allow us to see if the accent pattern of South Kyungsang Korean becomes similar to that of Seoul Korean.

Chapter 6 explores the generational difference in the phonetics and phonology of the lexical pitch system of South Kyungsang Korean, focusing on if the underlying representations of the lexical pitch accent in South Kyungsang Korean are maintained both by older and younger Kyungsang speakers. The topic is addressed by phonetically examining nominal accent patterns with suffixation. As stated in Section 1. 2. 2. 2, a phonological word of less than three syllables should be expanded with suffixes to determine the underlying lexical accent. Therefore, the full range of the nominal accent patterns expanded with various suffixes enables us to indicate if older and younger generations of Kyungsang speakers share the same underlying representations, and if we can apply the same phonological analysis for both generations of Kyungsang speakers. Tone assignments in the current dissertation are made for monosyllabic and disyllabic nouns

under suffixation for both older and younger Kyungsang speakers. In addition to the analysis of Kyungsang data, the accent structure of Seoul Korean is phonetically analyzed for a dialectal comparison.

1. 4. Subject description

A total of forty female speakers participated in a production experiment for segment and lexical pitch accent studies: 10 older and 10 younger speakers for each of the Seoul and Kyungsang groups. Gender was controlled in the current dissertation to eliminate gender as a possible source of variation, intending a homogeneous sample. Selection criteria for subject recruitment are as follows. For the Kyungsang group, subjects born and educated in the South Kyungsang region (mostly Pusan) were recruited. For the Seoul group, I recruited subjects who were born and educated in the Seoul or Kyunggi region where standard Korean is spoken. In addition to the target dialect of each participant, I recruited subjects whose parents were also speakers of the same target dialect. Regarding age, subjects born before 1950 and after 1985 were recruited for the older and younger groups, respectively.

Sociolinguistic studies (e.g., Labov 2001; Baranowski 2010) have reported effects of social class as well as gender on linguistic change. For example, Baranowski (2010) showed socio-economic differences in the acoustic realization of vowels as in *cot-caught* or *pin-pen*, with the higher or lower socio-economic class showing no vowel merger, but the middle socio-economic class showing a vowel merger. Accordingly, Baranowski (2010) suggested that the middle class is leading the phonetic shift of a vowel merger. For the current dissertation, controlling social factors is important in the sense that a potential source of linguistic variation is eliminated. For indicators of social standing as related to linguistic variation, Labov (2001) noted occupation as the best single indicator of social status, over education or income.

Therefore, in order to eliminate the possible variations from different social classes or different work experiences, this study tried to collect data from similar social classes with similar work experiences. The social environment of Korea has changed over the past few decades, which has resulted in increased overall education levels. In the current dissertation, while younger participants have almost equal education levels (i.e., high school graduation), older participants vary in their education levels. The difference in older generation's education was later considered as a covariate factor.

Tables 1. 2 and 1. 3 present the demographic information of each participant including the year of birth (YOB), education level (highest level of schooling), occupation, income level, and residential area. Most of the younger participants are currently college students, and most of the older participants are housewives. Regarding participants' income level, parents' annual income (for younger subjects) or annual income per household (for older subjects) is considered: three categories of income levels are 1) Low = less than $20,000, 2) Mid = $20,000 – $40,000, and 3) High = over $40,000.

	YOB	Education	Occupation	Income	Residential area
kso1	1945	elementary	housewife	Low	Pusan
kso2	1942	elementary	personal business	Mid	Pusan
kso3	1936	middle	personal business	Mid	Pusan
kso4	1950	middle	housewife	Mid	Pusan
kso5	1940	high	housewife	Mid	Pusan
kso6	1946	high	housewife	Mid	Pusan
kso7	1952	elementary	housewife	Low	Pusan
kso8	1952	high	housewife	Mid	Pusan
kso9	1947	high	private tutor	Mid	Pusan
kso10	1936	middle	housewife	Low	Pusan
ksy1	1989	high	college student	Mid	Pusan
ksy2	1991	high	college student	Mid	Pusan
ksy3	1991	high	college student	Mid	Ulsan
ksy4	1990	high	college student	Mid	Pusan
ksy5	1991	high	college student	Mid	Pusan
ksy6	1989	high	college student	Mid	Pusan
ksy7	1988	high	college student	High	Pusan
ksy8	1991	high	college student	Mid	Pusan
ksy9	1991	high	college student	Mid	Pusan
ksy10	1989	high	college student	High	Pusan

Table 1. 2. Demographic information for South Kyungsang participants (kso = older Kyungsang, ksy = younger Kyungsang)

	YOB	Education	Occupation	Income	Residential area
so1	1950	middle	housewife	Low	Kyunggi-Anyang
so2	1949	middle	housewife	Mid	Kyunggi-Anyang
so3	1949	middle	housewife	Mid	Kyunggi-Anyang
so4	1943	high	housewife	Mid	Seoul-Mapo
so5	1940	high	housewife	Mid	Seoul-Mapo
so6	1949	middle	housewife	Mid	Kyunggi-Anyang
so7	1946	college	housewife	Mid	Kyunggi-Anyang
so8	1942	college	private tutor	Mid	Seoul-Pangpae
so9	1942	high	housewife	Mid	Seoul-Satang
so10	1942	middle	housewife	Low	Kyunggi-Suwon
sy1	1992	high	college student	High	Seoul-Jamsil
sy2	1992	high	college student	Mid	Kyunggi-Ansung
sy3	1991	high	college student	Mid	Kyunggi-Ansung
sy4	1993	high	college student	Mid	Seoul-Kangpyen
sy5	1992	high	college student	Mid	Kyunggi-Suwon
sy6	1990	high	college student	Mid	Kyunggi-Ansung
sy7	1992	high	college student	High	Seoul-Suyu
sy8	1987	high	college student	High	Kyunggi-Sungnam
sy9	1989	high	college student	High	Seoul-Seocho
sy10	1985	college	office-worker	Mid	Kyunggi-Anyang

Table 1. 3. Demographic information for Seoul participants. (so = older Seoul, sy = younger Seoul)

For the Kyungsang dialect group, older participants were mostly recruited in the Youngdo Senior Welfare Centre in Pusan. The mean age was 66 years old (s.d. = 5.9). All younger participants were students of Pusan National University in Pusan. The mean age was 21 years old (s.d. = 1.2). A female Kyungsang language consultant assisted in the Kyungsang

recording session. The consultant was born in 1981, and was educated and lived in Pusan until she entered graduate school in the U.S. in 2011. Since the principal investigator for the current project speaks Seoul Korean, the talker interaction between Seoul and Kyungsang Korean may cause phonetic accommodation, or make Kyungsang participants conscious of their Kyungsang utterances. The presence of a native Kyungsang assistant minimized the use of Seoul Korean, and this helped to prevent any phonetic accommodation between the two dialects of Korean.

For the Seoul dialect group, older and younger participants were recruited through the experimenter's personal network in Seoul and Kyunggi regions, and most of the younger Seoul participants were students of Hankyung National University in Ansung, Kyunggi. The mean age was 66 years old (s.d. = 3.8) and 21 years old (s.d. = 2.6) for the older and younger Seoul participants, respectively. All of the participants in this dissertation were literate in Korean

1. 5. Overview of the dissertation

In the segment study, we tested whether young Kyungsang speakers maintain the consonant and vowel features unique to the Kyungsang dialect by examining acoustic parameters such as formant frequencies (F1–F3), F0, VOT and H1-H2 across dialects and generations.

Chapter 2 presents acoustic evidence of diachronic change in the vowels of Kyungsang Korean by showing vowel merger and split for the vowel pairs, /e/-/ɛ/ and /ʌ/-/ɨ/, for which a dialectal variation had been reported relative to Seoul Korean. Measures of formant frequencies 1–3 for the ten vowels in Figure 1. 3 (considered the ideal vowel system) show whether young Kyungsang speakers retain the six vowels exhibited by older speakers, or whether their speech exhibits the seven vowels of Seoul Korean. Vowel spaces for each of the dialect and age groups are provided.

Chapter 3, the chapter for stop consonants, not only considers the generational comparison in Kyungsang Korean, but also explores the reported diachronic change in Seoul Korean for the three-way distinction among voiceless stops. Measures of VOT, F0 and H1-H2 in the following vowel show 1) how differently younger Kyungsang speakers produce the stop consonants compared to the older generation, 2) how this generational change interacts with the initial lexical accent of Kyungsang Korean, and 3) how the laryngeal distinction in the production of younger Kyungsang speakers is made similarly to Seoul speakers.

Chapter 4 presents acoustic evidence of diachronic change in the fricatives of Kyungsang Korean. The two fricatives /s/ and /s'/ are less distinct for older Kyungsang speakers in terms of frication/aspiration duration and center of gravity values compared to the production of younger Kyungsang and Seoul speakers, whereas the two fricatives are well distinguished by younger Kyungsang speakers similarly to Seoul speakers. The acoustic findings suggest that younger Kyungsang speakers can make the two-way fricative distinction that is neutralized or less distinct for older speakers, and therefore the younger Kyungsang speakers share the identical consonant inventory with Seoul speakers.

The lexical pitch study investigates whether younger Kyungsang speakers retain contrastive lexical pitch accents both at the surface phonetic and underlying phonological levels.

Chapter 5 provides acoustic evidence of diachronic sound change for the lexical pitch accent of Kyungsang Korean in surface phonetic forms. F0 spectral measures (i.e., F0 maximum and minimum values (Hz)) and F0 temporal measures (i.e., F0 maximum and minimum duration (ms)) show how differently contrastive lexical accents of monosyllabic and disyllabic nouns in isolation are distinguished between older and younger Kyungsang generations. Moreover,

comparisons with Seoul utterances indicate how the accent structure produced by younger Kyungsang speakers becomes similar to that of non-tonal Seoul Korean.

Chapter 6 examines whether the underlying lexical tones in Kyungsang Korean are maintained by the younger Kyungsang generation as well as older generation based on phonetic analysis. Accent patterns were elicited for monosyllabic and disyllabic nouns with various suffixes for both older and younger Kyungsang speakers. The elicited full range of nominal accent patterns indicates how differently the underlying lexical tones are maintained by younger Kyungsang speakers compared to the older. The comparison with Seoul Korean provides an indirect indication of how non-pitch accent Seoul Korean affects the phonological representation of the prosodic system in Kyungsang Korean. Finally, a formal analysis to account for the generational difference in the lexical pitch accent system of Kyungsang Korean is proposed for the elicited tonal patterns within Optimality Theory (Prince & Smolensky 1993, 2004) framework.

Chapter 7 summarizes the main experimental findings for each of chapters 2–6, and discusses broader implications for the findings in this dissertation. Directions for future research are provided at the end.

CHAPTER 2

DIACHRONIC SOUND CHANGE IN SEGMENTS OF KYUNGSANG KOREAN: VOWELS

2. 1. Introduction

The vowel system of Kyungsang Korean is different from that of Seoul Korean; Seoul Korean has more vowels than Kyungsang. However, the increased influence of standard Seoul Korean questions whether the distinct vowel system of Kyungsang Korean is still maintained by the younger generation as well as the older. Although some studies (e.g., Cho 2002; Kuak 2003) mentioned generational differences in the vowel system of Kyungsang Korean, no studies provided acoustic evidence that reflects recent sound change in vowels of Kyungsang Korean. Therefore, the purpose of this chapter is to compare the vowel system of Kyungsang Korean between younger and older generations, and provide empirical evidence for sound change in vowels of Kyungsang Korean. In addition, through the comparison of vowel systems between Seoul and Kyungsang Korean, it is tested whether the vowel system of contemporary Kyungsang Korean is re-formed similarly to that of Seoul Korean.

2. 1. 1. Background

Previous studies on Korean vowels said that Seoul Korean has seven to ten monophthongs (e.g., Martin 1951; Kim 1968; Hong 1991; Yang 1996; Sohn 1999; Lee & Ramsey 2000; Kuak 2003; Lee & Ramsey 2011). The ten monophthongs in Seoul Korean are presented (1) below. The vowels in parentheses have been disappeared in the system or merged with the other.

(1)

	Front		**Mid**	**Back**
High	i	(y)	ɨ	u
Mid	e	(ø)		o
	(ɛ)			ʌ[5]
Low			a	

Specifically, the inconsistent number of vowels among previous studies is because of disappearance of two front rounded vowels /y/ and /ø/, and on-going merger between two front mid vowels /e/ and /ɛ/ in today's Seoul Korean. As for the two front rounded vowels, while some classic studies (e.g., Martin 1951; Kim 1968) argued that Seoul Korean has nine vowels including the vowel /ø/, recent studies generally agree that the two front rounded vowels have disappeared in the system. For example, Lee and Ramsey (2000) and Lee and Ramsey (2011) described that /y/ and /ø/ vowels become rounded with an initial consonant, but without an initial consonant they are pronounced as [wi] and [we], respectively. In addition, younger Seoul speakers pronounce [wi] and [we] in all phonological environments (Lee & Ramsey 2011). Hong (1991) also stated that the two front rounded vowels have become diphthongized, and they no longer exist in the vowel system of Seoul Korean. Kuak (2003) explains that the disappearance of the rounded vowels is driven by pressure from the system to reduce the effort of articulation by decreasing lip movement. In addition to the /y/ and /ø/ change, on-going merger of the two front mid vowels /e/-/ɛ/ has been reported in Seoul Korean. For instance, Lee and Ramsey (2011) mentioned that younger Seoul speakers distinguish the words such as /k**e**/ '*crab'* and /k**ɛ**/ '*dog'* only by contexts, but not by the phonemes. Hong (1991) compared

[5] /ʌ/ is sometimes transcribed as /ə/. The current study uses the symbol /ʌ/ based on our acoustic data in which the target vowel is closed to a back vowel rather than central (Section 2. 3. 3).

acoustic realization of /e/-/ɛ/ vowels produced by a younger (24 years old) and an older (76 years old) Seoul speakers. Hong (1991) showed that while the older speaker distinguished /e/-/ɛ/ vowels, the younger speaker did not; the low-mid vowel /ɛ/ is raised to the high-mid /e/ vowel space for the younger speaker. Accordingly, Hong (1991) argued the merger of /e/-/ɛ/ is on-going in contemporary Seoul Korean. To sum up, previous studies on vowels in standard Seoul Korean suggested that Seoul Korean has seven or eight vowels in actuality, and the ten monophthongs might be considered as parts of an ideal vowel system. The varying number of vowels between seven and eight is due to generational difference for the on-going merger of /e/-/ɛ/. That is, seven vowels are for younger generation of Seoul Korean speakers, while eight vowels are for the older.

As for Kyungsang Korean, previous studies (e.g., Kim 1986; Chung 1991; Sohn 1999; Kang 2001; Cho 2002; Kuak 2003) mostly agreed that Kyungsang Korean has six vowels. The dialectal difference in the number of vowels between Seoul and Kyungsang Korean derives from the neutralization in Kyungsang Korean of /ɨ/ and /ʌ/, and of /ɛ/ and /e/. Consistent with Seoul Korean, Kyungsang Korean does not have the two front rounded vowels. Table 2. 1 presents the vowel inventory in Kyungsang Korean in comparison with the vowels in Seoul Korean. Table 2. 1 only contains the vowels in actuality, not considering the ideal vowel system.

Seoul	i	e	ɛ	a	ʌ	o	ɨ	u
Kyungsang	i	e		a	(ʌ)	o	ɨ	u

Table 2. 1. Vowels in Seoul and Kyungsang Korean.

Regarding the neutralization between /ɨ/ and /ʌ/, there is some controversy. Specifically, Chung (1991) mentioned that /ʌ/ is a little bit higher in Kyungsang Korean compared to the

Seoul dialect, having a quality in between /ɨ/ and /ʌ/. On the other hand, Kim (1986) and Kang (2001) proposed that /ɨ/ is lower in (North) Kyungsang Korean than Seoul, and has quality of /ʌ/ rather than /ɨ/. For the two front mid vowels, previous studies (Chung 1991; Lee & Ramsey 2011; Kuak 2003) stated that the vowels have been merged long, and /ɛ/ does not exist in Kyungsang Korean.

To summarize, the dialectal difference in vowels is mainly due to Kyungsang's lack of /ɨ/ - /ʌ/ distinction. Therefore, if sound change occurs in vowels of Kyungsang Korean, and if the vowel system of contemporary Kyungsang Korean shifts towards to that of Seoul Korean, we can predict that the neutralized Kyungsang's /ɨ/-/ʌ/ vowels may be more distinct for younger Kyungsang speakers than older speakers. In other words, /ɨ/-/ʌ/ vowels may split into two separate phonemes for younger Kyungsang speakers. In addition to /ɨ/-/ʌ/ vowels, /ɛ/-/e/ vowels may be considered as a dialectal difference despite the fact that /ɛ/-/e/ vowels do not exist in both today's Seoul and Kyungsang Korean. This is because /ɛ/-/e/ have been merged long in Kyungsang Korean, while the merger is on-going in contemporary Seoul Korean. That is, the time difference of the merger occurrence can be considered as a dialectal difference between Seoul and Kyungsang Korean, and this may be reflected in phonetic properties of vowel systems for each dialect. Therefore, sound change in vowels of Kyungsang Korean can be addressed in terms of split (ɨ - ʌ) and merger (ɛ - e).

2.1.2. Goals

The goal of this chapter is to determine whether sound change occurs in the vowel system of Kyungsang Korean by testing the phonetic homogeneity of vowels between older and younger generations of Kyungsang. The primary focus of this chapter is on the vowel pairs for which dialectal variation has been reported (i.e., /ɨ/-/ʌ/, /ɛ/-/e/). Importantly, acoustic comparison

between Kyungsang and Seoul Korean allows us to test if the vowel system of Kyungsang Korean becomes similar with that of Seoul Korean. Along with the primary focus, this chapter also aims to clarify the issue on the two front rounded vowels /y/ and /ø/ in the Korean vowel system through the production study. Following questions and hypotheses are tested in this chapter.

(1) Is the lack of /ɨ/-/ʌ/ distinction maintained similarly for both generations of Kyungsang speakers? If it is not, do the /ɨ/-/ʌ/ vowels split for younger Kyungsang speakers similarly to Seoul Korean?

(2) How different or similar is the /ɛ/-/e/ merger between Kyungsang and contemporary Seoul Korean? How is the dialectal difference in timing of merger occurrence reflected in the phonetic realization?

(3) Do the two front rounded vowels /y/ and /ø/ indeed disappear in Korean vowel systems? Is the rounding feature of /y/ and /ø/ shown in comparisons with unrounded counterparts (i.e., /y/ vs. /i/, and /ø/ vs. /e/ and /ø/ vs. /ɛ/)?

(4) Is the acoustic observation of sound change or dialectal differences in vowels shown consistently for Non-word and Word contexts?

2. 2. Methodology

2. 2. 1. Participants

Forty female native speakers of Korean participated in a production experiment to investigate vowels. The data were collected from 10 younger and 10 older speakers for each of the Seoul and Kyungsang groups. The subjects' age ranges from 18 to 26 (mean = 21 years old) for the younger group and from 59 to 75 (mean = 66.5 years old) for the older group. All of the Seoul speakers were born in Seoul or the Kyunggi region where standard Korean is spoken.

Likewise, all of the Kyungsang speakers had lived in the South Kyungsang area (Pusan city). Parents of the participants were also speakers of the same dialect. No subject had lived in other dialect regions for more than one year, except for two older Kyungsang speakers who were born in Japan and had lived there for 10 years. None of the speakers of either dialect reported any speech or hearing disorders, and all of the speakers were literate in Korean. The socio-economic status of participants was considered as a covariate factor. The difference in socio-economic status between younger and older speaker groups allows us to test the effect of social factors on sound change. The description of the socio-economic status for the forty participants is presented in Section 1. 4. In the current study, while younger speakers in both Seoul and Kyungsang Korean have consistent education levels or work experiences, older speakers vary in their socio-economic status, particularly in education levels.

2. 2. 2. Procedure

Subjects were recorded in various quiet locations, such as the subject's campus, home, or village community center using a Marantz Digital Recorder (PMD 670) and a SHURE head-mounted microphone. Each target word was written on an index card, in Korean orthography. Subjects were instructed to read each word as naturally as possible at a normal speaking rate. Importantly, a female Kyungsang language consultant assisted in the Kyungsang recording session. Since the principal investigator for the current project speaks Seoul Korean, the talker interaction between Seoul and Kyungsang Korean may cause phonetic accommodation (Pardo, 2006). The presence of a native Kyungsang assistant minimized the use of Seoul Korean, and this helped to prevent any phonetic accommodation between the two dialects of Korean. Each of the subjects received instructions and practiced before the actual recording. The stimuli were

recorded at a sampling rate of 22050 Hz and analyzed using the software package Praat (Boersma & Weenink, 2010).

2. 2. 3. Speech materials

For the acoustic study of vowels, ten Korean monophthongs that are considered as ideal vowels in standard Korean were examined. That is, the production study included the two front rounded vowels as well as the front mid vowels reporting disappearance and on-going merger, respectively. Each Korean vowel occurred in a non-word context of /h(V)ba/ (V = vowel). Along with the non-word context, the current study recorded word minimal pairs containing vowels which the current chapter focused on (e.g., /ɨ/-/ʌ/, /e/-/ɛ/). Recording vowels in non-word and word contexts provided us with the difference in the lexical status. These contextual differences allowed us to examine if the reported dialectal difference is consistent across non-word and word contexts, and if sound change in vowels occurs consistently for both contexts. Each subject produced stimuli twice in random order in isolation at a normal speech rate. In total, 1360 tokens were obtained for investigating vowels (17 stimuli × 2 repetitions × 40 speakers). Table 2. 2 presents the stimulus list.

Vowel	Non-word	Word	
i	hiba	sita	‘being sour’
y	hyba	syta	‘take a rest’
e	heba	sɐk’i	‘three meals’
ø	høba	søt’oŋ	‘cattle dung’
ɛ	hɛba	sɛk’i	‘a young animal’
a	haba		
ʌ	hʌba	tʌk-i	‘virtue’
o	hoba		
ɨ	hɨba	tɨk-i	‘profit’
u	huba		

Table 2. 2. Stimuli recorded for the acoustic study of vowels.

2. 2. 4. Measurements

The first three formant frequencies (F1–F3) and fundamental frequency (F0) were measured for the vowel study. Formant frequencies 1 – 3 were extracted at the midpoint of the target vowel using LPC analyses with a 25 ms window. If the formant frequencies were not stable at the midpoint of the vowel as indicated by formant values on a spectrogram, F1–F3 were manually measured in the steady-state portion closest to the vowel midpoint with LPC spectra. A Praat script (by Lennes 2003) was used for this measurement. F0 values were measured at the midpoint of the target vowel using a Praat script (by Xu 2006). Vowel onset was determined as the onset of the first formant and vowel offset as the offset of the second formant in the spectrogram.

2. 2. 5. Data analysis

Measurements were averaged across the two repetitions for each speaker. All the data were evaluated based on repeated measures General Linear Model (GLM) Analyses of Variance (ANOVAs) testing a vowel pair showing a dialectal difference. Repeated measures ANOVAs were conducted on each dependent variable of the first (F1) and the second formant (F2) values separately for the i) ɨ – ʌ, and ii) e – ɛ vowel pairs. In addition, repeated measures ANOVAs tested the dependent variables of the second (F2) and third formant (F3) for vowel pairs of 'rounded – unrounded counterpart' to examine if the rounding feature is shown in the two front rounded vowels compared to the unrounded counterparts; the comparisons were made for the pairs of iii) 'y – i', iv) 'ø – e' and v) 'ø – ɛ'[6].

Three-way ANOVAs included a within-subjects factor of Vowel, and between-subjects factors of Dialect (Seoul, Kyungsang) and Age (Older, Younger). In order to further analyze the observed data within a factor, pairwise comparisons were reported for the factor showing a significant main effect. In addition, whenever there is an interaction effect of Vowel by Age by Dialect that indicates age and dialectal variation on a dependent variable, one-way ANOVAs were performed within each Age and Dialect group to test the effect of the Vowel factor for each speaker group. The statistical evaluation was made separately for Non-word and Word. This is because the target vowels for Non-word and Word occurred in different consonantal environments[7]: /h(V)ba/ for Non-word, and /s(V)t/, /s(V)k/ and /t(V)k/ for Word. By analyzing

[6] Although the unrounded counterpart for /ø/ is /e/, /ø/ is compared with both /e/ and /ɛ/. This is because the merger of /e/-/ɛ/ has been reported in previous research.

[7] The difference in consonantal environments may affect the formant frequency values in the target vowel (Hillenbrand et al. 2001).

the data separately for Non-word and Word, the current study intended to eliminate the variation that could be caused by the different consonantal environments. The F1/F2 values for '/a/, /o/, /u/' vowels were examined for the purpose of drawing vowel spaces for each dialect and age group.

2. 3. Results

2. 3. 1. Central high and back mid vowels: /ɨ/ and /ʌ/ distinction

2. 3. 1. 1. Non-word: /hɨba/ and /hʌba/

With the first formant (F1) as the dependent variable, a three-way repeated measures ANOVA (Vowel by Age by Dialect) reported significant main effects of Vowel (F (1, 36) = 227.650, $p < 0.001$), Age (F (1, 36) = 17.281, $p < 0.001$) and Dialect (F (1, 36) = 9.705, $p = 0.004$) for 'ɨ and ʌ' difference in Non-word. Pairwise comparisons show that F1 is lower for /ɨ/ than /ʌ/; F1 is lower for older speakers than younger, and it is lower for Kyungsang speakers than Seoul. In addition, there were significant two-way interaction effects of Vowel by Age (F (1, 36) = 18.786, $p < 0.001$) and Vowel by Dialect (F (1, 36) = 21.167, $p < 0.001$), and a significant three-way interaction of Vowel by Age by Dialect (F (1, 36) = 9.705, $p = 0.014$) on F1.

For the second formant (F2), a three-way repeated measures ANOVA (Vowel by Age by Dialect) reported significant main effects of Vowel (F (1, 36) = 159.497, $p < 0.001$), and Age (F (1, 36) = 5.919, $p = 0.020$), but there was no effect of Dialect (F (1, 36) = 0.078, $p = 0.782$). Pairwise comparisons show that F2 is higher for /ɨ/ than /ʌ/; F2 is lower for older speakers than younger. In addition to the main effects for F2, there were significant two-way interaction effects of Vowel by Age (F (1, 36) = 33.638, $p < 0.001$) and Vowel by Dialect (F (1, 36) =

10.279, $p = 0.003$), and a significant three-way interaction of Vowel by Age by Dialect (F (1, 36) = 11.467, $p = 0.002$).

Since the significant interaction effects on F1 and F2 indicate age and dialectal variations, one-way ANOVAs tested each of the F1 and F2 differences between 'ɨ and ʌ' vowels separately for each Dialect and Age group. Pairwise comparisons from the one-way ANOVAs showed that both older and younger Seoul speakers distinguish 'ɨ and ʌ' in both F1 and F2 ($p < 0.001$). In Seoul Korean, /ɨ/ has a lower average F1 than /ʌ/, indicating that /ɨ/ is a higher vowel than /ʌ/; /ɨ/ has a higher average F2 than /ʌ/, suggesting that /ɨ/ is more fronted than /ʌ/. In Kyungsang Korean, older speakers distinguish 'ɨ and ʌ' in F1 ($p = 0.018$), but not in F2 ($p = 0.885$). On the other hand, younger Kyungsang speakers distinguish 'ɨ and ʌ' in both F1 and F2 ($p < 0.001$); consistent with Seoul Korean, /ɨ/ has a lower average F1 than /ʌ/, and /ɨ/ has a higher average F2 than /ʌ/ for younger Kyungsang speakers. The 'ɨ and ʌ' vowels in Non-word are plotted separately by Age and by Dialect in Figures 2. 1 (Seoul) and 2. 2 (Kyungsang). Two clearly separate ellipses in Fig.2. 1-(a)/(b) and Fig. 2. 2-(b) for older/younger Seoul and younger Kyungsang groups indicate the significant distinction on both F1 and F2 for 'ɨ and ʌ' vowels. For older Kyungsang speaker group in Fig. 2. 2-(a), the small but significant difference for F1 (height) and non-significant difference for F2 (backness) between 'ɨ and ʌ' is indicated with two ellipses that are vertically distinct, but horizontally identical.

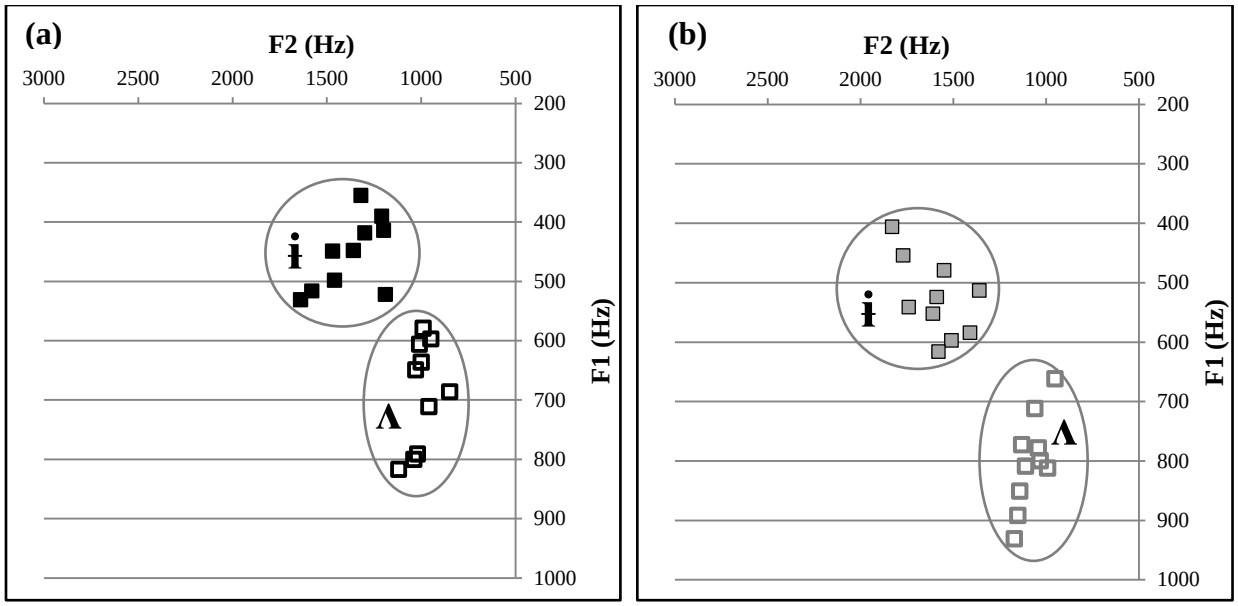

Figure 2. 1. Formant plots of 'ɨ and ʌ' vowels in Non-word for Older (a) and Younger (b) Seoul speakers.

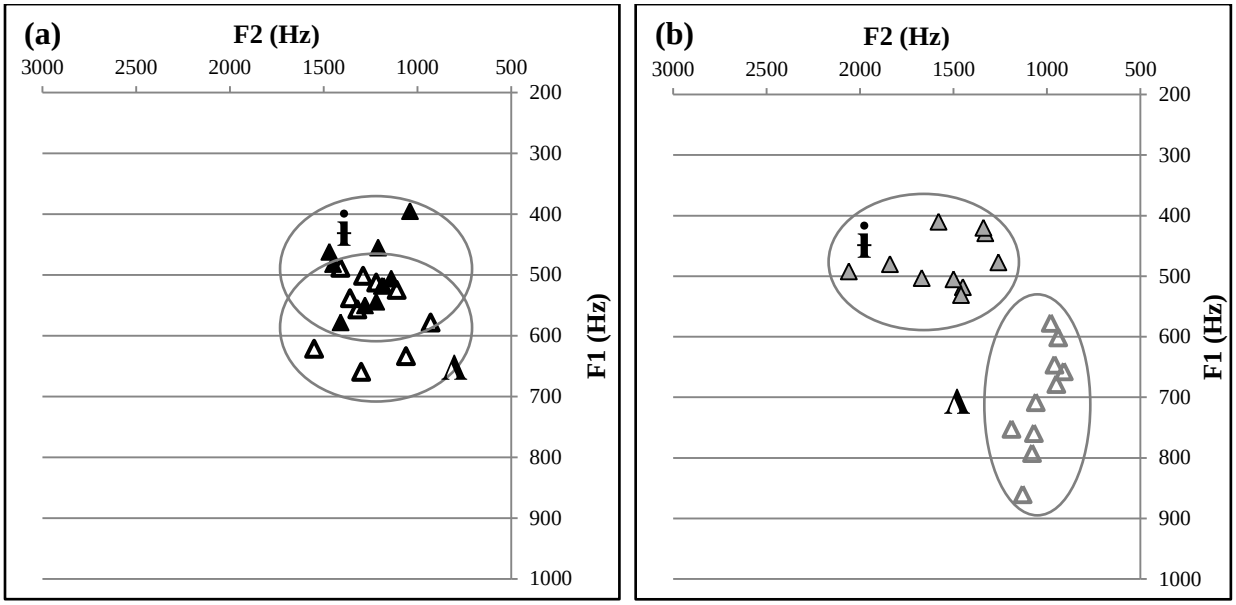

Figure 2. 2. Formant plots of 'ɨ and ʌ' vowels in Non-word for Older (a) and Younger (b) Kyungsang speakers.

2. 3. 1. 2. Word: /tɨk-i/ 'profit' and /tʌk-i/ 'virtue'

A three-way repeated measures ANOVA (Vowel by Age by Dialect) on F1 and F2 for 'ɨ and ʌ' vowels in Word reported generally consistent results with Non-word. With F1 as the dependent variable, there were significant main effects of Vowel (F (1, 36) = 323.840, p < 0.001), Age (F (1, 36) = 15.650, p < 0.001), and a non-significant trend effect of Dialect (F (1, 36) = 3.512, p = 0.069). In Word, pairwise comparisons were consistent with Non-word; F1 is lower for /ɨ/ than /ʌ/, lower for older speakers than younger, and lower for Kyungsang speakers than Seoul. Along with the main effects, there were significant two-way interaction effects of Vowel by Age (F (1, 36) = 22.363, p < 0.001) and Vowel by Dialect (F (1, 36) = 22.079, p < 0.001), and a significant three-way interaction of Vowel by Age by Dialect (F (1, 36) = 18.922, p = 0.001) on F1.

For the F2 variable, a three-way repeated measures ANOVA (Vowel by Age by Dialect) reported significant main effects of Vowel (F (1, 36) = 255.390, p < 0.001) and Dialect (F (1, 36) = 4.586, p = 0.039), but no effect of Age (F (1, 36) = 0.684, p = 0.414). Pairwise comparisons show that F2 is higher for /ʌ/ than /ɨ/, and it is higher for Kyungsang speakers than Seoul. In addition, there were significant two-way interaction effects of Vowel by Age (F (1, 36) = 65.007, p < 0.001) and Vowel by Dialect (F (1, 36) = 10.922, p = 0.002), and a three-way interaction effect of Vowel by Age by Dialect (F (1, 36) = 5.087, p = 0.030).

One-way ANOVAs that were performed separately for Dialect and Age groups also show consistent results between Word and Non-word. In Seoul Korean, /ɨ/ has a lower average F1 than /ʌ/ (p < 0.001), and /ɨ/ has a higher average F2 than /ʌ/ (p < 0.001) for both older and younger speakers. In Kyungsang Korean, older speakers distinguish 'ɨ and ʌ' only in F1 (p = 0.006), but not in F2 (p = 0.364). Unlike older Kyungsang speakers, however, younger

Kyungsang speakers distinguish 'ɨ and ʌ' in both F1 and F2 ($p < 0.001$), consistently with Seoul speakers. The 'ɨ and ʌ' vowels in Word are plotted separately by Age and by Dialect in Figures 2. 3 (Seoul) and 2. 4 (Kyungsang).

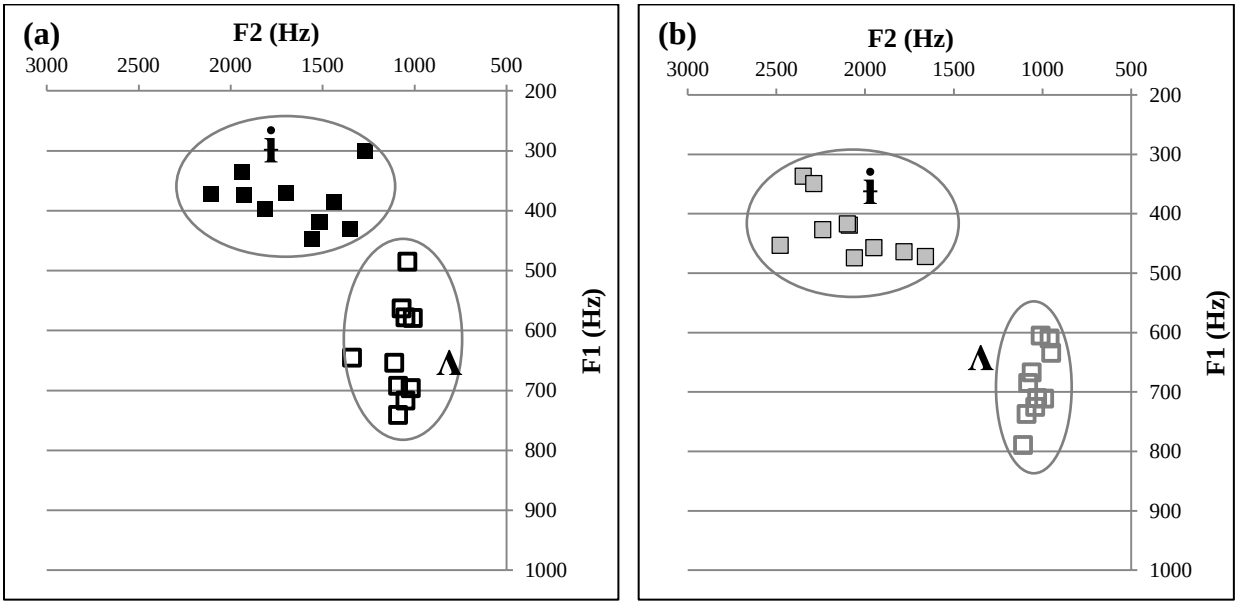

Figure 2. 3. Formant plots of 'ɨ and ʌ' vowels in Word for Older (a) and Younger (b) Seoul speakers.

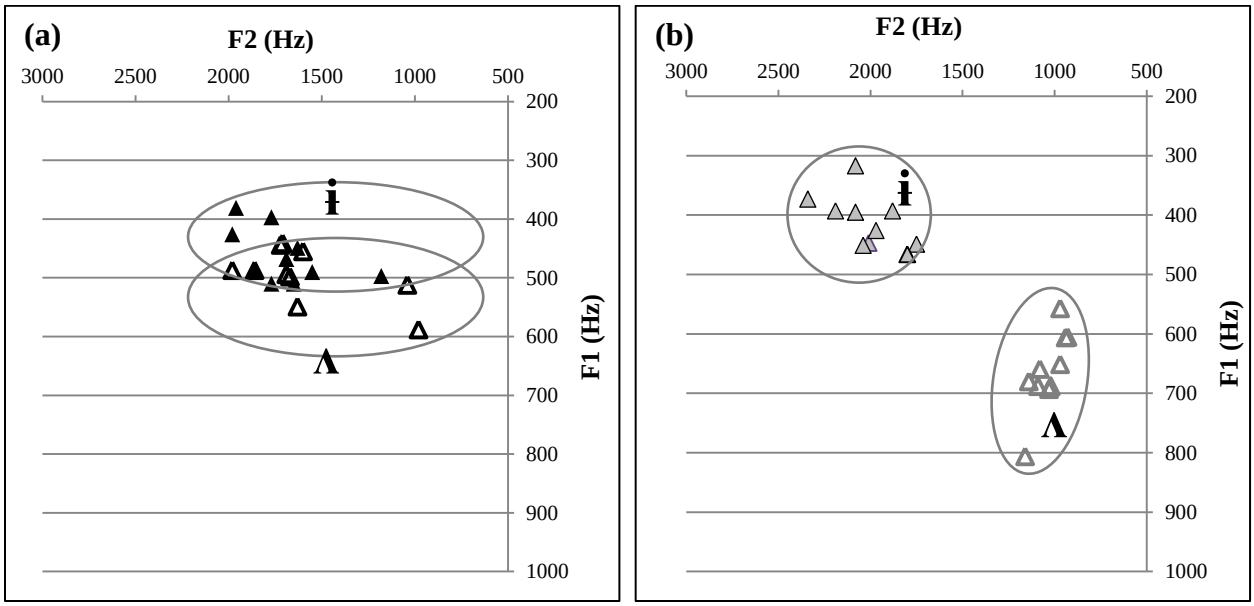

Figure 2. 4. Formant plots of 'ɨ and ʌ' vowels in Word for Older (a) and Younger (b) Kyungsang speakers.

2. 3. 1. 3. Summary and discussion of /ɨ/ and /ʌ/ distinction

The current chapter examined the /ɨ/ and /ʌ/ distinction in Non-word and Word across Dialect and Age groups. Results from ANOVAs were generally consistent between Non-word and Word except for the absence of an Age effect on F2 in Word.

The results from ANOVAs revealed that the two vowels are distinguished in their height (F1) and backness (F2) for Seoul Korean speakers, which is true for both generations of Seoul speakers. On the other hand, the non-significant difference in F2 for older Kyungsang speakers indicates that 'ɨ and ʌ' vowels are not different in backness (F2). Notably, although the F1 difference between 'ɨ and ʌ' vowels was statistically significant for the older Kyungsang speakers, the F1 difference was smaller than for the other groups. In Non-word, for example, the absolute average F1 difference between 'ɨ and ʌ' is only 62 Hz for older Kyungsang speakers, while it is 227 Hz for younger Kyungsang, 233 Hz for Older Seoul, and 274 Hz for younger Seoul. This suggests that not only the backness (F2), but also the height difference (F1) between 'ɨ and ʌ' vowels for older Kyungsang speakers is non- or less distinct than for the other groups.

In addition to separate F1 and F2 observation, we may address the merger of /ɨ/ and /ʌ/ among older Kyungsang speakers through considering combinations of F1 and F2. That is, comparing the difference between F1 and F2 for each of /ɨ/ and /ʌ/ vowels also reveals that 'ɨ - ʌ' vowels are merged for older Kyungsang speakers, but not for the other groups. We can predict that the difference between F1 and F2 may be greater for the central high vowel /ɨ/ than the back mid vowel /ʌ/; F1 of /ɨ/ is lower than /ʌ/, while F2 of /ɨ/ is higher than /ʌ/. Figure 2. 5 shows stylized formant frequencies (F1-F2) of each speaker for 'ɨ - ʌ' vowels in Non-word within each Dialect and Age group.

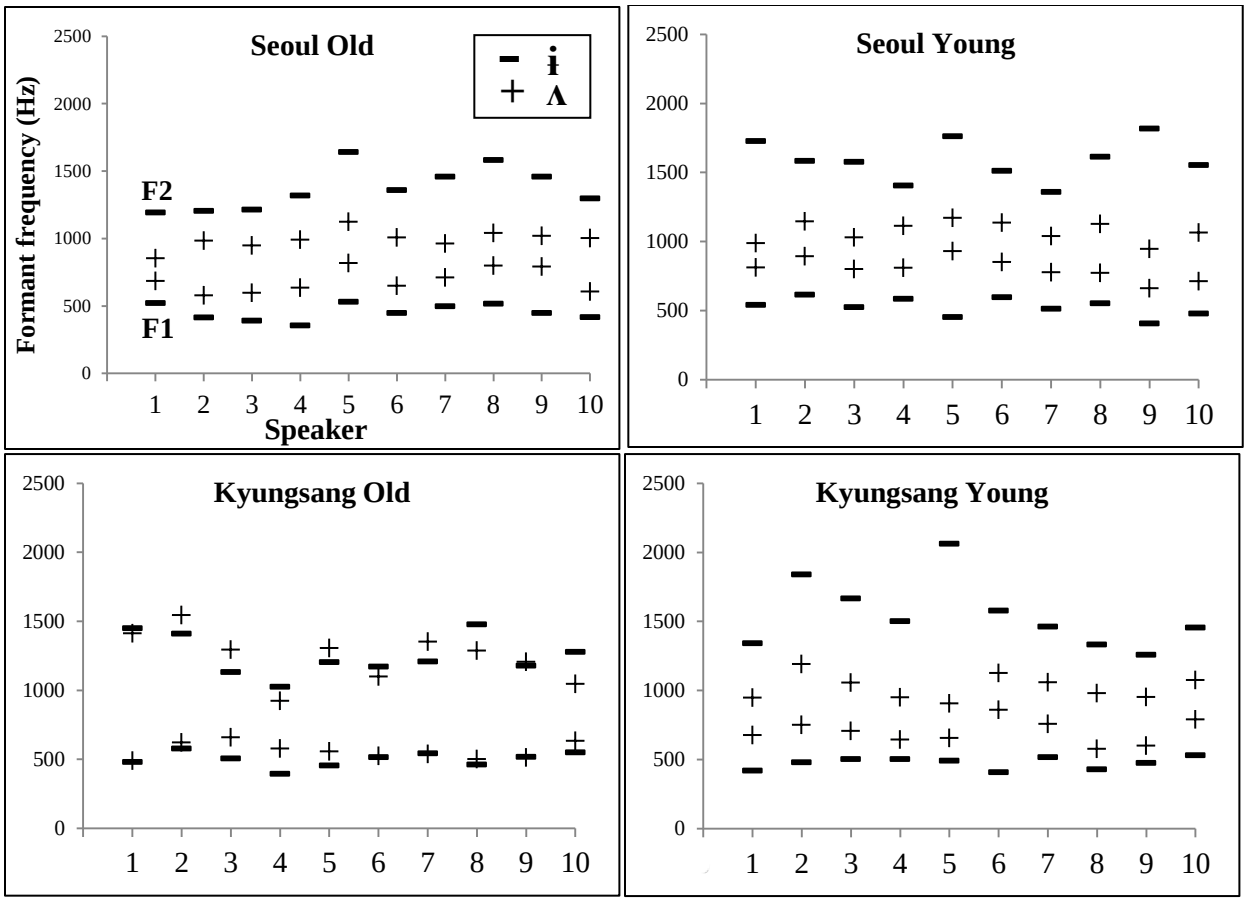

Figure 2. 5. Individual stylized formant frequencies (F1-F2) of 'ɨ - ʌ' vowels by each Dialect and Age group in Non-word. The x-axis indicates each speaker.

Figure 2. 5 above clearly shows an additional support for the merger of 'ɨ - ʌ' vowels for older Kyungsang speakers compared to the other groups. Specifically, it is noted that the difference between F1 and F2 is always larger for /ɨ/ than /ʌ/, which is true for every speaker in older/younger Seoul and Younger Kyungsang groups. For the older Kyungsang speaker group, however, the difference between F1 and F2 is comparable for /ɨ/ and /ʌ/, which seems true for most speakers. To see how systematic the speaker variation is, a repeated measures ANOVA was conducted with the dependent variable of F1-F2 difference and the independent variable of

Vowel (/ɨ/-/ʌ/), and this was conducted separately for each Dialect and Age group in Non-word[8]. As predicted, there was a main effect of Vowel for the older (F (1, 9) = 150.306, $p < 0.01$) and younger (F (1, 9) = 150.752, $p < 0.01$) Seoul speaker groups, indicating that the difference of F1-F2 is significantly different between /ɨ/ and /ʌ/ vowels; the F1-F2 difference was significantly larger for /ɨ/ than /ʌ/ for the Seoul speaker groups. For the older Kyungsang speakers, there was no main effect of Vowel (F (1, 9) = 1.849, $p = 0.207$), meaning that the difference of F1-F2 is indeed comparable between /ɨ/ and /ʌ/. Therefore, the results from observing both separate and combination of F1/F2 confirm that older Kyungsang speakers do not distinguish /ɨ/ and /ʌ/ as Seoul speakers do, and /ɨ/ and /ʌ/ vowels are merged.

Unlike older Kyungsang speakers, however, younger Kyungsang speakers distinguish /ɨ/ and /ʌ/. First, pairwise comparisons revealed the significant difference in both F1 and F2 between 'ɨ and ʌ' vowels for younger Kyungsang speakers. Second, the difference of F1-F2 is significantly different between /ɨ/ and /ʌ/ for younger Kyungsang speakers (F (1, 9) = 87.493, $p < 0.01$) as shown in Figure 2. 5. This indicates that younger Kyungsang speakers have the vowel distinction between /ɨ/ and /ʌ/, and they distinguish the vowels in a similar way as Seoul speakers. This suggests that the 'ɨ - ʌ' vowels that used to be less or non-distinct in Kyungsang Korean now become two distinct phonemes, and the vowel split between /ɨ/ and /ʌ/ has occurred among younger Kyungsang speakers.

Table 2. 3 presents the average F1 and F2 values for 'ɨ and ʌ' vowels in Non-word and Word separately for Dialect and Age groups. Figure 2. 6 presents F1 and F2 space for 'ɨ and ʌ'

[8] In terms of presence or absence of the main effect of Vowel on dependent variable of F1-F2 difference, the ANOVA reports were consistent between Non-word and Word data.

vowels in Non-word (a) and Word (b). The data in Figure 2. 6 were averaged across speakers within each Dialect and Age group.

			Non-Word				Word			
		Vowel	F1		F2		F1		F2	
Seoul	**Older**	ɨ	454	(60)	1373	(158)	383	(44)	1664	(279)
		ʌ	687	(89)	993	(69)	635	(81)	1089	(95)
	Younger	ɨ	527	(66)	1591	(147)	427	(49)	2104	(254)
		ʌ	801	(79)	1076	(74)	687	(59)	1033	(54)
Kyungsang	**Older**	ɨ	500	(53)	1254	(148)	455	(44)	1684	(213)
		ʌ	562	(59)	1247	(183)	502	(42)	1583	(323)
	Younger	ɨ	476	(42)	1550	(248)	411	(46)	2014	(176)
		ʌ	703	(88)	1025	(91)	663	(67)	1033	(81)

Table 2. 3. Average values of the first and the second formant frequencies (Hz) of 'ɨ and ʌ' vowels in Non-word and Word for older and younger speakers in each Seoul and Kyungsang Korean (standard deviation in parentheses).

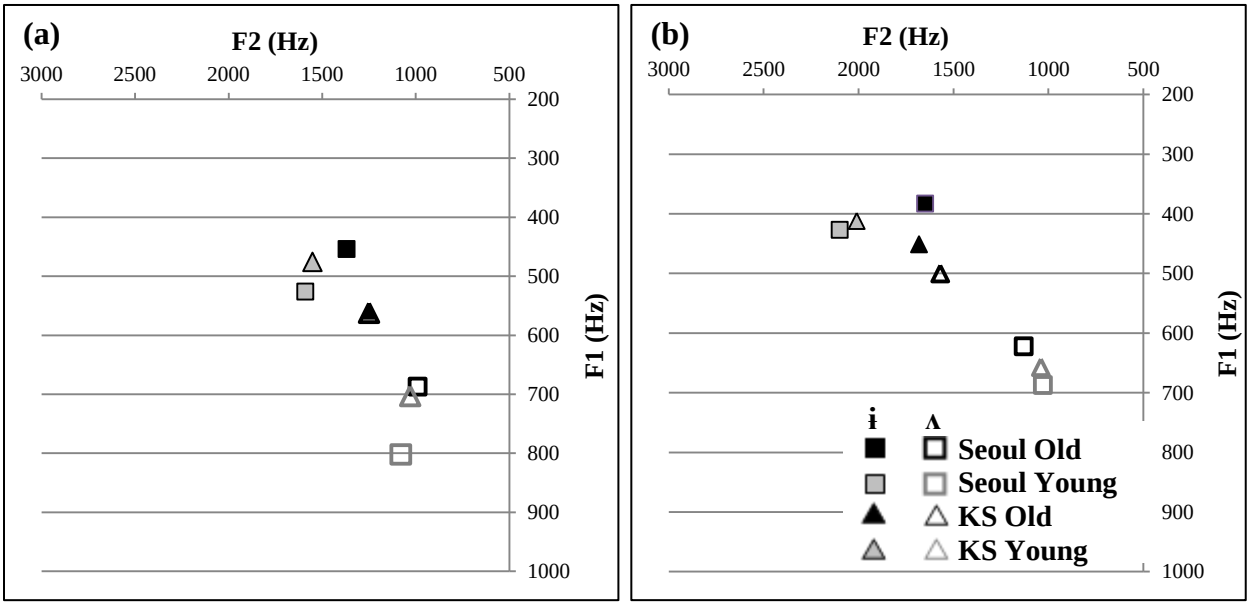

Figure 2. 6. Averaged F1 and F2 space of 'ɨ and ʌ' vowels by each Dialect and Age group in Non-word (a) and Word (b). (The marker for Older Kyungsang's /ʌ/ is underneath the marker for /ɨ/)

Considering the split between /ɨ/ and /ʌ/ for younger Kyungsang speakers, Figure 2. 6 shows that the two vowels are spaced similarly between Seoul and younger Kyungsang speakers for both Non-word and Word contexts, whereas the space or the category of 'ɨ and ʌ' vowels for older Kyungsang speakers is not apparent. A further question arises as to what the category or the quality of the less distinct phoneme for older Kyungsang speakers is. Importantly, determining the quality of the 'ɨ and ʌ' vowels produced by older Kyungsang speakers allows us to explore in which direction the 'ɨ and ʌ' split occurs among younger Kyungsang speakers. The present study conducted paired-samples t-test to compare F1 and F2 for each /ɨ/ and /ʌ/ of older Kyungsang speakers to those of the other three groups. For example, the current study compared F1/F2 of /ɨ/ between older Kyungsang and older Seoul; if the difference is not significant, it is assumed that the quality of /ɨ/ between the two groups is the same, and /ɨ/ produced by older Kyungsang speakers has the quality of /ɨ/ in Seoul Korean vowel system. The output summary of the t-test is presented in Table 2. 4.

		Non-word		**Word**	
		t	Sig. (2-tailed)	t	Sig. (2-tailed)
F1	/ɨ/ : KS Old – Seoul Old	1.809	$p = 0.104$	3.785	$p = 0.004$
	/ɨ/ : KS Old – KS Young	1.203	$p = 0.260$	2.677	$p = 0.025$
	/ɨ/ : KS Old – Seoul Young	-0.967	$p = 0.359$	1.372	$p = 0.203$
F2	/ɨ/ : KS Old – Seoul Old	-1.707	$p = 0.122$	0.187	$p = 0.856$
	/ɨ/ : KS Old – KS Young	-3.048	$p = 0.014$	-4.237	$p = 0.002$
	/ɨ/ : KS Old – Seoul Young	-6.252	$p < 0.001$	-3.843	$p = 0.004$
F1	/ʌ/ : KS Old – Seoul Old	-2.875	$p = 0.018$	-2.920	$p = 0.017$
	/ʌ/ : KS Old – KS Young	-5.068	$p = 0.001$	-5.899	$p < 0.001$
	/ʌ/ : KS Old – Seoul Young	-8.109	$p < 0.001$	-9.776	$p < 0.001$
F2	/ʌ/ : KS Old – Seoul Old	3.817	$p = 0.004$	3.492	$p = 0.007$
	/ʌ/ : KS Old – KS Young	3.800	$p = 0.004$	5.007	$p = 0.001$
	/ʌ/ : KS Old – Seoul Young	2.704	$p = 0.024$	5.075	$p = 0.001$

Table 2. 4. Summary of paired-samples t-test testing F1/F2 difference for each /ɨ/ and /ʌ/ between older Kyungsang and another group.

Based on the results from the t-test, the present study suggests that the quality of the non- or less distinct phoneme for older Kyungsang speakers is more similar to /ɨ/ rather than /ʌ/. This is because /ʌ/ produced by older Kyungsang speakers is significantly different from /ʌ/ produced by the other three groups in all comparisons; /ʌ/ in older Kyungsang Korean is located in a higher and more fronted space than /ʌ/ in others, which is true in both Non-word and Word contexts. In contrast, the paired-samples t-test results show that /ɨ/ by older Kyungsang speakers is not different from /ɨ/ by the others for many cases. According to this report, we may conclude that the 'ɨ and ʌ' split for Younger Kyungsang speakers is the result of /ʌ/ split from the ambiguous /ɨ/.

With regard to variation between Non-word (/h(V)b/) and Word (/t(V)k/) contexts, the data in Table 2. 3 and Figure 2. 6 show some consistency across Dialect and Age groups. To gain a deeper understanding regarding the variation by contexts, the current study conducted a four-way repeated measures ANOVA including Context (Non-word, Word) as a factor (Context by Vowel by Dialect by Age). Results from ANOVAs showed that F1 values in Word are lower than in Non-word (F (1, 36) = 86.30, $p < 0.001$); 'ɨ and ʌ' vowels are higher in Word. In addition, F2 values in Word are higher than in Non-word (F (1, 36) = 142.582, $p < 0.001$); 'ɨ and ʌ' vowels are fronted in Word. The variation pattern is systematically observed for every Dialect and Age group as indicated by the non-significant four-way interaction effect on both F1 and F2. The difference in consonantal environments between Non-word and Word contexts may explain this variation. For example, Hillenbrand, Clark and Nearey (2001) reveal the effect of place of articulation, reporting that alveolar/velar consonants considerably raise F2 for central/back vowels, and moderately lower F1 values for front vowels (p. 754). The observation in the current study is partially in line with Hillenbrand et al. (2000) in terms of upward F2 shifts in the

/t(V)k/ context compared to the /h(V)b/ context for the central/back /ɨ/-/ʌ/ vowels. In addition to the coarticulatory effect of adjacent consonants, a lexical effect may be another possible explanation. That is, a subject's lexical knowledge for the words /tɨk-i/ *'profit'* and /tʌk-i/ *'virtue'* can affect the production of the vowels. However, it is unclear in which way the lexical status would affect the spectral property of the vowels.

2. 3. 2. Front mid-high and mid-low vowels: /e/ and /ɛ/ distinction

2. 3. 2. 1. Non-word: /heba/ and /hɛba/

With the first formant (F1) variable in Non-word, a three-way repeated measures ANOVA (Vowel by Age by Dialect) reported significant main effects of Vowel (F (1, 36) = 14.178, p = 0.001), Age (F (1, 36) = 20.159, p < 0.001) and Dialect (F (1, 36) = 10.860, p = 0.002). Pairwise comparison reported that F1 is higher for /ɛ/ than /e/, higher for Seoul Korean than Kyungsang, and it is higher for younger speakers than the older. In addition, there were significant two-way interaction effects of Vowel by Age (F (1, 36) = 24.921, p < 0.001) and Vowel by Dialect (F (1, 36) = 6.674, p = 0.014), and a significant three-way interaction of Vowel by Age by Dialect (F (1, 36) = 7.474, p = 0.010) on F1.

For the second formant (F2) in Non-word, there were no main effects of Vowel (F (1, 36) = 3.022, p = 0.091), Age (F (1, 36) = 0.208, p = 0.651) or Dialect (F (1, 36) = 0.798, p = 0.378), and there were no significant interaction effects. This suggests that the 'e and ɛ' vowels are distinguished in height (F1), but not in backness (F2).

Since the interaction effects for F1 indicate age and dialectal variations, one-way ANOVAs tested the F1 difference between 'e and ɛ' vowels separately for each Dialect and Age group. Pairwise comparisons from the one-way ANOVAs showed that older Seoul speakers distinguish 'e and ɛ' in F1 (p = 0.002); /e/ has a lower average F1 than /ɛ/, indicating that /e/ is a

higher vowel than /ɛ/. For younger Seoul, older and Younger Kyungsang groups, that F1 between 'e and ɛ' is not significantly different. The 'e and ɛ' vowels in Non-word are plotted separately by Age and by Dialect in Figures 2. 7 (Seoul) and 2. 8 (Kyungsang). Each of younger Seoul and older/younger Kyungsang speaker groups reporting non-significant difference on both F1 and F2 between 'e and ɛ' vowels has only one ellipsis in Fig. 2. 7-(b) and Fig. 2. 8-(a)/(b). For older Seoul speaker group in Fig.2. 7-(a), although the ellipses are located in the horizontally identical position reflecting the non-significant difference on F2 (backness) between 'e and ɛ', the ellipses are vertically distinguished indicating the significant difference on F1 (height).

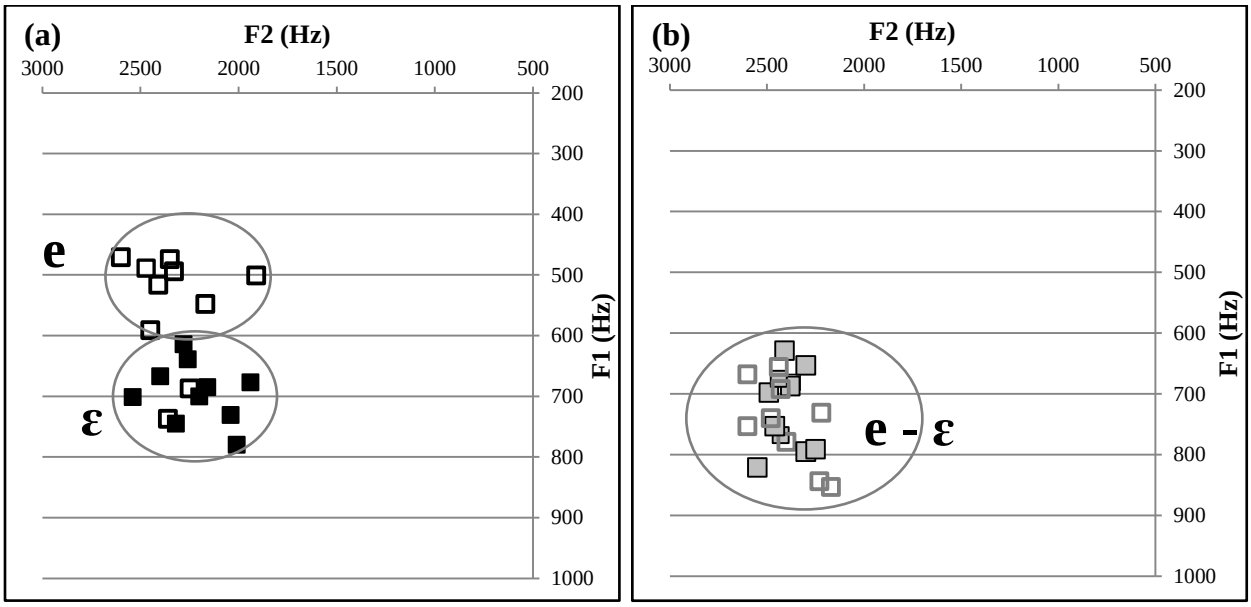

Figure 2. 7. Formant plots of 'e and ɛ' vowels in Non-word for Older (a) and Younger (b) Seoul speakers.

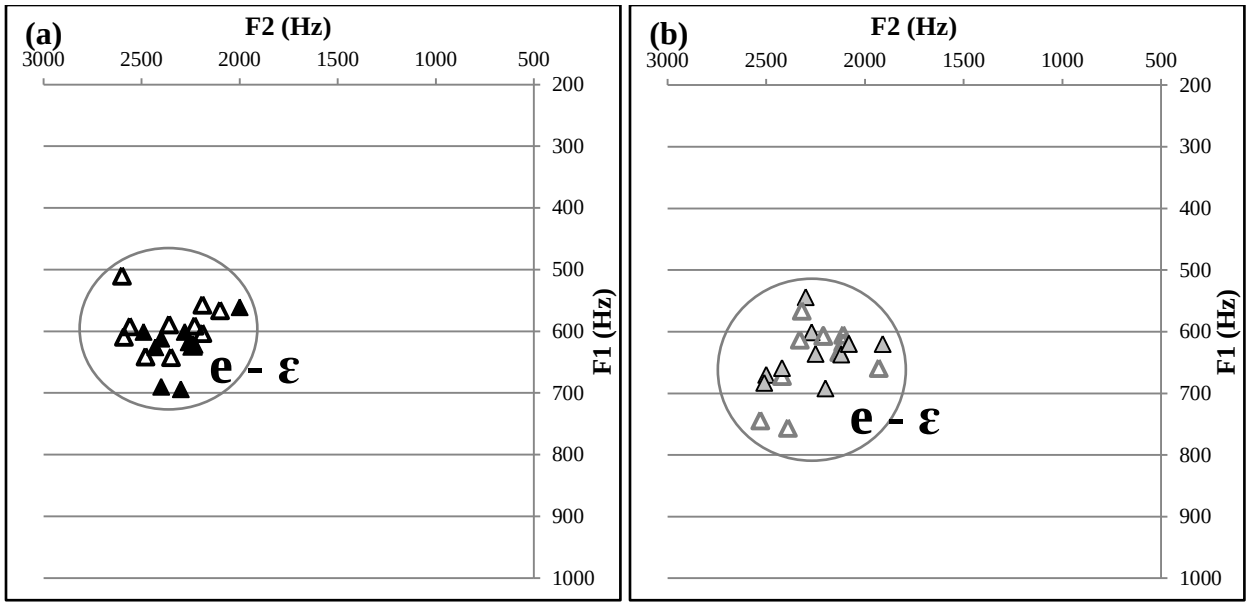

Figure 2. 8. Formant plots of 'e and ɛ' vowels in Non-word for Older (a) and Younger (b) Kyungsang speakers.

2. 3. 2. 2. Word: /sek'i/ 'three meals' and /sɛk'i/ 'a young animal'

With the first formant (F1) variable in Word, a three-way repeated measures ANOVA (Vowel by Age by Dialect) reported significant main effects of Vowel (F (1, 36) = 14.981, p < 0.001), Age (F (1, 36) = 11.796, p = 0.002) and Dialect (F (1, 36) = 10.641, p = 0.002). Consistent with Non-word, pairwise comparisons reported that F1 is higher for /ɛ/ than /e/, higher for Seoul Korean than Kyungsang, and higher for younger speakers than older. In addition, there was a significant three-way interaction of Vowel by Age by Dialect (F (1, 36) = 4.113, p = 0.050). For the second formant (F2) in Word, there were no main effects of Vowel (F (1, 36) = 0.540, p = 0.467), Age (F (1, 36) = 2.940, p = 0.095), or Dialect (F (1, 36) = 0.367, p = 0.548). There were no significant interaction effects among the factors.

Similarly to Non-word, pairwise comparisons for F1 in Word reported that older Seoul speakers distinguish /e/ from /ɛ/ with near-significance (p = 0.06); /e/ has a lower average F1

than /ɛ/, while the difference in F1 among younger Seoul speakers is not significant. In Kyungsang Korean, younger speakers showed a significant difference in F1 (p = 0.012), while the older Kyungsang speakers did not. The 'e and ɛ' vowels in Word are plotted separately by Age and by Dialect in Figures 2. 9 (Seoul) and 2. 10 (Kyungsang).

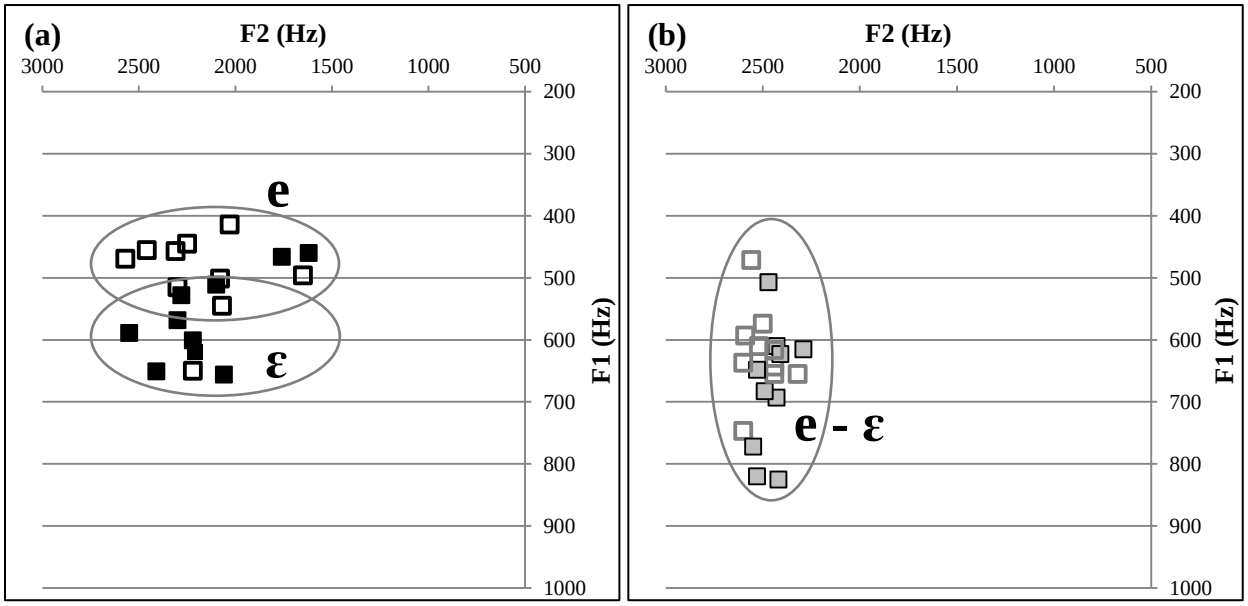

Figure 2. 9. Formant plots of 'e and ɛ' vowels in Word for Older (a) and Younger (b) Seoul speakers.

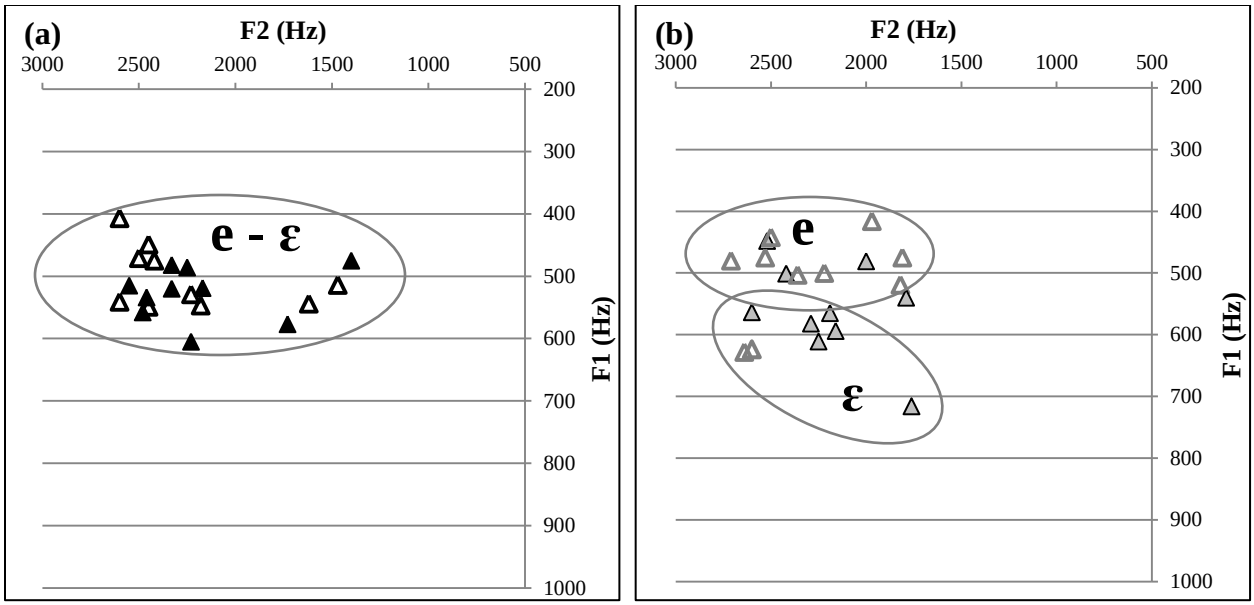

Figure 2. 10. Formant plots of 'e and ɛ' vowels in Word for Older (a) and Younger (b) Kyungsang speakers.

2. 3. 2. 3. Summary and discussion of /e/ and /ɛ/ distinction

We observed the /e/ and /ɛ/ distinction in Non-word and Word across Dialect and Age groups. The results from ANOVAs were generally comparable between Non-word and Word. Regarding the F1 variable, all of the main and interaction effects within factors were significant in Non-word, whereas there were no two-way interaction effects in Word. With regard to F2, none of factors had a significant effect in either Non-word or Word.

Previous studies have reported that 'e and ɛ' vowels had been merged in Kyungsang Korean, and that the merger is on-going for Seoul Korean. The present results confirm this notion on the merger for the two front mid vowels, particularly in Non-word. In Non-word, pairwise comparisons for F1 showed that 'e and ɛ' vowels differ in height (F1) only for older Seoul speakers, while the two vowels are not distinguished for the other groups; the absolute F1 difference between 'e and ɛ' vowels is 143 Hz for older Seoul, 14 Hz for younger Seoul, 35 Hz

for older Kyungsang and 11 Hz for younger Kyungsang groups in Non-word. In Word, we observed that both older Seoul and younger Kyungsang speakers made the vowel distinction in height (F1); the absolute F1 difference between 'e and ɛ' vowels is 70 Hz for older Seoul, 14 Hz for younger Seoul, 24 Hz for older Kyungsang and 54 Hz for younger Kyungsang groups in Word.

To observe the two F1 and F2 dimensions of individuals, Figure 2. 11 shows stylized formant frequencies (F1-F2) of each speaker for 'e and ɛ' vowels in Non-word within each Dialect and Age group.

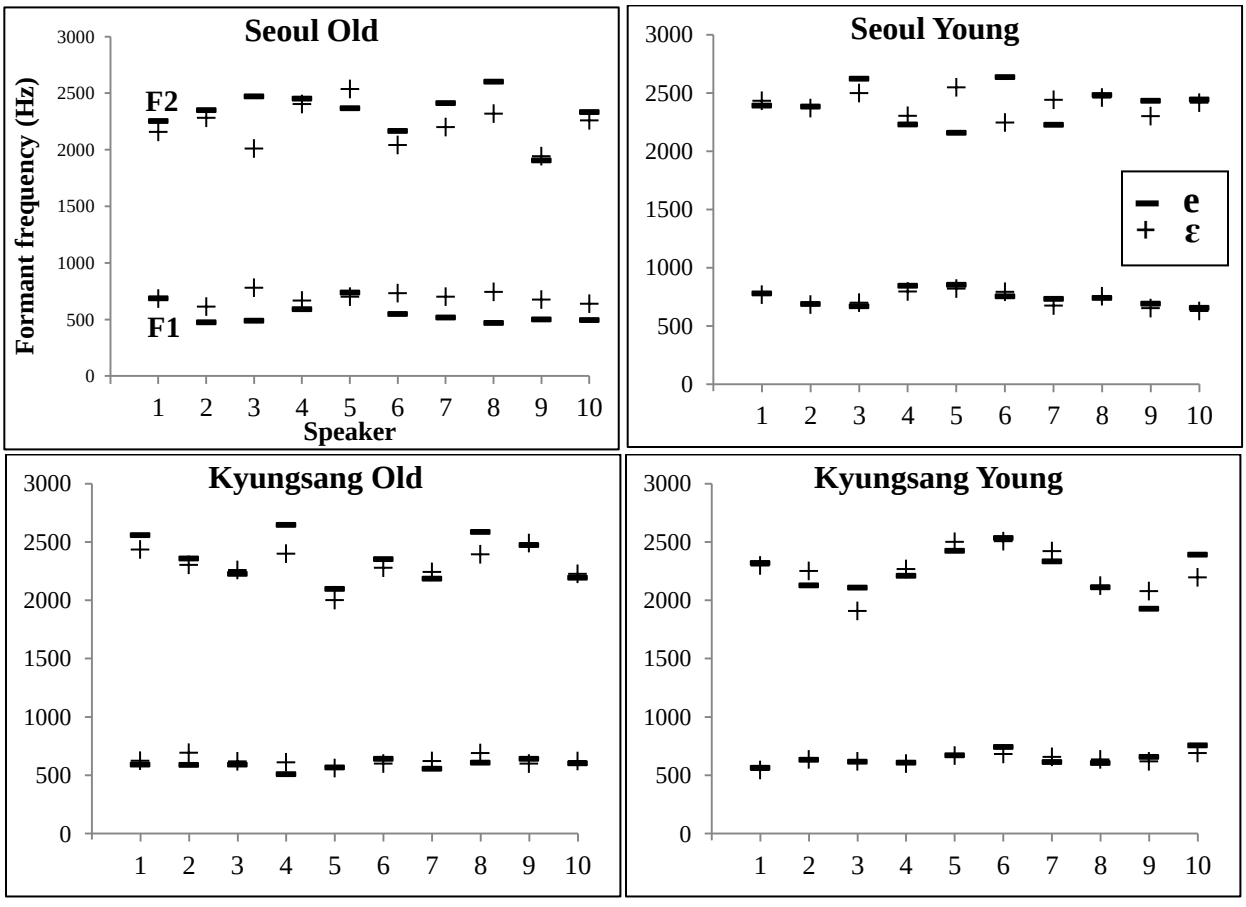

Figure 2. 11. Individual stylized formant frequencies (F1-F2) of 'e and ɛ' vowels by each Dialect and Age group in Non-word. The x-axis indicates each speaker.

Consistent with the pairwise comparisons, Figure 2. 11 above indicates that most of the older Seoul speakers have systematic F1 difference between /e/ and /ɛ/ except the speaker 1 and 5, indicating that the on-going merger of /e/ and /ɛ/ affects some older Seoul speakers. On the other hand, the merger seems true for all speakers in the other groups, as indicated with no visible F1 difference between /e/ and /ɛ/. We conducted ANOVAs with the dependent variable of F1-F2 difference and the independent variable of Vowel (/e/-/ɛ/) in Non-word separately for each Dialect and Age group to examine how the combination of F1 and F2 makes the distinction between /e/ and /ɛ/ across speakers within each group. There was a main effect of Vowel only for older Seoul speakers (F (1, 9) = 5.587, p = 0.042); the F1-F2 difference was significantly larger for /e/ than /ɛ/ for the older Seoul speaker group. On the other hand, the F1-F2 difference between the two vowels was not significantly different for the other three groups. This indicates that the /e/ and /ɛ/ vowels are indeed separate phonemes for older Seoul speakers, but merged for the younger Seoul and older/younger Kyungsang groups. The ANOVAs were also conducted in Word separately for each Dialect and Age group. There was no main effect of Vowel for all four groups: Older Seoul (F (1, 9) = 3.805, p = 0.083), Younger Seoul (F (1, 9) = 2.475, p = 0.150), Older Kyungsang (F (1, 9) = 0.347, p = 0.57), Younger Kyungsang (F (1, 9) = 2.234, p = 0.169). Notably, although younger Kyungsang speakers reported significant difference for F1 (p = 0.012) in Word, the F1-F2 difference between /e/ and /ɛ/ is not significant. This indicates the /e/ and /ɛ/ distinction in Word is not consistent between older Seoul and younger Kyungsang speakers. Table 2. 5 presents the average F1 and F2 values for 'e and ɛ' vowels in Non-word and Word separately for Dialect and Age groups. Figure 2. 12 presents the F1 and F2 space for /e/ and /ɛ/ vowels in Non-word (a) and Word (b). The data were averaged across speakers in each Dialect and Age group.

			Non-Word				Word			
		Vowel	F1		F2		F1		F2	
Seoul	Older	e	551	(93)	2331	(192)	495	(67)	2200	(255)
		ε	694	(49)	2215	(184)	565	(71)	2153	(282)
	Younger	e	740	(69)	2400	(161)	643	(93)	2500	(90)
		ε	726	(67)	2400	(95)	657	(91)	2462	(85)
Kyungsang	Older	e	590	(39)	2368	(191)	503	(49)	2253	(399)
		ε	625	(40)	2303	(139)	527	(43)	2344	(299)
	Younger	e	647	(62)	2249	(184)	506	(69)	2323	(347)
		ε	636	(43)	2256	(190)	560	(75)	2200	(285)

Table 2. 5. Average values of the first and the second formant frequencies (Hz) of 'e and ε' vowels in Non-word and Word for Older and Younger speakers in Seoul and Kyungsang Korean (standard deviation in parentheses).

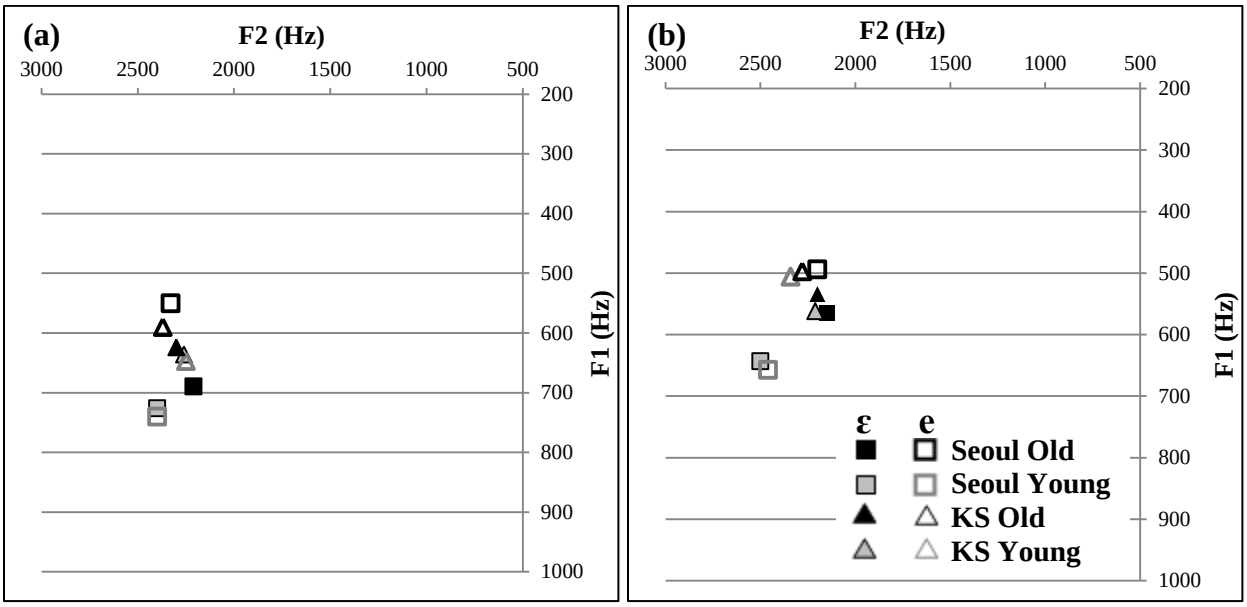

Figure 2. 12. Averaged F1 and F2 space of 'e and ε' vowels by each Dialect and Age group for Non-word (a) and Word (b).

Notably, the F1 value of /e/ produced by younger Seoul speakers is as high as that of /ε/ in Seoul Korean as indicated in Figure 2. 12. This suggests that the merger of the two front mid vowels occurs through transferring /e/ to /ε/, and the front mid vowel in the present Seoul dialect

of Korean is located in the front mid-low vowel /ɛ/ space. On the other hand, the merged phoneme in Kyungsang Korean has a lower F1 frequency than in Seoul Korean, indicating that the merged vowel is higher than in Seoul Korean.

Variation between Non-word (/h(V)b/) and Word (/s(V)k/) contexts is found for the two front 'e and ɛ' vowels as well as the central/back 'ɨ and ʌ' vowels. Specifically, F1 values become smaller in Word than Non-word (F (1, 36) = 103.332, $p < 0.001$), which is consistent with 'ɨ and ʌ' vowels. However, the F2 value does not change significantly between the two contexts (F (1, 36) = 0.084, $p = 0.774$), which is different from 'ɨ and ʌ' vowels. That is, the two front vowels are raised in the /s(V)k/ context, whereas the front vowels do not move forward, showing a different behavior from central/back (/ɨ/ - /ʌ/) vowels in Word. Regarding the variation between the two contexts, we previously suggested two possibilities, namely an effect of different consonantal environments or a lexical effect. The effect of consonantal environments reported by Hillenbrand et al. (2001) is in accord with the present data with regard to the downward F1 shift for front vowels with preceding alveolar/velar consonants. Interestingly, another variation between the two contexts was that Younger Kyungsang speakers made the /e/ and /ɛ/ distinction using a height (F1) difference in Word, but not in Non-word. This may suggest that both the different consonantal environment and presence of lexical knowledge have influences on change in phonetic realization and categorization. However, although the possibility of coarticulatory and lexical effects may explain this variation between Non-word and Word, it does not seem feasible to tease apart the two possibilities in the present data. A further study with more carefully controlled stimuli may be able to address the issues. For example, if we use stimuli with identical consonantal environments that differed in their lexicality (e.g.,

Non-word: /heba/-/hɛba/ vs. Word: /hebʌle/ *'being very widely'*-/hɛbʌjŋ/ *'marine'*), we will be able to directly test the lexical effect.

2. 3. 3. Front rounded vowels

The rounding feature for /y/ and /ø/ vowels was examined by observing the second (F2) and the third formant (F3) difference between the rounded vowel (i.e., /y/, /ø/) and the unrounded counterpart (i.e., /i/, /e/ and /ɛ/).

2. 3. 3. 1. Front high rounded and unrounded vowels: /y/ and /i/ distinction

With the F2 dependent variable in Non-word, a three-way repeated measures ANOVA (Vowel by Age by Dialect) reported a significant main effect of Age (F (1, 36) = 15.524), $p < 0.01$) and a significant interaction of Vowel by Dialect (F (1, 36) = 5.940, $p = 0.020$), but no main effects of Vowel or Dialect. The interactions of Vowel by Age or Vowel by Dialect by Age were not significant for F2. In Word (i.e., */syta/ 'take a rest'* - */sita/ 'being sour'*), there was a main effects of Vowel (F (1, 36) = 4.489, $p = 0.041$), but no main effects of Age or Dialect and no interactions among the factors on F2.

With the F3 dependent variable in Non-word, a three-way repeated measures ANOVA (Vowel by Age by Dialect) reported an effect of Vowel (F (1, 36) = 4.887, $p = 0.034$); F3 is higher for /i/ than /y/ for the /y/-/i/ comparison. However, there were no main effects of Age or Dialect, and no interaction effects among the factors. In Word (i.e., */syta/ 'take a rest'* - */sita/ 'being sour'*), there were no main effects of Vowel, Age or Dialect, and significant interactions.

2. 3. 3. 2. Front mid rounded and unrounded vowels: /ø/ and /e/-/ɛ/ distinction

First, a three-way repeated measures ANOVA (Vowel by Age by Dialect) was conducted for the /ø/ and /e/ vowel pair with the F2 variable. In Non-word, results of repeated measures

ANOVAs showed that there are no main effects of Vowel, Age or Dialect, and no interactions among the factors. In Word (i.e., */søt'oŋ/ 'cattle dung'* - */sek'i/ 'three meals'*), a three-way repeated measures ANOVA (Vowel by Age by Dialect) reported main effect of Vowel (F (1, 36) = 19.518, $p < 0.01$), and a significant interaction of Vowel by Age (F (1, 36) = 16.456, $p < 0.01$), but no interactions of Vowel by Dialect or Vowel by Age by Dialect on F2. F2 was lower for /ø/ (2134 Hz) than /e/ (2317 Hz), and the difference of F2 between the two vowels is great for younger speakers than older reflected in the interaction of Vowel by Age.

With the F3 variable, a three-way repeated measures ANOVA (Vowel by Age by Dialect) was conducted for the /ø/ and /e/ vowel pair. In Non-word, results of repeated measures ANOVAs showed that there are no main effects of Vowel, Age or Dialect, and no interactions among the factors. Likewise, consistent results were reported in Word (i.e., */søt'oŋ/ 'cattle dung'* - */sek'i/ 'three meals'*). A three-way repeated measures ANOVA (Vowel by Age by Dialect) in Word reported no main effects of Vowel, Age or Dialect on F3, and there were no interactions among the factors.

Second, a three-way repeated measures ANOVA (Vowel by Age by Dialect) was conducted for the /ø/ and /ɛ/ vowel pair with the F2 variable. In Non-word, results of repeated measures ANOVAs showed that there are no main effects of Vowel, Age or Dialect. Interactions among the factors were not significant except the interaction of Vowel by Age (F (1, 36) = 5.165, p = 0.029). In Word (i.e., */søt'oŋ/ 'cattle dung'* - */sɛk'i/ 'a young animal'*), a three-way repeated measures ANOVA (Vowel by Age by Dialect) reported main effect of Vowel (F (1, 36) = 13.232, $p < 0.01$), and a significant interaction of Vowel by Age (F (1, 36) = 7.429, p = 0.01), but no interactions of Vowel by Dialect or Vowel by Age by Dialect on F2. F2 was lower for /ø/

(2135 Hz) than /ɛ/ (2290 Hz), and younger speakers showed greater F2 difference between the two vowels than older.

With the F3 variable, a three-way repeated measures ANOVA (Vowel by Age by Dialect) was conducted for the /ø/ and /ɛ/ vowel pair. Consistent with the /ø/ and /e/ vowel pair, no significant main or interaction effects were reported for /ø/ and /ɛ/ comparison for both Non-word and Word.

2. 3. 3. 3. Summary and discussion of front rounded vowels

We tested whether the /y/ and /ø/ vowels can be characterized in the rounding feature by comparing each of F2 (backness/rounding) and F3 (rounding) between the rounded vowels and the unrounded counterparts (/i/, /e/-/ɛ/). This acoustic examination was made to clarify the issue on the disappearance of the front rounded vowels in the Korean vowel system. While some studies (Martin 1951; Kim 1968) counted the front rounded vowel (/ø/) for the Korean vowel system, most of the recent studies (Hong 1991; Lee & Ramsey 2000; Lee & Ramsey 2011; Kuak 2003) agree on the disappearance of /y/ and /ø/ vowels.

First, the results from ANOVAs for the pair of /y/ and /i/ revealed that these vowels are not characterized in terms of the rounding feature by showing the non-systematic difference of F2 or F3 between /y/ and /i/. For example, although ANOVA reported the main effect of Vowel on F2 in Word, the difference in F2 between /y/ and /i/ does not seem to indicate that /y/ is distinguished from /i/ in the rounding feature. This is because F2 was higher for /y/ (2555 Hz) than /i/ (2470 Hz), which is contradictory for the fact that rounded vowels have lower formant values than unrounded. In addition, although F3 was higher for /i/ than /y/, this effect was not observed consistently for Non-word and Word. Therefore, it is concluded that the distinction between /y/ and /i/ is not made by F2 (backness/rounding) or F3 (rounding), and the /y/ vowel

that used to be considered as the front high rounded vowel indeed disappear in the vowel system of Korean.

Second, the results from ANOVAs for the pair of /ø/-/e/ and /ø/-/ɛ/ also showed inconsistent patterns between F2 and F3 or between Word and Non-word, and accordingly failed to provide the supportive evidence for the presence of the mid front rounded vowel in the Korean vowel system. Specifically, while the observation indicated that the /ø/-/e/ or /ø/-/ɛ/ vowels are not distinguished in F3 (rounding) in both Non-word and Word, these vowels are distinguished in F2 (backness/rounding) limited to Word and to Younger speakers. One may possibly explain that /ø/-/e/ or /ø/-/ɛ/ vowels are distinguished in the rounding feature, but the distinction of the rounding is made only in /s**ø**t'oŋ/ vs. /s**e**k'i/ or /s**ɛ**k'i/ contexts, not in /h**ø**ba/ vs. /h**ɛ**ba/ or /h**e**ba/. However, the non-significant difference of F3 for the pair of /ø/-/e/ and /ø/-/ɛ/ in both Non-word and Word seems to conflict the explanation. That is, if /ø/-/e/ and /ø/-/ɛ/ vowels are indeed classified in the rounding limited to /s**ø**t'oŋ/ vs. /s**ɛ**k'i/ or /s**e**k'i/ contexts, F3 is also expected to show the difference between the rounded and unrounded vowels at least to the same contexts. However, F3 did not show the significant difference for the pair of /ø/-/e/ and /ø/-/ɛ/ in the Word (/s**ø**t'oŋ/ vs. /s**ɛ**k'i/ or /s**e**k'i/) context. The other possible explanation for the F2 difference between /ø/-/e/ or /ø/-/ɛ/ in Word is the difference of the following consonants in the Word context; while the alveolar /t'/ is placed after /ø/, the velar /k'/ is placed after /e/ or /ɛ/. Therefore, the upward F2 shift in /s**ɛ**k'i/ or /s**e**k'i/ contexts compared to /s**ø**t'oŋ/ may be due to the difference in the following consonants, but not the evidence of the presence of the rounding feature. Overall, the data pattern suggests the disappearance of the two front rounded vowels in the vowel system of Korean, showing non-systematic difference of F2 or F3 across Non-word and Word.

2. 3. 4. F0

Finally, the fundamental frequency (F0) values were examined for each vowel by Dialect and Age group to explore vowel-inherent pitch. The averaged F0 values for each vowel were generally low for a low vowel with the tendency of a negative correlation between F0 and F1. However, the correlation was not statistically significant ($r = – 0.031$, $p = 0.58$). In addition, one-way ANOVA reported that the overall F0 values are greater for younger speakers than older speakers (F (1, 318) = 130.553, $p < 0.01$); the average F0 was 275 Hz and 232 Hz for younger and older speakers, respectively. This report is in line with Benjamin (1981) saying that older speakers produced lower pitch, and larger pitch ranges than younger speakers did. Figure 2. 13 indicates the variation of F0 with vowel type for each Dialect and Age group.

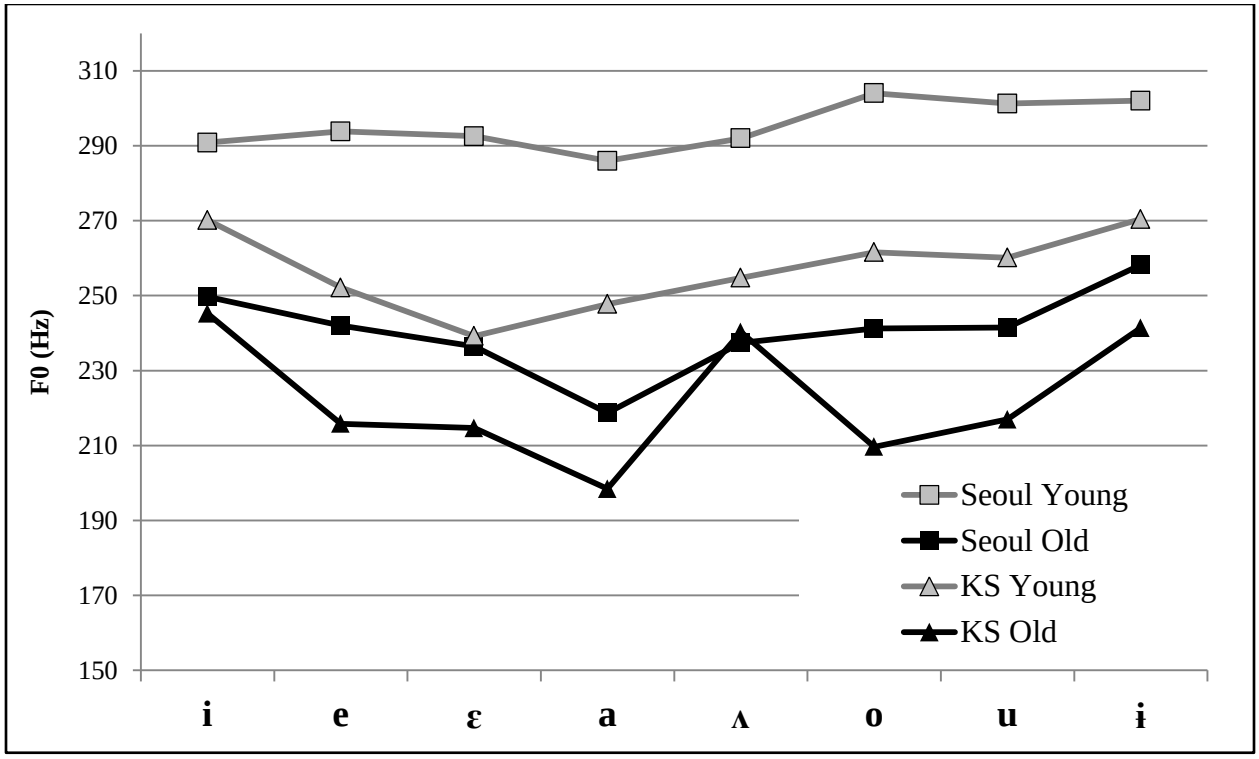

Figure 2. 13. The variation of F0 with vowel types for each Dialect and Age group.

It is noted that F0 of the non-high vowel /ʌ/ produced by older Kyungsang speakers is as high as for the high vowel /ɨ/, indicating that the pitch property of the two vowels is alike as well as the formant frequencies. The high F0 for /ʌ/ may be additional supporting evidence that /ʌ/ for older Kyungsang speakers is close to /ɨ/.

2. 4. Summary and general discussion

The current chapter examined whether linguistic distinctions in vowels of Kyungsang Korean are maintained by both younger and older speakers. The current chapter mainly focused on the vowel pairs of /ɨ/-/ʌ/ and /e/-/ɛ/ for which dialectal differences have been reported. Examining the vowels of Kyungsang Korean between younger and older generations provided us with evidence of whether and how the sound change in vowels occurs. In addition, comparing the acoustic data of younger Kyungsang speakers with Seoul Korean, it is tested whether vowels of Kyungsang Korean are changing to match those of Seoul Korean. The current chapter reported several important findings regarding generational and dialectal differences, and provided concrete evidence of sound change in the Korean vowel system. Main findings in the current chapter are summarized below.

a. Younger Kyungsang speakers have the phonemic distinction between 'ɨ and ʌ' vowels that is less distinct among older Kyungsang speakers, and the vowel distinction is the result from the split of /ʌ/ from /ɨ/.
b. The merger between 'e and ɛ' vowels is observed in younger Seoul, older and younger Kyungsang speaker groups, while these vowels are distinct only for older Seoul speakers. However, although the 'ɛ and e' merger is observed commonly for Seoul and Kyungsang groups, there is a dialectal difference in the acoustic realizations; the merged form in Seoul Korean has a higher F1 than that in Kyungsang.

c. The examination of F2 or F3 did not provide the systematic difference between the rounded vowels and unrounded counterparts, and therefore suggested the disappearance of the rounding feature in the Korean vowel system.

d. The variation between Non-word and Word showed systematic patterns. F1 and F2 for central/back vowels shifted downward and upward, respectively, and F1 for front vowels shifted downward in Word.

To gain a clear picture of sound change in the vowel system of Kyungsang Korean, we compare the vowel space across generations and dialects. Figures 2. 14 (Seoul) and 2. 15 (Kyungsang) present the vowel space for each dialect and age group. The formant values measured in vowels of 'non-word' contexts are reflected in the Figures below.

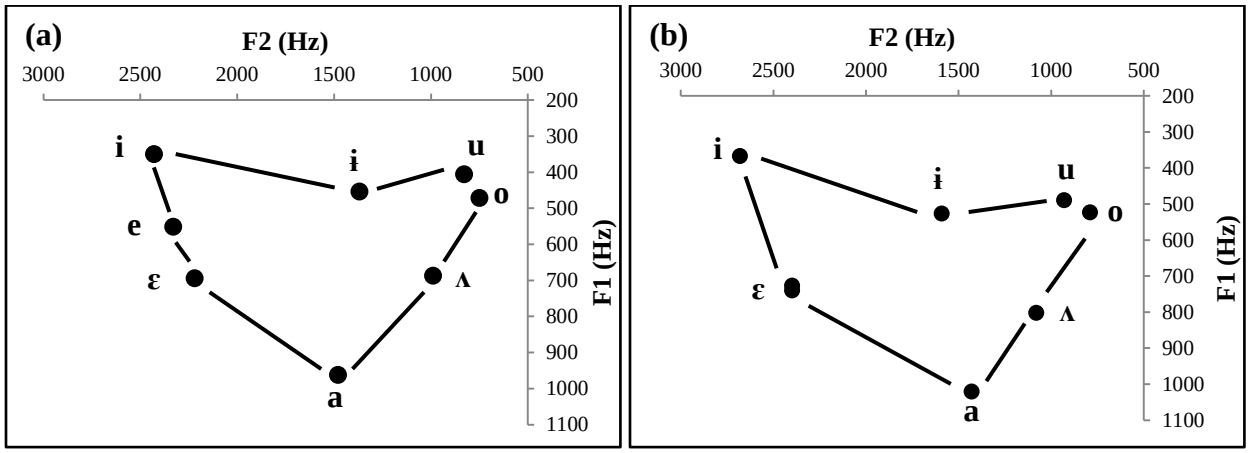

Figure 2. 14. Vowel space of Seoul Korean for Older (a) and Younger (b) speakers.

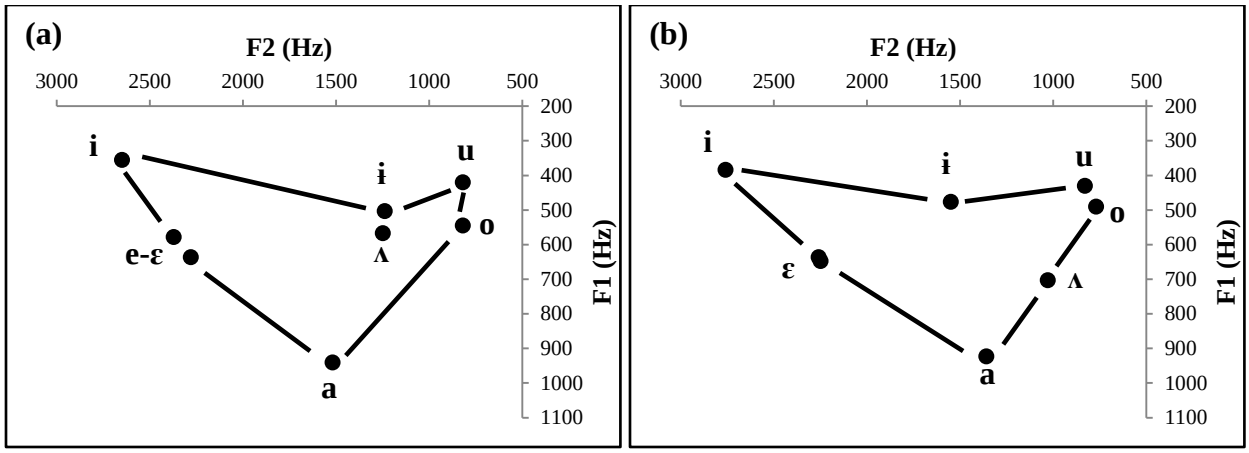

Figure 2. 15. Vowel space of Kyungsang Korean between Older (a) and Younger (b) speakers.

In Seoul Korean, while older speakers have eight vowels, younger speakers have seven vowels. The reduced number of vowels for younger Seoul speakers is due to the merger between the two front mid vowels. In Kyungsang Korean, older speakers have six or seven vowels, and the ambiguous number of vowels is because of the smaller distinction between /ʌ/ and /ɨ/ for older Kyungsang speakers compared to the other group[9]. Contrary to the ambiguous number of vowels for older speakers, younger Kyungsang speakers clearly show seven separate vowels. Therefore, the current study concludes that contemporary Seoul and Kyungsang Korean share the same number of vowels. The same seven vowels (i.e., /i/, /ɛ/, /a/, /ʌ/, /o/, /u/, /ɨ/) result from the split between /ɨ/-ʌ/ in Kyungsang Korean, and the merger between /e/-/ɛ/ in Seoul Korean.

[9] Note that most previous research on Kyungsang vowels has argued for six vowels, insisting no distinction between /ʌ/ and /ɨ/. However, none of the studies conducted systematic statistics. Since the current study reported a small, but significant difference in F1 for /ɨ/-/ʌ/ among older Kyungsang speakers, we consider /ʌ/ as a less distinct, rather than non-distinct phoneme.

First, regarding the split of /ʌ/ from /ɨ/ among younger Kyungsang speakers, previous studies on Kyungsang vowels have suggested external social factors such as education or mass media, rather than internal phonetic factors. For example, Cho (2002) and Kuak (2003) stated that the vowel split in Kyungsang Korean is less likely to be motivated by internal factors, and the researchers considered the influence of education as the most plausible reason. In fact, the education levels across the entire population in Korea have become higher than before. Particularly, the older speakers in the current study are the generation born before the Korean War (1950). That is, the older generation in Korea was not in a good environment to be educated. Therefore, considering the significant change in education between the two generations in Korea, the explanation for /ʌ/ and /ɨ/ vowels in Cho (2002) and Kuak (2003) seems reasonable.

The current chapter examined whether the influence of education is reflected in the present data by observing the acoustic pattern of /ʌ/ and /ɨ/ vowels. Among the twenty Kyungsang speakers in the current chapter, the ten younger speakers are all high school graduates, while the ten older speakers vary in their education levels: three elementary school graduates, three middle school graduates, and four high school graduates (see Table 1. 2). The difference in education levels between younger and older speaker groups provided us with an opportunity to test the effect of education. This study compares the vowel space of /ʌ/ and /ɨ/ across two groups of older Kyungsang speakers, which were divided by their education levels (four high school graduates vs. six non-high school graduates) to see whether the two groups have different acoustic realizations for /ʌ/ and /ɨ/ vowels. Figure 2. 16 presents the formant plot of /ʌ/ and /ɨ/ vowels produced by the ten younger and the two groups of older speakers.

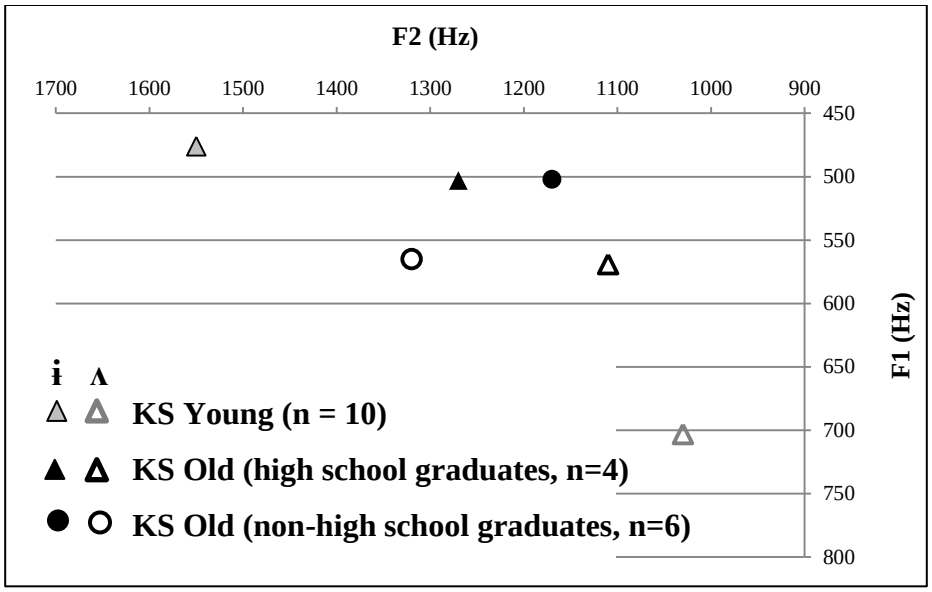

Figure 2. 16. Formant plot of /ʌ/ and /ɨ/ vowels for younger and older Kyungsang speakers. Data from younger and the older speakers with the higher education level are indicated with triangles. Data from non-high school graduates are indicated with circles.

As noticed earlier in Figures 2. 5 and 2. 6, younger Kyungsang speakers clearly distinguish /ʌ/ from /ɨ/, while the distinction between /ʌ/ and /ɨ/ vowels is not apparent for the older Kyungsang speakers. Importantly, it is noted that the older Kyungsang speakers with higher education level show an acoustic pattern of /ʌ/ and /ɨ/ vowels that is more like that of the younger speakers than the older speakers with lower education. Despite the parallel pattern, however, there was no effect of 'education' as a covariate factor for older Kyungsang speakers (r = 0.162, p = 0.843), indicating no relation between education and the vowel distinction. Therefore, a further study considering more details of sociolinguistic factors may be worthwhile to test the effect of education on the vowel change in Kyungsang Korean.

Second, the present data indicate the merger of /e/ and /ɛ/ in Seoul and Kyungsang Korean, and the merger in younger Seoul speakers also contributes to the identical number of vowels between the two dialects of Korean. Considering the merger in Seoul Korean first, the present data indicate that the merger in Seoul Korean results from lowering /e/ to /ɛ/, and of course, the merged phoneme for younger Seoul speakers has a higher F1 value than /e/ for older Seoul speakers. This merger pattern is contradictory to previous studies such as Hong (1999), Kang (1996, 2001), and Lee and Ramsey (2000) that argue for raising from /ɛ/ to /e/. However, the arguments in these previous studies need to be re-considered. This is because the argument or description of raising /ɛ/ to /e/ was not made based on acoustic evidence or quantitative analyses. Instead, most of the previous studies described the merger based on philological evidence or authors' impressions. Although Hong (1999) provided acoustic data, the data were collected only from four Seoul speakers aged 24, 39, 51 and 76, and based only on numerical comparison of formant frequencies without systematic inferential statistics. With such a small set of subjects, idiosyncrasies of each speaker may always be a problematic issue. On the other hand, the argument of lowering /e/ to /ɛ/ in the current study is supported by detailed acoustic observation, larger groups of subjects, and the statistical analysis of variation across all speakers.

In the current study, lowering /e/ to /ɛ/ among younger Seoul speakers also reflects Lindblom (1986), hypothesizing that *"...vowel systems tend to evolve to make the process of speech understanding efficient….Such efficiency depends in part on vowel identification, which can be assumed to be facilitated by the diachronic development of perceptual difference among the targets of a vowel system that are maximally or sufficiently large"* (p. 20). That is, diachronic development for vowels may occur in an effort to enhance the contrast among vowels. In the present data, the merged phoneme /ɛ/ for younger Seoul speakers is located at the

midpoint between the high and the low vowels, enhancing the high-mid-low contrast as shown in the vowel space (Fig.2. 12-b). In other words, lowering /e/ to the space of /ɛ/ is a better strategy than raising /ɛ/ to /e/ in order to maintain a sufficiently large contrast within the vowel system of younger Seoul speakers. This interpretation becomes clearer when we compare the acoustic realization of the merged front mid vowel between Seoul and Kyungsang Korean. Note that although the 'ɛ and e' merger is observed for both Seoul and Kyungsang groups, the merged form in Kyungsang Korean has a lower F1 than in Seoul, as shown in the vowel space (Fig.2. 12-b and 2. 13-b). However, regardless of the lower F1 values in Kyungsang Korean, the merged form in Kyungsang Korean is also located at the midpoint between /i/ and /a/ that enhances the height contrast within the vowel system of Kyungsang speakers. This suggests that the vowel merger occurs considering not only a relevant vowel pair, but also other vowels within the system.

Another interesting observation is that the /e/-/ɛ/ merger occurs at a different time between the two dialects of Korean. In the present data, while the merger was observed for both older and younger generations of Kyungsang, it occurs only for the younger generation of Seoul. This suggests that while Kyungsang Korean has completed the merger of /e/ and /ɛ/, the merger is on-going in Seoul Korean. In fact, Kuak (2003) states that the merger of /e/-/ɛ/ started earlier in Kyungsang Korean than Seoul to decrease the effort of articulation by reducing mouth opening. Specifically, Kuak (2003) describes that as the mouth opening became smaller, the four-way height distinction (High-Mid High-Mid Low-Low) changed into a three-way distinction, high-mid-low. Later, the merger of /e/-/ɛ/ motivated the merger of /ɨ/ with /ʌ/ in Kyungsang Korean to make the vowel system symmetrical, having a 2-2-2 vowel system.

According to Cho (2002) and Kuak (2003), the process of diachronic vowel change in Kyungsang Korean is summarized in (2).

(2)

18th – 19th century				**20th century**				**End of 20th century**				**20th–21st century**		
/i/	**/ɨ/**	**/u/**		**/i/**	**/ɨ/**	**/u/**		**/i/**	**/ɨ/**	**/u/**		**/i/**	**/ɨ/**	**/u/**
/e/		**/o/**	→	**/e/**		**/o/**	→	**/e/**		**/o/**	→	**/e/**		**/o/**
/ɛ/	**/a/**	**/ʌ/**			**/a/**	**/ʌ/**			**/a/**				**/a/**	**/ʌ/**

The present data support the different time of the /e/-/ɛ/ merger occurrence between the two dialects of Korean. Evidence of this time difference is the different acoustic realization of vowels between the younger Seoul and Kyungsang speaker groups. First, F1 is significantly higher in (younger) Seoul Korean than Kyungsang (p = 0.002) across vowels, which indicates that Seoul speakers produce vowels with a larger mouth opening than Kyungsang. Second, the F1 ranges from the highest /i/ to the lowest /a/ vowels are wider in (younger) Seoul Korean than Kyungsang. For younger Seoul speakers, the mean F1 for /i/ and /a/ is 367 Hz and 1022 Hz, respectively; for younger Kyungsang speakers, the mean F1 for /i/ and /a/ is 380 Hz and 919 Hz, respectively. The wider F1 range suggests that Seoul Korean has a larger height space (F1) than Kyungsang Korean. The different size of height space between the two dialects of Korean may be interpreted as a reflection of the time difference of the /e/-/ɛ/ merger occurrence. Specifically, until recently, Seoul speakers required a larger height (F1) space in order to make the four-way height distinction, namely High-Mid High-Mid Low-Low, but now the loss of the height distinction is on-going as indicated by the two groups of Seoul speakers with a 40 year-time gap in the present data. Therefore, although the younger Seoul speakers do not need the four-way height contrast anymore since losing the /e/-/ɛ/ distinction, the large height (F1) space seems to

remain as a remnant of the four-way height contrast. On the other hand, the present data showed that the loss of the four-way height distinction in Kyungsang Korean was completed earlier than Seoul Korean by merging /e/-/ɛ/, which was shown in the two groups of Kyungsang speakers at different time frames. The loss of /e/-/ɛ/ may facilitate the reduction in the height space in Kyungsang Korean earlier than in Seoul Korean because there was no longer a need for retaining a large height space. To summarize, Kyungsang's earlier loss of the four-way height distinction is reflected in a smaller F1 space than Seoul, while Seoul's recent loss of the height distinction is reflected in a larger F1 space than Kyungsang.

2. 5. Conclusion

The current chapter examined whether the vowel system of Kyungsang Korean is maintained by both younger and older speakers, and whether vowels of Kyungsang Korean are changing similarly to those of Seoul Korean. The primary focus in the current chapter was on the vowel pairs of /ɨ/-/ʌ/ and /e/-/ɛ/ for which dialectal variation had been reported. The results showed that both younger Seoul and Kyungsang speakers have the same seven vowels, and this identical number of vowels results from the split of /ɨ/-/ʌ/ in Kyungsang Korean and merger of /e/-/ɛ/ in Seoul Korean. Agreeing with previous studies on Korean vowels, the current study explained the split and the merger as the effect of education and internal phonetic factors, respectively.

CHAPTER 3

DIACHRONIC SOUND CHANGE IN SEGMENTS OF KYUNGSANG KOREAN: STOP CONSONANTS

3. 1. Introduction

It is well-known that Korean has an unusual three-way laryngeal distinction among voiceless stops, namely fortis, lenis and aspirated stops. The three stops are voiceless in word- or phrase-initial position, and each of these occurs at three places of articulation: bilabial, alveolar, and velar. The phonetic properties of this three-way contrast among the voiceless stops have been established not only for standard Seoul Korean, but also for other regional dialects of Korean such as Kyungsang or Cholla. Particularly, focusing on different tonal systems between Seoul and Kyungsang Korean, Lee and Jongman (2012) has demonstrated that while both Seoul and Kyungsang Korean share the same three-way contrast, the way to distinguish the contrast is different between the two dialects of Korean. Lee and Jongman (2012) revealed that the presence of tone or lexical pitch in Kyungsang Korean is related to the dialectal difference in distinguishing the stops. However, the influence of non-tonal Seoul Korean to tonal Kyungsang speakers has been increased for the past several decades. The purpose of this chapter is to compare the acoustic properties of the three-way contrast among the voiceless stops between younger and older generations of Kyungsang, and to address whether sound change occurs in segment level in Kyungsang Korean. Through comparing with standard Seoul Korean, it is tested whether the way to distinguish the stops for younger Kyungsang speakers becomes similar to that of Seoul Korean.

3. 1. 1. Background

Previous research on stops in Seoul Korean (e.g., Lisker & Abramson 1964; C.-W. Kim 1965; Cho, Jun & Ladefoged 2002; Kim 1965, 1970; Han & Weitzman 1970; Cho 1996; Choi 2002; Kim, Beddor & Horrocks 2002) agrees that both the stop consonant and following vowel after the stop release play an important role in classifying Korean stops. Specifically, previous research has showed that although the mean VOT in the consonant is longest for the aspirated stop, intermediate for the lenis stop, and shortest for the fortis stop, the validity of VOT as the single cue is questionable due to overlap of VOT values between the fortis and lenis and between the lenis and aspirated stops. Despite the unreliability of VOT as a single cue, however, acoustic properties conveyed by the following vowel after the stop release play a primary role along with VOT of the stop consonants in distinguishing the three stops. The fundamental frequency (F0) of the onset of the following vowel signals the stop distinction with the lowest value of F0 for the lenis stop, and a relatively high value of F0 for the aspirated and fortis stops. In addition to F0, previous research has proposed H1-H2 values as an additional cue for an indicator of the phonation type of the following vowel, reporting the lowest value for the fortis (i.e., creaky voice) and a high value for the lenis and aspirated stops (i.e., breathy voice).

An age variation in classifying the Korean stops has been noted for standard Seoul Korean. Previous studies (e.g., Silva 2006; Wright 2007; Kang & Guion 2008; Kuang & Oh 2011) have showed that the VOT difference between the lenis and aspirated stops in Seoul Korean has decreased over decades, and thereby suggested an on-going diachronic change in the stop of Seoul Korean. Specifically, Silva (2006) reported that while speakers born before 1965 showed well-separated VOT values for the three Korean stop, speakers born after 1965 revealed an overlap value of VOT for lenis and aspirated stops. Kang and Guion (2008) also indicated a

similar result. Kang and Guion (2008) examined the acoustic cue for the Korean stops between younger (mean age = 26) and older speaker (mean age = 47) groups, and compared the stop produced in various speech conditions such as clear, conversational and citation-form speech conditions. Regarding the age variation, Kang and Guion (2008) reported overlapped VOT values between aspirated and lenis stops in the conversational condition for younger speakers, but not for the older speakers. In addition, even in the clear speech condition, the VOT difference between lenis and aspirated stops was much smaller for the younger speaker group (10 ms) than the older group (31 ms). Recently, Kuang and Oh (2011) also showed that VOT of the aspirated stop is significantly shorter for the younger Seoul speakers than older speakers, indicating that the diachronic change in VOT of Korean stops is because of shortening VOT in the aspirated stop among younger Seoul speakers.

The phonetic properties in the Korean stops have reported dialectal variation, particularly with regard to different tonal or intonational systems between dialects (e.g., Choi 2002; Kenstowicz & Park 2006; Lee & Jongman 2012). Focusing on the role of F0 for the stop distinction, Kenstowicz and Park (2006) investigated the three-way laryngeal contrast of stops in tonal Kyungsang dialects by examining VOT, F0 and H1-H2. The researchers reported that the F0 values in the low tone fortis or the low tone aspirated stop is not distinguishable from the high tone lenis stop. Notably, the report in Kenstowicz and Park (2006) is different from previous reports on the stops in non-tonal Seoul Korean where F0 reliably distinguishes the lenis from the fortis and the aspirated stop. A recent study by Lee and Jongman (2012) examined the three-way contrast among stops through a comparative acoustic study between non-tonal Seoul and tonal Kyungsang Korean, and addressed whether and how the absence and presence of lexical tone in Kyungsang Korean affects the acoustic cue in distinguishing the stops. Consistent with

Kenstowicz and Park (2006), Lee and Jongman (2012) revealed that the role of F0 is unreliable in distinguishing the three-way contrast among the voiceless stops in tonal Kyungsang Korean. Importantly, the direct dialectal comparison between Seoul and Kyungsang Korean in Lee and Jongman (2012) demonstrated that while non-tonal Seoul Korean uses both VOT and F0 cues, tonal Kyungsang Korean primarily uses VOT to distinguish the three-way distinction. Lee and Jongman (2012) concluded that the different tonal system between the two dialects is responsible for the dialectal variation, and the presence of lexical pitch in the Kyungsang dialect makes the F0 cue unreliable to distinguish the three contrastive stops. That is, Lee and Jongman (2012) explains that the use of F0 for the lexical pitch distinction diminishes the F0 role for the segment distinction purpose. The reported dialectal variation in distinguishing the three-way contrast indicates that although the two dialects of Korean share the same segment distinction, the difference in their tonal systems affects the way to classify the segments.

As mentioned earlier, the dialectal variation in the Korean voiceless stops now becomes questionable due to the influence of Seoul Korean to the Kyungsang dialect. The current situation of Kyungsang Korean leads to test whether the way Kyungsang speakers distinguish the three-way distinction among voiceless stops is similar or different between the two generations of Kyungsang, and between Seoul and Kyungsang Korean. In addition, regarding the on-going diachronic change in VOT in Seoul Korean, it is asked whether VOT in younger Kyungsang speakers patterns closely to younger Seoul speakers, reflecting the simultaneous ongoing diachronic changes in VOT.

3. 1. 2. Goals

The goal of this chapter is to determine whether sound change occurs in the three-way distinction among the voiceless stops in Kyungsang Korean. This chapter tests if VOT, F0 and H1-H2 properties of stops are consistent between older and younger generations of Kyungsang speakers. Cross-dialectal comparison between Kyungsang and Seoul Korean addresses if younger Kyungsang speakers distinguish the stop in a similar way as younger Seoul speakers. The following research question and hypotheses are tested in this chapter.

(1) Is the way to distinguish the three stops the same between the two generations of Kyungsang Korean?

(1-1) The two generations of Kyungsang speakers who have been under different language situations may have different acoustic patterns for distinguishing the stops.

(1-2) Younger Kyungsang speakers who have been exposed to Seoul Korean more than older generation may have more similar acoustic patterns to those in Seoul Korean than older Kyungsang Korean.

(1-3) According to the reported dialectal variation (Lee & Jongman 2012), it is hypothesized that while older Kyungsang speakers rely mainly on VOT, younger Kyungsang speakers rely on both F0 and VOT for the stops as younger Seoul speakers do. That is, F0 effect in younger Kyungsang Korean may be greater than in older Kyungsang, and VOT effect in younger Kyungsang Korean may be smaller than in older Kyungsang.

3. 2. Methodology

3. 2. 1. Participants

The same forty female speakers in the vowel study also served as participants for the stop study.

3. 2. 2. Procedure

The data collection procedure is the same as the acoustic study of vowels.

3. 2. 3. Speech materials

For the acoustic study of stops, bilabial fortis, lenis, and aspirated stops were recorded. Each stop was placed in the initial position of a word in isolation, and was followed by the vowel /a/. Disyllabic words were drawn from each of the three contrastive HH, HL and LH tonal patterns. If there was no disyllabic word with an appropriate tonal pattern, monosyllabic words followed by the nominative case marker /-i/ with the proper tonal pattern, were used. Since the present study examines the acoustic cues of the three-way laryngeal distinction depending on tonal patterns across the two dialects of Korean, all stimuli were categorized according to tonal Kyungsang Korean rather than non-tonal Seoul Korean. Therefore, each stimulus was treated equally between the two dialects for the measurements and analyses, that is, as if the stimulus has the same tonal pattern. For example, the stimulus /pantal/ 'a half-moon', which has a LH pitch pattern in Kyungsang Korean, is also treated as LH for Seoul Korean. Each subject in both dialectal or age groups read the list twice. Overall, a total of 720 tokens were obtained (9 target words × 2 repetitions × 40 speakers) for the stop study. The word list that was used for the present study is shown in Table 3. 1.

		HH		HL		LH	
fortis	p’	p’al-ta	“to suck”	p’ang-i	“jail”	p’alɯm	“being fast”
lenis	p	pal-i	“foot”	pang-i	“room”	pantal	“a half-moon”
aspirated	p^h	p^han-i	“broad”	p^hal-i	“arm”	p^hacu	name of city

Table 3. 1. Stimuli recorded for the stop study

3. 2. 4. Measurements

Fundamental frequency (F0), voice onset time (VOT) and the amplitude difference between the first and the second harmonic (H1-H2) were measured using Praat. F0 values in the following vowel after the target stop release were measured every 10% using a script (by Xu 2006). Vowel onset was determined as the onset of the first formant and vowel offset as the offset of the second formant in the spectrogram. F0 at vowel midpoint was used for statistical analyses. VOT was measured from the point of stop burst release to the onset of voicing as seen in both waveform and spectrogram. The onset of the first full pitch period was determined as the onset of voicing as indicated in the waveform, additionally checked with the onset of the first formant in the spectrogram. The VOT values were extracted using a script (by Lennes 2002). The amplitude values for obtaining H1-H2 were taken from FFT spectra with a 25 ms window placed at the onset and midpoint of the following vowel.

3. 2. 5. Data analysis

Measurements were averaged across the two repetitions for each speaker. All the data were evaluated based on repeated measures General Linear Model (GLM) Analyses of Variance (ANOVAs) with the following factors: Laryngeal Distinction (Fortis, Lenis, Aspirated), Pitch Pattern (HH, HL, LH) and Position-in-Vowel (Onset, Midpoint) as within-subject factors and Dialect (Seoul, Kyungsang) and Age (Older, Younger) as between-subject factors. The three

acoustic parameters F0, VOT, and H1-H2 were all entered as dependent variables. Four-way repeated measures ANOVAs were conducted for the F0 and VOT dependent variables, and five-way repeated measures ANOVAs for the H1-H2 variable. Bonferroni *post hoc* comparisons were conducted ($\alpha = 0.05$) when significant main effects were obtained. After conducting Mauchly's test of sphericity, Huyhn-Feldt corrected degrees of freedom were used to report *F*-ratio and *p*-value for those cases where the sphericity assumption was violated.

Before considering Pitch Pattern as a factor in the statistical assessment, the present study first compared the F0 differences among HH, HL and LH stimuli in Seoul and Kyungsang Korean, pooled across the three stop categories and two age groups. This was done to verify that there is an absolute pitch (F0) difference between the initial High and Low pitch syllables in Kyungsang Korean compared to Seoul, and to justify the use of Pitch Pattern as a factor. F0 values measured at the midpoint of following vowels were used for this comparison. A two-way ANOVA with the F0 difference among HH, HL and LH stimuli as the dependent variable and Dialect as the independent variable showed a significant main effect of F0 difference (F (1.393, 52.937) = 32.005, $p < 0.01$) and Dialect (F (1, 38) = 72.978, $p < 0.01$). In addition, there was an interaction effect of F0 difference by Dialect (F (1.393, 52.937) = 13.793, $p < 0.01$). The interaction effect leads us to compare the F0 difference separately for each dialect. The F0 difference of the initial syllable among the HH, HL and LH stimuli was significant only for Kyungsang Korean. Specifically, Bonferroni *post hoc* comparisons reported that F0 is greatest for the HL pattern, intermediate for the HH pattern and lowest for the LH pattern in Kyungsang Korean, while the comparison in Seoul Korean was not significant across all pitch patterns at $p < 0.05$. This indicates that while Seoul does not have a pitch difference between the initial High (HH or HL) and Low (LH) pitch syllables, Kyungsang does have pitch differences across the

three pitch patterns, showing a higher F0 for HH and HL than for LH. Table 3. 2 presents the summary of the results.

	HL – HH		HH – LH		HL – LH	
Seoul	– 4	(9.57)	5	(9.73)	1	(7.15)
Kyungsang	9	(9.46)	27	(14.18)	36	(17.00)

Table 3. 2. Mean F0 differences (Hz) between HL and HH, HH and LH, and HL and LH in Seoul and Kyungsang Korean at midpoint of the following vowel. Data were pooled across Laryngeal Distinction and Age.

Having verified the presence of a pitch distinction for the contrastive pitch patterns in Kyungsang Korean, all subsequent statistical analyses considered Pitch Pattern as a factor.

3. 3. Results

3. 3. 1. F0

While Mauchly's test of sphericity reported no violation of sphericity for Pitch Pattern on F0, the outcome of Mauchly's test was significant ($p < 0.05$) for Laryngeal Distinction on F0, indicating a violation of the assumption of sphericity. Therefore, Huynh-Feldt-corrected and Sphericity-assumed values are reported for Laryngeal Distinction and Pitch Pattern for F0, respectively. A four-way repeated measures ANOVA (Laryngeal Distinction by Pitch Pattern by Age by Dialect) reported significant main effects of Laryngeal Distinction (F (1.794, 64.566) = 336.849, $p < 0.01$), Pitch Pattern (F (2, 72) = 108.294, $p < 0.01$), Age (F (1, 36) = 50.496, $p < 0.01$) and Dialect (F (1, 36) = 14.461, $p = 0.001$) on F0. In addition to the main effects, interaction effects among the factors were all significant. First, there were five significant two-way interaction effects: Laryngeal Distinction by Dialect (F (1.794, 64.566) = 28.962, $p < 0.01$), Laryngeal Distinction by Age (F (1.794, 64.566) = 32.640, $p < 0.01$), Pitch Pattern by Dialect (F

(2, 72) = 83.181, $p < 0.01$), Pitch Pattern by Age (F (2, 72) = 19.996, $p < 0.01$) and Laryngeal Distinction by Pitch Pattern (F (3.436, 123.688) = 3.40, $p = 0.015$). Second, the four possible three-way interactions were all significant: Laryngeal Distinction by Age by Dialect (F (1.794, 64.566) = 4.167, $p = 0.023$), Pitch Pattern by Age by Dialect (F (2, 72) = 11.785, $p < 0.01$), Laryngeal Distinction by Pitch Pattern by Dialect (F (3.436, 123.688) = 5.648, $p = 0.001$) and Laryngeal Distinction by Pitch Pattern by Age (F (3.436, 123.688) = 3.334, $p = 0.017$). Finally, there was a significant four-way interaction of Laryngeal Distinction by Pitch Pattern by Age by Dialect (F (3.436, 123.688) = 2.606, $p = 0.047$).

For further analyses, Bonferroni *post hoc* analyses were performed for the four significant main effects. For the main effect of Laryngeal Distinction, Bonferroni *post hoc* comparisons showed that F0 is smallest for the lenis stop, intermediate for the fortis stop, and greatest for the aspirated stop when the data were pooled across age and dialect groups. Regarding the Pitch Pattern effect, F0 is greater for the HH and HL patterns than the LH pitch pattern at $p < 0.01$; the F0 comparison between HH and HL is not significant ($p = 0.151$). There were also main effects for the two between-subject factors of Age and Dialect; F0 is greater for Seoul Korean than Kyungsang at $p = 0.001$, and F0 is greater for younger speakers than older speakers at $p < 0.01$. A summary of the results is presented in Table 3. 3.

			Fortis	Lenis	Aspirated
Seoul	Younger	HH	275 (7.13)	218 (11.26)	299 (14.98)
		HL	285 (19.54)	218 (11.15)	290 (17.13)
		LH	276 (9.61)	220 (7.47)	295 (8.78)
		Mean	279 (9.74)	219 (9.09)	295 (12.63)
	Older	HH	215 (31.94)	198 (21.76)	244 (35.95)
		HL	210 (27.41)	190 (23.16)	236 (31.94)
		LH	209 (23.70)	185 (21.26)	234 (35.98)
		Mean	211 (26.01)	191 (21.78)	238 (33.6)
Kyungsang	Younger	HH	245 (18.27)	211 (19.66)	255 (24.17)
		HL	242 (17.50)	219 (22.28)	266 (26.07)
		LH	225 (22.15)	201 (14.74)	235 (22.82)
		Mean	238 (17.74)	210 (18.45)	252 (23.30)
	Older	HH	198 (24.19)	193 (20.57)	228 (26.62)
		HL	211 (19.36)	211 (19.92)	238 (23.97)
		LH	176 (17.91)	155 (17.59)	176 (21.69)
		Mean	195 (18.79)	186 (17.67)	214 (20.83)

Table 3. 3. Mean F0 (Hz) for Younger and Older groups in Seoul and Kyungsang Korean as a function of Laryngeal Distinction and Pitch Pattern (standard deviation in parentheses).

The reported interactions above indicate important aspects for F0 as a function of Laryngeal Distinction. First, the significant two-way Laryngeal Distinction by Dialect and Laryngeal Distinction by Age interactions indicate that there are dialect and age variations in the way in which F0 distinguishes the three-way stop contrast. Specifically, F0 values among the three stops are more distinct for Seoul Korean than Kyungsang, and more distinct for younger speakers than older speakers. Notably, the age effect is different between Seoul and Kyungsang Korean as indicated by the three-way interaction of Laryngeal Distinction by Dialect by Age (Figure 3. 1). Importnatly, the four-way interaction of Laryngeal Distinction by Pitch Pattern by Dialect by Age indicates the relation between the three-way interaction and Pitch Pattern, leading us to compare F0 separately for all four factors. Table 3. 4 presents Bonferroni *post hoc* analyses

as a function of Laryngeal Distinction and Pitch Pattern for the two dialect groups and the two age groups.

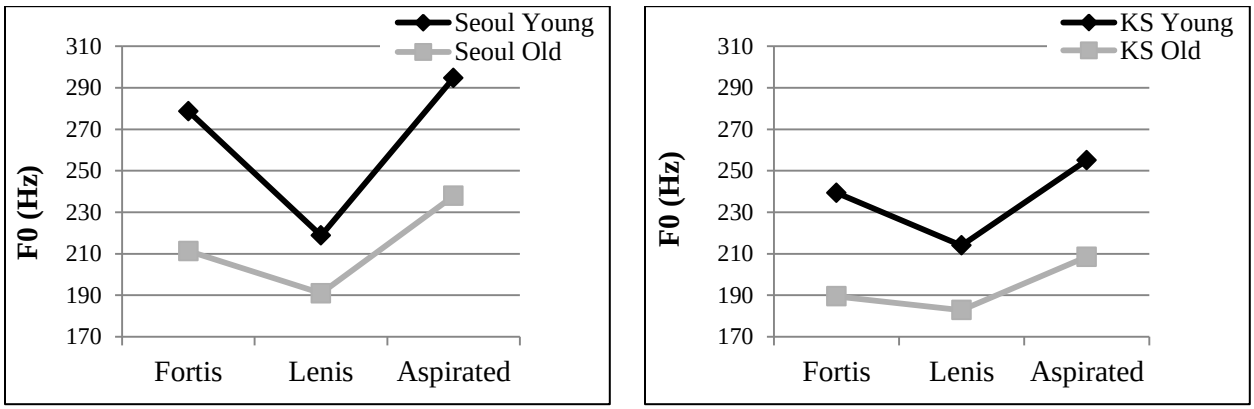

Figure 3. 1. F0 (Hz) patterns for Young and Old groups in Seoul and Kyungsang Korean as a function of Laryngeal Distinction.

		HH	**HL**	**LH**
Seoul	Younger	Lenis < Fortis < Aspirated	Lenis < Fortis = Aspirated	Lenis < Fortis < Aspirated
	Older	Lenis < Fortis < Aspirated	Lenis < Fortis < Aspirated	Lenis < Fortis < Aspirated
Kyungsang	Younger	Lenis < Fortis = Aspirated	Lenis < Fortis < Aspirated	Lenis < Fortis < Aspirated
	Older	Lenis = Fortis < Aspirated	Lenis = Fortis < Aspirated	Lenis < Fortis = Aspirated

Table 3. 4. Bonferroni *post hoc* analyses on F0 (Hz) between Seoul and Kyungsang Korean and between Younger and Older groups as a function of Laryngeal Distinction and Pitch Pattern.

In Seoul Korean, F0 is significantly different across all three stops for all three pitch patterns only for older speakers ($p < 0.05$). For younger Seoul speakers, while F0 is significantly different across all three stops for HH and LH pitch patterns ($p < 0.05$), the comparison between the fortis and aspirated stops for the HL pitch pattern was not significant ($p = 1.0$). In Kyungsang Korean, while younger speakers show an F0 overlap across the three stops only for the HH pitch pattern, older Kyungsang speakers reported F0 overlap for all three pitch patterns. Specifically, for younger Kyungsang speakers, while F0 is significantly different across all three

stops for HL and LH patterns ($p < 0.05$), F0 between the fortis and aspirated stops for HH was not significant ($p = 0.117$). For older Kyungsang speakers, Bonferroni *post hoc* tests reveal that F0 between the fortis and lenis stops in HH and HL, and between the lenis and aspirated stops was not significantly different.

3. 3. 2. VOT

Since Mauchly's test of sphericity reported no violation of sphericity for VOT, the statistical evaluation of Pitch Pattern and Laryngeal Distinction is reported without correction. A four-way repeated measures ANOVA (Laryngeal Distinction by Pitch Pattern by Age by Dialect) reported significant main effects of Laryngeal Distinction (F (2, 72) = 1114.122, $p < 0.01$), Age (F (1, 36) = 7.806, $p = 0.008$) and Dialect (F (1, 36) = 39.790, $p < 0.01$) on VOT. In addition to the main effects, there were significant two-way interaction effects of Laryngeal Distinction by Dialect (F (2, 72) = 35.642, $p < 0.01$), Laryngeal Distinction by Age (F (2, 72) = 96.472, $p < 0.01$) and Pitch Pattern by Dialect (F (2, 72) = 8.259, $p = 0.001$), and there were three-way interaction effects of Laryngeal Distinction by Age by Dialect (F (2, 72) = 10.937, $p < 0.01$) and Laryngeal Distinction by Pitch Pattern by Dialect (F (4, 144) = 3.414, $p = 0.011$). However, there was no significant main effect of Pitch Pattern; nor were there any other significant three-way or four-way interactions.

Bonferroni *post hoc* comparisons showed that the VOT of each Laryngeal Distinction is significantly different from the others at $p < 0.01$ for each comparison. The comparisons showed that VOT is shortest for the fortis stop, intermediate for the lenis stop, and longest for the aspirated stop. For the main effect of Dialect, the *post hoc* tests showed that VOT is longer for Seoul Korean than Kyungsang at $p = 0.01$. Regarding the effect of Age, Bonferroni *post hoc*

analyses reported longer VOT values for older speakers than younger speakers at $p = 0.001$. A summary of the results is shown in Table 3. 5.

			Fortis	**Lenis**	**Aspirated**
Seoul	Younger	HH	14 (3.50)	72 (8.75)	68 (12.00)
		HL	12 (2.53)	68 (8.99)	74 (7.42)
		LH	14 (6.55)	61 (11.53)	72 (7.32)
		Mean	13 (3.00)	68 (9.31)	71 (7.81)
	Older	HH	14 (2.93)	73 (10.30)	120 (11.56)
		HL	16 (2.75)	66 (10.12)	114 (14.49)
		LH	14 (3.72)	60 (11.14)	114 (16.41)
		Mean	15 (2.65)	67 (8.35)	116 (13.15)
Kyungsang	Younger	HH	11 (3.48)	53 (14.72)	76 (13.51)
		HL	10 (3.56)	48 (9.93)	74 (14.83)
		LH	10 (2.85)	54 (17.18)	82 (16.60)
		Mean	11 (2.46)	51 (12.39)	78 (13.80)
	Older	HH	11 (2.85)	22 (6.74)	94 (13.48)
		HL	11 (3.56)	23 (3.47)	95 (19.82)
		LH	13 (4.14)	27 (12.20)	94 (15.57)
		Mean	12 (3.40)	24 (5.92)	94 (13.42)

Table 3. 5. Mean VOT duration (ms) for Younger and Older groups in Seoul and Kyungsang Korean as a function of Laryngeal Distinction and Pitch Pattern (standard deviation in parentheses).

Regarding the reported interaction effects, there are several noteworthy aspects. First, the signficant Laryngeal Distinction by Dialect interaction indicates that the two dialects of Korean use VOT differently to categorize the three-way stop contrast; VOT for the lenis stop is longer for Seoul Korean than Kyungsang. Second, the two-way interaction effect of Laryngeal Disticntion by Age reveals that VOT for the stops patterns differently between the two age groups as well as the two dialect groups; while VOT for the lenis stop is longer for younger speakers, VOT for the aspirated stop is longer for older speakers. These reported interactions indicate both dialect and age variations on VOT as a function of Laryngeal Distinction.

Importantly, the three-way interaction effect of Laryngeal Distinction by Age by Dialect indicates a relation between the dialect and age effects. In other words, the age effect on VOT is different between Seoul and Kyungsang Korean, as shown in Figure 3. 2.

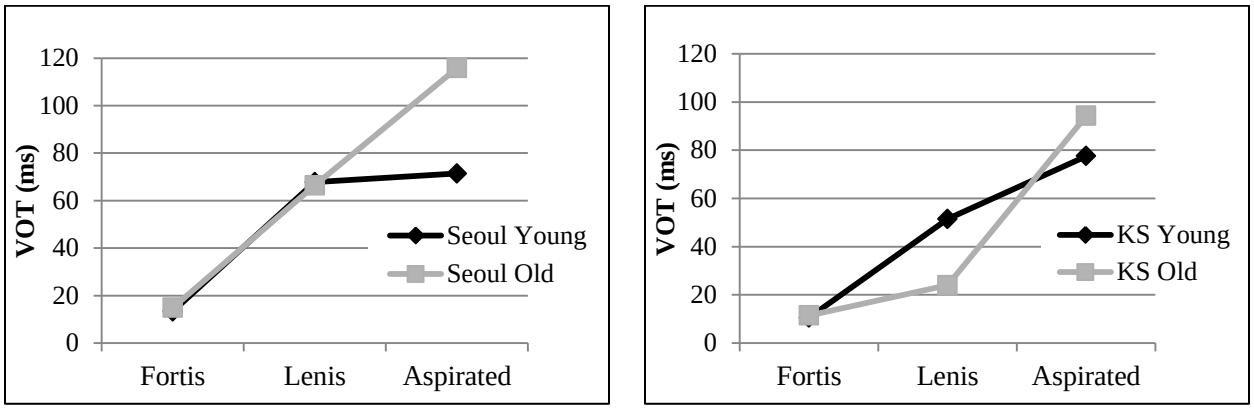

Figure 3. 2. VOT (ms) patterns for Younger and Older groups in Seoul and Kyungsang Korean as a function of Laryngeal Distinction.

The three-way interaction effect leads us to compare VOT for the stops separately for each dialect considering the Age factor. Within Seoul Korean, Bonferroni *post hoc* comparisons reported that while VOT as a function of Laryngeal Distinction is significantly different for older speakers at $p < 0.01$, VOT between the lenis and aspirated stops was not different for the younger speakers at $p = 0.065$. Within Kyungsang Korean, although VOT is significantly different across all three stops for both younger and older speakers at $p < 0.01$, the VOT pattern for the stops was not parallel between the two generations of Kyungsang; VOT for the lenis stop is longer for the younger Kyungsang speakers.

3. 3. 3. H1-H2

Mauchly's test of sphericity reported no violation of sphericity for H1-H2, and therefore the statistical evaluation of Pitch Pattern and Laryngeal Distinction is reported without correction. A five-way repeated measures ANOVA (Laryngeal Distinction by Position-in-

Vowel by Pitch Pattern by Age by Dialect) reported significant main effects of Laryngeal Distinction (F (2, 70)[10] = 116.928, $p < 0.01$) and Position-in-Vowel (F (1, 35) = 72.389, $p < 0.01$), and a non-significant trend for Age (F (1, 35) = 3.509, $p = 0.069$). Along with the main effects, there were significant two-way interaction effects of Laryngeal Distinction by Dialect (F (2, 70) = 4.320, $p = 0.017$), Position-in-Vowel by Laryngeal Distinction (F (2, 70) = 58.087, $p < 0.01$) and Position-in-Vowel by Pitch Pattern (F (2, 70) = 3.599, $p = 0.033$). There was a significant three-way interaction effect of Position-in-Vowel by Pitch Pattern by Age (F (2, 70) = 3.290, $p = 0.043$) as well as a non-significant trend effect for Position-in-Vowel by Pitch Pattern by Dialect by Age (F (2, 70) = 2.688, $p = 0.075$). However, there was no significant main effect of Pitch Pattern, or Dialect and there were no significant interactions.

Bonferroni *post hoc* comparisons showed that H1-H2 is significantly greater for the lenis and aspirated stops than for the fortis stop at $p < 0.01$, while the lenis and aspirated stops were comparable at $p = 1.00$. In addition, the comparisons showed that H1-H2 at vowel onset is greater than at vowel midpoint at $p < 0.001$. Regarding the trend effect of Age, older speakers are likely to produce the stop with smaller H1-H2 values than younger speakers. A summary of the results is shown in Table 3. 6.

[10] One older Kyungsang speaker produced the fortis stop with severe vocal fry, causing non-measureable H1 and H2 values in the extracted FFT spectra. Therefore, the statistical assessment on H1-H2 did not include the data from this older Kyungsang speaker, and the degrees of freedom reflect this.

			Vowel onset			Vowel midpoint		
			Fortis	**Lenis**	**Aspirated**	**Fortis**	**Lenis**	**Aspirated**
Seoul	Young	HH	0.48 (2.62)	5.27 (3.18)	7.70 (4.94)	1.50 (2.66)	3.09 (2.87)	4.63 (4.39)
		HL	0.29 (4.30)	5.90 (4.34)	6.40 (4.55)	2.98 (3.86)	3.91 (3.85)	3.88 (4.26)
		LH	1.46 (3.60)	5.92 (3.84)	6.28 (4.95)	2.48 (3.22)	3.80 (3.40)	3.31 (3.47)
		Mean	0.74 (3.20)	5.69 (3.60)	6.79 (4.71)	2.32 (3.08)	3.60 (3.28)	3.94 (3.91)
	Old	HH	-0.09 (3.19)	6.88 (3.98)	7.89 (2.58)	-0.67 (4.27)	3.07 (2.83)	5.71 (3.12)
		HL	-0.24 (1.90)	7.76 (4.96)	6.12 (2.73)	1.12 (2.84)	2.79 (4.87)	3.14 (2.38)
		LH	0.02 (1.90)	7.18 (4.73)	7.68 (3.67)	0.67 (2.67)	2.38 (2.70)	4.04 (2.93)
		Mean	-0.10 (1.94)	7.27 (4.25)	7.23 (2.72)	0.37 (2.15)	2.74 (3.22)	7.23 (2.72)
Kyungsang	Young	HH	0.28 (1.92)	9.70 (3.31)	9.70 (3.69)	1.08 (2.19)	4.04 (2.28)	5.75 (3.99)
		HL	1.06 (2.93)	8.69 (2.99)	8.70 (3.89)	3.00 (2.95)	4.82 (2.54)	4.31 (2.12)
		LH	0.52 (2.25)	8.96 (3.64)	7.87 (3.51)	2.43 (2.39)	6.14 (3.09)	3.46 (2.89)
		Mean	0.62 (2.06)	9.12 (2.76)	8.75 (3.51)	2.17 (2.35)	5.00 (2.45)	4.50 (2.86)
	Old	HH	-2.78 (4.48)	6.54 (3.84)	7.97 (4.83)	-0.84 (2.06)	3.35 (3.26)	3.53 (1.60)
		HL	-1.47 (3.34)	5.67 (3.45)	6.91 (3.85)	-1.10 (2.84)	4.93 (3.21)	2.12 (2.61)
		LH	-2.84 (1.53)	6.82 (4.29)	5.17 (2.81)	-1.81 (2.14)	2.14 (2.89)	0.32 (1.49)
		Mean	-2.82 (2.58)	6.34 (3.03)	6.68 (3.34)	-1.25 (1.49)	3.47 (2.33)	2.00 (1.59)

Table 3. 6. Mean H1-H2 (dB) for Younger and Older groups in Seoul and Kyungsang Korean as a function of Position-in-Vowel, Laryngeal Distinction and Pitch Pattern (standard deviation in parentheses).

The two-way interaction effect of Laryngeal Distinction by Dialect indicates that Seoul and Kyungsang speakers use H1-H2 differently to classify the three-way stop contrast, revealing dialect variation in H1-H2. H1-H2 patterns in the order of 'fortis < lenis = aspirated' for both dialects. However, H1-H2 between the fortis and lenis stops showed a larger difference for Kyungsang Korean than Seoul. In other words, H1-H2 for the fortis stop is smaller (negative) for Kyungsang Korean than Seoul, while H1-H2 for the lenis stop is greater for Kyungsang than for Seoul, as presented in Figure 3. 3 – (a). In addition, the interaction of Position-in-Vowel by Laryngeal Distinction reveals that while the H1-H2 effect for the three-way stop contrast is consistently greater at vowel onset than vowel midpoint, the H1-H2 change between vowel onset and midpoint is less for the fortis than for the other two stops, as presented in Figure 3. 3 – (b).

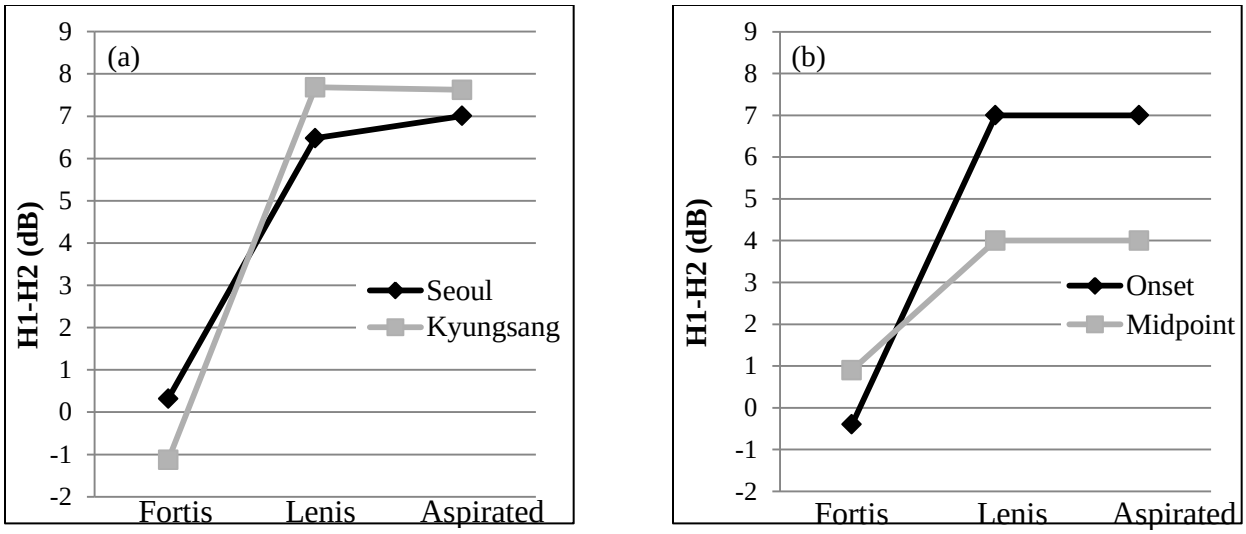

Figure 3. 3. H1-H2 (dB) as a function of Laryngeal Distinction for Seoul and Kyungsang Korean (a); H1-H2 (dB) as a function of Laryngeal Distinction for the onset and midpoint of the following vowels (b).

Finally, the absence of an interaction effect between Laryngeal Distinction and Age indicates that H1-H2 for the three-way stop contrast patterns similarly between the two age groups, and this is true for both Seoul and Kyungsang Korean.

3. 4. Summary of results

The current study compared acoustic cues to the three-way stop contrast among the Korean stops across Seoul and Kyungsang Korean, and across older and younger generations. Regarding the dialectal and age variations, the present study not only replicated previous findings, but also reported a number of new findings. First, consistent with previous research, significant main effects of Laryngeal Distinction on F0, VOT and H1-H2 were obtained, suggesting that the three-way contrast among the Korean stops is characterized with both consonantal and vocalic cues. Second, significant interactions of 'Laryngeal Distinction by Age by Dialect' for F0 and VOT suggest that these acoustic cues to the three-way laryngeal

distinction are used differently by the two age groups as well as by the two dialect groups. The three-way interactions indicate that the age variation is different between Seoul and Kyungsang Korean. Accordingly, Bonferroni *post hoc* analyses further tested how F0 and VOT can distinguish the stops, separately for Age and for Dialect.

With regard to F0, there were significant main effects of within-subject factors, Laryngeal Distinction and Pitch Pattern. However, the effect of Laryngeal Distinction varied depending on Dialect and Age factors as indicated by the three-way interaction of Laryngeal Distinction by Age by Dialect. Importantly, the four-way interaction of 'Laryngeal Distinction by Pitch Pattern by Age by Dialect' implies that the presence of lexical pitch accent in Kyungsang Korean is related to the dialectal and age variations. Bonferroni *post hoc* tests revealed that older Seoul speakers showed significantly different F0 across the three Korean stops for all HH, HL and LH pitch patterns, with F0 being highest for the aspirated stop, intermediate for the fortis stop, and lowest for the lenis stop. A non-significant difference in F0 between the fortis and aspirated stops was reported for the HL and HH pitch patterns for younger Seoul and younger Kyungsang speakers, respectively. Finally, older Kyungsang speakers showed non-significant F0 differences between the fortis and lenis stops for the HH and HL patterns, and between the lenis and aspirated stops for the LH pattern.

Although VOT of each laryngeal distinction generally patterns in the order of 'fortis < lenis < aspirated', we again observed age and dialectal variations. Younger and older generations in both Seoul and Kyungsang Korean use VOT differently to distinguish the stops, but sources of the age variation in the two dialects was different. In Seoul Korean, while VOT is different across all three stops for older speakers, VOT between the lenis and aspirated stops is not different for younger speakers: 'fortis < lenis < aspirated' for older Seoul, 'fortis < lenis =

aspirated' for younger Seoul. VOT for the aspirated stop in younger Seoul speakers is shorter than that in older speakers, which is the source of the age variation within Seoul Korean. In Kyungsang Korean, VOT patterns 'fortis < lenis < aspirated' for both younger and older speakers. However, VOT for the lenis stop is longer for younger speakers than older speakers, and VOT for the aspirated stop is longer for older speakers than younger speakers, which is shown by the non-parallel VOT pattern across stops between the two generations of Kyungsang.

The amplitude difference between the first and the second harmonic (H1-H2) was significant in distinguishing the fortis stop from the lenis and aspirated stops, patterning 'fortis < lenis = aspirated', and this is true for both Seoul and Kyungsang Korean. Despite the consistent pattern across dialects, however, the interaction between Laryngeal Distinction and Dialect indicates dialectal variation in H1-H2. H1-H2 between the fortis stop and the lenis and aspirated stops is more distinct for Kyungsang than for Seoul Korean. Finally, the lack of an interaction involving Age suggests that the two generations of Korean speakers use H1-H2 similarly.

3. 5. Discussion

One of the main foci in this chapter was to investigate age variation in how older and younger Kyungsang speakers distinguish the three contrastive stops, and thereby to verify diachronic sound change in stops for Kyungsang Korean. We compared how younger speakers of Kyungsang Korean categorize the three-way stop contrast relative to Seoul speakers whose dialect is considered as standard Korean. The comparison of the two dialects was intended to address whether standard Korean affects the phonetics of a regional dialect. Importantly, the increased influence of non-tonal Seoul Korean questions whether the younger and older Kyungsang speakers use pitch (F0) in the same way to distinguish the stops. If the function of

F0 is different between the two generations of tonal Kyungsang Korean speakers, the age effect on F0 may affect the role of other acoustic cues for categorizing the stops.

The present results are consistent with previous research regarding the effect of laryngeal distinction and the effect of dialect on F0. Although the general F0 pattern 'lenis < fortis < aspirated' indicates that the three-way stop distinction is reflected in the following vowel (e.g., Han and Weitzman 1970; Kim 1970; Cho 1996; Cho et al. 2002; Kang and Guion 2008), the pattern varies depending on the Seoul and Kyungsang dialects of Korean. The observed dialectal variation in the present study is in line with recent evidence. Lee and Jongman (2012) reported that the F0 differences among the three stops are greater for Seoul Korean than Kyungsang, and hence concluded that non-tonal Seoul uses F0 more than tonal Kyungsang as a cue to the three-way laryngeal distinction. In addition to dialectal variation, this dissertation showed an interaction of 'Laryngeal Distinction by Age' which suggests age differences in using F0 as a function of laryngeal distinction. Notably, the interaction among the four factors (Laryngeal Distinction, Pitch Patten, Age, Dialect) indicates that the dialect and age effects are related to each other, and that Pitch Pattern also plays a role in the variation.

The three-way interaction of 'Laryngeal Distinction by Age by Dialect' allows us to consider the age difference in F0 separately for Seoul and Kyungsang Korean. First, in Seoul Korean, the function of F0 in distinguishing the stops was different between the younger and older speakers; the difference in F0 between the lenis and the fortis and aspirated stops was greater for younger than older Seoul speakers (Figure 3. 1). That is, younger speakers use F0 more than older speakers. This observation is also in accordance with Kang and Guion (2008) in which younger speakers enhanced the difference between the aspirated and lenis stops by using F0 more than older speakers in clear speech compared to conversational speech. Second, the age

variation in F0 as a function of Laryngeal Distinction was observed in Kyungsang Korean as well as Seoul. Similarly to Seoul Korean, the F0 distinction across the stops was greater for younger speakers. Discriminant function analysis confirms the dialectal and age variations by quantifying the contribution of F0 as a single predictor in classifying the three Korean stops for each dialect and age group. For younger Seoul speakers, F0 as a single predictor classifies the three stop categories with 87% accuracy, but for older Seoul speakers, accuracy is 57%; for younger Kyungsang speakers, F0 could classify the three-way laryngeal distinction with 60% accuracy, but accuracy is only 42% for older Kyungsang speakers.

The discriminant analysis suggests several noteworthy aspects. First, F0 is a better predictor for classifying the three stops for non-tonal Seoul Korean, consistent with Lee and Jongman (2012). However, this statement needs to consider the age difference within Seoul Korean because F0 is not a reliable cue to the three-way stop distinction for older Seoul speakers. In fact, the accuracy rate for older Seoul speakers (57%) is lower than that for younger Kyungsang speakers (60%), though the difference is small. Therefore, the observation that non-tonal Seoul speakers use F0 more than tonal Kyungsang speakers is limited to younger Seoul speakers. Second, within Kyungsang Korean, the greater classification accuracy for younger (60%) than older (42%) Kyungsang speakers indicate that F0 is a better cue for younger speakers to the laryngeal distinction. This discriminant analysis reports are also consistent with the *post hoc* analysis where older Kyungsang speakers showed non-significant F0 distinctions across the stops at every pitch pattern (Table 3. 4). In short, younger Kyungsang speakers rely more on F0 than older Kyungsang speakers for the segmented distinction. Third, the comparison across the dialects shows that although the reliability of F0 is greater for younger than for older Kyungsang speakers, the use of F0 for the stop distinction in younger Kyungsang speakers is not as great as

that in younger Seoul speakers. This means that the use of F0 for the stops is not the same between the younger Seoul and Kyungsang speakers.

In sum, we have noted that F0 for the Korean stop is used differently across younger and older generations as well as across Seoul and Kyungsang Korean. F0 is most effectively used by younger Seoul speakers, while it is least effectively used by older Kyungsang speakers. Within Kyungsang, the role of F0 for categorizing the three stops is greater for the younger speakers. The discriminant analyses reporting the age difference in F0 in both Seoul and Kyungsang Korean lead us to predict that the role of other acoustic cues such as VOT or H1-H2 may be different for each of these dialect and age group. This prediction is based on the notion of phonetic trading relations (Repp 1983). For example, since F0 does not function well for the laryngeal distinction among older Kyungsang speakers compared to younger speakers, older Kyungsang speakers may compensate for the reduced F0 effect through VOT or H1-H2, and therefore we can expect age difference in VOT or H1-H2 as well as F0. Examining the VOT parameter confirms this prediction.

The present results reported a significant effect of VOT for the laryngeal distinction; VOT generally patterns from short to long in the order of fortis, lenis and aspirated stops. However, the effect of VOT as a function of the laryngeal distinction is different depending on Dialect or Age factors as indicated by the three-way interaction of 'Laryngeal Distinction by Age by Dialect'. Accordingly, we observed the age variation on VOT separately for Seoul and Kyungsang Korean.

Regarding the age difference for Seoul Korean, the present results showed that the two age groups of Seoul Korean use VOT differently to distinguish the three-way laryngeal stop contrast. While VOT successfully distinguishes the three stops for older Seoul speakers,

younger Seoul speakers do not make the distinction between the lenis and aspirated stops using VOT; the mean VOT difference between the lenis and aspirated stops was 50 ms and 4 ms for the older and younger speakers, respectively. Notably, the present results confirm the notion of diachronic change in VOT in Seoul Korean (e.g., Silva 2006; Wright 2007; Kang & Guion 2008; Perkins & Lee 2010; Kuang & Oh 2011). Many studies on Korean have noted that the VOT distinction between the lenis and aspirated stops has decreased over the past five decades, suggesting an ongoing sound change in stops for Seoul Korean. The previous studies indicated that VOT of the aspirated stop is shortened. The shortened VOT of the aspirated stop is observed in the present data as well; while VOT values for the fortis and lenis stops were comparable between the younger and older Seoul speakers, VOT of the aspirated stop was significantly shorter for the younger than older speakers (Figure 3. 2). This suggests that the diachronic change in VOT is not because of both lenis and aspirated stops, but because of the change only in the aspirated stop. In addition, Kuang and Oh (2011) observed stronger age variation pattern in female speakers than males, and concluded that the sound change mostly happens for women. The conclusion in Kuang and Oh (2011) is supported by the comparison between the present study and Lee and Jongman (2012). The present study tested only female speakers (mean age = 21 years old), while Lee and Jongman (2012) tested only male speakers (mean age = 27.5 years old). The male Seoul speakers in Lee and Jongman (2012) showed a statistically significant VOT distinction between the lenis and aspirated stops, while the females in the present study showed a non-significant difference (p = 0.085) between the two stop categories. In sociolinguistics, it is reported that women systematically use high-prestige standard variants more than men, and women lead linguistic change (Nevalainen & Raumolin-

Brunberg 2003). Therefore, the discrepancy between males and females in the stops of Seoul Korean also validates the notion that this sound change is led by female speakers.

Second, we observed the age difference in VOT not only in Seoul Korean, but also in Kyungsang; within Kyungsang Korean, VOT between younger and older speakers is not parallel because of the longer VOT for the lenis stop and the shorter VOT for the aspirated stop in younger Kyungsang speakers. Along with the interaction effect showing that VOT as a cue to the three stops is used differently between the two age groups in Kyungsang Korean, discriminant analyses show how much younger Kyungsang speakers rely on VOT as a single cue compared to older Kyungsang speakers, and whether their reliance on VOT is similar to that of younger Seoul speakers.

Discriminant analyses assessed the role of VOT as a single predictor separately for each of the four dialect and age groups. For younger Seoul speakers, VOT as a single predictor only yields a 76% accurate classification rate, but it is 97% for older Seoul speakers. Within Kyungsang Korean, VOT classifies the three-way laryngeal stop contrast with an 84% accuracy rate for younger speakers, and it is 90% for older speakers. The observed interaction effect regarding the age difference is well reflected in the discriminant analyses. Specifically, within Seoul Korean, younger speakers, who do not show a VOT difference between the lenis and aspirated stops, show a lower classification accuracy rate than older speakers. The discrepancy in the accuracy rate between the two generations of Seoul Korean suggests that while VOT alone can be a sufficient cue to distinguish the three-way laryngeal stop contrast for older speakers, it is not sufficient for younger speakers. For Kyungsang Korean, the high classification accuracy rates in both younger and older age groups indicate that VOT alone successfully distinguishes the three-way stop contrast. However, the lower accuracy rate for younger Kyungsang speakers

indicates that they rely less on VOT than older Kyungsang speakers, although the difference in the accuracy rate is not as great as in Seoul Korean. That is, the role of VOT as a single cue for younger Kyungsang speakers is smaller than for older Kyungsang speakers, but it is greater than for younger Seoul speakers. Therefore, we may conclude that the reliability of VOT for younger Kyungsang speakers is in between that for the younger Seoul and the older Kyungsang Korean speakers. Overall, the current result suggests that VOT is a reliable cue to the three-way stop distinction for groups which report a relatively low classification accuracy rate for the F0 predictor. Thus, we may conclude that the acoustic cues of F0 and VOT trade with each other, and the trading relation varies depending on age and dialect.

As an indicator of phonation type, the present study examined the amplitude difference between the first and the second harmonic (H1-H2). In the present results, the H1-H2 values were greater for the lenis and aspirated than fortis stops, and H1-H2 between the lenis and aspirated stops was not statistically different. This suggests that the voice quality of the vowel is creakier after the fortis stop than after the lenis and aspirated stops, and the vowel after the lenis and aspirated stops is more breathy (Han & Weitzman 1970; Blankenship 2002; Cho et al. 2002, Kang & Guion 2008; Kuang & Oh 2011).

Regarding the H1-H2 parameter, the absence of interactions involving the Age factor suggests that the two generations of Korean speakers use H1-H2 similarly, consistent with Kuang and Oh (2011). In terms of dialectal variation, Seoul and Kyungsang speakers use H1-H2 differently as indicated by the two-way interaction effect of 'Laryngeal Distinction by Dialect'. Specifically, the H1-H2 difference between the fortis and lenis or aspirated stops was greater for Kyungsang Korean than Seoul (Figure 3. 3-a). This means that the fortis stop in Kyungsang Korean has a creakier voice quality than in Seoul Korean, and the lenis and aspirated stops have

breathier quality in Kyungsang Korean than Seoul. In addition to the dialectal variation, H1-H2 for the three-way stop contrast varies depending on the point of measurement in the following vowel. H1-H2 showed a decreased effect at vowel midpoint compared to vowel onset; however, at the vowel midpoint measure, H1-H2 for the fortis stop decreased to a lesser extent as compared to the lenis and aspirated stops. This suggests that although voice qualities of the following vowels become weaker as being further apart from the stop consonant, the voice quality of the vowel after the fortis stop is kept better than any other stop types. Discriminant analysis was performed to estimate how much each dialectal or age group relies on H1-H2[11] as a single predictor. H1-H2 alone classifies the three categories of Korean stops with 62% and 48% accuracy for the older and younger Seoul speakers, respectively; it classifies the three stops with 64% and 60% accuracy for the older and younger Kyungsang speakers. Overall, the accuracy rates for H1-H2 across the four dialectal and age groups are not very high, indicating that the role of H1-H2 is not robust compared to F0 or VOT. Table 3. 7 presents the summary of the discriminant analysis reports for F0, VOT and H1-H2 predictors.

	Seoul		**Kyungsang**	
	Younger	Older	Younger	Older
F0	87%	57%	60%	42%
VOT	76%	97%	84%	90%
H1-H2	48%	62%	60%	64%

Table 3. 7. Comparison of classification accuracy rates from discriminant analyses for F0, VOT and H1-H2 as a function of the three-way laryngeal contrast across age and dialect groups.

[11] The discriminant analysis was conducted with H1-H2 values measured at the onset of the following vowel.

In Table 3. 7, the discriminant analyses for the three acoustic parameters support the notion of trading relations among multiple acoustic cues. Particularly, a comparison of the classification accuracy rates for F0 and VOT across the four age and dialect groups suggests that the two acoustic cues trade off with each other systematically. In other words, if the role of F0 is weak for categorizing the three stops as in the older Kyungsang group, VOT is strong enough to make up for the weak F0 effect. More importantly, the results in Table 3. 7 provide clear indication about whether Seoul or Kyungsang Korean undergoes sound change by enabling us to compare the difference in using F0 and VOT between two generations within a dialect.

The apparent difference in the trading relation between younger and older Seoul Korean speakers demonstrates that sound change happens for Seoul Korean. Specifically, while older Seoul speakers barely use F0 to categorize the three stops, VOT alone is reliable enough to compensate for the unreliability of F0. In contrast, although VOT is less reliable for younger Seoul speakers compared to the other groups to distinguish the stops, F0 makes up for the insufficiency of VOT. Silva (2002, 2006a, 2006b) also noted significantly shorter VOT in the aspirated stop for younger Seoul speakers, and suggested a language shift in Seoul Korean. Silva (2006b) suggested that the language shift occurs as a change in VOT, and VOT does not play a primary role in distinguishing the three-way laryngeal contrast. Silva (2006b) argues that the underlying contrast between the lenis and aspirated stops is maintained by a lower F0 in lenis than fortis or aspirated stops, that is, phonetic change occurs without a phonemic shift despite the neutralized VOT. Consistent with Silva's view, the present results show that although younger Seoul speakers have neutralized VOT between the lenis and aspirated stops due to the shortened VOT for the aspirated stop, F0 distinguishes the three stops with an 87% classification rate. To explain the sound change in Seoul Korean, Silva (2006a, 2006b) suggested that the standard

Seoul dialect may possibly associate its tone pattern with that of regional dialects such as Kyungsang (i.e., use lexical pitch accent) or Cholla (i.e., use phrasal pitch accent), and may be aligned with other dialects of Korean.

Next, we consider the sound change in stops for Kyungsang Korean in terms of using F0 and VOT. Previously, we questioned whether younger Kyungsang speakers distinguish the three-way stop contrast in the same way as Seoul speakers, and attempted to verify whether sound change happens for Kyungsang due to the influence of standard Seoul Korean. Since we observed a sound change in stops for Seoul Korean, the dialectal comparison is limited to contemporary Seoul Korean (younger Seoul speakers). As shown in Table 3. 7, both younger and older Kyungsang speakers primarily use VOT for the stop distinction, while the role of F0 for both younger and older Kyungsang groups is not as great as for younger Seoul speakers. Based on this, one may conclude that the acoustic pattern of F0 and VOT between contemporary Seoul and Kyungsang Korean is not similar, and therefore Kyungsang Korean is not undergoing sound change in stops. However, Kyungsang speakers' reliance on F0 for the stop distinction is clearly different between younger and older generations. Younger Kyungsang speakers use F0 more for the laryngeal distinction than older Kyungsang speakers, and the function of VOT is not the same between the two generations, as indicated by the interaction effect and the discriminant analysis reports.

The difference in the classification accuracy of the F0 predictor between the two age groups of tonal Kyungsang Korean questions whether the role of F0 in the distinction of HH, HL and LH pitch patterns is the same between younger and older Kyungsang speakers. Based on the different cue weights for F0 for categorizing the three stops, we can predict that the role of F0 in categorizing the three pitch patterns is not the same between the two generations of Kyungsang.

In fact, the three-way interaction of 'Pitch Pattern by Age by Dialect' indicates that F0 as a function of the three pitch patterns is different depending on Age and Dialect factors, as presented in Figure 3. 4.

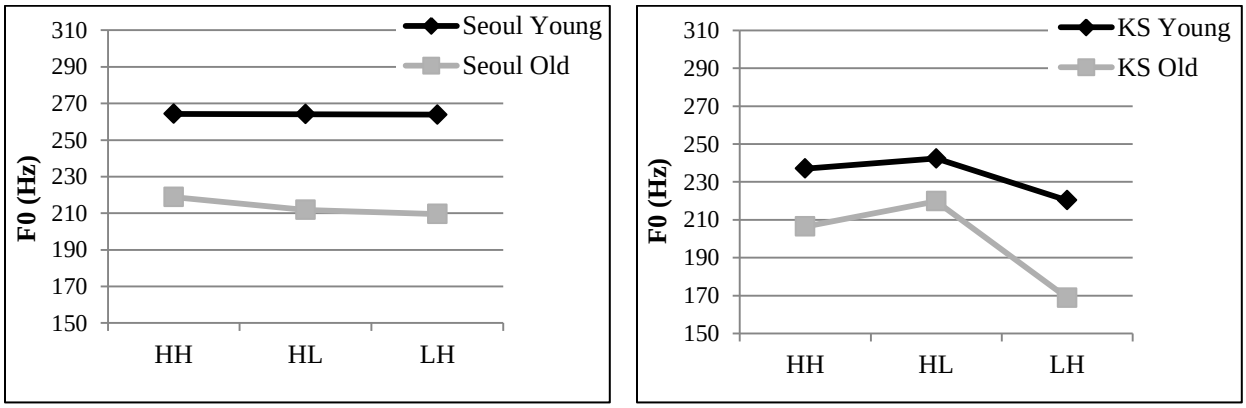

Figure 3. 4. F0 (Hz) patterns between Younger and Older groups in Seoul and Kyungsang Korean as a function of Pitch Pattern.

To determine how F0 distinguishes the three pitch patterns, a Bonferroni *post hoc* test was performed separately for each age and dialect group. As expected, F0 is not different across the three pitch patterns in non-tonal Seoul Korean for either younger or older speakers. In tonal Kyungsang Korean, however, pitch pattern has a significant effect, and the effect varies depending on age. Bonferroni *post hoc* tests reported that F0 is different across the three pitch patterns for older Kyungsang speakers ($p < 0.05$), revealing F0 values from high to low in the order of HL, HH and LH. However, for younger Kyungsang speakers, F0 is different only in distinguishing LH from HH and HL. This suggests that unlike F0 as a function of laryngeal distinction, the role of F0 for lexical pitch is greater for older than younger Kyungsang speakers. In addition, discriminant analysis confirms the age variation in the use of F0 for the lexical pitch distinction; older Kyungsang speakers could classify the three pitch patterns with 61% accuracy,

but the accuracy for younger speakers was only 41%. We suggest that the reduced role of F0 for lexical pitch in younger Kyungsang speakers results in an increased role of F0 for the laryngeal distinction. That is, since younger Kyungsang speakers use F0 less for the lexical pitch distinction, their use of F0 for the laryngeal distinction is increased. In sum, although age variation in the use of F0 and VOT for categorizing the three stops is less evident than in Seoul Korean, the difference in using F0 for laryngeal and lexical pitch distinctions suggests an ongoing sound change in stops for contemporary Kyungsang Korean. That is, the sound change in Kyungsang Korean is evidenced by the fact that younger Kyungsang speakers tend to minimize the role of F0 for the lexical pitch accent distinction, but maximize it for the laryngeal distinction, suggesting that the sound change in stops of Kyungsang Korean starts with F0, not VOT.

The present study suggests that the ongoing sound change in Kyungsang Korean is motivated by the difference in tonal systems between Seoul and Kyungsang Korean and a change in social environment. Under linguistic ideology that focuses on homogeneity among regional varieties of Korean, younger Kyungsang speakers may feel the need to correct any marked property in their language to Seoul Korean. Importantly, younger Kyungsang speakers do have more access to Seoul Korean through education, media or direct interaction with Seoul speakers than the older generation. Under the changed social environment, the younger Kyungsang generation is more likely to think that phonetic properties marking Kyungsang dialects are stigmatic compared to the Seoul dialect. Consequently, younger Kyungsang speakers may try to avoid the marked linguistic difference between Kyungsang and Seoul Korean, and the increased access to Seoul Korean provides the younger Kyungsang generation with a better environment to standardize their language to Seoul Korean.

Recall that while Kyungsang uses lexical pitch, standard Seoul Korean does not. The marked phonetic difference between Seoul and Kyungsang Korean that is relevant to segmental distinctions is the presence or absence of pitch accent. If younger Kyungsang speakers become easily aware of the lexical pitch accent in their dialect as a phonetically marked property under the changed social environment, they may try to minimize lexical pitch distinctions, considering them as a stigmatic feature in Kyungsang Korean compared to Seoul. Therefore, younger Kyungsang speakers' reluctance to use F0 for pitch accent distinctions opens the possibility to use F0 for segmental distinctions. Older Kyungsang speakers are more willing to use F0 for lexical pitch because they are less likely to consider the pitch accent property as marked or stigmatic property. Contrary to the younger Kyungsang generation, older Kyungsang speakers' maintained use of F0 for lexical pitch reduces the possibility of using F0 for segmental distinctions.

3. 6. Conclusion

The current chapter investigates age variation in the acoustic cues to the three-way distinction among voiceless stops in Kyungsang Korean through a comparison with Seoul Korean. Although the increased influence of Seoul Korean questions whether the way of classifying the stop for the Kyungsang dialect of Korean is similar between younger and older generations of Kyungsang speakers, the age factor has not yet been studied. Accordingly, by examining the acoustic cues across generations and across dialects, the current study addressed whether and how the stops in Kyungsang Korean are undergoing sound change. In this study, we not only replicated previous findings, but also found several acoustic factors that imply ongoing sound change in Kyungsang Korean.

First, the present result is in accordance with previous findings regarding dialectal variation and the diachronic change in the stops of Seoul Korean. In terms of dialectal variation, we confirm that F0 more effectively categorizes the three-way stop contrast for non-tonal Seoul speakers than tonal Kyungsang speakers, whereas VOT is more reliable for Kyungsang speakers. However, the reliance on F0 in Seoul Korean is limited to younger Seoul speakers, and older Seoul speakers do not use F0 in the same way as younger speakers. Consistent with Silva (2006a, 2006b), the current findings suggest that younger Seoul speakers' use F0 as a primary cue instead of VOT is related to a diachronic transition whereby the VOT in the aspirated stop in Seoul Korean has been shortened over time.

Second, the present study concludes that Kyungsang Korean is undergoing a process of sound change. The two generations of Kyungsang speakers showed a clear difference in using F0 as a function of laryngeal and lexical pitch accent distinctions; the older generation tends to use F0 more for the lexical pitch accent than laryngeal distinction, whereas the younger generation tends to use F0 more for the laryngeal than for the pitch distinction.

Finally, the current dissertation proposes that recent changes in the social environment motivate the diachronic sound change in Kyungsang Korean. That is, younger Kyungsang speakers' increased exposure to standard Seoul Korean may increase phonetic similarities between the two dialects of Korean. Dialect formation and change can result from opportunities for direct social contact among talkers as suggested by Labov (1974).

CHAPTER 4

DIACHRONIC SOUND CHANGE IN SEGMENTS OF KYUNGSANG KOREAN: FRICATIVES

4. 1. Introduction

While Kyungsang Korean shares the consonant inventory with Seoul Korean, it has been known that the two voiceless alveolar fricatives in Seoul Korean are not phonemically distinct in Kyungsang Korean (Sohn 1999; Lee & Ramsey 2011). However, several experimental studies exploring the unique fricative feature in Kyungsang Korean relative to Seoul have indicated that the two fricatives are in fact acoustically distinct from each other (Kenstowicz & Park 2006; Holliday 2012). The conflicting reports among studies raise the question whether the different findings are due to generational variation where some findings (Sohn 1999; Lee & Ramsey 2011) reflect the fricative exhibited in the production of older Kyungsang speakers, and others (Kenstowicz & Park 2006; Holliday 2012) reflect that of younger Kyungsang speakers. Since the previous acoustic studies (Kenstowicz & Park 2006; Holliday 2012) on Kyungsang's fricative did not consider age as a factor, it is not clear whether both older and younger Kyungsang speakers can make the two-way fricative distinction, or whether the acoustic distinction is related to generational change. The purpose of this fricative chapter is to compare acoustic properties of the fricative between younger and older generations of Kyungsang speakers, and to test if the discrepancy across studies is due to generational differences in Kyungsang Korean. In addition, a comparison of the acoustic properties of Kyungsang's fricatives with those of standard Seoul Korean will establish younger Kyungsang and Seoul Korean speakers distinguish the fricatives in the same way.

4. 1. 1. Background

In Seoul Korean, the two-way fricative distinction has been investigated by many researchers through comparing phonetic properties of the fricatives with those of stops and affricates. Korean stops and affricates have the typologically unusual three-way laryngeal distinction in the voiceless region, and these obstruents are generally categorized as fortis, lenis and aspirated with little controversy. Unlike the three-way laryngeal distinction for stops and affricates, the voiceless alveolar fricative in Seoul Korean has a two-way distinction. Accordingly, researchers have focused on categorizing the two types of fricatives in accordance with the three laryngeal gestures. For the two fricatives, while researchers have generally agreed that one could be categorized as fortis (/s'/), they disagreed on the categorization of the other fricative due to its phonologically ambiguous patterns and conflicting experimental results. For this reason, while the one type of fricative (/s'/) is named the fortis fricative, the other one is referred to as the non-fortis (Chang 2013), plain (Cho et al. 2002), or lenis-aspirated (Holliday 2012) fricative. Henceforth, I use the term 'non-fortis fricative' for /s/, following Chang (2013).

Researchers have noted that the non-fortis fricative /s/ has dual phonological properties, which makes its classification problematic from a phonological perspective (e.g., Jun 1993; Yoon 1999). The non-fortis fricative can be classified as the lenis fricative because it follows the *post obstruent tensing* rule as do the lenis stop and affricate in (1), but it can also be classified as the aspirated fricative because it disobeys the *intervocalic lenis voicing* rule as does the aspirated stop in (2).

(1) /hakte/ → [hakt'e] 'abuse'
/hakʧa/ → [hakʧ͈a] 'scholar'
/pakʧʰa/ → [pakʧʰa] 'a spur'
/paksu/ → [paks'u] 'a clap'

(2) /kepaŋ/ → [kɛbaŋ] ‘to open’
/kjep^{h}i/ → [kjɛp^{h}i] ‘cinnamon’
/kjeysan/ → [kjɛsan] ‘calculation’ (adapted from Jun 1993: 59, 60)

Under this ambiguous phonological behavior, the non-fortis fricative in Seoul Korean has been analyzed as lenis (Cho et al. 2002), as aspirated (Yoon 1999), and as both lenis and aspirated (G. Lee 2011; Chang 2013). Cho, Jun and Ladefoged (2002) analyzed the non-fortis fricative as lenis based on its parallel acoustic properties with the lenis stop. Cho et al. (2002) indicated lower F0 at the onset of the following vowel after the non-fortis fricative than after the fortis one, which is consistent with the F0 pattern between the fortis and lenis stops; they also noted intervocalic voicing for 46% of their tokens with word-medial /s/. On the other hand, Yoon (1999) argues for the aspirated fricative categorization based on the longer aspiration duration of the non-fortis fricative than the fortis fricative, and suggested that aspiration duration is the major acoustic parameter to distinguish the two fricatives. However, Yoon (1999, 2002) noted that this durational difference is observed only for mid and low vowel contexts, indicating the limitation regarding his ‘aspirated fricative’ categorization in a high vowel context. Phonetic findings in some other studies (G. Lee 2011; Chang 2013) have shown that the acoustic properties for the non-fortis fricative reflect both lenis and aspirated laryngeal features, and therefore suggested that classifying the non-fortis fricative as either lenis or aspirated may not be suitable due to its unique features.

Although classification of the non-fortis fricative /s/ in Seoul Korean still remains controversial among researchers, the phonetic properties of the two fricatives have been well documented (e.g., Yoon 1999, 2002; Cho, Jun & Ladefoged 2002; G. Lee 2011; Chang 2013).

Previous research on Seoul Korean has reported that the fortis and non-fortis fricatives differ in their centroid frequency, frication/aspiration duration, and H1-H2 in the following vowel.

For centroid frequency of the fricative noise (i.e., center of gravity) that reflects the size of the front cavity of a lingual fricative (Jongman, Wayland & Wong 2000), the fortis fricative has reported a higher centroid frequency than the non-fortis fricative in Seoul Korean (Yoon 1999; Cho et al. 2002; G. Lee 2011; Chang 2013). This indicates that the degree of linguopalatal contact is smaller for /s/ than /s'/ (i.e., the fortis /s'/ has a smaller front cavity than the non-fortis /s/).

For the durational property, in word-initial position the frication duration without the aspiration portion is shorter for the non-fortis /s/ than for the fortis /s'/ (Yoon 1999; Cho et al. 2002; Chang 2013); the aspiration duration is shorter for the fortis /s'/ than for the non-fortis /s/ (G. Lee 2011; Chang 2013). When the frication duration includes the aspiration portion, the duration difference is not significant between the two fricatives (G. Lee 2011). Cho et al. (2002) noted the maximized durational property in word-medial position: while the frication duration of the fortis /s'/ becomes even longer when it occurs word-medially compared to word-initial position, that of the non-fortis /s/ becomes shorter in word-medial position.

For H1-H2 in the following vowel, the previous studies agree that H1-H2 is higher for the non-fortis /s/ than the fortis /s'/, indicating that the /s/ is associated with more breathy phonation than /s'/. Regarding F0, although Cho et al. (2002) reported that F0 at the onset of the following vowel distinguishes the two fricatives, patterning /s/ < /s'/, this finding has not been replicated by subsequent studies. G. Lee (2011) and Chang (2013) reported no F0 difference between the two fricatives. Overall, the acoustic characteristics in the literature suggest that the two fricatives in Seoul Korean differ in terms of centroid frequency, frication/aspiration duration, and phonation

type, although these characteristics reflect the dual nature between the lenis and aspirated categorization for the non-fortis /s/.

In Kyungsang Korean, the two voiceless alveolar fricatives have been traditionally classified as non-distinct phonemes based on authors' impressions (Sohn 1999; Lee & Ramsey 2011). It is generally believed that the fortis /s'/ is phonetically realized as the non-fortis /s/ in Kyungsang Korean (e.g., *s'al* 'rice' is realized as *sal* 'flesh'). Several phonetic studies have investigated the non-distinct fricatives in Kyungsang Korean (K. Lee 2002; Kenstowicz & Park 2006; Holliday 2012). K. Lee (2002) examined fricatives produced by fourteen Seoul and Kyungsang (Pusan: South Kyungsang) speakers who ranged in age from their 20s to their 30s, and compared durational properties of the fricatives between the two dialects. K. Lee (2002) reported that for Kyungsang Korean, the frication duration was shorter for the non-fortis /s/ than the fortis /s'/[12] word-initially and word-medially, which is consistent with the findings for Seoul Korean. Regarding dialectal differences, K. Lee (2002) noted that Kyungsang's fricatives are generally shorter in their frication/aspiration duration compared to Seoul's fricatives. Based on the shorter duration of fricatives in Kyungsang than Seoul, K. Lee (2002) postulated that Kyungsang speakers would require more effort than Seoul speakers to make the two-way fricative distinction. Accordingly, under her assumption that Kyungsang speakers do not have the two-way fricative distinction, K. Lee (2002) concluded that the additional effort required for Kyungsang speakers makes it hard to produce the distinct phonemes. Inconsistent with the traditional view (Sohn 1999; Lee & Ramsey 2011) and K. Lee's (2002) conclusion, Kenstowicz and Park (2006) and Holliday (2012) reported different acoustic characteristics between the fortis /s'/ and the non-fortis /s/ in Kyungsang Korean. Kenstowicz and Park (2006) examined

[12] K. Lee (2002) did not report the statistical significance for the durational difference.

fricatives produced by seven Kyungsang speakers who ranged in age from their 20s to their 40s. In Kenstowicz and Park (2006), while Kyungsang speakers do not show reliable differences in F0 between the two fricatives, H1-H2 is higher for the non-fortis /s/ than the fortis /s'/. Based on this acoustic difference in H1-H2, Kenstowicz and Park (2006) argued that the two-way phonemic contrast is also expressed by Kyungsang speakers as well as Seoul speakers. Similar findings and conclusions were reported by Holliday (2012) who examined the acoustic properties of the two fricatives produced by twelve Seoul and thirteen Kyungsang (Daegu: North Kyungsang) speakers in their 20s and 30s. Holliday (2012) tested if the two fricatives are indeed neutralized in Kyungsang Korean by examining frication/aspiration duration, centroid frequency of the frication noise, F0 and H1-H2 at the onset of the following vowels. Consistent with K. Lee (2002), Holliday (2012) reported that the aspiration duration was generally shorter for the two fricatives in Kyungsang than those in Seoul. Based on this dialectal difference in duration, Holliday (2012) argued against the general belief that Kyungsang's fortis /s'/ is realized as non-fortis /s/; this is because the shorter aspiration duration in the two Kyungsang fricatives suggested more aspirated feature for Seoul Korean than Kyungsang. In addition, Holliday (2012) noted no inter-dialectal differences for the other acoustic parameters. Accordingly, Holliday (2012) concluded that the fortis and non-fortis fricatives are not neutralized in Kyungsang Korean, and suggested that other factors such as geographical and generational variation should be considered.

The inconsistency between the traditional view (Sohn 1999; Lee & Ramsey 2011) and experimental reports (Kenstowicz & Park 2006; Holliday 2012) prompts the question whether the inconsistency across studies is related to age variation in Kyungsang Korean. That is, while the findings in Kenstowicz and Park (2006) and Holliday (2012) might reflect the presence of the

two-way contrast in the fricative among younger Kyungsang speakers, the reports in Sohn (1999) and Lee and Ramsey (2011) might reflect the absence of the contrast among older Kyungsang speakers. As mentioned earlier, the previous acoustic studies (K. Lee 2002; Kenstowicz & Park 2006; Holliday 2012) did not consider age as a factor, and accordingly the studies were not in a position to directly address the issue of generational variation. Therefore, the current chapter examines whether and how older and younger Kyungsang speakers distinguish the fortis and non-fortis fricatives through observing acoustic parameters including frication/aspiration duration, center of gravity, H1-H2 and F0.

4. 1. 2. Goals

The goal of this chapter is to determine whether sound change occurs in the non-distinct fricatives of Kyungsang Korean. To this end, this chapter tests if the acoustic differences between the fortis and non-fortis fricatives reported for Seoul Korean are consistently expressed by older and younger Kyungsang generations. In addition, comparing the acoustic characteristics of the fricatives between Kyungsang and Seoul Korean allows us to address if younger Kyungsang speakers distinguish the fricatives in a similar way as Seoul speakers. The following research questions are addressed in this chapter.

(1) Do both older and younger Kyungsang generations show reliable acoustic differences between the two fricatives?

(2) If they do, what is the primary acoustic cue for Kyungsang speakers?

(3) If there is a generational difference in the acoustic cue, how differently the two fricatives are realized between older and younger Kyungsang speakers?

(4) Do younger Kyungsang speakers distinguish the two fricatives in a similar way as Seoul speakers?

4. 2. Methodology

4. 2. 1. Participants

The same forty female speakers in the vowel and stop studies also participated in the fricative study.

4. 2. 2. Procedure

The data collection procedure is the same as in the vowel and stop studies.

4. 2. 3. Speech materials

The non-fortis and fortis fricatives were recorded in word-initial and word-medial position in disyllabic words shown in Table 4. 1[13]. For the stimulus selection, lexical tone in Kyungsang Korean was controlled: the disyllabic words with word-initial fricatives have the HL pattern (i.e., ***s****ál-i* 'flesh-nom.', ***s'****ák-i* 'bud-nom.'), and the words with word-medial fricatives have the HH pattern (i.e., *sé****s****ál* 'proud flesh', *sé****s'****ák* 'shoot'). Each fricative was followed by the vowel /a/ because one expects more noticeable spectral differences between the two fricatives relative to other vowel contexts (Chang 2013). Each subject in both dialectal or age groups read the words twice in isolation. Overall, a total of 320 tokens were obtained (4 target words × 2 repetitions × 40 speakers) for the fricative study.

		word-initial		word-medial	
non-fortis	s	sal-i	"flesh-nom."	sesal	"proud flesh"
fortis	s'	s'ak-i	"bud-nom."	ses'ak	"shoot"

Table 4. 1. Stimuli recorded for the fricative study

[13] Although Kyungsang Korean reportedly does not distinguish between the fortis and non-fortis fricatives, Korean orthography does distinguish the two fricatives.

4. 2. 4. Measurements

Frication/aspiration duration, center of gravity, fundamental frequency (F0), and the amplitude difference between the first and the second harmonic (H1-H2) were measured using Praat. Frication duration was measured from onset of the aperiodic noise to the onset of the aspiration as indicated in both waveform and spectrograms; aspiration duration was measured from the onset of aspiration to the onset of voicing. The onset of aspiration was decided in spectrograms as indicated by the different distribution of spectrum energy between frication and aspiration (i.e., burst frequency); the onset of voicing was determined by the onset of the first formant, and this was considered as the onset of vowels (see Figure 4. 1). The aspiration duration was measured only for the word-initial fortis and non-fortis fricatives because aspiration did not appear for the majority of the word-medial fricatives. For the word-initial fricatives, tokens with no measurable aspiration (mostly for the fortis /s'/) were considered as having no aspiration (i.e., 0 ms).

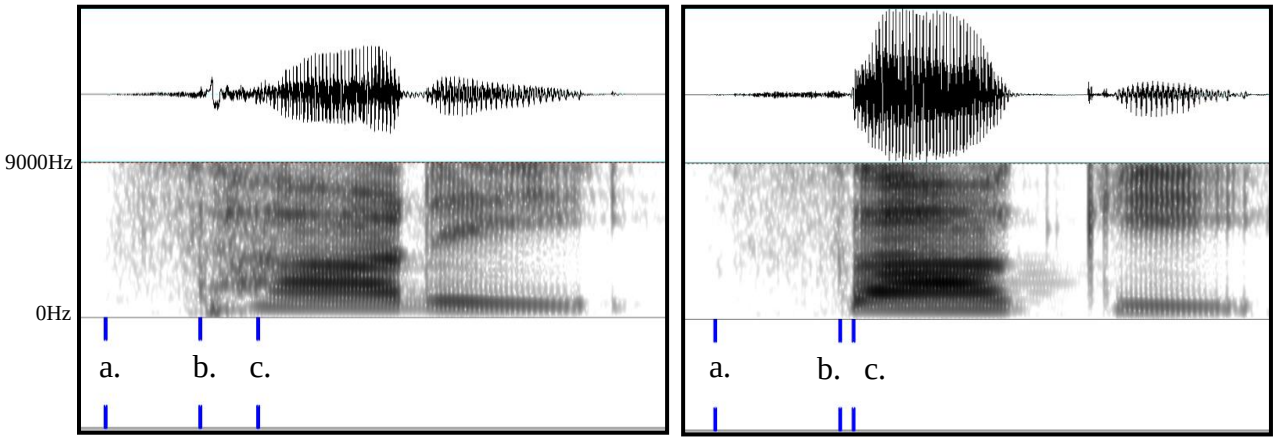

Figure 4. 1. Example of aspiration/frication measurement for word-initial fricatives *sal-i* 'flesh-nom.' (left) and *s'ak-i* 'bud-nom.' (right) (younger Seoul speaker): a = start of frication; b = start of aspiration; c = start of vowel.

Center of gravity was measured for the fricative portion using a Praat script (by Liu 2012). Center of gravity was taken from FFT spectra every 25% point between the onset and the offset of the frication noise using a 20 ms window. Then, the centroid frequency values were averaged across 25%, 50% and 75% points for statistical analysis. F0 and H1-H2 measures were made for the vowel portion. F0 values in the following vowel after the two types of fricatives were measured every 10% using a Praat script (by Xu 2006). F0 measured at the onset of the vowel only was considered for statistical analyses. The amplitude values for obtaining H1-H2 were taken from FFT spectra with a 25 ms window placed at the onset of the following vowel[14]. Tokens with glottalization were excluded in both the acoustic and the statistical analyses as reflected in the degrees of freedom. Of a total of 320 tokens, 28 tokens (8.8%) were produced with glottalization in vowels: 13 from older Kyungsang, 9 from older Seoul, 4 from younger Kyungsang, and 2 from younger Seoul groups.

4. 2. 5. Data analysis

Measurements were averaged across the two repetitions for each speaker. All the data were evaluated based on repeated measures General Linear Model (GLM) Analyses of Variance (ANOVAs) with the following factors: Fricative Type (Fortis, Non-fortis) and Position-in-Word (Word-initial, Word-medial) as within-subject factors, and Dialect (Seoul, Kyungsang) and Age (Older, Younger) as between-subject factors. Four-way repeated measures ANOVAs were

[14] F0 and H1-H2 at the midpoint of the following vowels were not considered in the current chapter. This is because the selected word stimuli in this chapter contain coda consonant of /l/ after the target vowels, which makes it hard to determine the exact midpoint of the following vowel due to a less clear-cut vowel offset across tokens.

conducted for each of the four acoustic parameters: frication duration (not including aspiration portion), center of gravity, F0 and H1-H2.

4. 3. Results

4. 3. 1. Aspiration and frication duration

A four-way repeated measures ANOVA (Fricative Type by Position-in-Word by Age by Dialect) reported significant main effects of Fricative Type (F (1, 30) = 379.722, $p < 0.01$), Position-in-Word (F (1, 30) = 44.546, $p < 0.01$), Age (F (1, 30) = 12.244, $p = 0.001$) and Dialect (F (1, 30) = 7.572, $p = 0.01$) on frication duration (not including aspiration portion). Pairwise comparisons show that across other factors, frication duration is shorter for the non-fortis /s/ than the fortis /s'/; it is shorter in word-initial position than word-medial; it is shorter for younger speakers than older, and it is shorter for Kyungsang speakers than Seoul.

In addition to these main effects, there were significant two-way interaction effects of Fricative Type by Dialect (F (1, 30) = 19.297, $p < 0.01$), Fricative Type by Age (F (1, 30) = 16.125, $p < 0.01$), Position-in-Word by Age (F (1, 30) = 10.939, $p = 0.002$), Fricative Type by Position-in-Word (F (1, 30) = 46.417, $p < 0.01$) and Position-in-Word by Dialect (F (1, 30) = 8.714, $p = 0.006$). Significant three-way interaction effects were Fricative Type by Age by Dialect (F (1, 30) = 29.560, $p < 0.01$), Position-in-Word by Dialect by Age (F (1, 30) = 18.408, $p < 0.01$) and Fricative Type by Position-in-Word by Age (F (1, 30) = 20.097, $p < 0.01$). A summary of the results is shown in Table 4. 2 and Figure 4. 2.

		Word-initial				Word-medial	
		/s'/		/s/		/s'/	/s/
		frication	aspiration	frication	aspiration	frication	frication
Seoul	Older	181 (58)	11 (14)	102 (39)	92 (21)	228 (42)	138 (46)
	Younger	123 (14)	20 (28)	87 (15)	60 (11)	196 (23)	81 (14)
Kyungsang	Older	140 (31)	20 (11)	131 (24)	60 (14)	135 (50)	106 (17)
	Younger	111 (27)	14 (6)	60 (18)	60 (19)	187 (23)	74 (12)

Table 4. 2. Mean frication/aspiration duration (ms) for Older and Younger groups between Seoul and Kyungsang Korean as a function of Fricative Type and Position-in-Word (standard deviation in parentheses).

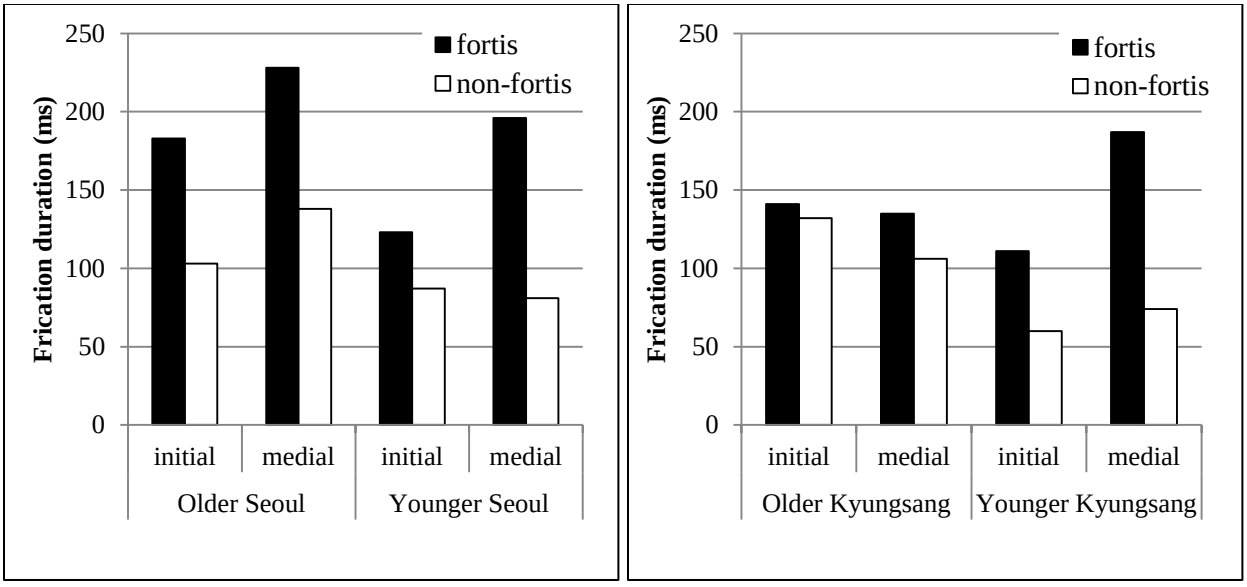

Figure 4. 2. Frication duration (ms) (not including aspiration portion) for Older and Younger groups between Seoul (left) and Kyungsang (right) Korean as a function of Fricative Type and Position-in-Word.

Some new and replicated findings are noted for aspiration and frication duration. First, the signficant Fricative Type by Position-in-Word interaction indicates that the frication duration between the two fricatives differs by their positions in words. Specfically, across Dialect and Age groups, while frication duration for the fortis /s'/ is 44 ms longer than that for the non-fortis

/s/ in word-initial position, frication duration for /s'/ is 87 ms longer than that for /s/ in word-medial position. This finding is consistent with Cho et al. (2002) where the difference in frication duration between /s'/ and /s/ is maximized word-medially. Second, as observed by K. Lee (2002), frication duration was generally shorter for Kyungsang speakers than Seoul speakers across Age and Fricative Type.

Notably, the significant three-way interaction effect of Fricative Type by Age by Dialect indicates that the frication duration patterns differently depending on the Age and Dialect factors; separate three-way ANOVAs (Fricative Type by Position-in-Word by Age) were therefore conducted for each dialect group to see which speaker group is the source of this interaction. Table 4. 3. summarizes the three-way ANOVAs conducted separately for Seoul and Kyungsang groups.

	Seoul (F (1, 16))	**Kyungsang (F (1, 14))**
Fricative Type	659.907***	66.414***
Position-in-Word	87.476***	$4.359^{n.s.}$ (p=.056)
Age	7.947**	5.387*
Fricative Type by Position-in-Word	25.811***	21.013***
Fricative Type by Age	$2.338^{n.s.}$	26.048***
Position-in-Word by Age	$0.912^{n.s.}$	18.163***
Fricative Type by Position-in-Word by Age	16.014**	5.628*

Table 4. 3. Summary of separate ANOVAs for Seoul and Kyungsang gourps on frication duration; F-ratios are reported with a statistical significance (n.s. = $p > 0.05$; * = $p < 0.05$; ** = $p < 0.01$; *** = $p < 0.0001$).

For Seoul Korean, frication duration generally patterns consistently between the two generations. In both age groups, the non-fortis /s/ has shorter frication duration than the fortis /s'/, and the word-initial fricative has shorter frication duration than the word-medial fricative.

However, the three-way interaction of Fricative Type by Position-in-Word by Age arose because while frication duration for word-initial /s/ increased by 36 ms in the word-medial position for older Seoul speakers, the duration decreased by 6 ms word-medially for younger Seoul speakers (see Table 4. 2 and Figure 4. 2). This age variation seems related to the different aspiration duration for the non-fortis /s/ between older and younger Seoul speakers. Table 4. 2 shows that while the aspiration duration for /s/ is 92 ms for older speakers, it is 60 ms for younger speakers: while the aspiration proportion of the total fricative duration is 47% (i.e., aspiration/fricative duration * 100 (92/(102 + 92) * 100)) for older Seoul speakers, that for younger Seoul speakers is 41%. This age difference in the aspiration proportion is systemtic across individuals. One-way ANOVA testing the effect of Age on the aspiration proportion reported the main effect of Age (F (1, 18) = 5.598, p = 0.029), indicating that 41% for younger Seoul speakers is significantly smaller than 47% for older speakers. In this sense, the shorter aspiration duration might be reflected as longer frication duration in word-initial position for /s/ for the younger speakers compared to the older, which makes the positional difference of frication duration for younger speaekrs smaller compared to that for older speakers.

For Kyungsang Korean, the interaction effects including the Age factor indicate that frication duration patterns differently between the two generations of Kyungsang speakers. Across the two fricative positions in words, while the fortis /s'/ has a 19 ms longer frication duration than the non-fortis /s/ for older Kyungsang speakers, /s'/ has a 82 ms longer frication duration than /s/ for younger speakers. In addition, across the two fricative types, while word-initial fricatives have a 16 ms longer frication duration than the word-medial fricatives for older speakers, word-initial fricatives are 45 ms shorter than the word-medial fricatives for younger speakers (see Table 4. 2 and Figure 4. 2). The interaction of Fricative Type by Position-in-Word

by Age for the Kyungsang group arose because while younger Kyungsang speakers showed increased frication duration for /s'/ word-medially compared to word-initially, older Kyungsang speakers did not. Notably, the younger Kyungsang speakers' pattern of frication duration as a function of Fricative Type and Position-in-Word is consistent with that of Seoul speakers.

Regarding the aspiration duration, Kyungsang speakers also showed a generational difference. Although both older and younger Kyungsang speakers reported the same aspiration duration of 60 ms, it differs proportionally: while the aspiration proportion of the fricative is 31% (i.e., aspiration/fricative duration * 100 (60/(131 + 60) * 100)) for older Kyungsang speakers, that for younger Kyungsang speakers is 50%. One-way ANOVA reported the main effect of Age for the Kyungsang group (F (1, 18) = 15.640, p = 0.001), indicating that that 31% for older Kyungsang speakers is significantly smaller than 50% for younger speakers.

4. 3. 2. Center of gravity

A four-way repeated measures ANOVA (Fricative Type by Position-in-Word by Age by Dialect) reported significant main effects of Fricative Type (F (1, 31) = 143.033, $p < 0.01$) and Position-in-Word (F (1, 31) = 79.518, $p < 0.01$); however, there were no main effects of Age (F (1, 31) = 0.451, p = 0.507) or Dialect (F (1, 31) = 2.340, p = 0.136) on center of gravity. Pairwise comparisons show that across Age and Dialect factors center of gravity is higher for the fortis /s'/ than the non-fortis /s/; it is higher in word-medial than word-initial position.

In addition to these main effects, there were significant two-way interaction effects of Fricative Type by Age (F (1, 31) = 6.036, p = 0.02) and Fricative Type by Position-in-Word (F (1, 31) = 6.310, p = 0.017); there was a near-significant effect of Fricative Type by Dialect (F (1, 31) = 3.757, p = 0.062). A significant three-way interaction effect was found for Fricative Type

by Age by Dialect (F (1, 31) = 6.701, p = 0.015). A summary of the results is shown in Table 4. 4 and Figure 4. 3.

		Word-initial		Word-medial	
		fortis /s'/	**non-fortis /s/**	**fortis /s'/**	**non-fortis /s/**
Seoul	Older	8103 (489)	6695 (407)	8525 (409)	7209 (574)
	Younger	8412 (670)	6808 (471)	8874 (481)	7807 (563)
Kyungsang	Older	8087 (875)	7521 (483)	8587 (575)	8188 (354)
	Younger	8540 (645)	6707 (785)	8806 (347)	7715 (892)

Table 4. 4. Mean center of gravity (Hz) for Older and Younger groups between Seoul and Kyungsang Korean as a function of Fricative Type and Position-in-Word (standard deviation in parentheses).

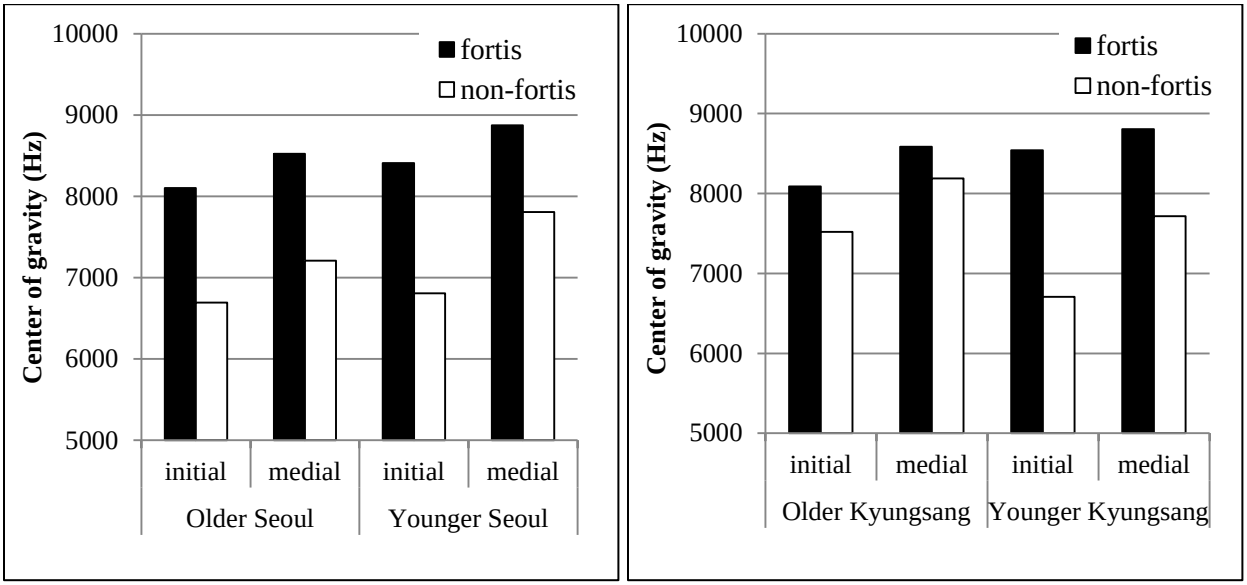

Figure 4. 3. Mean center of gravity (Hz) for Older and Younger groups between Seoul (left) and Kyungsang (right) Korean as a function of Fricative Type and Position-in-Word.

The previous finding for center of gravity was replicated (Yoon 1999; Cho et al. 2002; G. Lee 2011; Holliday 2012; Chang 2013), reporting higher centroid frequency values for the fortis /s'/ (Mean = 8492 Hz) than the non-fortis /s/ (Mean = 7331 Hz), suggesting a smaller front

cavity for the production of /s'/ than /s/. In addition, as indicated by the two-way interaction of Fricative Type by Position-in-Word, the difference in the center of gravity between the two fricatives is larger in word-initial position than word-medial position: across dialect and age groups, while the center of gravity difference between /s'/ and /s/ is 1353 Hz word-initially, it is 968 Hz word-medially.

Notably, the interaction effects including Dialect and Age factors require further discussion. First, the signficant Fricative Type by Age interaction indicates that the difference in center of gravity between the two fricatives was greater for younger speakers than older speakers; across Position-in-Word and Dialect while center of gravity for the fortis /s'/ is 922 Hz higher than the non-fortis /s/ for older speakers, this difference is 1399 Hz for younger speakers. Second, the signficant Fricative Type by Dialect interaction indicates that the difference in the center of gravity between the two fricatives was greater for Seoul speakers than Kyungang speakers; across Position-in-Word and Age while center of gravity for the fortis /s'/ is 972 Hz higher than for the non-fortis /s/ for Kyungsang speakers, this difference is 1349 Hz for Seoul speakers.

Importantly, the significant three-way interaction of Fricative Type by Age by Dialect motivates the use of separate three-way ANOVAs (Fricative Type by Position-in-Word by Age) for each dialect group to see which speaker group is the source of this interaction. Table 4. 5. summarizes the three-way ANOVAs conducted separately for Seoul and Kyungsang groups.

	Seoul (F (1, 17))	Kyungsang (F (1, 14))
Fricative Type	157.246***	33.011***
Position-in-Word	52.940***	30.187***
Age	$3.790^{n.s.(p=.068)}$	$0.471^{n.s.}$
Fricative Type by Position-in-Word	$3.413^{n.s.\ (p=.082)}$	$2.910^{n.s.}$
Fricative Type by Age	$0.014^{n.s.}$	8.367*
Position-in-Word by Age	$2.541^{n.s.}$	$0.058^{n.s.}$
Fricative Type by Position-in-Word by Age	$1.710^{n.s.}$	$1.169^{n.s.}$

Table 4. 5. Summary of separate ANOVAs for Seoul and Kyungsang goups on center of gravity; F-ratios are reported with statistical significance (n.s. = $p > 0.05$; * = $p < 0.05$; ** = $p < 0.01$; *** = $p < 0.0001$).

In Table 4. 5., the significant interaction of Fricative Type by Age for the Kyungsang group indicates that center of gravity as a fucntion of Fricative Type patterns differently between older and younger Kyungsang speakers; however, there was no such generational variaion for Seoul speakers. A closer observation of Figure 4. 3. shows that the center of gravity difference between /s'/ and /s/ is larger for the younger Kyungsang speakers than the older. Notably, younger Kyungsang speakers' center of gravity patterns are similar to those of the younger Seoul speakers. In fact, an independent samples t-test comparing the center of gravity between the two groups reported no group difference, suggesting a similar pattern of center of gravity between younger Kyungsang and Seoul speakers.

4. 3. 3. F0

A four-way repeated measures ANOVA (Fricative Type by Position-in-Word by Age by Dialect) reported significant main effects of Fricative Type (F (1, 30) = 6.019, p = 0.02) and

Position-in-Word (F (1, 30) = 40.975, $p < 0.01$), and Age (F (1, 30) = 87.889, $p < 0.01$), but there was no effect of Dialect (F (1, 30) = 0.060, $p = 0.808$) on F0 at the onset of the following vowel. Pairwise comparisons show that, across other factors, F0 is higher for the non-fortis /s/ than the fortis /s'/; it is higher in word-initial position than word-medial position; it is higher for younger than older speakers. The higher F0 values for younger speakers than older speakers were also observed in the previous Chapters 2 (vowels) and 3 (stop consonants) where the age effect on pitch was noted according to Benjamin (1981).

In addition to these main effects, there were significant two-way interaction effects of Position-in-Word by Dialect (F (1, 30) = 29.146, $p < 0.01$), Position-in-Word by Age (F (1, 30) = 5.178, $p = 0.03$), and Fricative Type by Position-in-Word (F (1, 30) = 4.265, $p = 0.048$). A summary of the results is shown in Table 4. 6. and Figure 4. 4.

		Word-initial		**Word-medial**	
		fortis /s'/	**non-fortis /s/**	**fortis /s'/**	**non-fortis /s/**
Seoul	Older	224 (21)	223 (24)	192 (12)	199 (21)
	Younger	280 (17)	286 (13)	225 (13)	242 (14)
Kyungsang	Older	197 (32)	203 (27)	195 (25)	208 (30)
	Younger	268 (24)	269 (22)	259 (24)	261 (26)

Table 4. 6. Mean F0 (Hz) at the onset of the following vowel for Older and Younger groups between Seoul and Kyungsang Korean as a function of Fricative Type and Position-in-Word (standard deviation in parentheses).

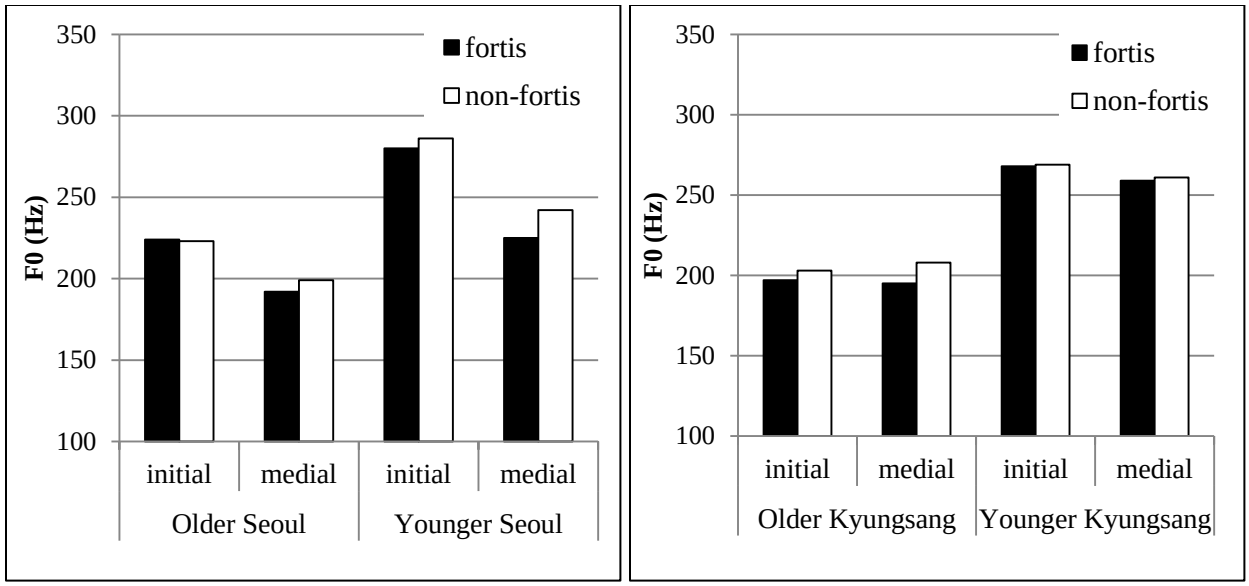

Figure 4. 4. Mean F0 (Hz) for Older and Younger groups between Seoul (left) and Kyungsang (right) Korean as a function of Fricative Type and Position-in-Word.

Regarding the interaction of Fricative Type by Position-in-Word, the higher F0 for the non-fortis /s/ becomes even higher in word-medial than word-initial position: across the age and dialect groups while F0 for the non-fortis /s/ is 3 Hz higher than that for the fortis /s'/ in word-initial position, F0 for /s/ is 10 Hz higher than that for /s'/ in word-medial position. Paired sample *t*-test reported the significant difference in F0 as a function of Fricative Type for word-medial fricatives (t (37) = 4.1, $p < 0.001$), but not for word-initial fricatives (t (35) = 0.895, p = 0.377). For the interaction of Position-in-Word by Dialect, the F0 difference between the two fricative positions in words is greater for the Seoul than Kyungsang group: across the two fricatives and age groups while F0 measured for the word-initial position is 38 Hz higher than that measured for the word-medial position in the Seoul group, F0 measured for the word-initial position is 3 Hz higher than that measured for the word-medial position in the Kyungsang group. For the interaction of Position-in-Word by Age, the F0 difference between the two positions in

words is greater for younger speakers than older speakers. Overall, as indicated in Figure 4. 4., younger Seoul speakers seem representative of the F0 effect in terms of showing 1) the largest F0 difference between the two fricative types, and 2) the maximized F0 difference in word-medial relative to word-initial position.

However, given the absence of any significant three-way and four-way interaction effects, it is concluded that although the two fricatives have different F0 values (F0: /s'/ < /s/) that interact with the position in words, the F0 patterns are not different across Seoul and Kyungsang and across Older and Younger groups.

4. 3. 4. H1-H2

A four-way repeated measures ANOVA (Fricative Type by Position-in-Word by Age by Dialect) reported a significant main effect of Fricative Type (F (1, 31) = 74.620, $p < 0.01$), but there were no main effects of Position-in-Word, Age and Dialect on H1-H2 at the onset of the following vowel. Pairwise comparisons show that, across other factors, H1-H2 is higher for the non-fortis /s/ than the fortis /s'/, indicating more a breathy phonation for /s/ than for /s'/.

There was a significant three-way interaction of Fricative Type by Position-in-Word by Age (F (1, 31) = 8.948, p = 0.005), and a non-significant interaction trend of Fricative Type by Age (F (1, 31) = 3.749, p = 0.062). A summary of the results is shown in Table 4. 7 and Figure 4. 5.

		Word-initial		Word-medial	
		fortis /s'/	**non-fortis /s/**	**fortis /s'/**	**non-fortis /s/**
Seoul	Older	-1.31 (4.0)	5.57 (2.8)	-0.66 (4.1)	4.90 (2.6)
	Younger	0.80 (3.0)	4.92 (4.1)	-2.14 (4.0)	7.34 (2.9)
Kyungsang	Older	-1.56 (11.5)	5.70 (3.7)	0.13 (1.7)	2.77 (1.9)
	Younger	-4.42 (7.3)	5.54 (2.9)	-5.12 (5.3)	6.56 (3.3)

Table 4. 7. Mean H1-H2 values (dB) at the onset of the following vowel for Older and Younger groups between Seoul and Kyungsang Korean as a function of Fricative Type and Position-in-Word (standard deviation in parentheses).

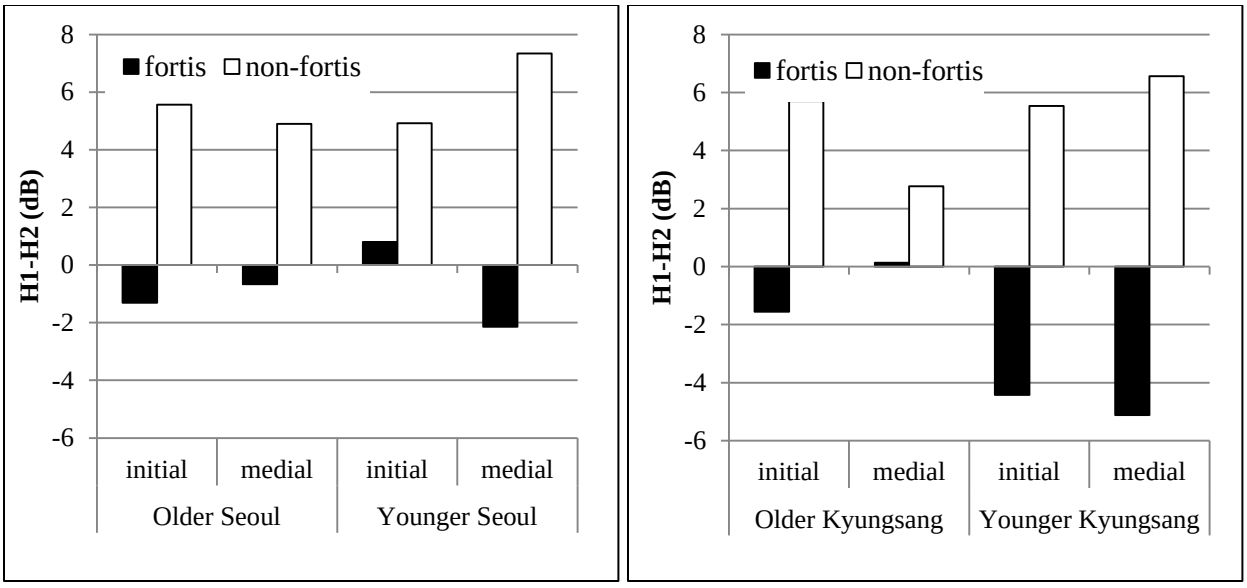

Figure 4. 5. Mean H1-H2 values (dB) for Older and Younger groups between Seoul (left) and Kyungsang (right) Korean as a function of Fricative Type and Position-in-Word.

Regarding the near-significant interaction of Fricative by Age, the difference in H1-H2 between the two fricatives was greater for younger speakers than older speakers; across Position-in-Word and Dialect while H1-H2 for the non-fortis /s/ is 5.6 dB higher than the fortis /s'/ for older speakers, that for /s/ is 8.8 dB higher than /s'/ for younger speakers. The interaction of Fricative Type by Position-in-Word by Age seems to be a random effect given the absence of a

main effect of Position-in-Word. Finally, the absence of interactions including Dialect and Age factors indicates that the H1-H2 patterns similarly across Seoul and Kyungsang and across Older and Younger groups.

4. 4. Summary of results

The current chapter examined acoustic characteristics of the voiceless alveolar fricatives across Seoul and Kyungsang Korean and across older and younger generations. For the two-way fricative distinction, the present study replicated previous findings, and reported several new findings related to generational variations.

Consistent with previous research, the fortis and non-fortis fricatives differed in their frication duration (/s/ < /s'/), center of gravity (/s/ < /s'/) and H1-H2 (/s/ > /s'/), and the direction of these acoustic difference was also consistent with previous reports. Regarding F0, this chapter also found non-distinct F0 for word-initial fricatives /s/ and /s'/, consistent with the previous report (Kenstowicz & Park 2006; G. Lee 2011; Holliday 2012; Chang 2013). Contrary to the F0 pattern in word-initial position, however, F0 for the non-fortis /s/ was 10 Hz higher than that for the fortis /s'/ in word-medial position. The different effect of F0 between word-initial and word-medial positions seems to be related to the different segmental environments.

Repeated measures ANOVAs reported dialectal and generational variations for frication duration and center of gravity, but not for F0 and H1-H2. Further separate ANOVAs for the Seoul and Kyungsang groups revealed that older Kyungsang speakers have different patterns of frication duration and center of gravity: the acoustic difference between /s'/ and /s/ in frication duration and center of gravity was always smaller for older Kyungsang speakers compared to younger Kyungsang speakers and the Seoul group. Aspiration duration also showed generational

variation; the aspiration proportion in the non-fortis fricative is 47% for older Seoul and 41% for younger Seoul speakers, and 31% for older and 50% for younger Kyungsang speakers.

4. 5. Discussion

The goal of the current chapter was to examine whether the fricative features in Kyungsang Korean are similar between older and younger speakers. Although the two-way fricative contrast is traditionally believed to be neutralized for Kyungsang Korean, several experimental studies suggested that the two fricatives are acoustically distinct for Kyungsang speakers. Accordingly, this chapter explored if the two fricatives are indeed acoustically distinct for Kyungsang Korean, and if the discrepancy between the traditional view and experimental findings is related to the age factor. Our finding that the two fricatives are acoustically less distinct for older Kyungsang speakers compared to younger Kyungsang and (younger and older) Seoul speakers suggests that the discrepancy is indeed due to the age variation in Kyungsang Korean. Therefore, the generational comparison in the present chapter suggests that sound change occurs for the two voiceless alveolar fricatives in Kyungsang Korean.

Discriminant function analysis confirms the age variation by quantifying the contribution of each predictor in classifying the fortis and non-fortis fricatives for older and younger Kyungsang speakers. Table 4. 8 summarizes the comparison of classification accuracy rates from discriminant analyses.

	Seoul		Kyungsang	
	Older	Younger	Older	Younger
Frication duration	84%	95%	66%	84%
Center of gravity	90%	90%	72%	90%
F0	47%	50%	50%	47%
H1-H2	90%	75%	77%	84%

Table 4. 8. Comparison of classification accuracy rates from discriminant analyses for frication duration, center of gravity, F0 and H1-H2 as a function of classifying the word-initial two-way fricative contrast.

Along with the ANOVA reports in Section 4. 3., Table 4. 8 indicates several noteworthy aspects regarding the contribution of each acoustic cue to the two-way fricative distinction across age and dialect groups. First, across speaker groups, frication duration, center of gravity and H1-H2 seem to be reliable predictors in distinguishing the fortis fricative from the non-fortis one, which is consistent with the reports from ANOVAs. However, although the result from ANOVAs indicated significantly higher F0 for the non-fortis /s/ than fortis /s'/, the lower classification accuracy of F0 relative to other acoustic parameters might indicate the unreliability of F0 as a cue to the fricative distinction. Second, the lower classification accuracy rates of frication duration and center of gravity for older Kyungsang speakers compared to those for other groups confirm that the two acoustic cues to the two-way fricative distinction are less effective for older Kyungsang speakers. Therefore, the following discussion focuses on the two acoustic parameters, namely aspiration/frication duration and center of gravity, for which age and dialectal variations were observed for Korean fricatives.

The durational measure can be discussed in terms of frication and aspiration duration. The present ANOVAs and discriminant analyses showed that the fortis and non-fortis fricatives are more distinct for younger than older Kyungsang speakers in terms of the frication duration. We also observed that the proportion of aspiration is significantly greater for younger Kyungsang speakers than older speakers: the aspiration proportion of the fricative is 31% and 50% for older and younger Kyungsang speakers, respectively. The smaller aspiration proportion for older speakers than for younger Kyungsang speakers suggests that the non-fortis fricative is less aspirated for older speakers than younger Kyungsang speakers.

Given the fact that the effect of aspiration is reflected in the center of gravity for Korean fricatives (G. Lee 2011), this notion of a less aspirated non-fortis /s/ for older Kyungsang speakers than younger speakers is also reflected in the measured center of gravity values between the two Kyungsang generations. G. Lee (2011) indicated that the center of the spectral energy shifts from a high to a low frequency range accompanying the onset of aspiration. In the current chapter, the mean center of gravity for the word-initial non-fortis /s/ is 7521 Hz and 6707 Hz for older and younger Kyungsang speakers, respectively (see Table 4. 4). Recall that 7521 Hz and 6707 Hz were obtained averged acorss center of gravity at three time windows (i.e., 25%, 50%, 75%). Given 31% and 50% of the aspiration proportion for the non-fortis /s/ between older and younger Kyungsang speakers, the center of gravity at 50% and 75% of time windows is less likely to include the aspiration portion for older speakers than for younger speakers. Accordingly, the higher center of gravity for older Kyungsang speakers might be due to the fact that older Kyungsang speakers' center of gravity was measured including less aspiration portion than younger speakers, which is in line with the smaller aspirated portion for the non-fortis /s/ for older speakers than for younger speakers.

Figure 4. 6 presents the mean center of gravity value measured at five window locations throughout the fricative (0%, 25%, 50%, 75%, 100%) for the word-initial /s'/ and /s/ across age and dialect groups. A four-way ANOVA including Window Location as a factor (Fricative Type by Window Location by Age by Dialect) was also conducted for the word-initial fricatives to see how the observed generational difference in Kyungsang Korean is related to the measurement location of center of gravity.

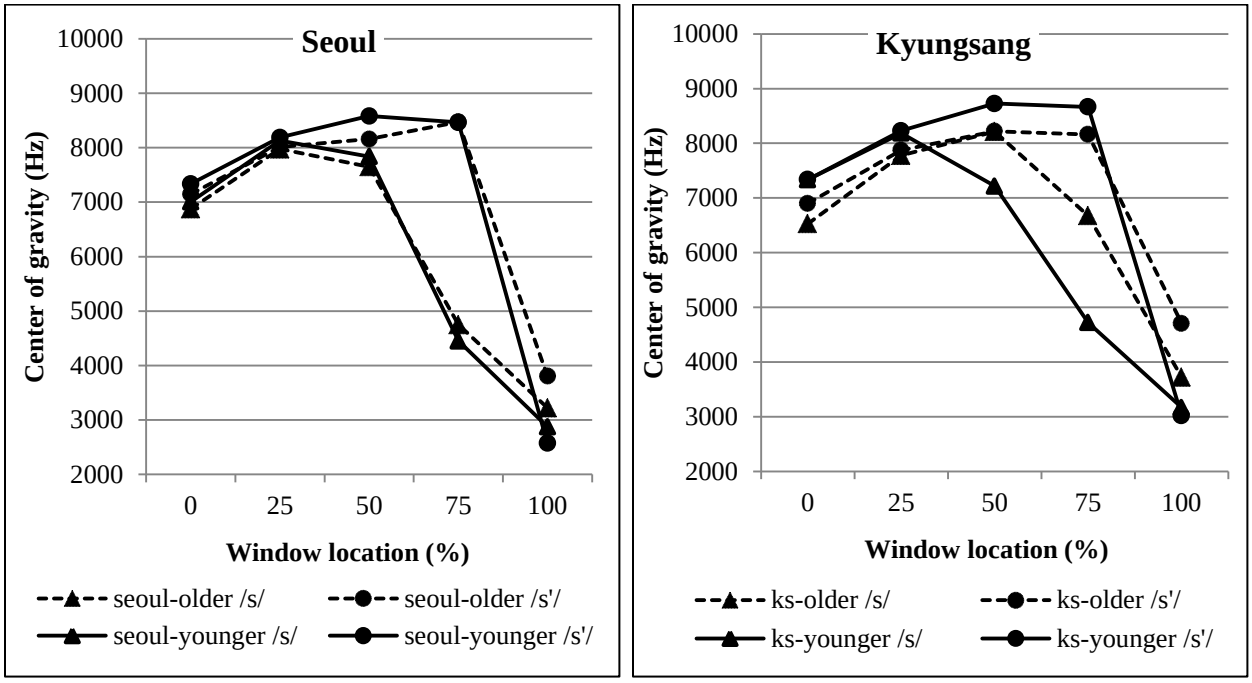

Figure 4. 6. Mean center of gravity (Hz) for word-initial /s'/ and /s/ for each window location for Older and Younger groups between Seoul and Kyungsang Korean.

Figure 4. 6 indicates similar patterns of center of gravity between the two generations of Seoul speakers across the five window locations. For Kyungsang Korean, on the other hand, the generational difference is mainly observed for 50% and 75% time points of fricatives: the center of gravity values at 50% and 75% for older Kyungsang speakers' non-fortis /s/ are not as low as those for younger Kyungsang speakers. Reports from ANOVAs confirmed this dialectal and

generational difference regarding Window Location, reporting the four-way interaction effect. Further ANOVAs testing the effect of Fricative Type, Window Location, and Age were conducted separately for each dialect group as summarized in Table 4. 9.

	Seoul (F (1, 18))	**Kyungsang (F (1, 15))**
Fricative Type	107.423***	23.221***
Window Location	242.552***	135.876***
Age	$0.102^{n.s.}$	$0.991^{n.s.}$
Fricative Type by Window Location	70.946***	17.198***
Fricative Type by Age	$0.093^{n.s.}$	$1.949^{n.s.}$
Window Location by Age	$2.822^{n.s.(p=.051)}$	5.501**
Fricative Type by Window Location by Age	$1.550^{n.s.}$	7.784***

Table 4. 9. Summary of separate ANOVAs for Seoul and Kyungsang goups on center of gravity measured for word-initial fricatives; F-ratios are reported with statistical significance (n.s. = $p > 0.05$; * = $p < 0.05$; ** = $p < 0.01$; *** = $p < 0.0001$).

In Table 4. 9., the significant interaction of Fricative Type by Window Location by Age for the Kyungsang group indicates that the observed age variation on center of gravity as a function of fricative distinction is related to Window Location. To sum up, the observation in Figure 4. 6. and reports from ANOVA indicate that the high centroid frequency at 50% and 75% time window is in line with the smaller proportion of aspiration for older Kyungsang speakers than younger speakers.

Overall, the present results suggest that the generational variation for Kyungsang's fricatives is primarily due to older Kyungsang speakers' absence of aspiration in the production of the non-fortis fricative. That is, the small distinction between the two fricatives for older Kyungsang speakers is because that their non-fortis fricative is closer to the fortis fricative,

whereas the clear distinction between the two fricatives for younger Kyungsang speakers might result from younger Kyungsang speakers' use of the aspiration feature to signal the non-fortis /s/. Notably, the lack of aspiration for the non-fortis /s/ among older Kyungsang speakers is opposite from the traditional view on Kyungsang's fricatives that the fortis /s'/ is realized as the non-fortis /s/. The present finding, opposite from the traditional view, is in line with Holliday (2012) who suggested that the fricative feature in Kyungsang Korean tends to be closer to the fortis /s'/ rather than the non-fortis /s/. However, while Holliday (2012) observed this lack of aspiration for the non-fortis /s/ for younger Kyungsang speakers, the current study observed it for older Kyungsang speakers. We saw that the younger Kyungsang speakers express the aspiration for the non-fortis /s/ similarly to Seoul Korean speakers. It seems difficult to explain why Holliday (2012) and the present results show an inconsistent pattern across the two generations of Kyungsang speakers. It may be due to the different geographical background of Kyungsang participants between the two studies (Holliday (2012) examined North Kyungsang, whereas the current study examined South Kyungsang).

Another noteworthy aspect of the discriminant analysis reports is the somewhat high predictability of each predictor for older Kyungsang speakers' fricative distinction. Recall that traditional view is that the two fricatives are neutralized in Kyungsang Korean (Sohn 1999, Lee & Ramsey 2011). However, given the classification accuracy rates for the frication duration (66%), center of gravity (72%) and H1-H2 (77%) predictors in Table 4. 7, it seems hard to argue that the two fricatives are perfectly neutralized among older Kyungsang speakers. Instead, the fricatives are merely less distinct compared to those of other groups. The incompletely neutralized fricatives for older Kyungsang speakers prompt the following questions regarding individual variation: 1) do all the older Kyungsang participants in the present chapter show less

distinct acoustic patterns for the two fricatives, contrary to the traditional view about the neutralized fricative in Kyungsang Korean; 2) do some older speakers have distinct acoustic patterns for the two fricatives, but others do not, suggesting that the smaller acoustic distinction observed in the present data is due to speaker variation.

To address this issue, Figures 4. 7 and 4. 8 present the difference in center of gravity, frication duration and H1-H2 between the two word-initial fricatives for each of the older and younger Kyungsang speakers. Since the fortis /s'/ has a higher center of gravity and longer frication duration than the non-fortis /s/ in Seoul Korean, one could reasonably expect positive values for the difference of these acoustic cues between /s'/ – /s/; negative values are expected for the H1-H2 difference between /s'/ – /s/ because H1-H2 is negative or smaller for /s'/ than /s/. For the older speakers, the highest level of schooling is also marked for each individual to examine the correlation between their education levels and their fricative distinction.

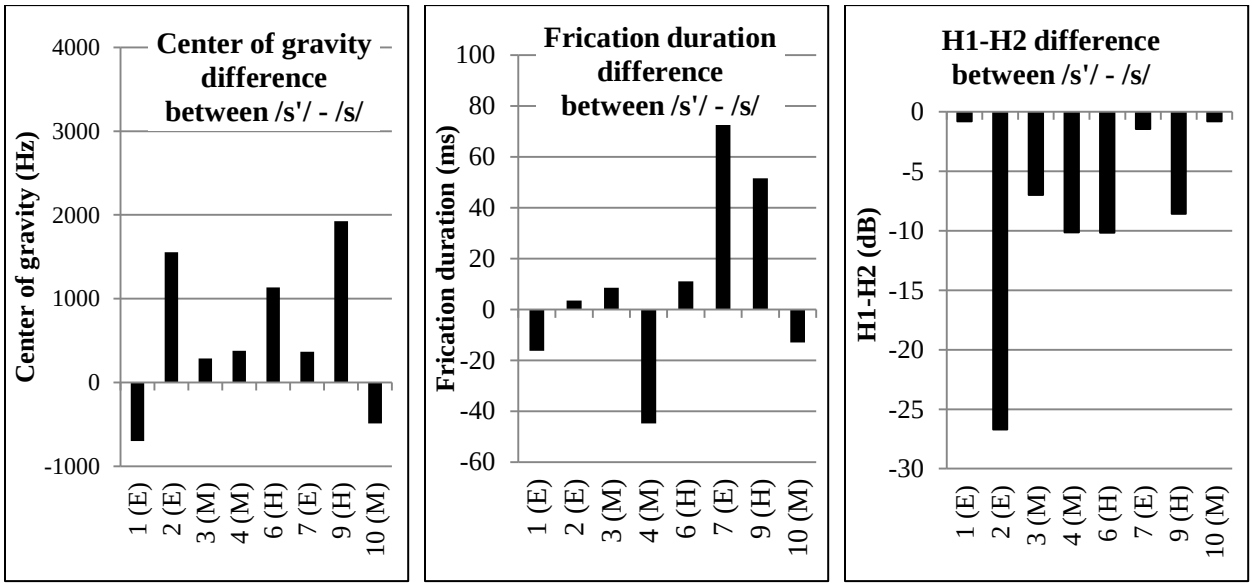

Figure 4. 7. Difference in center of gravity (left), frication duration (middle), and H1-H2 (right) between word-initial /s'/ and /s/ for each of eight older Kyungsang speakers. Two speakers (kso#5, kso#8) were excluded due to glottalized tokens. Highest level of schooling for each individual is indicated in parentheses (E = elementary school, M = middle school, H = high school).

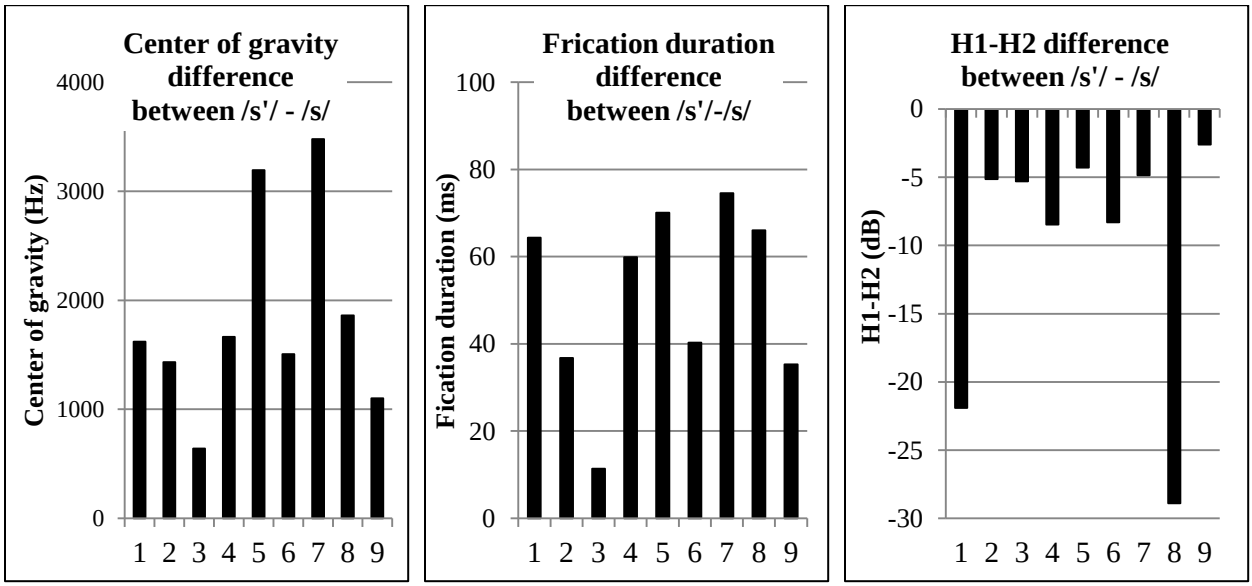

Figure 4. 8. Difference in center of gravity (left), frication duration (middle), and H1-H2 (right) between word-initial /s'/ and /s/ for each of nine younger Kyungsang speakers. One speaker (ksy#10) was excluded due to glottalized tokens. The highest level of schooling is high school graduation for all younger Kyungsang participants.

Comparison between Figures 4. 7 and 4. 8 shows that the younger Kyungsang speakers generally distinguish the fricatives more than the older speakers. Specifically, the difference of center in gravity and frication duration for /s'/ – /s/ is positive across all younger speakers. On the other hand, the acoustic difference for /s'/ – /s/ varies across older Kyungsang speakers: some older Kyungsang speakers (kso#1, kso#4, kso#10) show negative values; some shows small acoustic differences (kso#3); others (kso#9) show a reliable difference for /s'/ – /s/. This suggests that while the two fricatives are properly distinguished across all the younger Kyungsang participants, they are not across the older speakers. Particularly, the negative values of the acoustic parameters for kso#1, kso#4 and kso#10 indicate that the fortis /s'/ tends to be

realized as the non-fortis /s/ by some older speakers. This observation is consistent with the traditional view that the fortis /s'/ is realized as the non-fortis /s/ for Kyungsang speakers. Overall, although the acoustic cues to distinguish /s'/ from /s/ are generally less effective for older Kyungsang speakers than for younger speakers, some older speakers (kso#9) are able to distinguish the two fricatives to a similar extent as younger Kyungsang speakers. Therefore, it might be said that the sound change for the two-way fricative distinction is observed not only for younger Kyungsang speakers, but also for some of the older Kyungsang speakers.

Regarding the speaker variation by education levels, it seems hard to argue that more educated older Kyungsang speakers are better at distinguishing one fricative from the other. This is because of the cases where a less educated speaker (e.g., kso#2) makes a greater distinction than a more educated speaker (e.g., kso#6). Among the eight older Kyungsang speakers, kso#2 (E), kso#6 (H) and kso#9 (H) showed reliable center of gravity differences for /s'/ – /s/; kso#7 (E) and kso#9 (H) showed reliable durational differences between /s'/ – /s/; kso#2 (E), kso#3 (M), kso#4 (M), kso#6 (H) and kso#9 (H) showed reliable H1-H2 differences between /s'/ – /s/.

Finally, in addition to the age variation in Kyungsang's fricatives, it is also noted that older and younger Seoul speakers have different aspiration proportions: the aspiration proportion of the non-fortis fricative is 47% and 41% for older and younger Seoul speakers, respectively, indicating greater aspiration proportion for older Seoul speakers than younger speakers. This tendency of a generational difference in aspiration duration for Seoul Korean might be in line with the diachronic change in VOT between the lenis and aspirated stops (See Chapter 3) in which VOT for the aspirated stop has decreased over serveal decades. In other words, the tendency of reduced aspiration for the non-fortis /s/ among the younger Seoul speakers might

indicate that the diachronic change in VOT (or aspiration) is not limited to the Korean stop, but rather it is a common phenomenon occuring across Korean obstruents. A further investigation that tests the reduced aspiration for the three-way laryngeal contrast among voiceless affricates will allow us to test this hypothesis regarding the diachronic change in Korean obstruents.

4. 6. Conclusion

The current chapter examined whether the non-distinct fricative of Kyungsang Korean is maintained by both younger and older speakers, and whether the fricatives of Kyungsang Korean are changing to become similar to those of Seoul Korean. We examined how the frication/aspiration duration, center of gravity, H1-H2 and F0 cues to the two-way fricative distinction differed across older and younger speakers and across Seoul and Kyungsang dialects. The present results showed that while the fricative contrast is expressed similarly by younger Kyungsang speakers and younger and older Seoul speakers, it is not for older Kyungsang speakers. Through establishing the generational variation in Kyungsang's fricatives, the current chapter not only concludes that the fricatives are undergoing a sound change, but also clarifies the inconsistent reports across previous studies about whether or not Kyungsang Korean has one or two fricatives.

CHAPTER 5

DIACHRONIC SOUND CHANGE IN LEXICAL PITCHACCENTS OF KYUNGSANG KOREAN: GENERATIONAL CHANGE IN PHONETIC PROPERTIES

5. 1. Introduction

The prosody of Kyungsang Korean is different from that of Seoul Korean; the presence of a pitch accent is lexically determined at the word level in Kyungsang Korean, while the accent pattern of Seoul Korean is prosodically determined at the phrase level. An example (1) shows three words of Kyungsang Korean, which are segmentally homonyms, but lexically distinct by a different placement of High pitch within the word.

(1)

Kyungsang	kái HL 'type'	kácí HH 'branch'	kací LH 'eggplant'
Seoul	kaci 'type', 'branch' or 'eggplant'		

The lexical pitch accents of Kyungsang Korean have been well documented regarding its phonetic characteristics as well as phonology by a number of researchers (e.g., Ramsey 1975; Kenstowicz & Sohn 1997; Kenstowicz & Park 2006; Chang 2007; H. Lee 2008; Schuh & Kim 2006; Kim & Jun 2009; D. Lee 2009). However, the increased interaction with non-lexical pitch accent Seoul Korean raises the question whether the lexical pitch accent properties of Kyungsang Korean is maintained by the younger Kyungsang generation as well as the older generation. Therefore, the current chapter examines age variation in the phonetic properties of lexical pitch accent, and provides empirical evidence for sound change in lexical pitch accents of Kyungsang Korean. In addition, the comparison of accent structure between Kyungsang and Seoul Korean

tests whether the accent properties of contemporary Kyungsang Korean is becoming similar to that of non-lexical pitch accent Seoul Korean.

5. 1. 1. Background

5. 1. 1. 1. Lexical pitch accent in Kyungsang Korean

South Kyungsang Korean has HL, HH and LH accent classes in disyllabic words, and a High (H) and Rising (R) accent contrast in monosyllabic words. Unlike a tone language such as Mandarin Chinese in which each syllable carries its own tone, only one prominence of high pitch within a word is allowed in Kyungsang Korean. For example, the disyllabic HL pitch class is described as a High tone on the first syllable, and a Low tone on the second syllable. For the disyllabic HL pitch class, once the pitch prominence occurs on the first syllable, no high pitch is allowed again. Likewise, the disyllabic HH pitch class is described as High tones on the first two syllables, that is, the pitch prominence occurs on the first two consecutive syllables.

Previous research (e.g., Ramsey 1975; Schuh & Kim 2007; S.-E. Chang 2007) noted that a phonological word consisting of less than three syllables should be expanded with suffixes in order to determine the underlying tonal class. Specifically, adding suffixes reveals that there are two kinds of H(igh) tones and two kinds of LH tones, indicating that the neutralized tones in word isolation actually belong to different underlying tone classes. Regarding the monosyllabic High pitch class, for example, although both *nwún* 'eye' and *mún* 'door' have a High tone in isolation, when the suffix *–i* (nominative case marker) is added, the pitch pattern for 'eye' is *nwún-í*(H-H), while the pitch pattern for 'door' is *mún-ì* (H-L). Similarly, disyllabic words *sàlám* 'person' and *pàlám* 'wind', both of which have LH, also show similar variations in tonal pattern when suffixed: when the suffix *-i* is added, 'person' patterns as *sàlám-í* (LH-H), while 'wind' patterns as *pàlám-ì* (LH-L). Therefore, monosyllabic words in South Kyungsang Korean are

classified into three underlying tone classes, and disyllabic words are classified into four underlying tone classes. Previous research (e.g., Schuh & Kim 2007) has proposed underlying representations to capture the pitch accent system of nouns in South Kyungsang Korean. In this chapter, however, I would like to categorize the neutralized H and LH tones simply as H1-H2 and LH1-LH2, respectively, before providing a phonological analysis in the next chapter of this dissertation.

In the literature, accent or tone distinctions have been explored in two acoustic dimensions, namely the vertical and horizontal dimensions of fundamental frequency (F0); the vertical dimension is F0 pitch values, and the horizontal dimension indicates timing of F0 (turning point duration) (e.g., Bruce 1977; Xu 1993; Prieto et al. 1995; Arvaniti et al. 1998). For example, Bruce (1977) investigated two accent types (i.e., acute and grave) in Swedish, and noted that "*reaching a certain pitch level at a particular point in time is the important thing*" (p. 132), proposing the importance of spectral and temporal F0 properties. That is, the two contrastive accents are distinguished in terms of i) how high the pitch value is (vertical dimension of F0), and ii) where the high peak is located (horizontal dimension of F0).

These two acoustic dimensions have been used to describe the lexical pitch accent in Kyungsang Korean. H.-S. Lee (2008) investigated the phonetic realizations of HL, HH and LH pitch accents of disyllabic words in North Kyungsang Korean, considering how various phonetic factors such as vowel height, vowel length[15], and speaking rates affect the phonetic properties of lexical accents in North Kyungsang Korean. H.-S. Lee (2008) examined temporal and spectral F0 properties for words differing in their underlying tones. The temporal distance from the onset of a target word to the maximum F0 point was defined as the timing of maximum F0, and the

[15] North Kyungsang Korean has a vowel length contrast (e.g., mál 'horse' vs. má:l 'speech')

distance from the onset of a target word to pre-accentual F0 minimum point was measured for the timing of minimum F0. H.-S. Lee (2008) found that the temporal F0 properties varied with segment duration, and the F0 maximum-minimum values varied depending on vowel height or onset consonants. More importantly, H.-S. Lee (2008) showed that HL, HH and LH tonal patterns are well distinguished using the distinct temporal distance and F0 maximum-minimum values across the three underlying accent classes. Regarding the timing of F0 properties, H.-S. Lee (2008) reported that the timing of F0 maximum is shortest for HL, intermediate for HH and longest for LH, but the timing of F0 maximum for HH overlaps with that of HL and LH. Figure 5. 1 presents a graphical illustration of the findings in H.-S. Lee (2008). The target words in H.-S. Lee (2008) were preceded by a quotation suffix /-*ila*/ or /-*lako*/ that was altered by the structure of the preceding syllable (i.e., /-*ila*/ after a word with a coda, /-*lako*/ after a word without a coda), and, accordingly, the C3 and V3 in Figure 5. 1 indicate the consonant and vowel of the suffix.

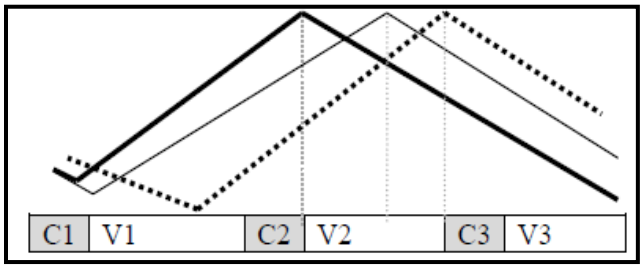

Figure 5. 1. Schematic pitch contours for disyllabic words in HL (thick solid), HH (thin solid) and LH (dotted) classes reported by Lee (2008: 49)

For the location of an H peak, it is noteworthy that H.-S. Lee (2008) reported that the F0 peak is anchored to the onset of the first post-accentual vowel for HL (onset of V2), to the onset of the first post-accentual syllable consonant (onset of C3) for LH, and to the middle of the

second vowel (V2) for HH. That is, although the tonal description places a High tone on the first syllable for HL, the finding in H.-S. Lee (2008) indicates the High tone on the second syllable. This will be further discussed in the discussion section related to age variation observed in the present data (Section 5. 4). As for the timing of the F0 minimum, H.-S. Lee (2008) reported that the F0 minimum point is reached later for LH than HL and HH.

H.-S. Lee (2008) also examined F0 maximum and minimum values across HL, HH and LH pitch classes; while the F0 minimum value is lower for LH than the other two accent classes, the F0 maximum value is not significantly different across HL, HH and LH. This finding in H.-S. Lee (2008) is inconsistent with what Kenstowicz and Park (2006) reported.

Kenstowicz and Park (2006) examined the effect of laryngeal contrast on F0 of the following vowel in Kyungsang Korean. As part of their study, Kenstowicz and Park (2006) reported F0 values for the High peaks of HL, HH and LH tonal categories. Unlike the non-significant difference in the F0 peak (maximum) values for the three pitch classes in H.-S. Lee (2008), Kenstowicz and Park (2006) showed that F0 peak values are consistently different across HL, HH, and LH, being highest for HL, intermediate for HH and lowest for LH in Kyungsang Korean. Kenstowicz and Park (2006) mentioned that the higher peak value for HL than HH is also observed cross-linguistically. Kenstowicz and Park (2006) explained that a Low tone boosts a preceding High tone compared to a High tone in HH; the Low tone before the High tone in LH triggers downstep in High tones as in many African languages.

Chang (2007) has explored the spectral and temporal F0 properties for H1, H2[16] and Rising accent classes of monosyllabic words in South Kyungsang Korean, primarily focusing on clarifying inconsistent tonal descriptions among studies. In her production study, Chang (2007)

[16] Chang (2007) categorized and analyzed H2 as M-class (Middle tone).

also measured F0 minimum-maximum values, timing of F0 (F0 peak and fall delay), and syllable duration for words in isolation and words with suffixes. Chang (2007) compared these acoustic properties between Rising and H2, and between H1 and H2. Chang (2007) noted that the H2 class is distinct from Rising and H1 in its acoustic properties, and suggested that the tonal description should reflect the phonetic difference across tonal patterns.

First, regarding Rising and H2 comparison, Chang (2007) reported that both the timing of the F0 peak (from first syllable onset to F0 peak onset) and F0 fall (from first syllable onset to F0 peak offset) came later for words of the Rising accent class than words of the H2 class for both unsuffixed and suffixed words. In addition, the syllable duration is longer for Rising class than H2 class words. As for the low and peak F0 values, Chang (2007) showed that while peak F0 was not significantly different between Rising and H2 class words, low F0 values were lower for Rising class words than H2 class words. Figure 5. 2 shows a graphic illustration of the reports in Chang (2007).

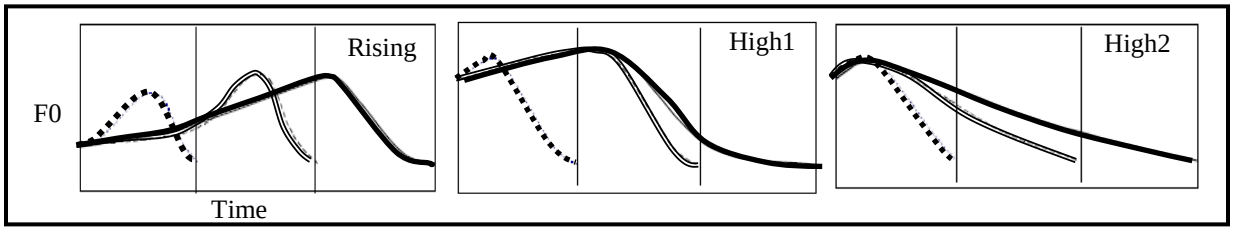

Figure 5. 2. Schematic pitch contours for monosyllabic words in Rising, H1and H2 classes: unsuffixed-dotted line, monosyllabic suffix-twofold line and disyllabic suffix-solid line. The vertical lines indicate syllable boundaries. Adopted from Chang (2007: 28, 87)

Second, for the H1 and H2 comparison, Chang (2007) reported that the timing differences of F0 peak and fall between H1 and H2 accent classes were significant only for suffixed words. For suffixed words, Chang (2007) noted that the timing of F0 peak and fall was

greater for H1 than H2 class words. That is, the F0 peak point occurs later for H1 class than H2 class words. For words in isolation, however, the timing of F0 was not different for H1 and H2 classes. The difference between unsuffixed and suffixed words was due to the fact that while F0 peak in H1 class is spread to the next syllable (suffix), the F0 peak in H2 class is not spread to the next. This difference of the spreading feature in H1 and H2 accent classes was also reflected as longer peak plateau for H1 accent words than H2 words. As for the peak F0 value among unsuffixed words, Chang (2007) showed that peak F0 is slightly higher for H1 class words than H2 class words. Based on the results, Chang (2007) suggested that the tonal description should reflect the phonetic difference, and needed to be revised.

To summarize, the presence of a pitch accent is lexically determined in South Kyungsang Korean. In South Kyungsang Korean, the tonal patterns of disyllabic words are HH, HL and LH, and those of monosyllabic words are H and Rising in isolation. Importantly, suffixation may also bear contrastive accents, revealing that there are three accent classes for monosyllabic nouns (H1, R, and H2) and four accent classes for disyllabic nouns (HL, HH, LH1, LH2). Phonetically, the contrastive accents in South Kyungsang Korean can be characterized in terms of the spectral properties of F0 (F0 maximum-minimum values (Hz)) and the temporal properties of F0 (F0 maximum-minimum duration (ms)).

5. 1. 1. 2. Prosody of Seoul Korean

Jun (1993, 1998) has investigated the phonetics and phonology of Seoul Korean prosody. Jun (1993, 1998) suggested that surface phonetic forms of an utterance can be used to define prosodic units at different levels, and she proposed a prosodic hierarchy of Seoul Korean based on phonetic patterns. Jun (1993, 1998) proposed the accentual phrase (AP) as the smallest unit, which establishes a tonal boundary in Seoul Korean. Jun (1993, 1998) showed that every AP has

a phrase-final rising pattern (LH), which characterizes the prosody of Seoul Korean. Jun (1993, 1998) proposed that the underlying tonal pattern of the AP in Seoul Korean is LHLH or HHLH, and the alternative patterns between LHLH and HHLH are determined by the phrase-initial segment; when the segment has [+stiff vocal cords] with aspirated or tense consonants and fricatives[17], the phrase starts with a H(HLH), but otherwise with a L(HLH). While each tone of LHLH (or HHLH) is realized when an AP has more than four syllables, some of the tones are undershot when there are less than four syllables. According to Jun (1998), an AP consisting of one or two syllables has the phrase-final rising LH pattern (or HH for [+stiff vocal cords] phrase-initial segment); an AP with three syllables has either LLH (or HLH) or LHH (or HHH) depending on which syllable is undershot.

To sum up, while the presence of a pitch accent is lexically determined in South Kyungsang Korean, the accent pattern of Seoul Korean is prosodically determined at an accentual phrase. Accordingly, while tonal pattern varies with the tone class of words for Kyungsang Korean, the underlying accent patterns of Seoul Korean are either LHLH (or HHLH) with phrase-final High tone (H%) or LH for APs with one or two syllables.

[17] Jun (1993) noted the obstruent [s] regarding its ambiguous categorization. In phonology, [s] can be categorized as either lenis or aspirated based on the consistent pattern with the Post Obstruent Tensing rule (= lenis) and the absence of voicing in intervocalic position (= aspirated). However, Jun (1993) proposed the aspirated obstruent categorization for /s/ rather than lenis based on 1) an glottal width observation in Kagaya (1974) indicating [+spread glottis] feature and 2) consistent HHL prosodic pattern between initial [s] and other aspirated obstruents (e.g., [t^h]).

5. 1. 2. Goals

The goal of this chapter is to determine whether sound change occurs in the lexical pitch accent of South Kyungsang Korean by testing the phonetic homogeneity of contrastive accents between older and younger generations of Kyungsang. The primary focus of this chapter is to test whether spectral and temporal properties of F0 characterizing the contrastive accents of South Kyungsang Korean are maintained consistently by both older and younger speakers. To address this, the current chapter examines*F0 minimum-maximum values* (spectral properties of F0) and *F0 minimum-maximum duration* (temporal properties of F0). In addition, through the comparison with Seoul Korean, it is tested whether the accent properties or prosodic structure of South Kyungsang Korean becomes similar to that of non-lexical pitch accent Seoul Korean. The following questions and hypotheses are tested in the current chapter.

(1) Do younger Kyungsang speakers show consistent patterns of *F0 minimum-maximum values* with Older Kyungsang speakers for accent classes of disyllabic and monosyllabic words? For example, do the two generations of Kyungsang speakers share the 'LH < HH < HL' pattern for the *F0 maximum value* as reported in Kenstowicz and Park (2006)?

(1-1) If the two generations of Kyungsang Korean speakers show the same pattern of *F0 minimum-maximum values*, is the degree of F0 differences across accent classes similar between older and younger generations of Kyungsang? For example, do younger Kyungsang speakers show a comparable difference in the *F0 maximum value* with older Kyungsang speakers to distinguish HL from HH?

(2) Do younger Kyungsang speakers show consistent patterns of *F0 minimum-maximum duration* with Older Kyungsang speakers for accents classes of disyllabic and monosyllabic

words? For example, H-.S. Lee (2008) showed the pattern of 'HL < HH < LH' for the *F0 maximum duration*. The research question in (2) asks whether the two generations of Kyungsang Korean speakers share the same pattern of the *F0 minimum-maximum duration* across accent classes of disyllabic and monosyllabic words.

(2-1) If the *F0 minimum-maximum duration* shows a consistent pattern between the two generations of Kyungsang speakers, is the degree of duration differences across accent classes similar between older and younger generations of Kyungsang? For example, do younger Kyungsang speakers show a comparable difference in *F0 maximum duration* with older Kyungsang speakers to distinguish HL from HH?

(3) If the spectral and temporal properties of F0 for the lexical accent are different between younger and older Kyungsang speakers, do younger speakers have prosodic properties similar to Seoul Korean in terms of spectral and temporal F0?

5. 2. Methodology

5. 2. 1. Participants

The same forty female speakers in the previous chapters also served as participants for the lexical pitch study.

5. 2. 2. Procedure

The data collection procedure for this lexical pitch accent study is the same as for the acoustic study of segments.

5. 2. 3. Speech materials

In the acoustic study of lexical pitch, monosyllabic and disyllabic words that differ in their underlying pitch classes were recorded. Two words were selected from each of the

disyllabic and monosyllabic underlying pitch classes. As mentioned earlier, the neutralized surface monosyllabic H or disyllabic LH tones actually belong to two different underlying tones. In this chapter, the different underlying tone classes were considered by dividing the neutralized H and LH tones into H1-H2 and LH1-LH2, respectively. Therefore, word stimuli were selected according to the three underlying pitch classes for monosyllabic words (H1, H2 and Rising), and the four underlying pitch classes for disyllabic words (HH, HL, LH1 and LH2).

Since the present study compares the prosodic structure of lexical items across the two dialects of Korean, all stimuli were categorized according to tonal Kyungsang Korean rather than non-tonal Seoul Korean. Therefore, each stimulus was treated equally between the two dialects for the measurements and analyses, that is, as if the stimulus has the same tonal pattern. For example, the stimulus *móle* 'n. sand', which belongs to the HL accent class in Kyungsang Korean, is also treated as HL for Seoul Korean.

For word stimuli, phonetic factors that might affect spectral and temporal F0 properties were controlled as much as possible. Specifically, the word stimuli were mostly sonorant, and tense or aspirated consonants and fricatives were avoided. For example, all vowels and consonants for the monosyllabic word stems are sonorant, and onset consonants are mostly sonorant or lenis stops, and coda consonants are all sonorant for the disyllabic word stems. In addition to the segmental environments, syllable structure was controlled: CVC and CV.CV structures for all monosyllabic and disyllabic words, respectively. The word lists for the lexical pitch accent study are presented in Table 5. 1 for monosyllabic words and in Table 5. 2 for disyllabic words.

Rising		High1		High2	
mal	‘speech’	mul	‘water’	mal	‘horse’
nwun	‘snow’	nwun	‘eye’	mun	‘door’

Table 5. 1. Stimuli for pitch accent study in monosyllabic words

HH		HL		LH1		LH2	
moki	‘mosquito’	meli	‘head’	papo	‘fool’	tali	‘bridge’
mole	‘the day after tomorrow’	mole	‘sand’	popay	‘treasure’	namu	‘tree’

Table 5. 2. Stimuli for pitch accent study in disyllabic words

For the phonetic study of lexical pitch, only word stems were recorded without a suffix. Speakers produced each target word embedded in a sentential frame [*ije* ____ *-chota* ‘Now, (I) like _____’] with two repetitions. In order to help the subjects to distinguish the segmental homonyms such as *măl* (Rising) ‘speech’ and *mál* (High) ‘horse’, a corresponding picture was provided next to each stimulus. In total, 1120 tokens were obtained for the phonetic study of lexical pitch: 480 tokens for the monosyllabic words (2 words × 3 underlying accent classes × 2 repetitions × 40 speakers) and 640 tokens for the disyllabic words (2 words × 4 underlying accent classes × 2 repetitions × 40 speakers).

5. 2. 4. Measurements

For the phonetic observation of lexical pitch, spectral (Hz) and temporal (ms) properties of F0 were examined for the disyllabic words of the four accent classes, and for the monosyllabic words of the three accent classes. Measurements included *1) Local, 2) F0 minimum value, 3) F0*

maximum value, 4) F0 minimum duration, and *5) F0 maximum duration*. The measurement criteria and examples of the measurements are presented below.

First, after annotating a target word (= 1st tier in Figure 5. 3), *Local* was defined as the interval from the onset of the first vowel to the offset of the target word, which includes V.CV for disyllabic words and VC for monosyllabic words. The marked intervals on the second tiers in Figure 5. 3 indicate *Local*.

Then, *F0 maximum value* was measured at the point of the highest F0 within *Local* (solid arrows in Figure 5. 3), and pre-accentual *F0 minimum value* was measured at the point of the lowest F0 occurring before the *F0 maximum* point (dotted arrows in Figure 5. 3). The points of the *F0 minimum-maximum values* were annotated as 'F0 Max. duration' (3rd tier in Figure 5. 3) and 'F0 Min. duration' (4th tier in Figure 5. 3). *F0 minimum-maximum values* (Hz) were measured using "Move cursor to minimum/maximum pitch" function in Praat.

The temporal distance of the *F0 minimum-maximum* was also measured. The *F0 maximum duration* was measured from *Local* onset to the point of the *F0 maximum value* within *Local*. The *F0 minimum duration* was measured from *Local* onset to the point of the *F0 minimum value* within *Local*. That is, the marked intervals in the third tiers in Figure 5. 3 indicate the *F0 maximum duration,* and the marked intervals in the fourth tiers indicate the *F0 minimum duration*[18]. *F0 minimum-maximum duration* was first measured in milliseconds, and then converted into a ratio. For example, the ratio of *F0 maximum duration* was obtained by dividing *F0 maximum duration* by *Local* duration, expressing the point where F0 maximum occurs as a percentage of the *Local* duration.

[18] Note that the *F0 minimum duration* of the word *meli* (HL) 'head' is not visible in the 4th tier of Figure 5. 3 because the *F0 minimum value* occurs closely at the onset of *Local*.

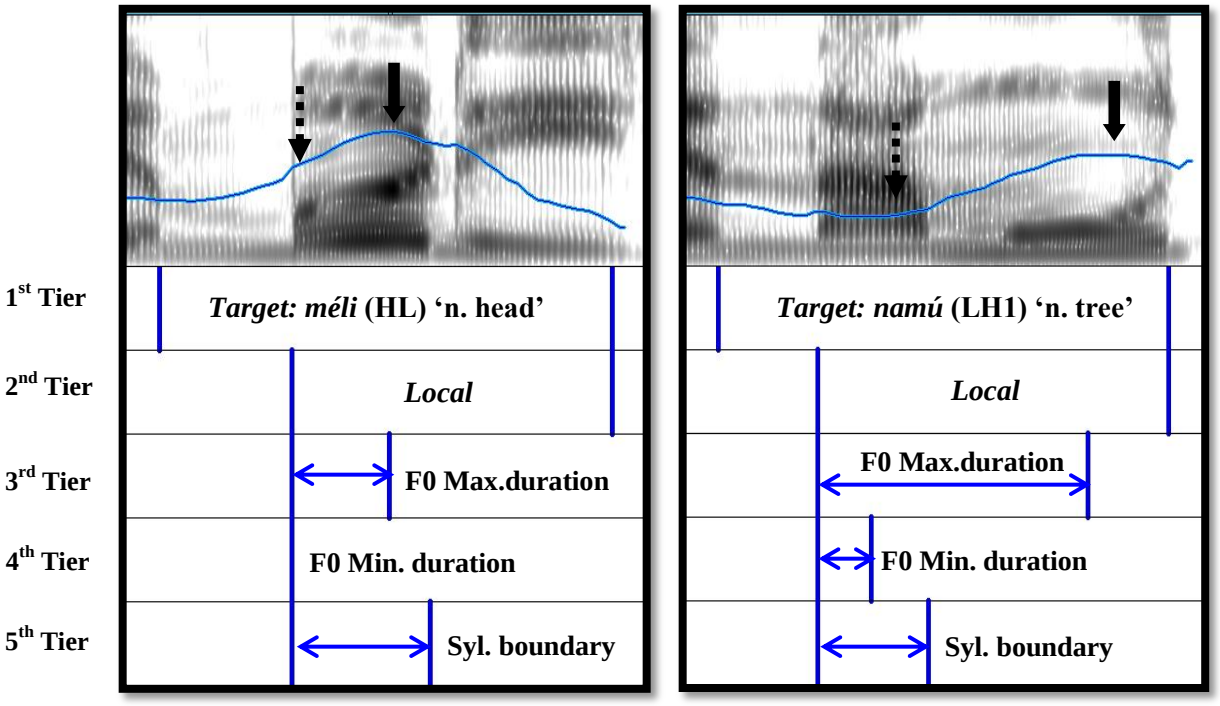

Figure 5. 3. Example of measurements in the phonetic study of lexical pitch for disyllabic words *méli* (HL) 'n. head' vs. *namú* (LH1) 'n. tree'.

Onset and offset F0 values of *Local* were measured in order to compare schematized pitch contours of the accented region between Kyungsang and Seoul, and between older and younger generations. Finally, syllable boundaries are marked at the offset of the first vowel for disyllabic word stimuli, annotated as 'Syl. boundary' (5th tier in Figure 5. 3).

5. 2. 5. Data analysis

For each subject, measurements were averaged across two repetitions and two word stimuli within an accent class. All the data were evaluated based on repeated measures General Linear Model (GLM) Analyses of Variance (ANOVAs). Repeated measures ANOVAs were

conducted for each of the four dependent variables: *1) F0 minimum value, 2) F0 maximum value, 3) F0 minimum duration,* and *4) F0 maximum duration.*

Three-way ANOVAs included a within-subjects factor of Accent Class, and between-subjects factors of Dialect (Kyungsang, Seoul) and Age (Older, Younger). After conducting Mauchly's test of sphericity, Huyhn-Feldt corrected degrees of freedom were used to report *F*-ratio and *p*-value for those cases when the sphericity assumption was violated. In reporting the results of repeated measured ANOVAs, *p*-values less than 0.05 were considered significant. In order to further analyze the observed data, pairwise comparisons were presented when a significant main effect was obtained; for the Accent Class factor with more than three levels, Bonferroni adjustment was used for the multiple comparisons.

Along with interaction effects among factors that indicate Age and Dialect variations, the current chapter tested the effect of the Accent Class factor within each Age and Dialect group with one-way ANOVAs. By analyzing the Accent Class factor within each Dialect and Age group, the current chapter intends to provide detailed descriptions of how different the accent structure is between Seoul and Kyungsang Korean, and of the source of age variation.

The statistical evaluation was made separately for disyllabic and monosyllabic words due to the different number of levels of the Accent Class factor. The four-level of Accent Class for disyllabic words included HH, HL, LH1 and LH2, while the three-level of Accent Class for monosyllabic words included H1, H2 and Rising.

5. 3. Results

5. 3. 1. Disyllabic words: HL, HH, LH1 and LH2

5. 3. 1. 1. Spectral properties of F0: F0 minimum and F0 maximum values

The outcome of Mauchly's test was significant ($p < 0.05$) for Accent Class on the *F0 minimum value* variable, indicating a violation of the assumption of sphericity. Therefore, Huynh-Feldt-corrected and Sphericity-assumed values are reported for Accent Class for the dependent variable of *F0 minimum value*. Mean *F0 minimum* and *maximum values* are shown in Table 5. 3. A three-way repeated measures ANOVA (Accent Class by Age by Dialect) reported significant main effects of Accent Class (F (2.427, 87.386) = 79.060, $p < 0.01$) and Age (F (1, 36) = 26.566, $p < 0.01$) on *F0 minimum value*, but there was no main effect of Dialect (F (1, 36) = 0.812, $p = 0.374$). Pairwise comparisons showed that*F0 minimum value* is lowest for LH1/LH2, intermediate for HH, and highest for HL at $p < 0.01$,when the data were pooled across age and dialect groups; *F0 minimum value* is not significantly different between LH1 and LH2. Regarding the main effect of Age, *F0 minimum value* is greater for younger speakers than older speakers. In addition, interaction effects among the factors were all significant. Two-way interaction effects of Accent Class by Dialect (F (2.427, 87.386) = 79.822, $p < 0.01$), and Accent Class by Age (F (2.427, 87.386) = 24.696, $p < 0.01$), and a three-way interaction effect of Accent Class by Dialect by Age (F (2.427, 87.386) = 24.834, $p < 0.01$) were found for *F0 minimum value*.

With *F0 maximum value*s the dependent variable, a three-way repeated measures ANOVA (Accent Class by Age by Dialect) reported significant main effects of Accent Class (F (2.833, 101.978) = 41.000, $p < 0.001$) and Age (F (1, 36) = 6.250, $p = 0.017$), but no main effect of Dialect (F (1, 36) = 2.349, $p = 0.134$). Pairwise comparisons show that the *F0 maximum*

value is lowest for LH1/LH2, intermediate for HH, and highest for HL; *F0 maximum value* is lower for older than younger speakers. In addition, there were significant two-way interaction effects of Accent Class by Age (F (2.833, 101.978) = 9.095, $p < 0.001$) and Accent Class by Dialect (F (2.833, 101.978) = 19.816, $p < 0.001$), and a significant three-way interaction of Accent Class by Age by Dialect (F (2.833, 101.978) = 8.885, $p < 0.001$) was reported for *F0 maximum value*.

The significant three-way interaction effects for the *F0 minimum-maximum value* variables indicate that the spectral F0 properties pattern differently depending on Age and Dialect. For more detailed analyses of the age and dialectal variations, one-way ANOVAs tested each*F0 minimum-maximum value* difference for HH, HL, LH1 and LH2 accent classes separately for each group, and the results from *post hoc* analyses are reported here.

For the lexical pitch accent Kyungsang dialect, Bonferroni *post hoc* analyses reported a significantly different *F0 minimum value* across HH, HL and LH1/LH2 accent classes for Older speakers ($p < 0.01$), patterning 'LH1 = LH2 < HH < HL'; for Younger Kyungsang speakers, however, *F0 minimum value* is significantly different only between HH/HL and LH1/LH2 accent classes ($p < 0.01$), indicating 'LH1 = LH2 < HH = HL'. Regarding the *F0 maximum value* variable, Older Kyungsang speakers showed significantly different *F0 maximum value* across HH, HL and LH1/LH2 pitch classes ($p < 0.01$), patterning 'LH1 = LH2 < HH < HL'. On the other hand, Younger Kyungsang speakers reported no significant difference across the four accent classes; only the near-significant difference in *F0 maximum value* was observed for the comparison between HH and LH1 at $p = 0.053$.

For the non-lexical pitch accent Seoul dialect, Bonferroni *post hoc* analyses showed that *F0 minimum-maximum values* are not different across the four pitch classes of Kyungsang

Korean, and the non-significant difference was true for both Older and Younger Seoul speakers. Table 5. 3 presents the averaged *F0 minimum and F0 maximum values* for HH, HL, LH1 and LH2 separately for each Dialect and Age group. Figures 5. 4 and 5. 5 show the distribution of the *F0 minimum* and *F0 maximum values* for the four disyllabic accent classes in boxplots separately for each Dialect and Age group.

			F0 minimum		**F0 maximum**	
Kyungsang	Older	HH	193	(25)	239	(43)
		HL	218	(30)	266	(53)
		LH1	146	(17)	217	(47)
		LH2	149	(19)	225	(41)
	Younger	HH	216	(20)	264	(29)
		HL	219	(16)	262	(28)
		LH1	201	(15)	247	(19)
		LH2	198	(17)	252	(19)
Seoul	Older	HH	173	(23)	219	(29)
		HL	174	(22)	221	(31)
		LH1	176	(21)	217	(29)
		LH2	172	(19)	216	(31)
	Younger	HH	201	(12)	249	(12)
		HL	201	(14)	248	(14)
		LH1	202	(13)	244	(11)
		LH2	200	(17)	242	(14)

Table 5. 3. Averaged *F0 minimum* and *F0 maximum values* (Hz) for disyllabic HH, HL, LH1 and LH2 accent classes for Older and Younger speakers within Seoul and Kyungsang Korean (standard deviation in parentheses).

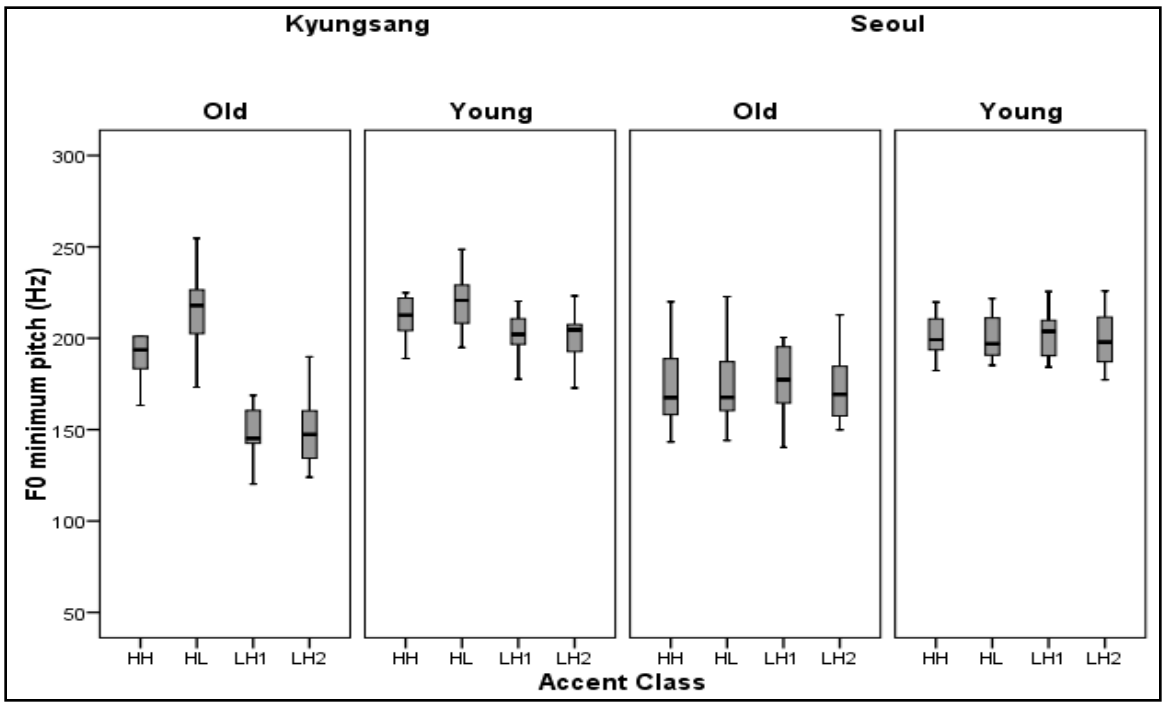

Figure 5. 4. Distribution of *F0 minimum value* for Older and Younger speakers in Kyungsang and Seoul Korean. The horizontal line in each box represents the median value of the data, and the ends of the vertical lines indicate the minimum and maximum data values.

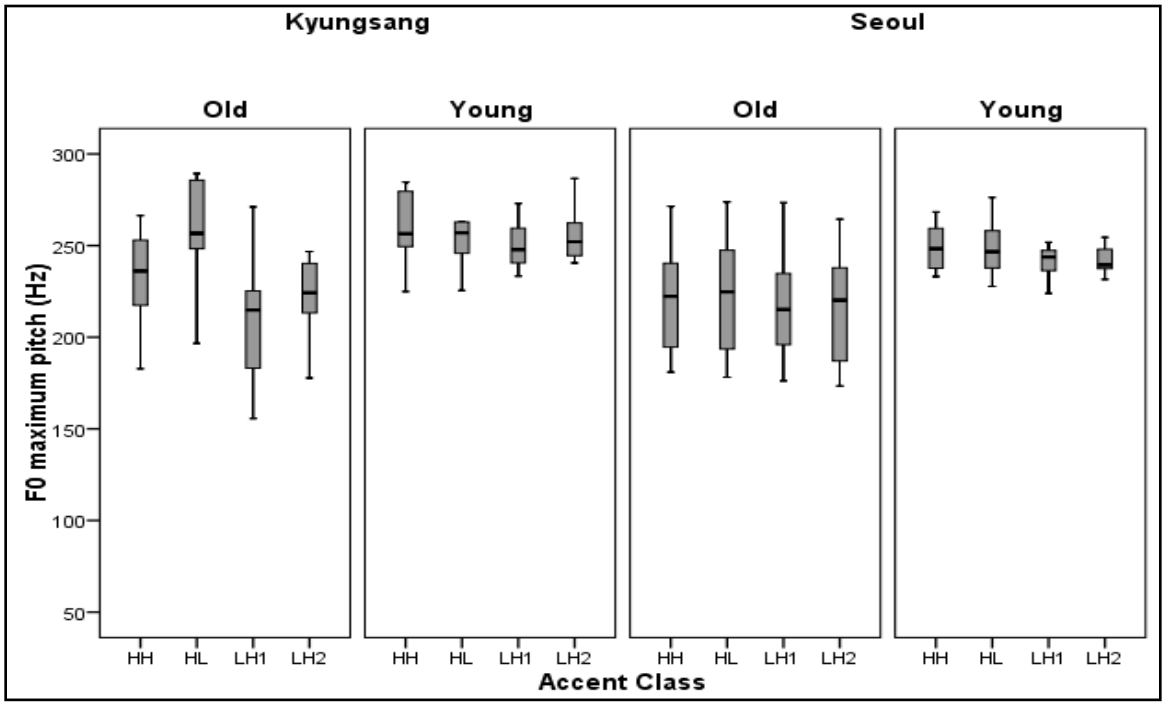

Figure 5. 5. Distribution of *F0 maximum value* for Older and Younger speakers in Kyungsang and Seoul Korean. The horizontal line in each box represents the median value of the data, and the ends of the vertical lines indicate the minimum and maximum data values.

5. 3. 1. 2. Temporal distance of F0: F0 minimum and F0 maximum duration

The outcome of Mauchly's test was significant (p = 0.038) for Accent Class on the *F0 minimum duration* variable, indicating a violation of the assumption of sphericity. Therefore, Huynh-Feldt-corrected and Sphericity-assumed values are reported for Accent Class for the dependent variable of *F0 minimum duration*. Averaged ratios of the *F0 maximum-minimum duration* are shown in Table 5. 4. A three-way repeated measures ANOVA (Accent Class by Age by Dialect) reported significant main effects of Accent Class (F (2.830, 101.880) = 29.773, $p < 0.01$) and Dialect (F (1, 36) = 12.045, $p < 0.01$) for *F0 minimum duration*, but near-significant effect of Age (F (1, 36) = 3.816, p = 0.059). Bonferroni *post hoc* analysis was performed for the significant main effect of Accent Class; *F0 minimum duration* is shortest for HH/HL, intermediate for LH2, and longest for LH1 at $p < 0.05$, when the data were pooled across age and dialect groups. Regarding the significant effect of Dialect and the near-significant effect of Age, pairwise comparisons reported that *F0 minimum duration* is longer for Seoul Korean than Kyungsang; it is longer for younger than older speakers. In addition to the main effects, there were significant two-way interaction effects of Accent Class by Dialect (F (2.830, 101.880) = 11.005, $p < 0.01$), and Accent Class by Age (F (2.830, 101.880) = 5.639, p = 0.002), but no three-way interaction effect of Accent Class by Dialect by Age (F (2.830, 101.880) = 2.291, p = 0.089) for the *F0 minimum duration* variable.

With *F0 maximum duration* as the dependent variable, a three-way repeated measures ANOVA (Accent Class by Age by Dialect) reported significant main effects of Accent Class (F (2.969, 106.901) = 32.414, $p < 0.001$), Age (F (1, 36) = 7.751, p = 0.009), and Dialect (F (1, 36) = 14.681, $p < 0.001$). Bonferroni *post hoc* analysis shows that *F0 maximum duration* is shortest for HL, intermediate for HH/LH1, and longest for LH2, when the data were pooled across age

and dialect groups. Regarding the main effects of Age and Dialect, pairwise comparisons indicate that *F0 maximum duration* is longer for younger than older speakers; it is longer for Seoul than Kyungsang speakers. In addition, interactions among the factors were all significant; there were significant two-way interaction effects of Accent Class by Age (F (2.969, 106.901) = 7.962, $p < 0.001$) and Accent Class by Dialect (F (2.969, 106.901) = 66.549, $p < 0.001$), and a significant three-way interaction of Accent Class by Age by Dialect (F (2.969, 106.901) = 4.198, $p = 0.008$) was reported for *F0 maximum duration*.

One-way ANOVAs tested each of *F0 minimum-maximum duration* differences across HH, HL, LH1 and LH2 accent classes separately for each Dialect and Age group, and the results from Bonferroni *post hoc* analyses are reported here.

For Kyungsang Korean, Bonferroni *post hoc* analyses reported the significantly different *F0 minimum duration* between HH/HL and LH1/LH2 for Older Kyungsang ($p = 0.009$), patterning 'HH = HL < LH1 = LH2'; for Younger Kyungsang, the comparison of *F0 minimum duration* was significant between HL and LH1/LH2 ($p < 0.001$), indicating 'HL < LH1 = LH2'; the comparison between HH and the other accent classes was not significant. Overall, the pattern of *F0 minimum duration* for Younger Kyungsang is 'HL ≤ HH ≤ LH1 = LH2'. To linearly express this order of *F0 minimum duration* for Younger Kyungsang, I use the '≤' symbol that indicates 'no difference with the right next category, but different from the category after the next'. That is, HL ≤ HH ≤ LH1 = LH2 indicates that the *F0 minimum duration* for HL is not different from that for HH, but different from that for LH1/LH2. The Regarding the *F0 maximum duration* variable, Older Kyungsang speakers showed significantly different *F0 maximum duration* across HH, HL and LH1/LH2 ($p < 0.01$), patterning HL < HH < LH1 = LH2. On the other hand, Younger Kyungsang speakers reported the significant difference in *F0*

maximum duration between HL and HH/LH1/LH2, and between HH and LH2 ($p < 0.05$), patterning HL < HH = LH1 ≤ LH2.

For the non-lexical pitch accent Seoul dialect, one-way ANOVAs reported no effect of Accent Class on both *F0 minimum* and *F0 maximum duration* for both Older and Younger Seoul speakers, indicating that the temporal distances of F0 are not different across the four pitch classes of Kyungsang Korean. Table 5. 4 presents the averaged ratios of *F0 minimum-maximum duration* for HH, HL, LH1 and LH2 accent classes separately for each Dialect and Age group. Figures 5. 6 and 5. 7 show the distribution of the ratios of *F0 minimum-maximum duration* for the four accent classes in boxplots separately for each Dialect and Age group.

			F0 minimum duration		**F0 maximum duration**	
Kyungsang	Older	HH	1.2	(0.6)	53.9	(10.2)
		HL	1.3	(0.6)	34.4	(3.8)
		LH1	18.8	(10.6)	79.3	(10.4)
		LH2	15.1	(8.5)	85.7	(5.2)
	Younger	HH	17.3	(16.0)	79.4	(9.6)
		HL	4.1	(3.8)	60.4	(9.2)
		LH1	33.7	(5.9)	82.7	(10.5)
		LH2	30.6	(7.7)	90.1	(3.4)
Seoul	Older	HH	27.3	(17.4)	83.0	(6.6)
		HL	25.4	(17.7)	82.3	(6.5)
		LH1	30.1	(12.9)	77.7	(14.8)
		LH2	17.5	(6.1)	78.6	(12.3)
	Younger	HH	16.6	(11.7)	80.5	(6.9)
		HL	16.3	(12.7)	82.5	(6.3)
		LH1	30.7	(3.6)	72.8	(8.1)
		LH2	24.7	(9.4)	74.3	(19.6)

Table 5. 4. Averaged ratios of *F0 minimum* and *F0 maximum duration* (%) for disyllabic HH, HL, LH1 and LH2 accent classes for Older and Younger speakers within each Seoul and Kyungsang Korean (standard deviation in parentheses).

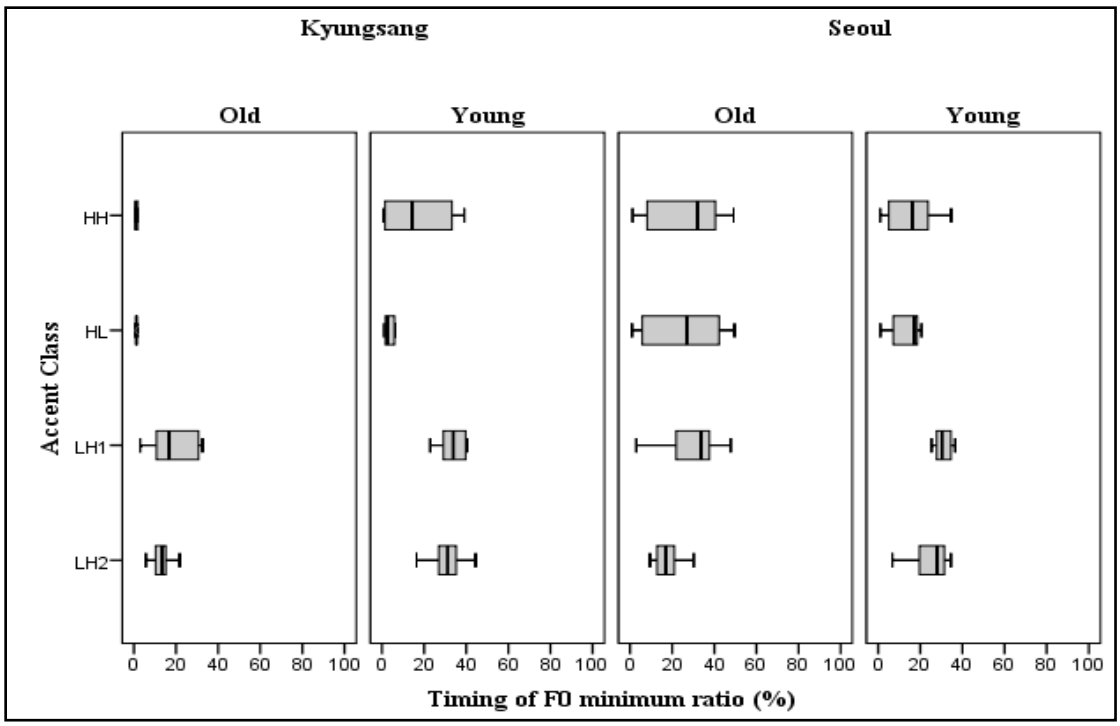

Figure 5. 6. Distribution of ratios of *F0 minimum duration* for Older and Younger speakers in Kyungsang and Seoul Korean. The horizontal line in each box represents the median value of the data, and the ends of the vertical lines indicate the minimum and maximum data values.

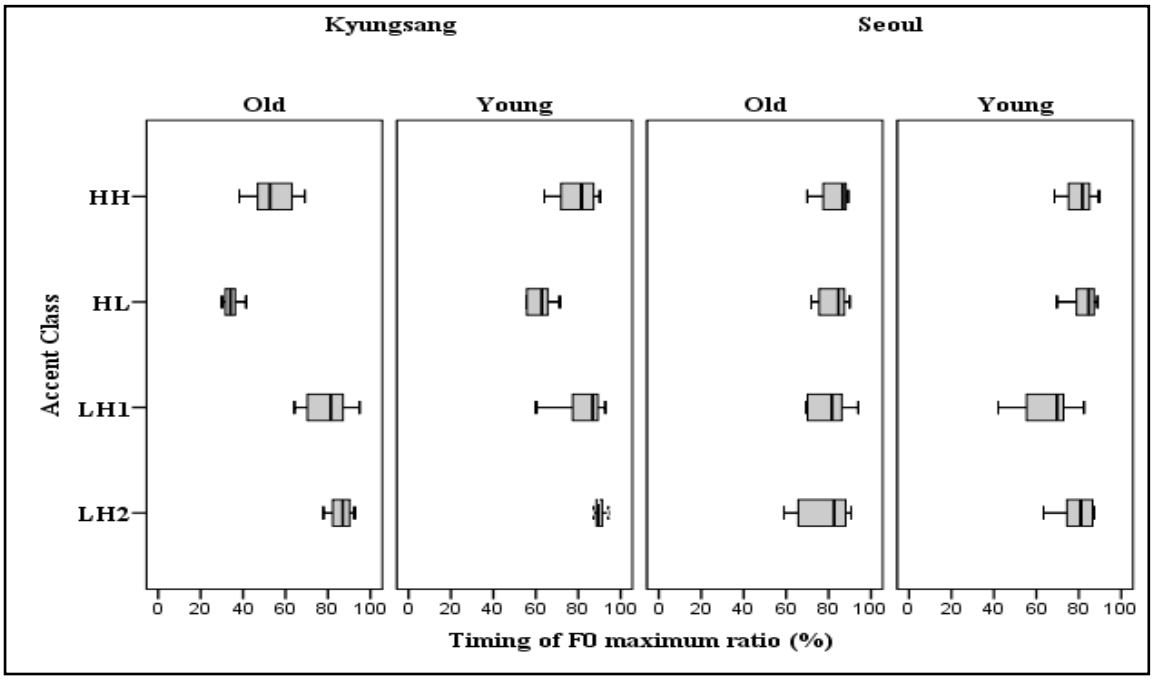

Figure 5. 7. Distribution of ratios of *F0 maximum duration* for Older and Younger speakers in Kyungsang and Seoul Korean. The horizontal line in each box represents the median value of the data, and the ends of the vertical lines indicate the minimum and maximum data values.

5. 3. 1. 3. Result summary and graphical illustrations of accent structure for disyllabic words

The current chapter examined the spectral and temporal F0 properties for HH, HL, LH1 and LH2 accent classes of disyllabic words between Kyungsang and Seoul Korean and between older and younger generations. First, three-way ANOVAs (Accent Class by Age by Dialect) were conducted for each of the four dependent variables, 1) F0 minimum value, 2) F0 maximum value, 3) F0 minimum duration, and4) F0 maximum duration, and further analyses were done to test the effect of Accent Class within each Age and Dialect group. Results from ANOVAs indicated dialectal and age variations in the spectral and temporal F0 properties for HH, HL, LH1 and LH2 disyllabic accent classes, suggesting the four underlying pitch classes are distinguished differently for each of the Age and Dialect groups. Table 5. 5 summarizes the Bonferroni post hoc comparisons testing the effect of Pitch Class within each Dialect and Age group. Figures 5. 8 and 5. 9 present the schematized pitch contours for the HH, HL, LH1 and LH2 accent classes for each Dialect and Age group.

		F0 minimum	**F0 maximum**	**F0 min. duration**	**F0 max. duration**
Kyungsang	**Older**	LH1/LH2 < HH < HL	LH1/LH2 < HH < HL	HL = HH < LH1/LH2	HL < HH < LH1/LH2
	Younger	LH1/LH2 < HH = HL	Non-sig.	HL ≤ HH ≤ LH1/LH2	HL < HH=LH1≤ LH2
Seoul	**Older**	Non-sig.	Non-sig.	Non-sig.	Non-sig.
	Younger	Non-sig.	Non-sig.	Non-sig.	Non-sig.

Table 5. 5. Summary of Bonferroni *post hoc* comparisons for disyllabic Accent Class within each Dialect and Age group. '≤' indicates that the *F0 minimum duration* for HL is not different from that for HH, but different from that for LH1/LH2, and *F0 maximum duration* for LH2 is not different from that for LH1, but different from that for HH.

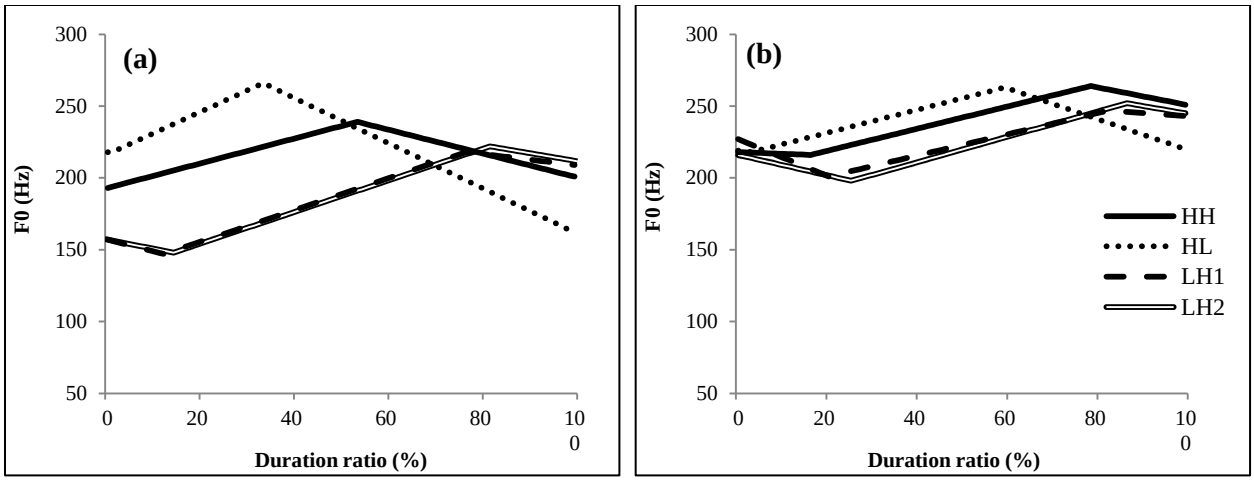

Figure 5. 8. Schematized pitch contours of HH, HL, LH1 and LH2 accent classes for Older (a) and Younger (b) Kyungsang Korean speakers. The data were averaged across speakers, two repetitions, and words of the same pitch class.

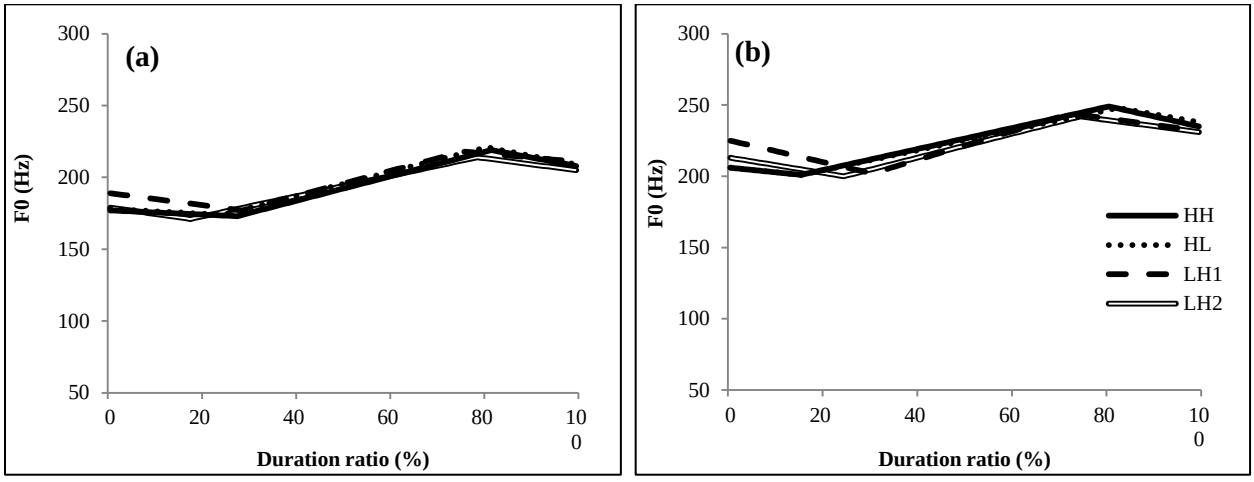

Figure 5. 9. Schematized pitch contours of HH, HL, LH1 and LH2 accent classes for Older (a) and Younger (b) Seoul Korean speakers. The data were averaged across speakers, two repetitions, and words of the same pitch class.

First, Table 5. 5 and Figures 5. 8 and 5. 9 indicate dialectal differences in prosodic properties; while the *F0 minimum-maximum values* and *F0 minimum-maximum duration* are distinct for the four accent classes in Kyungsang Korean, the spectral and temporal F0 properties are not different across the word stimuli in Seoul Korean. For Kyungsang Korean, for example,

F0 minimum-maximum values are lower for LH than HL/HH, and the *F0 minimum-maximum duration* is shorter for HL than LH across the two generations of Kyungsang. For Seoul Korean, on the other hand, the spectral and temporal F0 properties are identical across all Kyungsang Korean's accent classes, and the prosodic structure of all disyllabic words shows a final rising pattern (i.e., LH) for both generations of Seoul. This dialectal variation is not surprising given the fact that Kyungsang and Seoul Korean differ in their tonal systems; Kyungsang Korean is a lexical pitch accent language, and Seoul Korean is not. That is, the observed dialectal variation verifies that the prosodic structure of Seoul Korean is not related to the lexical pitch accents of Kyungsang Korean, and this confirms that the HH, HL and LH1/LH2 lexical accent distinctions are present for Kyungsang Korean, but not for Seoul Korean.

Second, a more interesting observation is the age variation of the accent distinction within the South Kyungsang dialect. The age variation in spectral and temporal F0 properties can be interpreted in terms of i) whether accent classes are distinct from each other for younger Kyungsang speakers as well as older, and ii) how comparably the accent distinction is made between the two generations of Kyungsang.

Table 5. 5 and Figure 5. 8 indicate a reduced accent distinction among younger Kyungsang speakers compared to older speakers. First, younger Kyungsang speakers do not use the spectral properties of F0 in the same way as older Kyungsang speakers. Table 5. 5 and Figure 5. 8 show more overlap in *F0 minimum-maximum values* across accent classes for younger Kyungsang speakers than older, suggesting that the difference in *F0 minimum-maximum values* is less effective for younger than older speakers to characterize the four accent classes. In Table 5. 5, the *F0 minimum-maximum values* are significantly different across LH1/LH2, HH, and HL for older Kyungsang speakers, patterning LH1/LH2 < HH < HL, but not for younger

Kyungsang speakers. In addition, although some pitch classes (e.g., LH1/LH2 and HL) are statistically distinguished in *F0 minimum values* for younger Kyungsang speakers, the degree of F0 value differences is not comparable between younger and older generations of Kyungsang; the F0 value differences across accent classes are smaller for younger than older speakers in Figure 5. 8. For older Kyungsang speakers, for example, the differences in *F0 minimum* and *F0 maximum values* between HL and LH1 are 72 Hz and 49 Hz, respectively, but they are only 18 Hz and 15 Hz for younger Kyungsang speakers.

In addition to the reduced F0 value difference across accent classes, *F0 minimum-maximum duration* also shows a reduced distinction across the four accent classes. *F0 maximum duration* is significantly different across HL, HH and LH1/LH2 for older Kyungsang speakers, patterning HL < HH < LH1/LH2, but not for younger Kyungsang speakers. In addition, although some accent classes such as HL and LH1/LH2 are statistically distinguished in *F0 minimum-maximum duration* for younger Kyungsang speakers, the duration differences between the two pitch classes are smaller for younger than older speakers in Figure 5. 8. Specifically, the ratio difference of the *F0 maximum duration* between HL and LH1 is 41% for older Kyungsang speakers, but 22% for younger Kyungsang speakers. In sum, while the HH, HL and LH1/LH2 accents are clearly distinguished using both the spectral and temporal F0 properties among older Kyungsang speakers, younger Kyungsang speakers do not use the acoustic properties as much as older Kyungsang speakers do, and therefore, the accent distinction is reduced for the younger speakers.

Along with the reduced spectral and temporal F0 properties for accent distinction among younger Kyungsang speakers, Figure 5. 8 and Table 5.6 indicate age variation with respect to the temporal F0 properties. Figure 5. 8 shows that *F0 maximum duration* for the four pitch classes is

longer for younger Kyungsang speakers than for the older. In other words, the points at which F0 reaches its maximum value occur later for younger Kyungsang speakers compared to older. For example, while the F0 maximum point of HL occurs at 34% within Local for older Kyungsang speakers, it occurs at 60% for younger speakers. Paired-samples *t*-tests in Table 5. 6 provide statistical support for this later occurrence of F0 maximum points among younger compared to older Kyungsang speakers.

	Paired Differences			
	Mean dif.	SD	t	Sig.
Difference of F0 max. duration for HH btw Old and Young	-25.5	10.9	-7.432	0.000
Difference of F0 max. duration for HL btw Old and Young	-26.0	10.4	-7.905	0.000
Difference of F0 max. duration for LH1 btw Old and Young	-3.4	11.2	-.959	0.363
Difference of F0 max. duration for LH2 btw Old and Young	-4.5	5.2	-2.725	0.023

Table 5. 6. Paired-samples t-tests to compare the difference in *F0 maximum duration* (ratio) for each accent class between Older and Younger Kyungsang speakers.

In Table 5. 6, the results from the paired-samples *t*-tests confirm the later occurrence of F0 maximum points, showing significantly longer F0 maximum duration for HH, HL and LH2 accents for younger than for older Kyungsang speakers. This comparison indicates that the accent structure of HL for younger speakers is similar to that of older speakers' HH, and the accent structure of HH for younger speakers is similar to that of older speakers' LH. Crucially, the laterF0 maximum point among younger Kyungsang speakers questions whether the F0 maximum point of HL occurs on the first syllable or the second syllable in the disyllabic stems. In Kyungsang Korean, the HL and HH classes are described as a High tone on the first syllable and a Low tone on the second syllable for HL, and High tones on the two consecutive syllables for HH, respectively. That is, the presence or absence of F0 maximum point for each syllable is an important factor in distinguishing two contrastive accents. Therefore, if the later occurrence

of F0 maximum points affects the placement of the F0 peak for HL, the validity of the High tone on the first syllable is questionable for younger Kyungsang speakers.

To address this issue, the current chapter examined whether F0 maximum points of each accent class occur comparably between older and younger Kyungsang speakers by observing if the F0 maximum point occurs before or after a syllable boundary. Table 5. 7 presents ratios of the syllable boundaries and F0 maximum points for each of the four disyllabic accent classes between older and younger Kyungsang speakers. The ratio of each syllable boundary was calculated from 'syllable boundary duration divided by *Local* duration', indicating where a syllable boundary occurs within a *Local*. In Table 5. 7, a F0 maximum point ratio that is smaller than the syllable boundary ratio indicates that the F0 maximum point occurs within the first syllable; conversely, a F0 maximum point ratio that is greater than the syllable boundary ratio indicates that the F0 maximum point occurs after the first syllable, that is, on the second syllable.

		HH	**HL**	**LH1**	**LH2**
Kyungsang Older	Syllable boundary	44 (1.5)	45 (2.2)	41 (3.7)	38 (5.6)
	F0 max. point	54 (10.2)	34 (3.8)	79 (10.4)	86 (5.2)
Kyungsang Younger	Syllable boundary	46 (0.7)	50 (2.5)	37 (1.0)	47 (4.9)
	F0 max. point	79 (9.6)	60 (9.2)	83 (10.5)	90 (3.4)

Table 5. 7. Average ratio of syllable boundary and F0 maximum point (%) between older and younger Kyungsang speakers (standard deviation in parentheses).

Table 5. 7 reveals that F0 maximum points for all accent classes are located on the second syllable for younger Kyungsang speakers. Importantly, while older Kyungsang speakers locate the F0 maximum point on the first syllable for HL, younger speakers locate it on the second syllable. To summarize, we observed a significantly longer *F0 maximum duration* for all accent classes among younger as compared to older Kyungsang speakers. This age variation in

temporal F0 properties suggests that younger Kyungsang speakers shift the F0 peak (F0 maximum point) rightwards. Crucially, the rightward F0 peak shift results in the loss of a High tone on the first syllable for the HL disyllabic words and results in the reduced distinction between HH and LH in terms of F0 peak location.

5. 3. 2. Monosyllabic words: H1, H2 and Rising distinction

Statistical assessments were made for monosyllabic words with the following three factors: Accent Class (H1, H2, Rising), Age (Older, Younger) and Dialect (Kyungsang, Seoul).

5. 3. 2. 1. Scaling of F0: F0 maximum and minimum

A three-way repeated measures ANOVA (Accent Class by Age by Dialect) reported significant main effects of Accent Class (F (1.754, 63.131) = 30.876, $p < 0.001$) and Age (F (1, 36) = 25.920, $p < 0.001$) for the *F0 minimum value* variable, but there was no main effect of Dialect (F (1, 36) = .178, $p = 0.676$). Pairwise comparisons showed that *F0 minimum value* is lower for Rising and H2 than for H1 at $p < 0.01$, when the data were pooled across age and dialect groups; *F0 minimum value* tends to be higher for H2 than Rising with near-significance ($p = 0.078$). Regarding the main effect of Age, *F0 minimum value* is greater for younger speakers than older speakers. In addition to the main effects, interaction effects among the factors were all significant. Two-way interaction effects of Accent Class by Dialect (F (1.754, 63.131) = 25.104, $p < 0.001$), and Accent Class by Age (F (1.754, 63.131) = 8.283, $p = 0.001$), and a three-way interaction effect of Accent Class by Dialect by Age (F (1.754, 63.131) = 9.676, $p < 0.001$) were found for *F0 minimum value*.

With *F0 maximum value* as the dependent variable, a three-way repeated measures ANOVA (Accent Class by Age by Dialect) reported significant main effects of Accent Class (F (2, 72) = 20.925, $p < 0.001$) and Age (F (1, 36) = 6.115, $p = 0.018$), but no main effect of Dialect

(F (1, 36) = 2.642, p = 0.113). Pairwise comparisons show that *F0 maximum value* is lower for Rising and H2 than H1; it is lower for Older than Younger speakers. In addition, there was a significant interaction of Accent Class by Dialect (F (2, 72) = 3.309, p = 0.042); there was no two-way interaction of Accent Class by Age (F (2, 72) = 0.064, p = 0.938), and no three-way interaction of Accent Class by Age by Dialect (F (2, 72) = 0.039, p = 0.962) for *F0 maximum value*.

For more detailed analyses on age and dialectal variations, one-way ANOVAs tested each of the F0 minimum and F0 maximum differences across H1, H2 and Rising separately for each group, and the results from *post hoc* analyses are reported here.

Regarding the *F0 minimum value* variable within Kyungsang Korean, Bonferroni *post hoc* analyses reported a significant difference between H1 and H2/Rising accent classes for Older speakers ($p < 0.01$), patterning 'R = H2 < H1'. For Younger Kyungsang speakers, *F0 minimum value* is significantly different across the three accent classes ($p < 0.01$), indicating 'R < H2 < H1'. Regarding *F0 maximum value*, older Kyungsang speakers showed significantly different *F0 maximum value* betweenH1/H2 and Rising pitch classes ($p < 0.05$), patterning 'R < H2 ≤ H1'. Younger Kyungsang speakers reported a significant difference in *F0 maximum value* between H1 and H2/Rising, indicating 'R = H2 < H1' ($p < 0.05$).

For the non-pitch accent Seoul dialect, Bonferroni *post hoc* analyses showed that *F0 minimum-maximum values* are not different across the three pitch classes for most cases, except that younger Seoul speakers reported a higher *F0 maximum value* for H1 than H2 at p = 0.024. Table 5. 8 presents the averaged *F0 minimum-maximum values* for monosyllabic H1, H2 and Rising accents separately for each Dialect and Age group. Figures 5. 10 and 5. 11 show the

distribution of *F0 minimum-maximum values* of the three monosyllabic accent classes in boxplots separately for Dialect and Age groups.

			F0 minimum		F0 maximum	
Kyungsang	Older	H1	205	(25)	236	(49)
		H2	178	(27)	226	(46)
		Rising	162	(16)	222	(43)
	Younger	H1	224	(14)	259	(20)
		H2	216	(14)	250	(16)
		Rising	212	(14)	247	(17)
Seoul	Older	H1	192	(25)	217	(36)
		H2	189	(24)	212	(29)
		Rising	191	(24)	212	(32)
	Younger	H1	214	(13)	240	(13)
		H2	214	(14)	234	(14)
		Rising	212	(13)	235	(12)

Table 5. 8. Averaged *F0 minimum* and *F0 maximum values* (Hz) for monosyllabic H1, H2, and Rising accent classes for Older and Younger speakers within Seoul and Kyungsang Korean (standard deviation in parentheses).

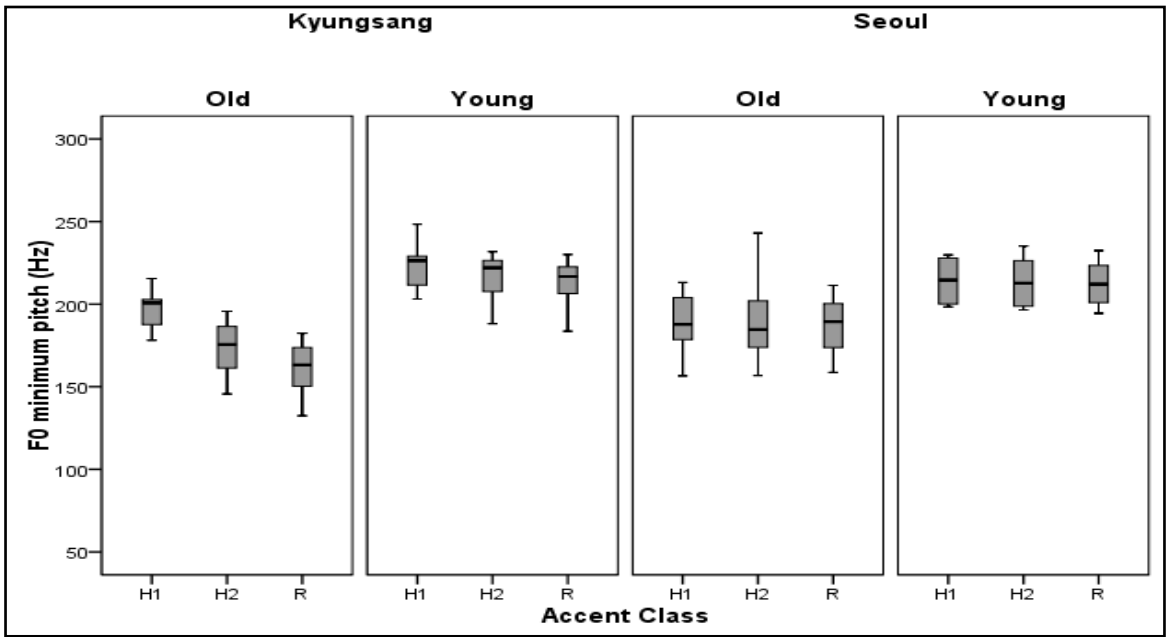

Figure 5. 10. Distribution of *F0 minimum value* for Older and Younger speakers in Kyungsang and Seoul Korean. The horizontal line in each box represents the median value of the data, and the ends of the vertical lines indicate the minimum and maximum data values.

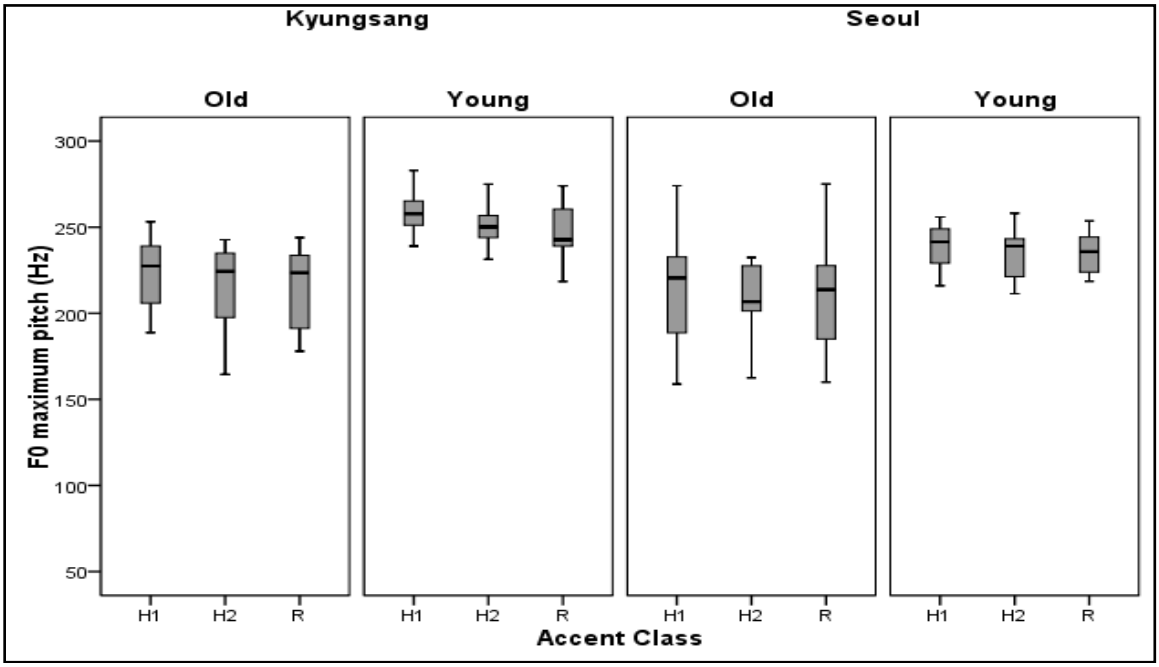

Figure 5. 11. Distribution of *F0 maximum value* for Older and Younger speakers in Kyungsang and Seoul Korean. The horizontal line in each box represents the median value of the data, and the ends of the vertical lines indicate the minimum and maximum data values.

5. 3. 2. 2. Temporal distance of F0: F0 minimum and F0 maximum duration

With the dependent variable of *F0 minimum duration*, a three-way repeated measures ANOVA (Accent Class by Age by Dialect) reported significant main effects of Accent Class (F (2, 72) = 25.966, $p < 0.01$) and Age (F (1, 36) = 6.631, $p = 0.014$), but no effect of Dialect (F (1, 36) = 0.232, $p = 0.633$). Pairwise comparisons showed that *F0 minimum duration* is shorter for H1 than H2/Rising at $p < 0.01$, when the data were pooled across age and dialect groups; *F0 minimum duration* is comparable between H2 and Rising (p =1.0). Regarding the main effect of Age, *F0 minimum duration* is shorter for older than younger speakers. In addition, there was a significant interaction effect of Accent Class by Dialect (F (2, 72) = 3.787, $p = 0.027$), but no

significant interactions of Accent Class by Age (F (2, 72) = 1.384, p = 0.257), and Accent Class by Dialect by Age (F (2, 72) = 2.022, p = 0.140) were found on *F0 minimum duration*.

With *F0 maximum duration* as the dependent variable, a three-way repeated measures ANOVA (Accent Class by Age by Dialect) reported significant main effects of Accent Class (F (2, 72) = 17.901, $p < 0.001$), Age (F (1, 36) = 5.697, p = 0.022) and Dialect (F (1, 36) = 6.124, p = 0.018).Pairwise comparisons show that *F0 maximum duration* is shorter for H1 than H2/Rising; it is shorter for older than younger speakers; it is shorter for Seoul than Kyungsang. In addition to these main effects, the interactions among the three factors were all significant: Accent Class by Dialect (F (2, 72) = 13.469, $p < 0.001$), Accent Class by Age (F (2, 72) = 4.492, p = 0.015), and Accent Class by Age by Dialect (F (2, 72) = 5.637, p = 0.005).

For more detailed analyses on age and dialectal variations, one-way ANOVAs tested each of the *F0 minimum-maximum duration* differences across H1, H2 and Rising separately for each dialect and age group, and the results from *post hoc* analyses are reported here.

In Kyungsang Korean, Bonferroni *post hoc* analyses reported that *F0 minimum duration* is significantly different between H1/H2 and Rising pitch classes for Older Kyungsang speakers ($p < 0.05$), patterning 'H1 = H2 < R'. For Younger Kyungsang, *F0 minimum duration* is significantly different between H1 and H2/R ($p < 0.01$), indicating 'H1< H2 = R'. Regarding *F0 maximum duration*, older Kyungsang speakers showed significantly different *F0 maximum duration* across the three pitch classes ($p < 0.05$), patterning 'H1 < H2 < R'. On the other hand, Younger Kyungsang speakers showed a significant difference between H1 and H2/Rising, indicating 'H1 < H2 = R' ($p < 0.05$).

For the non-lexical pitch accent Seoul dialect, Bonferroni *post hoc* analyses showed that *F0 minimum-maximum duration* is not different across the three pitch classes for most cases,

except that older Seoul speakers reported a shorter *F0 minimum duration* for H1 than H2 at p = 0.016. Table 5. 9 presents the averaged*F0 minimum-maximum duration* for monosyllabic H1, H2 and Rising accents separately for each Dialect and Age group. Figures 5. 12 and 5. 13 show the distribution of the ratios of *F0 minimum* and *F0 maximum duration* for the three monosyllabic accent classes in boxplots separately for each Dialect and Age group.

			F0 minimum duration		F0 maximum duration	
Kyungsang	**Older**	H1	1.4	(0.7)	50.5	(9.3)
		H2	3.2	(2.3)	65.4	(9.3)
		Rising	7.3	(4.2)	79.2	(10.3)
	Younger	H1	3.5	(2.2)	75.1	(5.4)
		H2	9.5	(5.0)	83.0	(5.6)
		Rising	9.3	(4.2)	84.1	(6.3)
Seoul	**Older**	H1	3.4	(3.1)	59.3	(18.0)
		H2	7.9	(5.7)	63.0	(16.6)
		Rising	5.7	(3.6)	60.8	(20.4)
	Younger	H1	3.8	(3.7)	65.4	(11.4)
		H2	8.5	(4.0)	61.8	(24.8)
		Rising	7.3	(2.5)	66.8	(17.3)

Table 5. 9. Averaged ratios of *F0 minimum* and *F0 maximum duration* (%) for monosyllabic H1, H2, and Rising accent classes for Older and Younger speakers within each Seoul and Kyungsang Korean (standard deviation in parentheses).

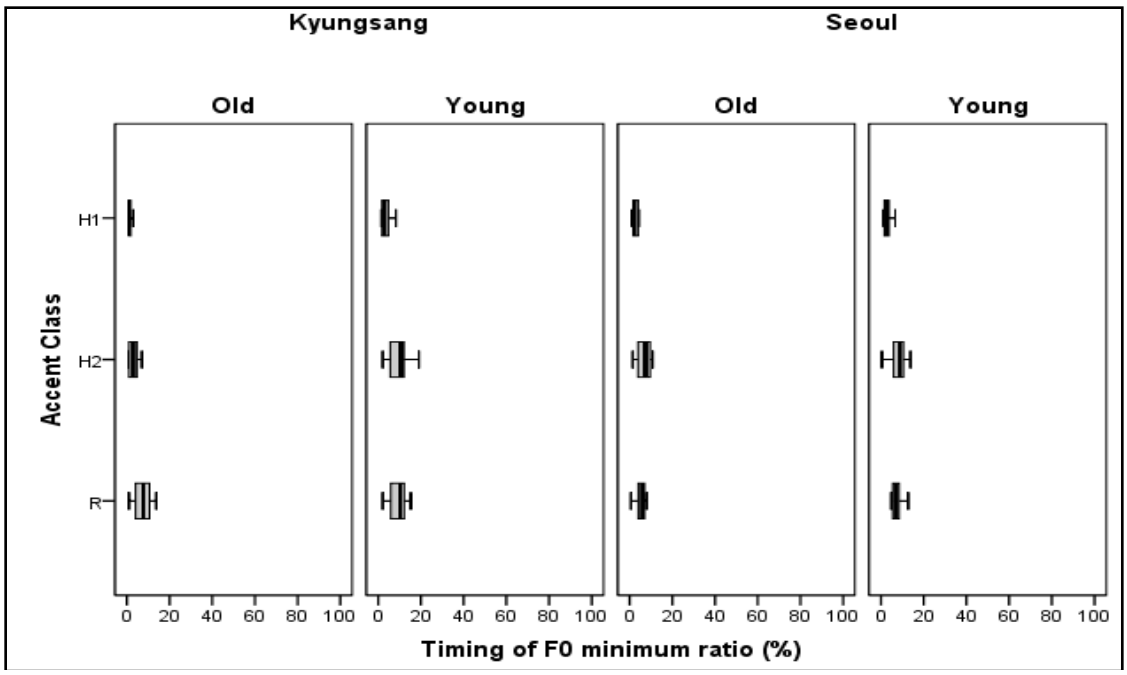

Figure 5. 12. Distribution of ratios of *F0 minimum duration* for Older and Younger speakers in Kyungsang and Seoul Korean. The horizontal line in each box represents the median value of the data, and the ends of the vertical lines indicate the minimum and maximum data values.

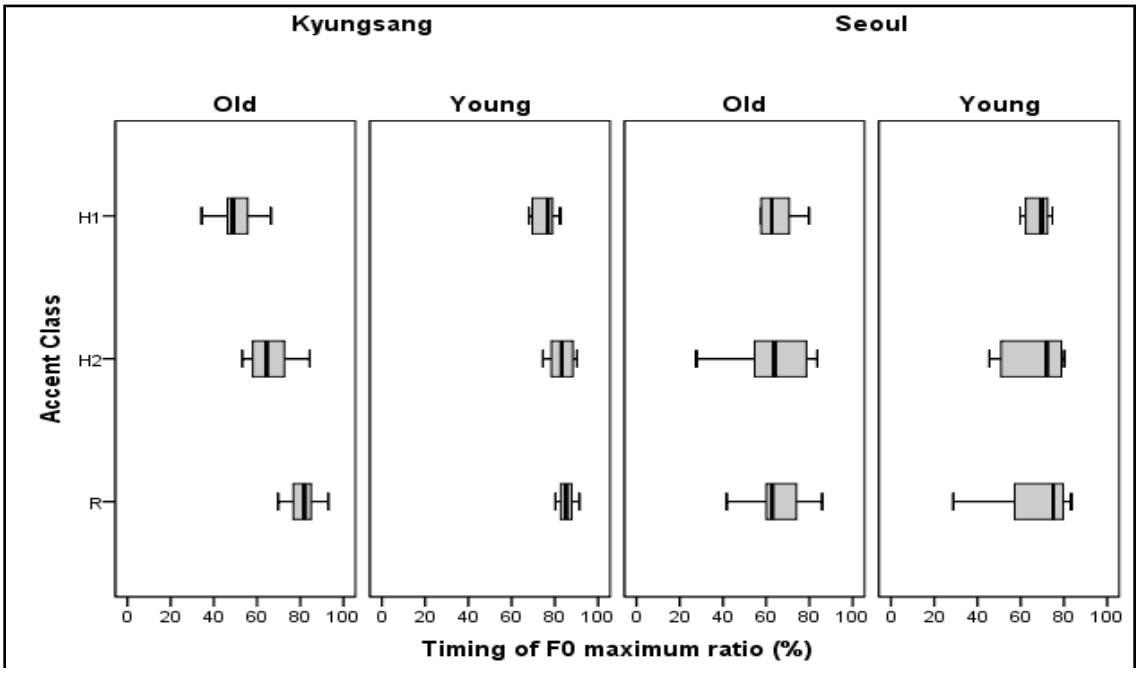

Figure 5. 13. Distribution of ratios of *F0 maximum duration* for Older and Younger speakers in Kyungsang and Seoul Korean. The horizontal line in each box represents the median value of the data, and the ends of the vertical lines indicate the minimum and maximum data values.

5. 3. 2. 3. Result summary and graphical illustrations of accent structure for monosyllabic words

The current chapter examined the spectral and temporal F0 properties for monosyllabic H1, H2 and Rising accent classes across Dialect and Age groups. Three-way ANOVAs (Accent Class by Age by Dialect) first tested the effect of each factor on the four dependent variables: *1) F0 minimum value, 2) F0 maximum value, 3) F0 minimum duration,* and *4) F0 maximum duration.* Then, the effect of Accent Class was tested for the four dependent variables within each dialect and age group for detailed observation of dialect and age variations. Consistent with the disyllabic data, results from ANOVAs for monosyllabic data indicated dialectal and age variations on spectral and temporal F0 properties. Table 5. 10 summarizes the results from Bonferroni *post hoc* comparisons testing the effect of Pitch Class within each Dialect and Age group for the four dependent variables. Figures 5. 14 and 5. 15 present the schematized pitch contours ofH1, H2 and Rising accent classes for each Dialect and Age group.

		F0 minimum	**F0 maximum**	**F0 min. duration**	**F0 max. duration**
Kyungsang	**Older**	R = H2 < H1	R < H1= H2	H1=H2 < R	H1 < H2 < R
	Younger	R < H2 < H1	R = H2 < H1	H1 < H2 = R	H1 < H2 = R
Seoul	**Older**	Non-sig.	Non-sig.	H1 ≤ R ≤ H2	Non-sig.
	Younger	Non-sig.	H2 ≤ R ≤ H1	Non-sig.	Non-sig.

Table 5. 10. Summary of Bonferroni *post hoc* comparisons for monosyllabic Accent Class within each Dialect and Age group.

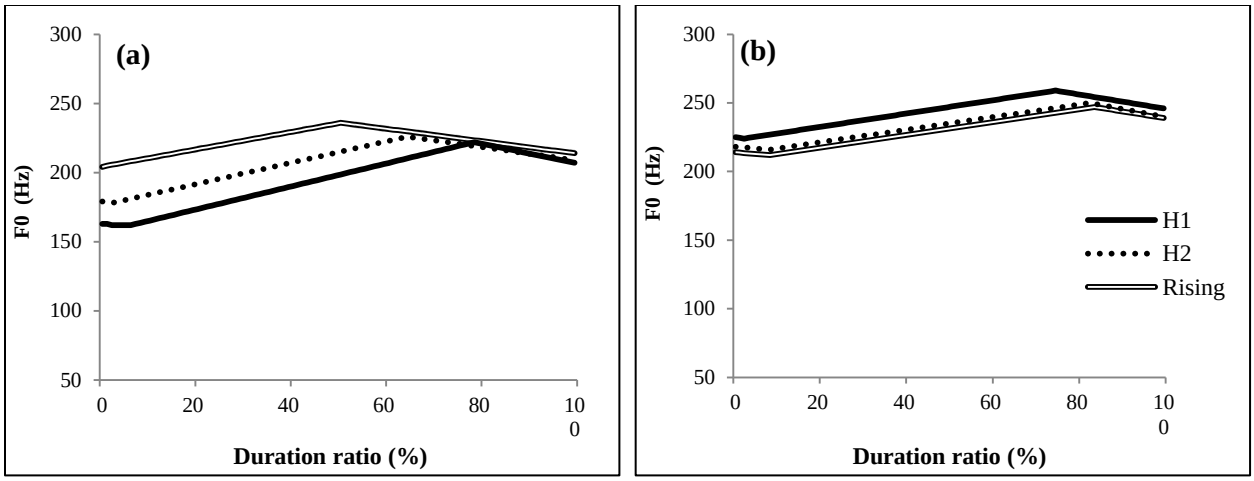

Figure 5. 14. Schematized pitch contours of H1, H2, and Rising accent classes for Older (a) and Younger (b) Kyungsang speakers. The data were averaged across speakers, two repetitions, and words of the same pitch class.

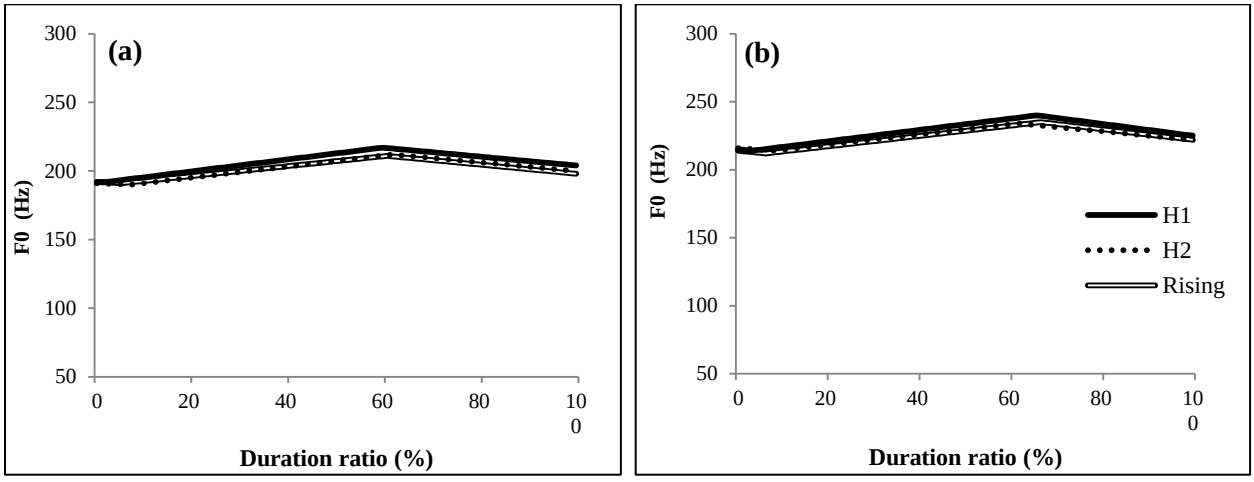

Figure 5. 15. Schematized pitch contours of H1, H2, and Rising accent classes for Older (a) and Younger (b) Seoul speakers. The data were averaged across speakers, two repetitions, and words of the same pitch class.

First, Table 5. 10 and Figures 5. 14 and 5. 15 show dialectal differences; consistent with the disyllabic data, the *F0 minimum-maximum values* and *F0 minimum-maximum duration* across pitch classes are more distinct for Kyungsang Korean than Seoul. In Kyungsang Korean,

F0 minimum-maximum values are lower for Rising than H1, and *F0 minimum-maximum duration* is shorter for H1 than Rising across older and younger Kyungsang generations. In Seoul Korean, however, although some pitch classes are different in their spectral and temporal F0 properties (e.g., H2 < H1 in *F0 maximum value* for younger Seoul speakers), it seems hard to find any systematic difference in the two acoustic properties across the three monosyllabic pitch classes for both generations of Seoul Korean. Therefore, similar to the observation in disyllabic words, the dialectal variation in the monosyllabic data indicates that the prosodic structure of Seoul Korean is not related to the lexical pitch accents of Kyungsang Korean.

Second, there is age variation in spectral and temporal F0 properties for the monosyllabic accent classes within Kyungsang Korean. Previously, in the disyllabic data, we observed younger Kyungsang speakers having more overlap across disyllabic accent classes compared to older speakers. For the monosyllabic words, the statistical assessments in Table 5. 10 show that the three pitch classes are not particularly more distinct for older than for younger Kyungsang speakers. However, as indicated by the three-way interaction effects of Accent Class by Dialect by Age for the *F0 minimum value* (Section 5. 3. 2. 1) and *F0 maximum duration* (Section 5. 3. 2. 2) variables, the accent distinction is not made comparably between the two generations of Kyungsang. Figure 5. 14 shows that older Kyungsang speakers distinguish the three monosyllabic accent classes with larger differences in spectral and temporal F0 dimensions than younger speakers. Specifically, the difference in *F0 minimum value* between H1 and Rising are 43 Hz and 12 Hz for older and younger Kyungsang speakers, respectively; the ratio differences in *F0 maximum duration* between H1 and Rising are 29% and 9% for older and younger Kyungsang speakers, respectively. In sum, the differences in *F0 minimum value* and *F0 maximum duration* across the monosyllabic accent classes were smaller for younger than for

older Kyungsang speakers, and the spectral and temporal F0 distinctions are less effective for younger speakers to signal the lexical pitch accents.

Consistent with the observation in disyllabic words, *F0 maximum duration* across the three monosyllabic pitch classes is always longer for younger Kyungsang speakers, indicating the later occurrence of F0 maximum point within monosyllabic words. This confirms that younger Kyungsang speakers shift the F0 peak (F0 maximum point) rightward not only for disyllabic words, but also for monosyllabic words.

5. 4. Summary and general discussion

The current chapter examined whether the phonetic distinction in lexical pitch accents of Kyungsang Korean are maintained by both younger and older generations. The primary focus of this chapter was to address whether and how age variation in disyllabic and monosyllabic accent contrasts is shown. We examined spectral and temporal F0 dimensions across disyllabic and monosyllabic accent classes of Kyungsang Korean between younger and older generations, and provided concrete evidence of sound change in the lexical pitch accent of Kyungsang Korean. The current chapter reported several important findings regarding the generational and dialectal differences. Main findings of the current chapter are summarized below.

e. The accent structure of Kyungsang Korean is different depending on the lexically determined pitch accent classes, being revealed as distinctive spectral and temporal F0 properties. On the other hand, the accent structure of Seoul Korean is identical across words that were categorized according to Kyungsang's accent classes, showing the final rising pattern (LH).

f. There was age variation in the spectral and temporal F0 properties that characterize the contrastive accents of Kyungsang Korean. The spectral and temporal F0 differences across disyllabic and monosyllabic contrastive accents are less distinct for younger than older Kyungsang speakers, suggesting that the accent distinction is reduced for younger Kyungsang speakers compared to older Kyungsang speakers.

g. Another important source of the age variation is the younger Kyungsang speakers' rightward F0 peak shift. *F0 maximum duration* is always longer for younger than older Kyungsang speakers for all disyllabic and monosyllabic accent classes. Thus, F0 peak (F0 maximum point) always occurs later within a word for younger Kyungsang speakers compared to older speakers. Crucially, this is reflected as the absence of an F0 peak on the first syllable for HL disyllabic words.

The discussion in this section focuses on 1) how the observed age variation in the present data can also be supported by a comparison with previous literature, and 2) how the comparison between Kyungsang and Seoul Korean explains the age variation in the lexical pitch accent of South Kyungsang Korean.

First, it is worthwhile to compare the present observation with previous studies (Kenstowicz & Park 2006; Lee 2008) to have more supportive evidence for the reduced accent distinction of younger Kyungsang speakers. Recall that the reports on F0 maximum value for HH, HL and LH pitch classes were not consistent between Kenstowicz and Park (2006) and H.-S. Lee (2008); while H.-S. Lee (2008) reported a non-significant difference in the F0 peak(maximum) values for the three accents, Kenstowicz and Park (2006) showed the highest F0 for HL, intermediate for HH, and lowest for LH in Kyungsang Korean (p.5). The inconsistency

between Kenstowicz and Park (2006) and H.-S. Lee (2008) may be due to the difference in speakers' mean ages between the two studies. The speakers in Kenstowicz and Park (2006) are presumably older than those in H.-S. Lee (2008); the data in Kenstowicz and Park (2006) were collected from seven Kyungsang speakers aged from their mid-twenties to mid-forties, and the data in H.-S. Lee (2008) were collected from five female North Kyungsang speakers aged from their early twenties to early thirties[19]. A comparison of the two previous studies with the present observation supports the notion of mean age differences as an explanation for the inconsistent reports between Kenstowicz and Park (2006) and H.-S. Lee (2008), and accordingly provides additional evidence for age variation observed in the current study. The present data showed significantly different F0 maximum values across pitch classes for older Kyungsang speakers, patterning 'LH < HH < HL', but a less distinct F0 maximum value for younger speakers with 'LH ≤ HL ≤ HH' (significant difference only between LH < HH). In other words, while the pattern of F0 maximum value of older Kyungsang speakers is consistent with the report in Kenstowicz and Park (2006), that of younger speakers is similar to H.-S. Lee (2008)'s observation. Therefore, the comparisons across the three studies indicate that the inconsistency between Kenstowicz and Park (2006) and H.-S. Lee (2008) may not be random, but a reflection of a generational difference in the spectral F0 property.

Second, the younger Kyungsang subjects in H.-S. Lee (2008) lead us to question the validity of the temporal F0 property as well as F0 maximum value reported by H.-S. Lee (2008). In fact, the comparison between H.-S. Lee (2008) and the present data indicates that the reports in H.-S. Lee (2008) represent younger Kyungsang speakers, and provides additional support for age variation, particularly regarding younger Kyungsang speakers' rightward F0 peak shift. H.-

[19] Four speakers were in their early twenties, and one was in her early thirties.

S. Lee (2008) reported that F0 maximum duration is shortest for HL, intermediate for HH, and longest for LH, and this 'HL < HH < LH' pattern is consistent with the present data for older Kyungsang speakers. Despite the consistency in pattern, however, the points at which F0 reach its peak (maximum point) in H.-S. Lee (2008) are more similar to the present data for younger speakers, rather than older speakers. For example, H.-S. Lee (2008) reported that the F0 peak occurs on the second syllable for the HL pitch class, not on the first syllable, and the present data for younger speakers also showed the F0 peak on the second syllable for HL. In contrast, the present data for older speakers indicated an F0 peak on the first syllable for the disyllabic HL pitch class, not on the second syllable. In the current chapter, the F0 peak occurrence on the second syllable for younger Kyungsang speakers is explained by their shifting the F0 peak rightwards compared to older Kyungsang speakers. That is, based on the inconsistency between H.-S. Lee (2008) and the present data for older speakers, and the consistency between H.-S. Lee (2008) and the present data for younger speakers, we gain additional evidence of age variation in lexical pitch accents regarding the temporal F0 property as well as the spectral F0 property.

In addition to the occurrence of the F0 peak on the second syllable for HL, it is noteworthy that while the F0 peak for LH occurs on the third syllable in H.-S. Lee (2008), it occurs at the end of the second syllable in the present data of younger Kyungsang speakers. The discrepancy between H.-S. Lee (2008) and the current study for LH may be due to the difference in the number of syllables that the two studies examined; while H.-S. Lee (2008) examined the accent structure of disyllabic words with suffixes (i.e., /-*ila*/ or /-*lako*/ quotation particle), the current study examined disyllabic stems only. The comparison of the F0 temporal properties for LH under the two different stimulus conditions indicates several important aspects. First, younger Kyungsang speakers seem to locate the F0 peak even later if there is an available (suffix)

syllable after a disyllabic LH stem. Second, younger Kyungsang speakers' rightward F0 peak shift affects LH as well as HL in terms of locating the F0 peak one syllable later. Third, younger Kyungsang speakers' rightward F0 peak shift seems to be more clearly seen in words with more than two syllables by showing the F0 peak shift across a morpheme boundary.

For a better observation of younger Kyungsang speakers' rightward F0 peak shift, the current chapter comparedF0 contours between older and younger Kyungsang speakers for four-syllable words consisting of disyllabic stems and a disyllabic suffix. Four disyllabic stems differing in their underlying pitch classes (HH, HL, LH1, LH2)and the suffix */-pota/* 'than' were selected for the F0 contour observation of four-syllable words; the four disyllabic stems are *mólé* (HH) 'day after tomorrow', *méli* (HL) 'head', *papó* (LH1) 'fool', *namú* (LH2) 'tree'. The same older[20] and younger Kyungsang speakers who served as subjects in this chapter also produced these four-syllable words with two repetitions. Each of the four-syllable words was embedded in a sentential frame. F0 was measured every 10%within each of the four syllables, and therefore the duration of each syllable was normalized[21]. Figure 5. 16 presents the F0 contours of the four-syllable words averaged across 6 older (a) and 10 younger (b) Kyungsang speakers; the first two syllables are disyllabic stems, and the last two syllables are the suffix /*-pota*/ 'than'.

[20]Among the ten old speakers, however, four speakers were excluded due to their unnaturally raised phrase-final pitch.

[21]A Praat script (Xu 2006) was used for extracting F0 contours.

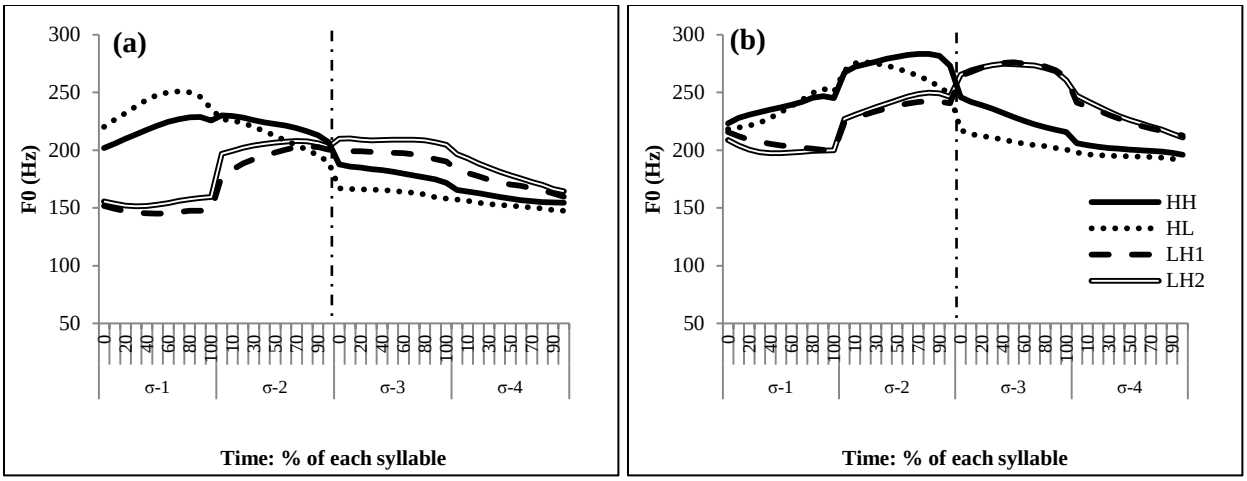

Figure 5. 16. F0 contours off our-syllable words between Older (a) and Younger (b) Kyungsang speakers. The data were averaged across speakers and across two repetitions. The vertical dotted lines in the middle indicate the morpheme boundary.

A comparison the F0 contours of the four-syllable words between older and younger Kyungsang speakers demonstrates younger Kyungsang speakers' rightward F0 peak shift, showing that the F0 peak occurs one syllable later for younger speakers compared to older speakers across all disyllabic pitch classes. The accent descriptions between older and younger Kyungsang speakers are summarized in Table 5. 11. As a criterion for the presence or absence of an F0 peak for each syllable, I considered which syllable carries the prominence of pitch within a four-syllable word by observing the occurrence of F0 maximum. Table 5. 11 shows that 1) while older speakers show equal prominence of pitch on the first two syllables for HH + /-*pota*/, younger speakers show the pitch prominence on the second syllable for HH + /-*pota*/; 2) while older speakers show the pitch prominence on the first syllable of HL + /-*pota*/, younger speakers show the prominence on the second syllable of HL + /-*pota*/; 3) while older speakers show the pitch prominence on the second and third syllables for LH1/LH2 + /-*pota*/, younger speakers show the prominence on the third syllable for LH1/LH2 + /-*pota*/.

	Older Kyungsang	Younger Kyungsang
HH + /*-pota*/	**HH**.LL	L**H**.LL
HL + /*-pota*/	**H**L.LL	L**H**.LL
LH1 + /*-pota*/	L**H.H**L	LL.**H**L
LH2 + /*-pota*/	L**H.H**L	LL.**H**L

Table 5. 11. Summary of accent patterns for disyllabic stems with the /*-pota*/ 'than' suffix between older and younger Kyungsang speakers. The period indicates a morpheme boundary.

To sum up, the comparison across previous and current studies reveals conclusive evidence of age variation in lexical pitch accent of Kyungsang Korean. First, although there were inconsistent reports among previous studies, the comparison across the previous and the present data suggested that the inconsistency is a reflection of the generational difference in lexical pitch accent of Kyungsang Korean. Second, younger Kyungsang speakers' rightward F0 peak shift is observed not only in the present data, but also in previous research (Lee 2008). Thus, the comparison between H.-S. Lee (2008) and the present data provided additional evidence of age variation in the temporal F0 property of lexical pitch. Third, the difference in stimuli conditions between H.-S. Lee (2008) and the current project leads us to compare the accent pattern between the two generations of Kyungsang with the four-syllable words, and this comparison demonstrated younger Kyungsang speakers' rightward F0 peak shift by showing that younger speakers place the F0 peak one syllable later compared to older speakers.

So far, we have discussed the phonetic evidence of generational differences in lexical pitch accent, which suggests a sound change in the lexical pitch accents of Kyungsang Korean. Now, let us consider whether and how the lexical pitch accent properties of Kyungsang Korean is maintained uniquely and distinct from the non-lexical pitch accent Seoul Korean. Figure 5. 17 compares the schematized pitch contours of the disyllabic accent classes for the older Kyungsang

(a), younger Kyungsang (b), and younger Seoul Korean[22]speaker (c) groups (also Figures 5.8 and 5.9).

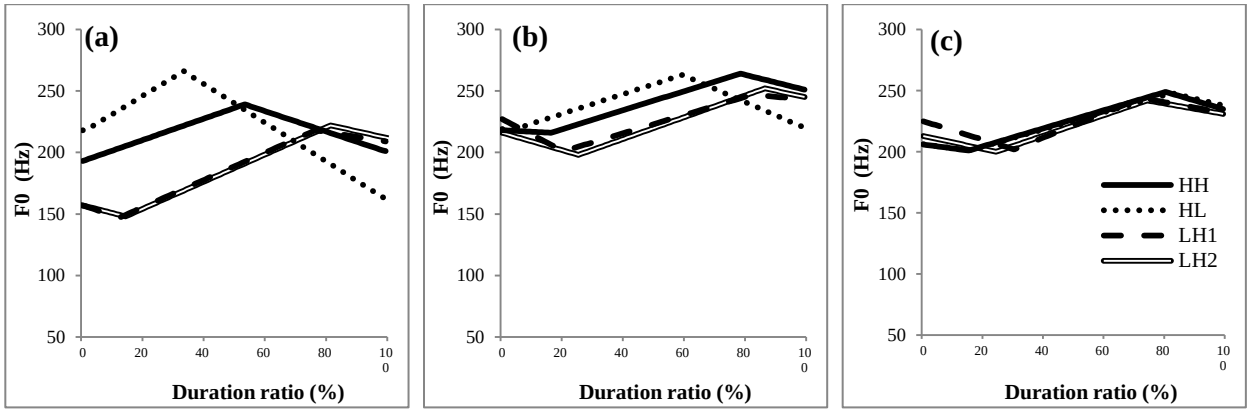

Figure 5. 17. Comparison of pitch contours of HH, HL, LH1 and LH2 accents for Older Kyungsang (a), Younger Kyungsang (b), and Younger Seoul speakers(c).

The comparison between Fig.5.17-(b) and Fig. 5.17-(c) shows how similar and different the accent structures are between younger Kyungsang and Seoul speakers.

The accent structure of younger Kyungsang Korean is similar to that of Seoul Korean in terms of the small F0 difference across accent classes and the location of the F0 maximum points within disyllabic stems. Specifically, F0 minimum-maximum values across the four pitch classes are less distinct for younger Kyungsang speakers compared to older Kyungsang speakers, and this makes the accent structures similar to Seoul Korean which has comparable F0 minimum-maximum values across disyllabic words. In addition, the location of F0 maximum points of younger Kyungsang speakers makes the accent structure similar to Seoul Korean. The F0 peak never occurs on the first syllable for younger Kyungsang speakers due to their rightward F0 peak

[22] Since the accent structure of Seoul Korean is identical between old and younger Seoul speakers, I only present the younger Seoul speakers here.

shift, which surfaces as a Low tone on the first syllable and a High tone on the second syllable, that is, LH for all disyllabic pitch classes. Notably, the present data for Seoul Korean also show an LH pattern for all disyllabic words, confirming Jun (1998) who proposed a phrase-final rising tone or LH for the accentual phrase with less than four syllables. In sum, the reduced F0 distinction for contrastive accents and younger Kyungsang speakers' rightward F0 shift make the accent structure of younger Kyungsang speakers similar to that of Seoul Korean, but different from older Kyungsang.

Despite the similarities, however, the accent between younger Kyungsang and Seoul Korean speakers is not identical. The phonetic realization across all disyllabic words is the same for Seoul Korean in terms of spectral and temporal F0 properties. On the other hand, although the phonetic distinction across the four pitch classes is reduced for younger Kyungsang as compared to older Kyungsang speakers, spectral and temporal F0 differences for contrastive accents still exist among younger Kyungsang speakers. According to the *post hoc* reports (Table 5. 5), while the F0 minimum-maximum values are lower for LH than HL/HH for younger Kyungsang speakers, there were no F0 differences across words in Seoul Korean; while the F0 maximum point for HL occurs earlier than HH/LH for younger Kyungsang speakers, there were no differences in temporal F0 distance across words in Seoul Korean. In other words, the small, but existing phonetic differences for contrastive accents among younger Kyungsang speakers indicate a dialectal difference in their prosodic properties between (younger) Kyungsang and Seoul Korean, implying the maintenance of lexical pitch accent by younger Kyungsang speakers.

In fact, the younger Kyungsang speakers' maintenance of the lexical pitch accent is clearly seen in four-syllable words. Figure 5. 18 presents the comparison of F0 contours between younger Kyungsang and Seoul speakers for four-syllable words consisting of disyllabic

stems and a disyllabic suffix (Fig.5.18-(a) is Fig.5.16-(b)). The same disyllabic stems with the previous F0 contour observation were examined with the suffix /-*pota*/. The ten younger Seoul speakers who served as subjects in this chapter also produced these four-syllable words with two repetitions, and each of the four-syllable words was embedded in a sentential frame.

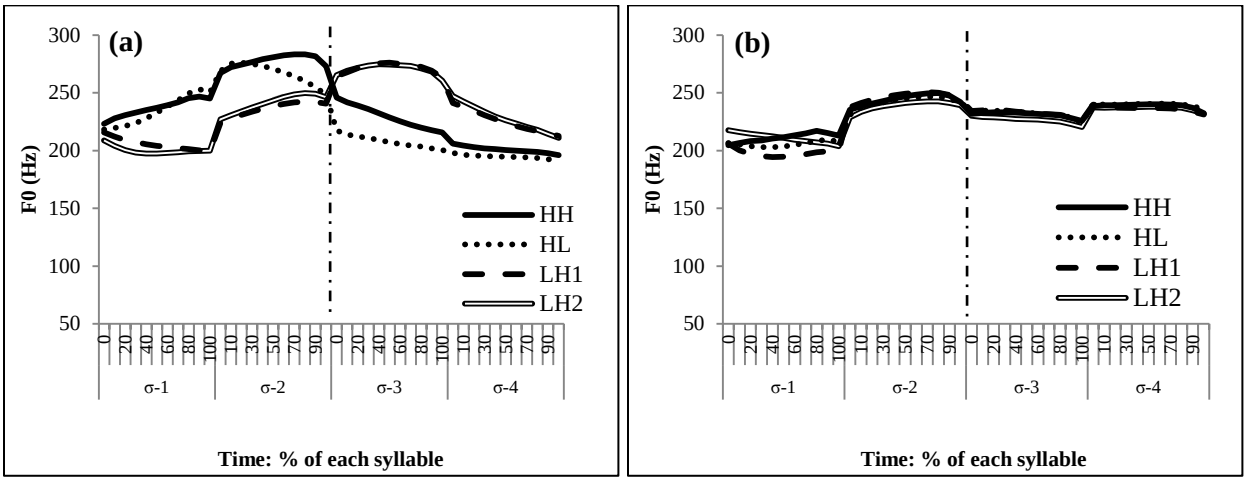

Figure 5. 18. F0 contours of four-syllable words between younger Kyungsang (a) and Seoul (b) speakers. The data were averaged across speakers and across two repetitions. The vertical dotted lines in the middle indicate the morpheme boundary.

The comparison of accent patterns with the four-syllable words clearly shows dialectal differences in tonal properties between (younger) Kyungsang and Seoul Korean. Specifically, Seoul Korean in Fig. 5. 18-(b) has LHLH patterns for all disyllabic stems with /-*pota*/, and the LHLH is prosodically determined for the four-syllable words. For younger Kyungsang speakers, we can identify two different accent patterns, LH.LL and LL.HL, and the two patterns are determined according to the initial High tone (HH/HL) and non-initial High tone (LH1/LH2) lexical items. This dialectal difference suggests that despite the similarities in the accent structure with Seoul Korean, the lexically determined pitch accent pattern is maintained by

younger Kyungsang speakers, and the tonal system between (younger) Kyungsang and Seoul Korean is distinct.

5. 5. Conclusion

The current chapter tested whether the lexical pitch accent of South Kyungsang Korean is maintained consistently by younger and older speakers, and whether the accent of Kyungsang Korean is becoming similar to that of Seoul Korean. We examined the spectral and temporal F0 properties in lexical pitch accents across generations and dialects. The findings of this chapter provided concrete evidence of sound change in the lexical pitch accents of South Kyungsang Korean. For younger Kyungsang speakers, the spectral and temporal F0 properties across contrastive accents are less distinct compared to older Kyungsang, suggesting that the phonetic distinction among lexical accents is reduced. In addition, younger Kyungsang speakers shift the F0 peak rightwards, which results in the loss of a High tone on the first syllable for all words. The reduced phonetic distinction and the loss of the High tone on the first syllable across accent classes make the accent structure of younger Kyungsang speakers similar to that of Seoul Korean. However, although the accent pattern of younger Kyungsang speakers becomes similar to that of Seoul Korean, the comparison of the accent patterns with four-syllable words between (younger) Kyungsang and Seoul Korean revealed clear dialectal differences. This indicated that Kyungsang Korean is still distinct from Seoul Korean regarding its maintenance of the lexical pitch accent. Therefore, the current chapter concludes that the sound change in lexical pitch accent is on-going by satisfying the prosodic property of both Seoul and Kyungsang Korean.

CHAPTER 6

DIACHRONIC SOUND CHANGE IN LEXICAL PITCH ACCENTS OF KYUNGSANG KOREAN: GENERATIONAL CHANGE IN PHONOLOGICAL PROPERTIES

6. 1. Introduction

In the previous chapter, we observed that the phonetic realization of lexical pitch accent is different between older and younger Kyungsang generations. Younger Kyungsang speakers use spectral and temporal F0 properties differently from older Kyungsang speakers in contrasting lexical accents. The spectral and temporal F0 properties across contrastive accents are less distinct for younger Kyungsang compared to older Kyungsang speakers, suggesting that the phonetic distinction between lexical accents is reduced. In addition, younger Kyungsang speakers shift F0 peak rightwards, which results in the loss of a high tone on the first syllable for disyllabic words. According to this observed age variation, I suggested on-going sound change in surface phonetic forms for the lexical pitch accents in the South Kyungsang dialect of Korean. The age variation in the surface forms now questions whether and how the age variation occurs in the underlying forms, raising the question whether the underlying lexical tones are maintained by the younger Kyungsang generation as well as the older. Thus, this chapter aims to examine whether the lexical pitch accent shows age variation in the underlying forms, and, accordingly, to determine if the diachronic sound change occurs at the underlying level as well as the surface phonetic level. A particular focus in the current chapter is on the nominal lexical accent pattern of South Kyungsang Korean. The organization of this chapter is as follows. I first explain the descriptive accent patterns, and introduce a previous phonological analysis that accounts for the nominal accents of South Kyungsang Korean (Section 6. 1). Then, an acoustic study examining the accent pattern in nouns is reported for both older and younger Kyungsang speakers;

examination of the prosody of Seoul Korean is also presented for the comparison between Kyungsang and Seoul Korean (Section 6. 2). Based on the empirical data, the current chapter not only re-visits previous theoretical analyses, but also provides a new analysis that accounts for on-going sound change in lexical pitch accents; an Optimality-Theoretic analysis (Prince & Smolensky 1993, 2004) that derives the surface tone patterns for the production of younger Kyungsang speakers is proposed (Section 6. 3)

6. 1. 1. Background

Although North and South Kyungsang dialects of Korean share some pitch contrasts as in (1), the two Korean varieties differ in their preservation of a rising pitch accent (R) from Middle Korean (15th century). While South Kyungsang Korean has preserved the rising accent in monosyllabic and LH in disyllabic roots, it has merged with H(H) in North Kyungsang as in (2). The difference indicates that South and North Kyungsang Korean have different underlying tones. To avoid the geographical variation in the lexical pitch accent, the current chapter focuses on South Kyungsang Korean rather than North Kyungsang. Henceforth, Kyungsang Korean in this chapter refers to South Kyungsang Korean. The Kyungsang data are transcribed according to the Yale Romanization (Martin 1992).

(1) South and North Kyungsang:

HL	kácì	'type (n.)'
HH	kácí	'branch'
LH	kàcí	'eggplant'

(2)

South Kyungsang:		North Kyungsang:		
R	nwŭn	H	nwú:n	'snow'
LH	sàlám	HH	sá:lám	'person'

6. 1. 1. 1. Descriptions of nominal accent patterns in Kyungsang Korean

As introduced in Chapter 5, South Kyungsang Korean has a High (H) and Rising (R) accent contrast in monosyllabic words, and HL, HH and LH accent classes in disyllabic words (Ramsey 1975, Kenstowicz & Park 2006, Chang 2007, Kenstowicz, Cho & Kim 2008). For the monosyllabic nouns, the H and R contrast is phonetically distinct in isolation: the high peak of the R class occurs later than that of the H class words within a monosyllable, and the R class words have longer rime duration than the H class words and create the rising contour (Chang 2007, Kenstowicz et al. 2008). Importantly, although we only see one H monosyllabic accent in isolation, the behavior of monosyllabic noun roots under suffixation indicates that there are two different types of underlying H accents (Ramsey 1975, Kim and Schuh 2006, Schuh and Kim 2007, Chang 2007). For example, both *nwún* 'eye' and *mún* 'door' have an H pitch in isolation, but when the suffix *-i* (nominative case marker) is added, the pitch pattern becomes *nwún-í* (H-H) for 'eye' but *mún-i* (H-L) for 'door'. In addition, when the disyllabic suffixes *-imyen* 'if' and *-pota* 'than' are added to these words, the pitch patterns become *nwún-ímyen* (H-HL) and *nwún-póta* (H-HL), but *mún-imyen* (H-LL) and *mun-póta* (L-HL). That is, the accent patterns for *nwún* 'eye' are consistent regardless of suffix type—two consecutive Hs on the first two syllables; on the other hand, the pattern for *mún* 'door' varies by suffixes—while the high tone occurs only at the root with the monosyllabic *-i* and disyllabic *-imyen* suffixes, the high tone occurs on the first syllable of the suffix *-pota*. This indicates that suffixation plays an important role in revealing the fact that the neutralized H should belong to two separate accent classes. The current chapter tentatively uses numerical indication to mark the two High accent classes as in H1 and H2: H1 is for the H class without accent variations, and H2 is for the H class with accent variations under suffixation, respectively. Finally, the accent pattern for Rising (R) is consistent under

suffixation—the H tone occurs on the second and third syllables if there is an available third syllable, while the root syllable takes an L tone. Table 6. 1 summarizes the pitch patterns for H1, H2, and R on monosyllabic nouns under different types of suffixation.

H1		**H2**		**R**	
nwún ‘eye’	H	mún ‘door’	H	nwŭn ‘snow’	R
nwún-í	H-H	mún-i	H-L	nwun-í	L-H
nwún-ímyen	H-HL	mún-imyen	H-LL	nwun-ímyén	L-HH
nwún-póta	H-HL	mun-póta	L-HL	nwun-pótá	L-HH

Table 6. 1. Pitch accent patterns for H1, H2 and R in monosyllabic nouns under suffixation. Data were adapted from Kim and Schuh (2006) and Chang (2007).

The role of suffixation is also observed for disyllabic nouns. Similar to monosyllabic nouns, one LH shows no tonal variation regardless of suffixes, but the other LH has accent variations by suffix type, indicating that there are two LH classes. For example, although both *salám* ‘person’ and *palám* ‘wind’ have an LH pitch pattern in isolation, they pattern differently when suffixed: when the monosyllabic suffix *-i* is added, ‘person’ becomes *salám-í* (LH-H), but ‘wind’ becomes *palám-i* (LH-L). Also, when the disyllabic suffixes *-imyen* ‘if’ and *-pota* ‘than’ are added to these words, ‘person’ patterns as *salám-ímyen* (LH-HL) and *salám-póta* (LH-HL), but ‘wind’ patterns as *palám-imyen* (LH-LL) and *palám-póta* (LH-HL). In other words, the accent pattern for *salám* ‘person’ consistently shows two consecutive Hs on the second and available third syllables regardless of suffix type; in contrast, the pattern for *palám* ‘wind’ varies by suffix—while the high tone occurs only on the second syllable of the root with the suffixes *-i* and *-imyen*, the high tone always occurs on the first syllable of the suffix *-pota*. The numerical indication as in LH1 and LH2 is used for marking the neutralized disyllabic LHs in isolation

form. Regarding the disyllabic HL and HH accents, the accent patterns under suffixation are consistent: the suffixed syllables take an L tone, while the HL and HH tones remain on the root. The pitch patterns for HL, HH, LH1 and LH2 on disyllabic noun roots under different types of suffixation are summarized in Table 6. 2.

HL		**HH**		**LH1**		**LH2**	
kéwul 'mirror'	HL	kúlím 'painting'	HH	salám 'person'	LH	palám 'wind'	LH
kéwul-i	HL-L	kúlím-i	HH-L	salám-í	LH-H	palám-i	LH-L
kéwul-imyen	HL-LL	kúlím-imyen	HH-LL	salám-ímyen	LH-HL	palám-imyen	LH-LL
kéwul-pota	HL-LL	kúlím-pota	HH-LL	salám-póta	LH-HL	palám-póta	LH-HL

Table 6. 2. Pitch accent patterns for HL, HH, LH1 and LH2 in disyllabic nouns under suffixation. Data were adapted from Kim and Schuh (2006) and Chang (2007).

These observations with various suffixation indicate that although the accent patterns are H and R for monosyllables, and HL, HH and LH for disyllables in isolation, the monosyllabic and disyllabic nouns in Kyungsang Korean underlyingly belong to three (H1, H2 and R) and four (HL, HH, LH1 and LH2) accent classes, respectively.

6. 1. 1. 2. Theoretical analysis for the lexical accent in South Kyungsang Korean

The accent patterns in Kyungsang Korean have been phonologically analyzed in previous research. Lee and Zhang (in press) proposed four underlying accent classes according to the parallels between the monosyllabic and disyllabic pitch patterns, and provided an analysis within the Optimality Theory (Prince & Smolensky 1993, 2004) framework. The parallels between

monosyllabic and disyllabic nouns are summarized in Table 6. 3. The parallel with trisyllabic nouns is also provided to show how Lee and Zhang's analysis works.

			H1	**R**	**H2**
	isolation		H	R	H
Mono-	monosyllabic suffix: -i		H-H	L-H	H-L
	disyllabic suffix: -imyen		H-HL	L-HH	H-LL
	disyllabic suffix: -pota		H-HL	L-HH	L-HL
		HL	**HH**	**LH1**	**LH2**
	isolation	HL	HH	LH	LH
Di-	monosyllabic suffix: -i	HL-L	HH-L	LH-H	LH-L
	disyllabic suffix: -imyen	HL-LL	HH-LL	LH-HL	LH-LL
	disyllabic suffix: -pota	HL-LL	HH-LL	LH-HL	LH-HL
		LHL	**HHL**	**LHH1**	**LHH2**[23]
	isolation	LHL	HHL	LHH	LHH
Tri-	monosyllabic suffix: -i	LHL-L	HHL-L	LHH-L	LHH-L
	disyllabic suffix: -imyen	LHL-LL	HHL-LL	LHH-LL	LHH-LL
	disyllabic suffix: -pota	LHL-LL	HHL-LL	LHH-LL	LHH-HL

Table 6. 3. Parallels in pitch accent patterns among monosyllabic, disyllabic and trisyllabic nouns (according to the formal analysis proposed by Lee & Zhang).

[23] The accent patterns for LHH2 in Table 6. 3 represent the theoretically expected pattern for the LHH2 class. However, Utsugi (2009) has reported that the trisyllabic LHH2 class has merged with the LHH1 class. Utsugi's argument about the merger was based on the same tonal patterns between 'LHH2-*imyen'* and 'LHH2-*pota'*, both of which reported LHH-LL. The consistent LHH-LL regardless of -*imyen* and -*pota* was also empirically observed in Lee and Zhang (in press), supporting the argument by Utsugi (2009).

In Table 6. 3, H1 in monosyllables, HH in disyllables and HHL in trisyllables behave in parallel in having an H tone on the first and second syllables if there is an available second syllable. R in monosyllables, LH1 in disyllables and LHH1 in trisyllables behave in parallel in having an H tone on the second and available third syllables. HL in disyllables and LHL in trisyllables behave in parallel in having an H tone on the penultimate syllable. Finally, the monosyllabic H2, disyllabic LH2 and trisyllabic LHH2 classes have tonal variations by suffixes: when words in these tone classes are suffixed with *-pota* 'than', the H tone always occurs on the first syllable of the suffix; but when they are suffixed with *-i* (nom.) or *-imyen* 'if', the H tone occurs on the last syllable of the root and the rest of the syllables take a L tone.

Lee and Zhang (in press) proposed that underlying accent classes are divided into two accent groups. One group included the H1/HH/HHL, R/LH1/LHH1 and HL/LHL classes that have a consistent pitch pattern regardless of suffix type, and these were analyzed as having an underlyingly pre-linked H tone. The other group included the H2/LH2/(LHH2) class that shows tonal variations by suffix, and this was analyzed as a *toneless* class. Based on the accent variations by suffixes for H2/LH2/(LLH2), Lee and Zhang (in press) proposed that a suffix like *-pota* bears an underlying tone, but suffixes such as *-i* and *-imyen* do not have an underlying tone. The phonological analysis in Lee and Zhang (in press) is presented in Table 6. 4.

	HL/LHL	H1/HH/HHL	R/LH1/LHH1	H2/LH2/(LHH2)
Location of the pre-linked H tone	Penult	Initial	Pen-initial	Toneless
Presence/absence of Spreading property	No spreading	Spreading	Spreading	—
Underlying representation	H | μμ#	H^+ | #μ	H^+ | #μμ	—

Table 6. 4. Phonological analysis in Lee and Zhang (in press)

According to Lee and Zhang (in press), the underlying tone classes are determined by the location of the pre-linked H and the presence/absence of a spreading property of the pre-linked H tone. Table 6. 4 shows that the underlying H tone is docked to either initial, pen-initial or penultimate syllables, and if the H tone occurs across two consecutive syllables, the H tone is analyzed as having a rightward spreading property marked with a (+) diacritic as in H^+. The accent patterns in the *toneless* class surface by constraint interactions and suffixal tones.

The current chapter of this dissertation investigates whether these underlying lexical pitch accents are maintained by younger as well as older Kyungsang speakers under the increased influence of Seoul Korean, a non-lexical pitch accent language. Speculation about the role of age variation in phonology in addition to phonetics becomes plausible based on the observed age differences in the previous Chapter 5. The finding in Chapter 5 particularly motivates me to examine how the *rightward accent shift* is reflected in the phonology of Kyungsang's lexical accent. Since Lee and Zhang (in press) suggested that the location of the pre-linked H tone determines an underlying accent class, if the *rightward accent shift* is reflected in the phonology of lexical accents among younger Kyungsang speakers, it might be expected that older and

younger Kyungsang speakers have different underlying accent tones in terms of the location of the pre-linked underlying H tone.

6. 1. 1. 3. Goals

The goal of this chapter is to determine whether sound change occurs in the phonology of the lexical pitch accents of South Kyungsang Korean by examining empirical data from older and younger Kyungsang generations. An acoustic study first compared the full range of nominal accent patterns between the two generations of Kyungsang speakers to examine if younger Kyungsang speakers show the reported tonal pattern consistently with older speakers and accordingly to determine if the same phonological analysis can be applied to both younger and older Kyungsang speakers. Since a phonological word of less than three syllables should be expanded with suffixes to determine the underlying tone class, the acoustic study observed the accent pattern of monosyllabic and disyllabic noun stems expanded with various suffixes. This allowed us not only to re-visit previous phonological analyses proposed for the older Kyungsang generation, but also to examine the age variation in underlying accent classes in the language. A particular focus in the acoustic study was to see if each syllable within a phonological word has an H tone or not, and therefore to obtain the entire accent pattern for the test word. Moreover, through the comparison with Seoul Korean, we tested whether the underlying tonal property of South Kyungsang Korean becomes similar to that of non-lexical pitch accent Seoul Korean. The following questions are addressed in the current chapter.

(1) Do younger Kyungsang speakers show accent patterns consistent with older Kyungsang speakers for disyllabic and monosyllabic nouns when suffixes are added? If not, what is the full range of nominal accent patterns for younger Kyungsang speakers?

(2) Can the phonological analysis in Lee and Zhang (in press) be applied to the accent system of the younger Kyungsang generation? If not, how can we analyze the accent patterns of younger Kyungsang speakers, and how can the age variation be captured in the phonology?

(3) If there is a generational change in the lexical pitch accent system of Kyungsang Korean, does the accent system of younger Kyungsang generations look similar to the prosody of non-tonal Seoul Korean?

6. 2. Acoustic study

6. 2. 1. Methods

6. 2. 1. 1. Participants

The same forty female speakers in the segment (vowels, stops, fricatives) study also served as participants for the lexical pitch accent study. From the forty, however, one older Kyungsang speaker was excluded due to her unnatural production of longer words.

6. 2. 1. 2. Procedure

The data collection procedure for this lexical pitch accent study is the same as for the segment study.

6. 2. 1. 3. Speech materials

Fourteen monosyllabic and disyllabic noun stems differing in their underlying accent classes were selected. Two words from each of the four underlying accent classes were chosen, and therefore six monosyllabic and eight disyllabic nouns were examined. Between the two selected stems for each underlying accent class, one has a coda, and the other does not, which provides the condition where alternation of a suffix can occur. The suffixes *-i* and *-imyen* have alternation in which *-ka* and *-laymen* is used when a coda of a preceding word is absent.

Therefore, the selected noun stems make it possible to observe the accent pattern of a particular accent class by the two suffix alternations. The word lists for the lexical pitch accent study are presented in Table 6. 5 for monosyllabic words and in Table 6. 6 for disyllabic words.

High1		**Rising**		**High2**	
nwun	'eye'	nwun	'snow'	mun	'door'
tay	'bamboo'	key	'crab'	pay	'pear'

Table 6. 5. Monosyllabic test words

HH		**HL**		**LH1**		**LH2**	
kulim	'painting'	meli	'head'	salam	'person'	palam	'wind'
mole	'the day after tomorrow'	mole	'sand'	papo	'fool'	namu	'tree'

Table 6. 6. Disyllabic test words

These monosyllabic and disyllabic noun stems were expanded with each of the four suffixes differing in their number of syllables (monosyllabic vs. disyllabic) and underlying accent classes (toneless vs. pre-linked H at penult). The four suffixes recorded with stems are summarized in Table 6. 7.

	Suffix		**Underlying tone**
Monosyllabic suffix	*-i/ka*	'nom. case marker'	toneless
Disyllabic suffix	*-imyen/-lamyen*	'if'	toneless
	-pota	'than'	Pre-linked H at penult
	-mankhum	'as much as'	Pre-linked H at penult

Table 6. 7. List of suffixes recorded with noun stems

Speakers produced each target word embedded in a sentential frame [*ije* ____ *-choketta* 'Now, (I) like _____'] with two repetitions. In order to help subjects to distinguish segmental homonyms such as *nwún* (High) 'eye' and *nwŭn* (Rising) 'snow', a corresponding picture was

provided next to each stimulus. In total, 4368 tokens were obtained for the study of lexical pitch accent: 1872 tokens for the monosyllabic words (2 noun stems × 3 underlying accent classes × 4 suffixes × 2 repetitions × 39 speakers) and 2496 tokens for the disyllabic words (2 noun stems × 4 underlying accent classes × 4 suffixes × 2 repetitions × 39 speakers).

6. 2. 1. 4. Measurements and tone assignment

To obtain the entire accent pattern for a test word, a High or a Low tone is assigned for each syllable within a test word in an objective manner. The process of this tone assignment is as follows.

First, segmentation was made to separate each syllable within a test word. A segmented syllable includes a vowel, or a vowel with a coda nasal (i.e., rime-only). The beginning of each segmented syllable was determined at the onset of the vowel, and accordingly the initial consonant of each syllable was excluded. Excluding the initial consonant of each syllable has two advantages. First, it minimizes segment effects caused by differences in onset consonants; some syllable onset consonants are sonorant (nasal, tap), but others are obstruent (plosive, fricative) in the current chapter. Second, excluding the word-initial consonant allowed consistent syllabification throughout the stimuli. Specifically, the word-initial consonants include nasals, stops, and fricatives. While the onset of nasals or fricatives can be easily determined, the beginning of closure for word-initial stops is less clear. Therefore, excluding the word-initial consonant of each stimulus enabled us to have a consistently segmented 'vowel (+ nasal coda)' syllable across all stimuli. The onset and offset of a vowel was determined by the onset of the first formant and offset of the second formant, respectively, as seen in the spectrogram. The boundary between nasal and vowel or nasal and oral consonant was determined based on

amplitude change in both waveform and spectrogram. In addition to the rime-only segmentation, the current chapter considered resyllabification for test words including vowel-initial suffixes to see if the resyllabification affects the results (e.g., *nun-i* → *nu-ni*, *palam-imyen* → *pala-mimyen*).

Second, after segmenting each syllable, the mean F0 value (Hz) per syllable was measured within a test word. For instance, if a test word consists of two syllables (i.e., monosyllabic stem + monosyllabic suffix), the mean F0 values for each of the two syllables were measured; if a test word has four syllables (i.e., disyllabic stem + disyllabic suffix), the mean F0 values for each of the four syllables were measured.

Third, according to the obtained mean F0 value per syllable, either a High or Low tone was assigned to each syllable. For this assignment, a syllable with the highest mean F0 was first selected, and a High tone was assigned to that syllable. Then, if there is another syllable whose mean F0 is within 95%[24] of the highest mean F0, a second High tone is assigned to that syllable. In other words, any syllable having less than a 5% F0 difference was considered as a High tone syllable. All other syllables having more than a 5% F0 difference were assigned with Low tones. Using the percentage criterion (i.e., less than 5%) instead of a fixed criterion (e.g., less than 10 Hz) for the tone assignment is advantageous in terms of considering inter- and intra-speaker variations in F0.

Figure 6. 1 illustrates the example of tone assignment for the test words *nwun-imyen* 'if eyes' (Fig. 1-left column) and *mun-pota* 'than door' (Fig. 1-right column). For the *nwun-imyen*, a three-syllable test word, an H tone is first assigned to the second syllable whose mean F0 of 233 Hz is the highest among the three syllables, and then another H tone is assigned to the first

[24] The 95% criterion was determined because the value elicited the most consistent tonal patterns across all speakers compared to 94%, 96% and 97% criteria.

syllable with a mean F0 of 224 Hz less than 5% lower than the highest mean F0 value. Finally, an L tone is assigned to the third syllable of 165 Hz because its mean F0 difference from the highest F0 syllable is more than 5%. Therefore, the assigned tonal pattern for the test word *nwun-imyen* is H-HL. For the *mun-pota* in the right column of Figure 6. 1, an H tone is assigned to the second syllable whose mean F0 of 255 Hz is the highest among the three syllables. For the first and third syllables, L tones are assigned because their mean F0s of 177 Hz and 183 Hz are more than 5% lower than the highest F0. Therefore, the assigned tonal pattern for the test word *mun-pota* is L-HL.

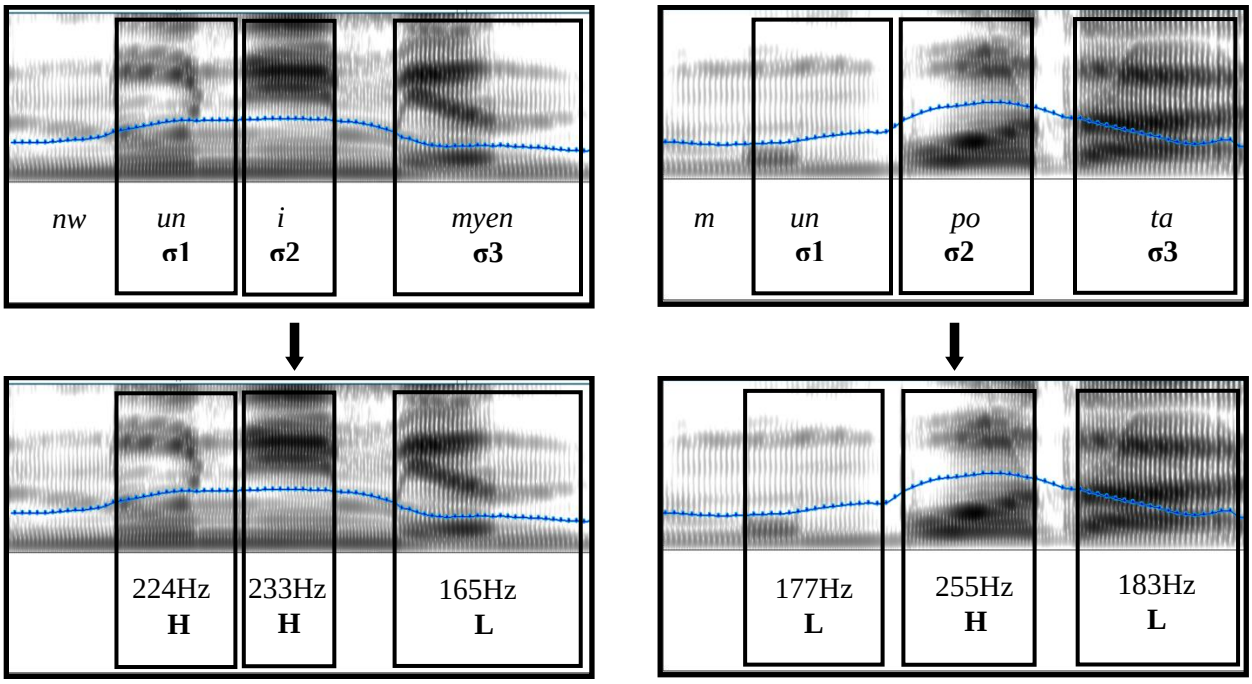

Figure 6. 1. Example of tone assignments for three-syllable test words, *nwun-imyen* (left) and *mun-pota* (right) (see text for explanation).

This tone assignment was made for all test words obtained from nine older and ten younger Kyungsang speakers except for glottalized tokens. For non-tonal Seoul Korean, the

current chapter examined the prosodic structure of test words through F0 tracings and measured mean F0 per syllable without eliciting the entire tonal pattern as for the Kyungsang data.

6. 2. 1. 5. Data analysis

For Kyungsang data, the current chapter presents the elicited accent patterns from older and younger Kyungsang speakers through graphs that show the frequency of production separately for each of the HL, H1/HH, R/LH1 and H2/LH2 accent classes. Each graph represents nine older and ten younger Kyungsang speakers' elicited accent patterns for a particular accent class by each of the four suffixes in Table 6. 7. Each bar in the graphs shows the percentage of elicited accent patterns for each suffix, representing 36 (2 test words × 2 repetitions × 9 older speakers) and 40 (2 test words × 2 repetitions × 10 younger speakers) utterances for older and younger Kyungsang speakers, respectively. The data description in this chapter focuses on *Dominant* and *Secondary* accent patterns, the largest and second largest proportion, respectively, of responses. The percentage of glottalized tokens is also indicated in the graphs, and the accent patterns that occur only once or twice were categorized as *others* in the bar graphs. Both glottalized tokens and tokens classified as *others* were excluded in data analysis. F0 tracings for each accent class by suffix are provided along with the measured F0 mean value (Hz) for each syllable to show how the lexical accent is phonetically realized by the two generations of Kyungsang speakers. To extract F0 contours, F0 was measured every 10% within each syllable (i.e., rime) of a test word using a Praat script by Xu (2006) across stimuli within the same accent class and across speakers between younger and older speaker groups.

A separate section presents results for the Seoul data obtained from twenty Seoul speakers (10 older, 10 younger). For Seoul Korean, the current chapter did not elicit the tonal

patterns using the tone assignment method used for the Kyungsang data because Seoul Korean, not a pitch accent language, is not expected to have distinct tonal patterns across test words. Instead, the current dissertation observed F0 tracings that allowed us to see how prosodic patterns of Seoul Korean are realized. As introduced in the preceding chapter (section 5. 4. 1.), Jun (1993, 1998) proposed that the realization of the underlying LHLH tonal patterns in Seoul Korean varies with the number of syllables of accentual phrases (APs). Therefore, the Seoul data are presented according to the number of syllables in each subsection: i) two-syllable (monosyllabic stem + monosyllabic suffix), ii) three-syllable (i. monosyllabic stem + disyllabic suffix, ii. disyllabic stem + monosyllabic suffix), and iii) four-syllable (disyllabic stem + disyllabic suffix) words.

6. 2. 2. Results[25]

6. 2. 2. 1. Lexical pitch accent patterns of Kyungsang Korean

6. 2. 2. 1. 1. HL

Figure 6. 2 presents the elicited accent patterns between older and younger Kyungsang speakers for the disyllabic HL accent class. Morpheme boundaries are marked with '.' throughout the results section.

[25] For most cases, the elicited accent patterns showed comparable results between rime-only and resyllabified segmentation. Resyllabification does not change *dominant* or *secondary* patterns except the LH2 class. Thus, the current chapter will present the results according to the rime-only segmentation instead of both the rime-only and resyllabified conditions. A section for LH2 in this chapter considers the two different syllabification conditions.

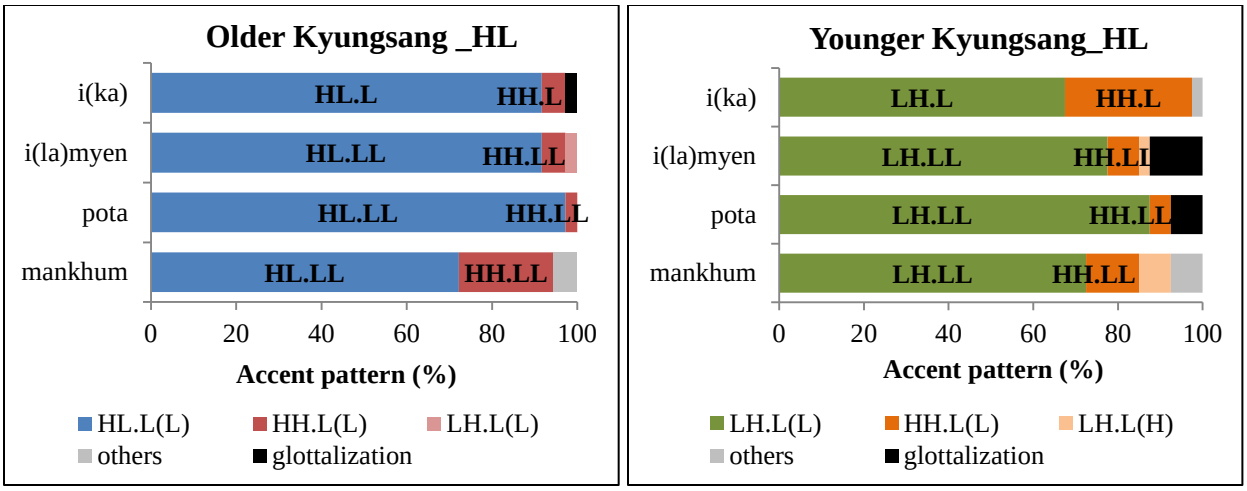

Figure 6. 2. Elicited accent patterns for the disyllabic HL accent by four suffixes between Older (left) and Younger (right) Kyungsang speakers.

For older Kyungsang speakers, the dominant accent pattern for the disyllabic HL accent class is **HL.L(L)**: 92%, 92%, 97% and 72% of HL.L(L) were elicited for the suffixes *-i/ka*, *-imyen/lamyen*, *-pota* and *-mankhum*, respectively. That is, for most cases, the first syllable showed the highest mean F0, and the mean F0 difference between the first and the other syllables is more than 5% (i.e., the mean F0 for the rest of the syllables is not as high as the first syllable).

For younger Kyungsang speakers, the dominant accent pattern for the disyllabic HL accent class is **LH.L(L)**: 68%, 78%, 88% and 73% of LH.L(L) were elicited for the suffixes *-i/ka*, *-imyen/lamyen*, *-pota* and *-mankhum*, respectively. In other words, the second syllable had the highest mean F0, and the mean F0 difference between the second and the other syllables is more than 5%. Figure 6. 3 and Table 6. 8 present F0 contours and mean F0 for each syllable, respectively, for the HL accent class in suffixed forms between older and younger Kyungsang speakers. F0 in Figures and Tables was averaged across two word stimuli within the same tonal

class, two repetitions, and speakers of each age group; F0 tracings in isolation forms are also provided throughout the present result section.

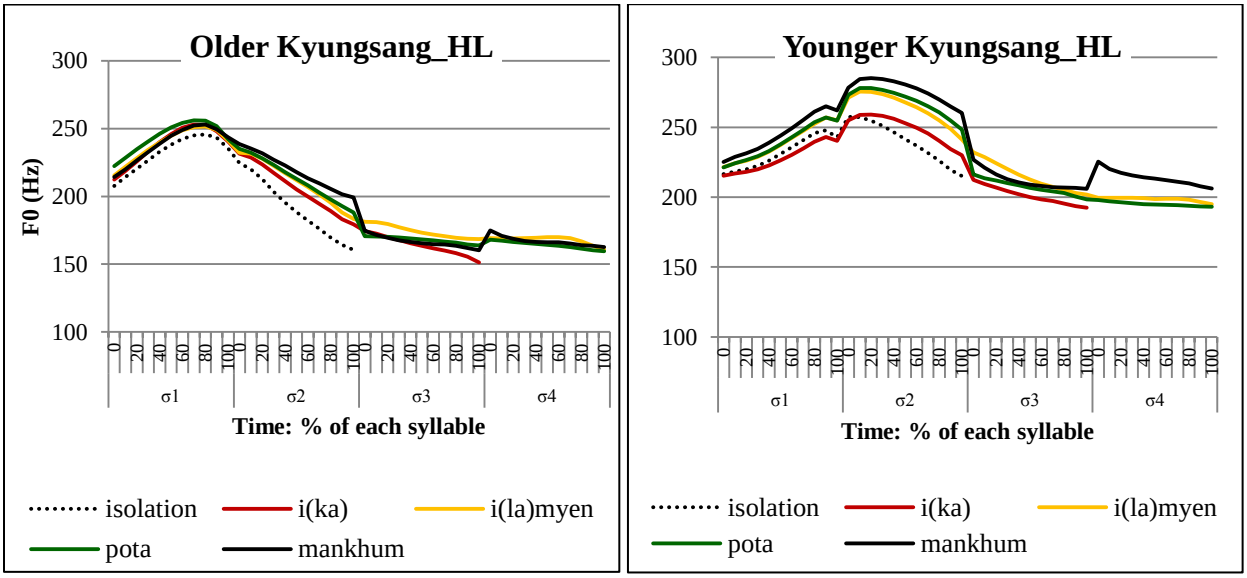

Figure 6. 3[26]. F0 contours of the HL accent class in isolation and suffixed forms between older and younger Kyungsang speakers.

	Older Kyungsang				Younger Kyungsang			
	σ1	σ2	σ3	σ4	σ1	σ2	σ3	σ4
-i(ka)	242 (29)	215 (25)	167 (20)		230 (17)	249 (17)	202 (16)	
-(la)myen	239 (23)	215 (25)	175 (20)	168 (16)	239 (21)	265 (18)	213 (15)	193 (28)
-pota	242 (27)	215 (27)	169 (21)	163 (27)	238 (20)	269 (17)	208 (15)	195 (22)
-mankhum	238 (20)	219 (24)	167 (18)	168 (31)	244 (17)	277 (18)	214 (19)	215 (28)

Table 6. 8. Mean F0 (Hz) in each syllable for the HL accent class by four suffixes between older and younger Kyungsang speakers (standard deviation in parentheses)

[26] The sudden decrease of F0 for the suffix *–mankhum* is due to the exclusion of the onset /m/ consonant in the segmentation.

The secondary accent pattern for the HL class of older Kyungsang speakers is HH.L(L), reporting 6%, 6%, 3% and 22% of HH.L(L) for the suffixes *-i/ka*, *-imyen/lamyen*, *-pota* and *-mankhum*, respectively. Younger Kyungsang speakers' secondary pattern is HH.L(L), reporting 30%, 8%, 5% and 13% of HH.L(L) for *-i/ka*, *-imyen/lamyen*, *-pota* and *-mankhum*, respectively.

6. 2. 2. 1. 2. H1 & HH

Figure 6. 4 presents the elicited accent patterns from older and younger Kyungsang speakers for the monosyllabic H1 accent class.

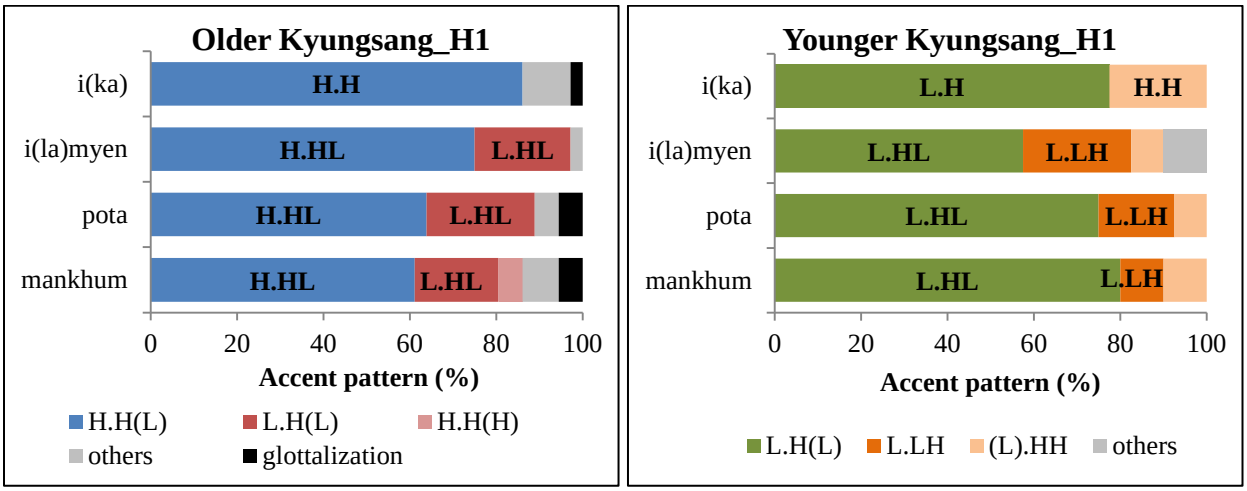

Figure 6. 4. Elicited accent patterns for the monosyllabic H1 accent by four suffixes between Older (left) and Younger (right) Kyungsang speakers.

For older Kyungsang speakers, the dominant accent pattern for the monosyllabic H1 accent class is **H.H(L)**: 86%, 75%, 64% and 61% of H.H(L) were reported for the suffixes *-i/ka*, *-imyen*/*lamyen*, *-pota* and *-mankhum*, respectively. This indicates that although the second syllable has the highest mean F0 value, F0 of the first syllable is also as high as the second syllable (i.e., the mean F0 difference between the second and the first syllables is less than 5%).

For younger Kyungsang speakers, the dominant accent pattern for the monosyllabic H1 accent class is **L.H(L)**: 78%, 58%, 75% and 80% of L.H(L) were reported for the suffixes *-i/ka*, *-imyen/lamyen*, *-pota* and *-mankhum*, respectively. Similar to the observation for the younger Kyungsang's HL class the mean F0 was highest in the second syllable and differed from the other syllable by more than 5%, resulting in L.HL. Figure 6. 5 and Table 6. 9 present F0 contours and mean F0 in each syllable, respectively, for the H1 accent class in suffixed forms between older and younger Kyungsang speakers.

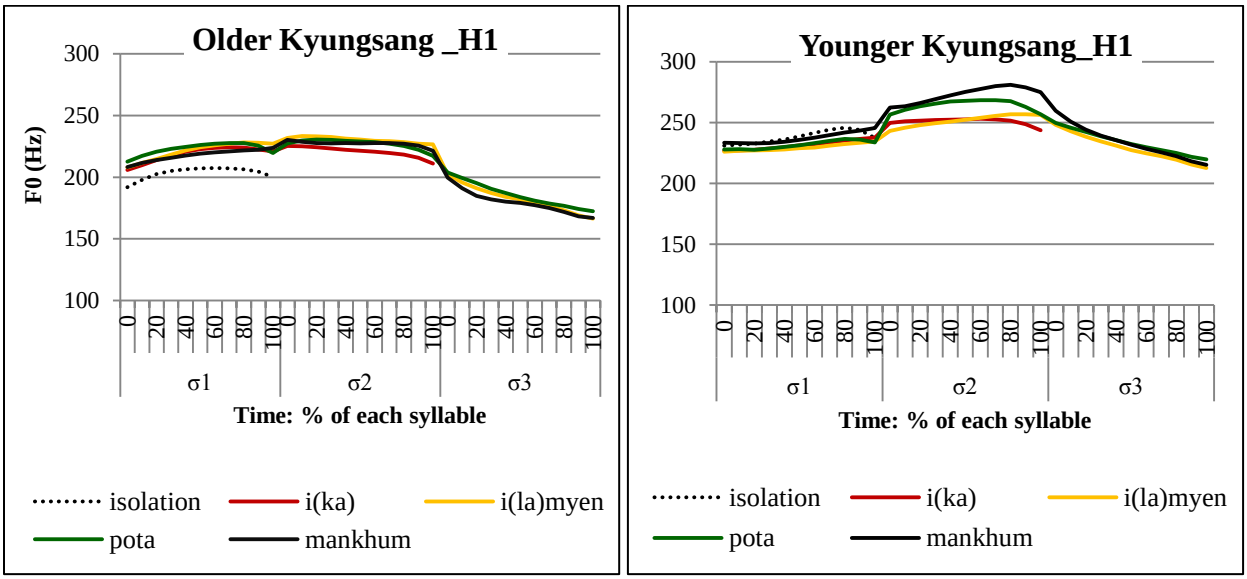

Figure 6. 5. F0 contours of the H1 accent class in isolation and suffixed forms between older and younger Kyungsang speakers.

	Older Kyungsang			Younger Kyungsang		
	σ1	σ2	σ3	σ1	σ2	σ3
-i(ka)	222 (22)	226 (27)		231 (21)	252 (20)	
-(la)myen	221 (21)	231 (27)	185 (20)	229 (13)	251 (10)	232 (19)
-pota	218 (24)	223 (31)	185 (22)	230 (17)	263 (19)	237 (18)
-mankhum	218 (20)	226 (30)	182 (23)	237 (17)	273 (20)	236 (20)

Table 6. 9. Mean F0 (Hz) in each syllable for the H1 accent class by four suffixes between older and younger Kyungsang speakers (standard deviation in parentheses)

The secondary accent pattern for the monosyllabic H1 class is L.HL for older Kyungsang speakers: 22%, 25%, and 19% of L.HL was elicited for the suffixes -*imyen*/*lamyen*, -*pota* and -*mankhum*, respectively. For the younger Kyungsang speakers, there are two types of secondary patterns. First, L.LH was reported with disyllabic suffixes -*imyen/laymen* (25%), -*pota* (18%) and -*mankhum* (10%). Second, H.H(L) was elicited for -*i/ka* (23%), -*imyen/lamyen* (8%), -*pota* (8%), and -*mankhum* (10%).

Figure 6. 6 presents the elicited accent patterns from older and younger Kyungsang speakers for the disyllabic HH accent class.

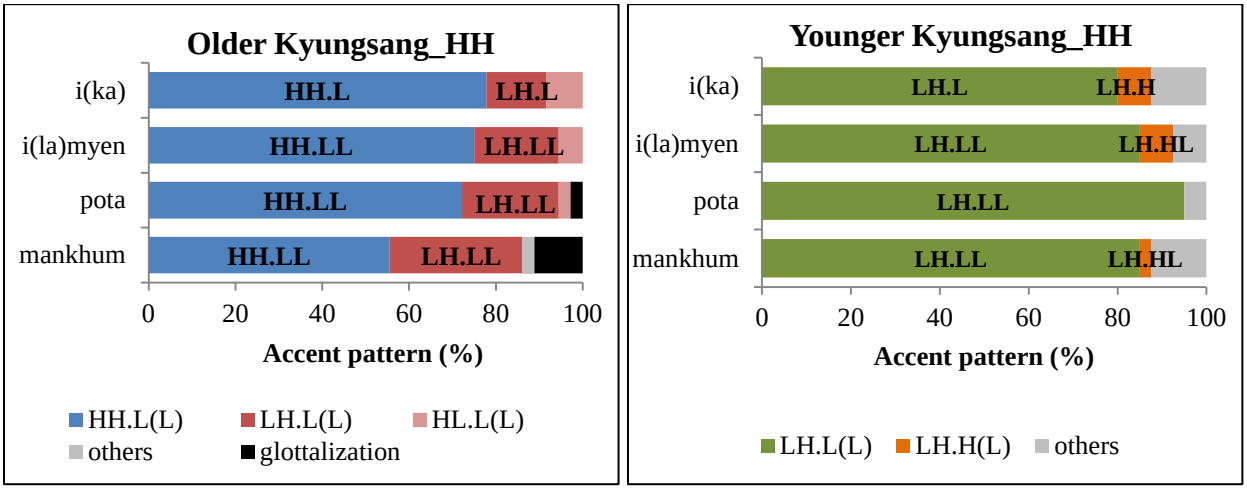

Figure 6. 6. Elicited accent patterns for the disyllabic HH accent by four suffixes between older (left) and younger Kyungsang (right) speakers.

For older Kyungsang speakers, the dominant accent pattern for the disyllabic HH accent class is **HH.L(L)**: 78%, 75%, 72% and 56% of HH.L(L) were reported for the suffixes -*i/ka*, -*imyen*/*lamyen*, -*pota* and -*mankhum*, respectively. Consistent with the monosyllabic H1 class, measured F0 values are comparable between the first and second syllable, as seen in Table 6. 10.

For younger Kyungsang speakers, the dominant accent pattern for the disyllabic HH accent class is **LH.L(L)**: 80%, 85%, 95% and 85% of LH.L(L) were reported for the suffixes -*i/ka*, -*imyen/lamyen*, -*pota* and -*mankhum*, respectively. The high tone on the second syllable is also consistent with the observation for the disyllabic HL and monosyllabic H1 classes. Figure 6. 7 and Table 6. 10 show F0 contours and mean F0 in each syllable, respectively, for the HH accent class in suffixed forms between older and younger Kyungsang speakers.

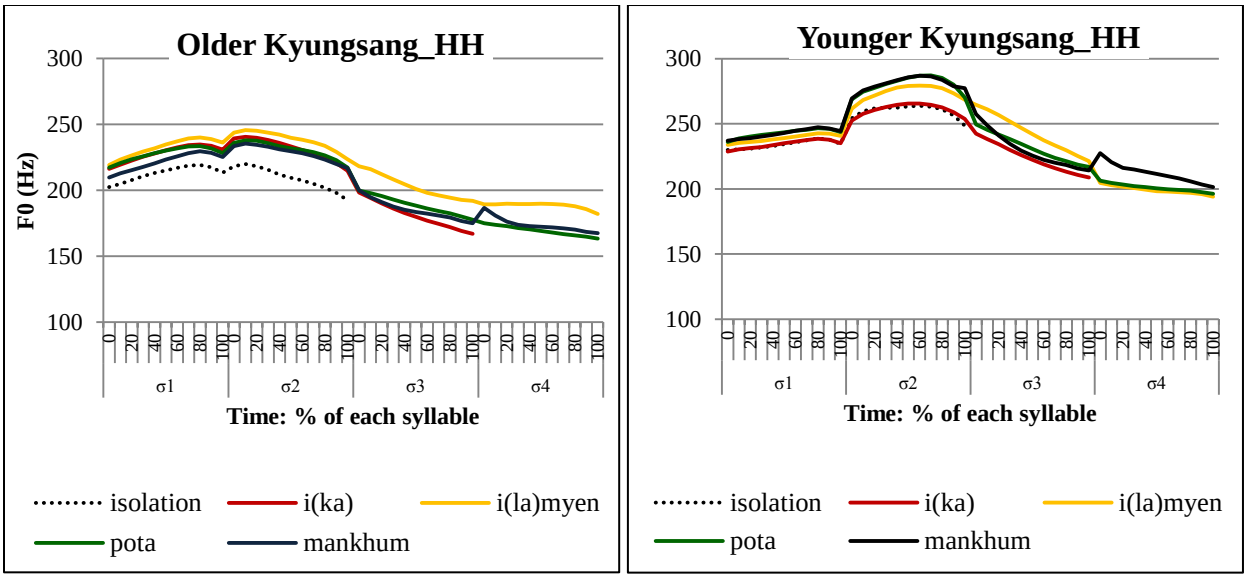

Figure 6. 7. F0 contours of the HH accent class in isolation and suffixed forms between older and younger Kyungsang speakers.

	Older Kyungsang				Younger Kyungsang			
	σ1	σ2	σ3	σ4	σ1	σ2	σ3	σ4
-i(ka)	230 (21)	232 (23)	181 (14)		235 (18)	260 (22)	225 (21)	
-(la)myen	229 (24)	234 (28)	199 (25)	185 (27)	240 (18)	274 (17)	246 (19)	196 (23)
-pota	225 (23)	229 (26)	188 (19)	167 (22)	242 (20)	280 (19)	234 (22)	202 (21)
-mankhum	223 (18)	232 (26)	185 (18)	167 (37)	243 (21)	281 (19)	235 (20)	215 (25)

Table 6. 10. Mean F0 (Hz) in each syllable for the HH accent class by four suffixes between older and younger Kyungsang speakers (standard deviation in parentheses)

For older Kyungsang speakers, the secondary accent pattern for the HH class is LH.L(L), reporting 14%, 19%, 22% and 31% for the suffixes *-i/ka, -imyen/lamyen, -pota* and *-mankhum*, respectively. Younger Kyungsang's secondary pattern is LH.H(L), reporting 8%, 8%, and 3% of LH.H(L) for *-i/ka*, *-imyen/laymen* and *-mankhum*.

6. 2. 2. 1. 3. R & LH1

Figure 6. 8 presents the elicited accent patterns from older and younger Kyungsang speakers for the monosyllabic rising accent class.

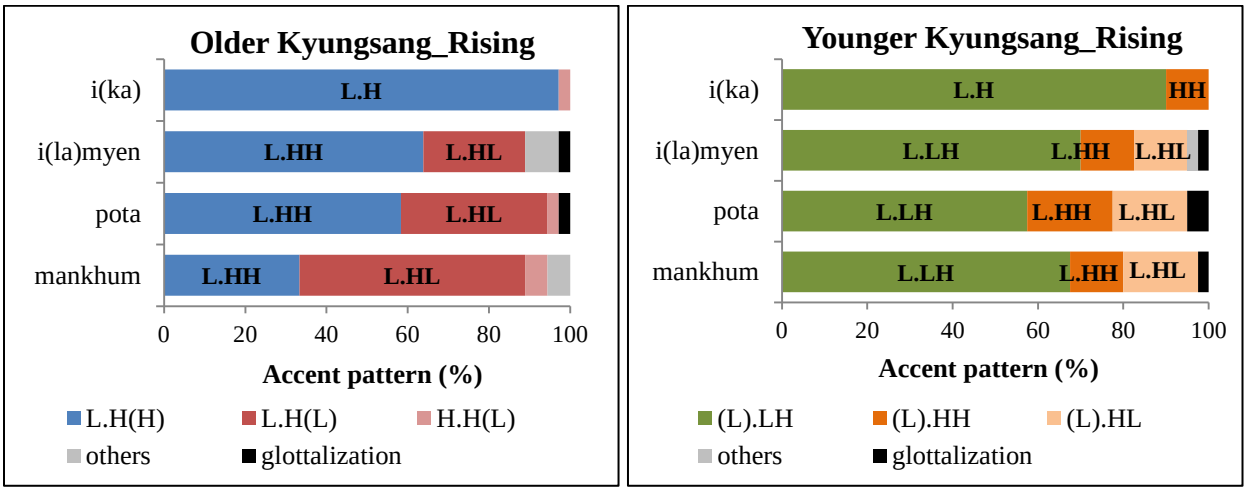

Figure 6. 8. Elicited accent patterns for the monosyllabic rising accent by four suffixes between Older (left) and Younger (right) Kyungsang speakers.

For older Kyungsang speakers, the dominant accent pattern for the monosyllabic rising accent class is **L.H(H)**: 97%, 64%, 58% and 33% of L.H(H) were reported for the suffixes -*i/ka*, -*imyen*/*lamyen*, -*pota* and -*mankhum*[27], respectively. This indicates that in general the second syllable has the highest F0 mean, and the third syllable also has comparably high F0, as seen in Table 6. 11.

For younger Kyungsang speakers, the dominant accent patterns for the monosyllabic rising accent class are **L.H** with -*i/ka* and **L.LH** with -*imyen*/*laymen*, -*pota* and -*mankhum*: 90%,

[27] Although the most frequently elicited accent pattern is L.HL for R with -*mankhum* for the older Kyungsang speakers (56%), this section treats the L.HH pattern as the dominant pattern based on the dominant L.HH pattern for R with other suffixes, -*imyen/lamyen* and -*pota*.

70%, 58% and 68% of (L)LH are reported for the suffixes *-i/ka*, *-imyen/lamyen*, *-pota* and *-mankhum*, respectively. That is, it seems that a high tone is on an available third syllable. Figure 6. 9 and Table 6. 11 present F0 contours and mean F0 in each syllable, respectively, for the rising accent class in suffixed forms between older and younger Kyungsang speakers.

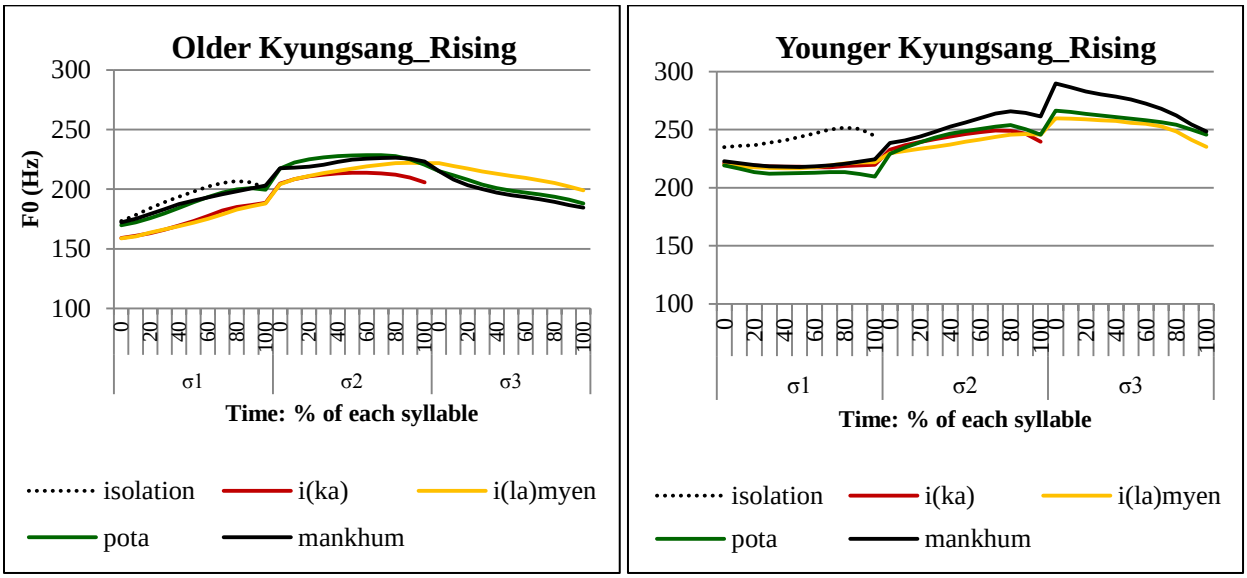

Figure 6. 9. F0 contours of the rising accent class in isolation and suffixed forms between older and younger Kyungsang speakers.

	Older Kyungsang			Younger Kyungsang		
	σ1	σ2	σ3	σ1	σ2	σ3
-i(ka)	177 (22)	215 (23)		220 (21)	244 (21)	
-(la)myen	176 (20)	218 (26)	212 (21)	219 (18)	240 (23)	256 (25)
-pota	185 (31)	219 (33)	195 (22)	218 (19)	244 (17)	259 (25)
-mankhum	181 (28)	218 (33)	197 (23)	222 (23)	256 (23)	275 (32)

Table 6. 11. Mean F0 (Hz) in each syllable for the rising accent class by four suffixes between older and younger Kyungsang speakers (standard deviation in parentheses)

Older Kyungsang speakers' secondary accent patterns for the rising class are L.HL for *-imyen/lamyen* (25%) and *-pota* (36%), for *-mankhum* (56%). For younger Kyungsang speakers,

there are two types of secondary accent patterns. First, L.HH was elicited for the suffix -*imyen/lamyen* (13%), -*pota* (20%), and -*mankhum* (13%). Second, L.HL was elicited for -*imyen/lamyen* (13%), -*pota* (18%) and -*mankhum* (18%).

Figure 6. 10 presents the elicited accent patterns from older and younger Kyungsang speakers for the disyllabic LH1 accent class.

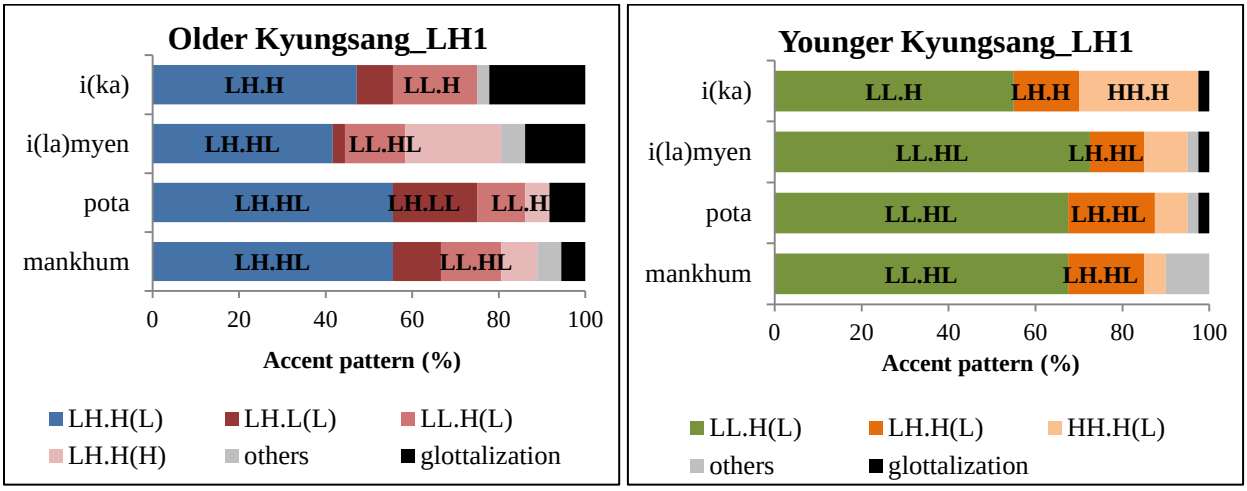

Figure 6. 10. Elicited accent patterns for the disyllabic LH1 accent by four suffixes between Older (left) and Younger (right) Kyungsang speakers.

For older Kyungsang speakers, the dominant accent pattern for the disyllabic LH1 accent class is **LH.H(L)**: 47%, 42%, 56% and 56% of LH.H(L) were reported for the suffixes -*i/ka*, -*imyen*/*lamyen*, -*pota* and -*mankhum*, respectively. Consistent with the monosyllabic rising class, two high tones generally occur on the second and third syllables.

For younger Kyungsang speakers, the dominant accent pattern for the disyllabic LH1 class is **LL.H(L)**: 55%, 73%, 68% and 68% of LL.H(L) were reported for the suffixes -*i/ka*, -*imyen/lamyen*, -*pota* and -*mankhum*, respectively. Figure 6. 11 and Table 6. 12 show F0

contours and mean F0 in each syllable, respectively, for the LH1 accent class in suffixed forms between older and younger Kyungsang speakers.

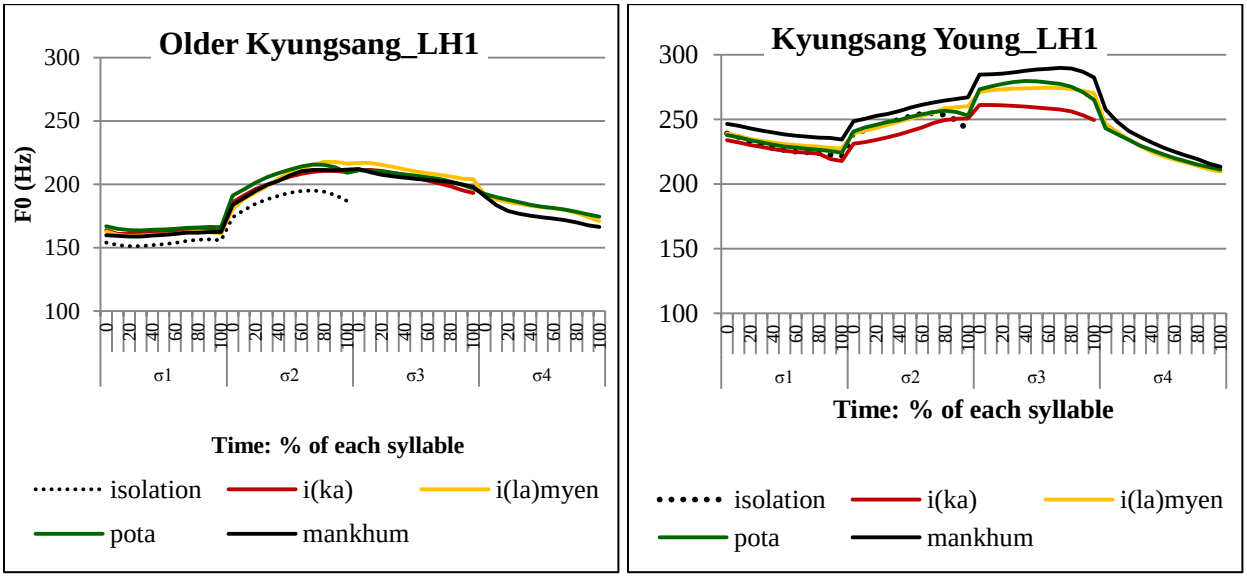

Figure 6. 11. F0 contours of the LH1 accent class in isolation and suffixed forms between older and younger Kyungsang speakers.

	Older Kyungsang				Younger Kyungsang			
	σ1	σ2	σ3	σ4	σ1	σ2	σ3	σ4
-i(ka)	157 (21)	198 (17)	204 (17)		226 (19)	241 (12)	259 (16)	
-(la)myen	157 (20)	199 (26)	204 (29)	185 (26)	233 (18)	250 (14)	273 (14)	228 (18)
-pota	159 (21)	201 (25)	200 (27)	175 (25)	232 (16)	251 (15)	277 (21)	224 (18)
-mankhum	162 (18)	203 (20)	204 (24)	176 (24)	240 (15)	258 (10)	287 (15)	234 (20)

Table 6. 12. Mean F0 (Hz) in each syllable for the LH1 accent class by four suffixes between older and younger Kyungsang speakers (standard deviation in parentheses)

For older Kyungsang speakers, three types of secondary accent patterns were elicited for the LH1 class. First, LL.H(L) was reported for -*i/ka* (19%), -*imyen*/*lamyen* (14%), -*pota* (11%) and -*mankhum* (14%). Second, LH.L(L) was reported for -*i/ka* (8%), -*imyen*/*lamyen* (3%), -*pota*

(19%) and *-mankhum* (11%). Third, LH.HH was reported for *-imyen*/*lamyen* (22%), *-pota* (6%) and *-mankhum* (8%). Younger Kyungsang speakers show two types of secondary accent patterns for the LH1 class. First, LH.H(L) was reported for *-i/ka* (15%), *-imyen*/*lamyen* (13%), *-pota* (20%) and *-mankhum* (18%). Second, HH.H(L) was reported for *-i/ka* (28%), *-imyen*/*lamyen* (10%), *-pota* (8%) and *-mankhum* (5%).

6. 2. 2. 1. 4. H2 & LH2

Figure 6. 12 presents the elicited accent patterns from older and younger Kyungsang speakers for the monosyllabic H2 accent class.

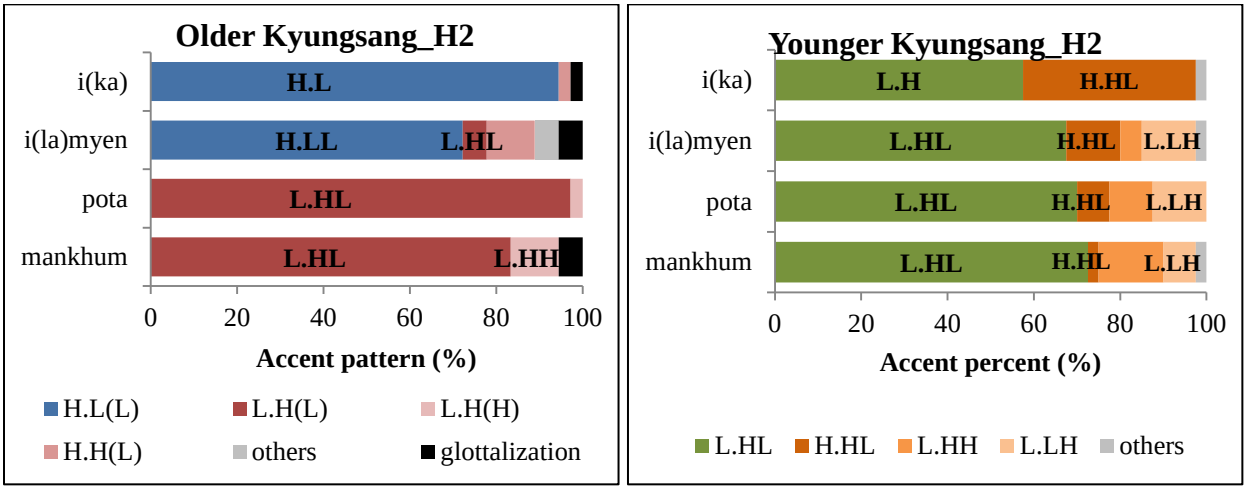

Figure 6. 12. Elicited accent patterns for the monosyllabic H2 accent by four suffixes between Older (left) and Younger (right) Kyungsang speakers.

For older Kyungsang speakers, there are two types of dominant accent patterns which differ by suffix type. The dominant accent patterns for the monosyllabic H2 accent class are **H.L(L)** for suffixes *-i/ka* (94%) and *-imyen/lamyen* (72%), and **L.HL** for suffixes *-pota* (97%) and *-mankhum* (83%).

For younger Kyungsang speakers, the dominant accent pattern for the monosyllabic H2 accent class is **L.H(L)**: 58%, 68%, 70% and 73% of L.H(L) were reported for the suffixes *-i/ka*, *-imyen/lamyen*, *-pota* and *-mankhum*, respectively. Notably, while older Kyungsang speakers showed accent variations depending on suffix types, younger Kyungsang speakers did not report those variations by suffixes. Figure 6. 13 and Table 6. 13 present F0 contours and mean F0 in each syllable, respectively, for the H2 accent class in suffixed forms between older and younger Kyungsang speakers.

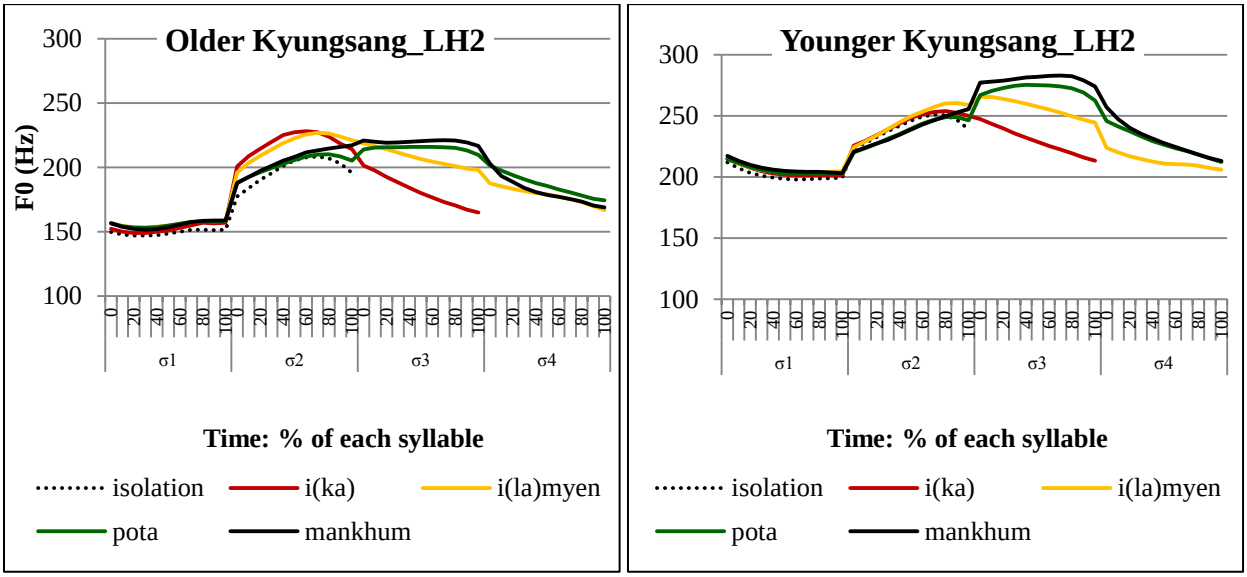

Figure 6. 13. F0 contours of the H2 accent class in isolation and suffixed forms between older and younger Kyungsang speakers.

	Older Kyungsang			Younger Kyungsang		
	σ1	σ2	σ3	σ1	σ2	σ3
-i(ka)	238 (20)	191 (21)		232 (21)	244 (19)	
-(la)myen	234 (25)	212 (26)	167 (20)	232 (18)	253 (19)	220 (20)
-pota	177 (25)	220 (28)	187 (28)	228 (21)	261 (24)	234 (21)
-mankhum	180 (22)	228 (26)	185 (24)	231 (19)	264 (22)	234 (24)

Table 6. 13. Mean F0 (Hz) in each syllable for the H2 accent class by four suffixes between older and younger Kyungsang speakers (standard deviation in parentheses)

For older Kyungsang speakers, there are no systematic secondary patterns that are observed for the monosyllabic H2 with the four suffixes. Three types of secondary patterns were elicited for younger Kyungsang's H2 with suffixes. First, H.H(L) was reported for *-i/ka* (40%), *-imyen/lamyen* (13%), *-pota* (8%) and *-mankhum* (3%). Second, L.HH was reported for *-imyen/lamyen* (5%), *-pota* (10%) and *-mankhum* (15%). Third, L.LH was reported for *-imyen/lamyen* (13%), *-pota* (13%) and *-mankhum* (8%).

Figure 6. 14 presents the elicited accent patterns from older and younger Kyungsang speakers for the disyllabic LH2 accent class.

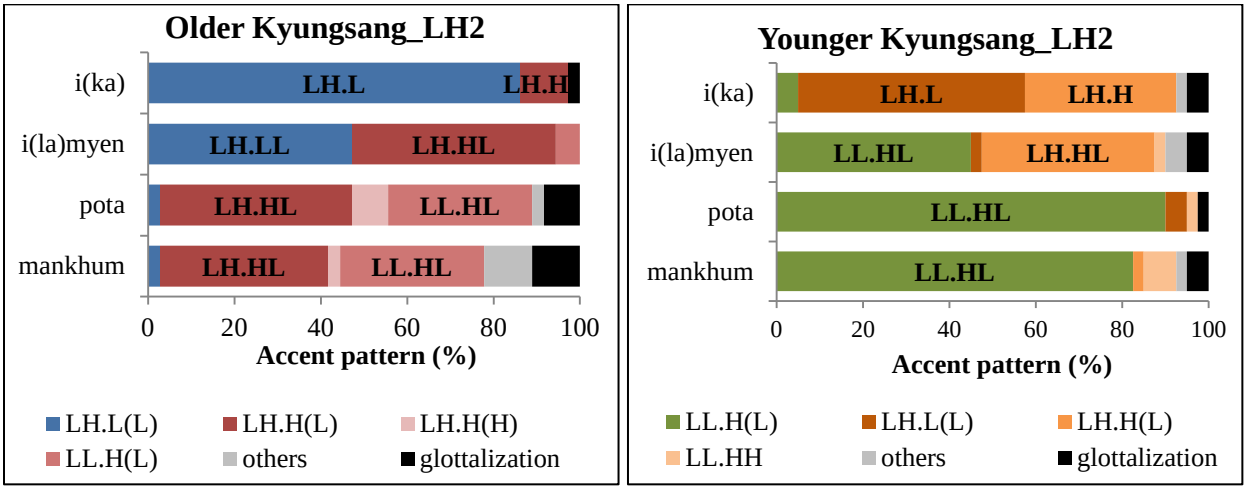

Figure 6. 14. Elicited accent patterns for the disyllabic LH2 accent by four suffixes between Older (left) and Younger (right) Kyungsang speakers.

For older Kyungsang speakers, the accent variation by suffixes is observed for the disyllabic LH2 class as well as the monosyllabic H2 class. The two types of dominant accent patterns for the LH2 class are **LH.L(L)** for the suffixes *-i/ka* (86%) and *-imyen/lamyen* (47%), and **LH.HL** for the suffixes *-pota* (44%) and *-mankhum* (39%).

For younger Kyungsang speakers, the dominant accent patterns for the disyllabic LH2 accent class are **LH.L** for *-i/ka* (53%) and **LL.HL** for *-imyen/lamyen* (45%), *-pota* (90%) and *-mankhum* (83%). Figure 6. 15 and Table 6. 14 present F0 contours and mean F0 in each syllable, respectively, for the LH2 accent class in suffixed forms between older and younger Kyungsang speakers.

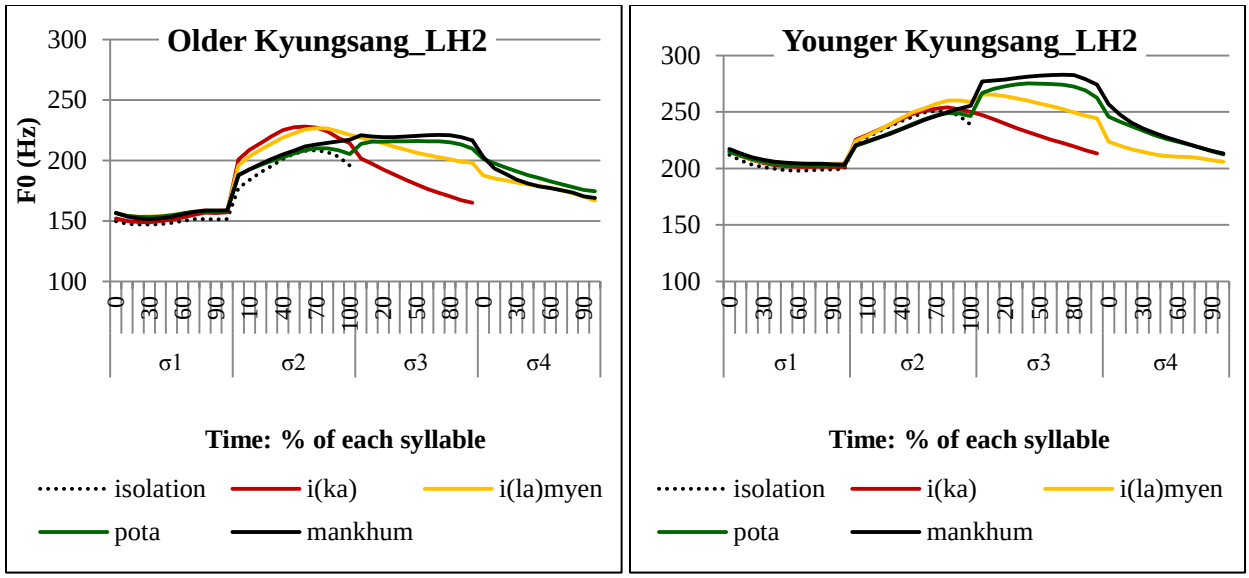

Figure 6. 15. F0 contours of the LH2 accent class in isolation and suffixed forms between older and younger Kyungsang speakers.

	Older Kyungsang				Younger Kyungsang			
	σ1	σ2	σ3	σ4	σ1	σ2	σ3	σ4
-i(ka)	154 (17)	222 (24)	185 (21)		205 (21)	244 (15)	230 (18)	
-(la)myen	157 (18)	215 (28)	208 (34)	178 (26)	204 (20)	247 (16)	257 (19)	214 (23)
-pota	155 (18)	201 (24)	217 (32)	186 (27)	207 (20)	237 (15)	273 (22)	230 (21)
-mankhum	157 (17)	206 (20)	220 (27)	185 (23)	208 (19)	238 (11)	277 (16)	235 (23)

Table 6. 14. Mean F0 (Hz) in each syllable for the LH2 accent class by four suffixes between older and younger Kyungsang speakers (standard deviation in parentheses)

For older Kyungsang speakers, secondary accent patterns are LH.H(L) for *-i/ka* (11%) and *-imyen/lamyen* (47%), and LL.HL for *-pota* (33%) and *-mankhum* (33%). For younger Kyungsang speakers, secondary accent patterns are LH.H(L) for *-i/ka* (35%) and *-imyen/lamyen* (40%).

6. 2. 2. 1. 5. LH2 with resyllabification

As mentioned earlier, the current chapter also considered the accent pattern in the resyllabified condition for the test words including vowel initial suffixes. While most of the elicited tonal patterns based on rime-only segmentation are comparable with those based on resyllabified segmentation, only the LH2 with suffixes *-i/ka* and *-imyen/lamyen* case showed different results between the two segmentation conditions. Figure 6. 16 presents accent patterns for the disyllabic LH2 accent class elicited based on resyllabified segmentation (also including rime-only for a comparison between the two segmentation conditions).

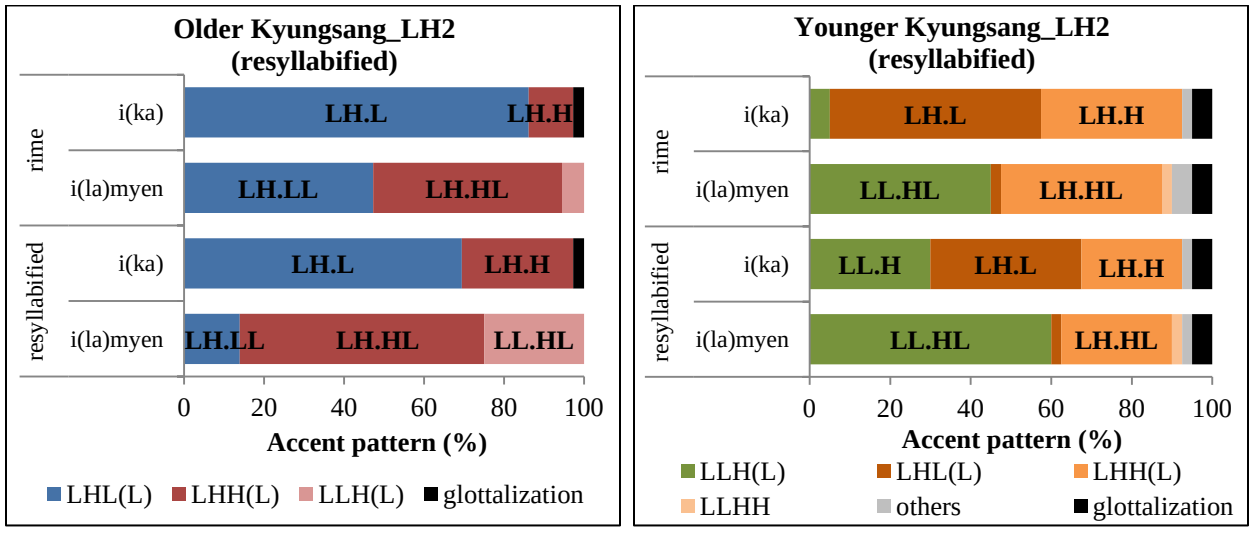

Figure 6. 16. Accent patterns elicited based on the resyllabified segmentation condition for the disyllabic LH2 accent by *-i/ka* and *-imyen/lamyen* suffixes, between Older (left) and Younger (right) Kyungsang speakers.

While older Kyungsang's LH2 with *-i/ka* shows the consistent dominant LH.L and secondary LH.H patterns across two segmentation conditions, that with *-imyen/lamyen* elicited changed dominant and secondary pattern between rime-only and resyllabified segmentation. In rime-only segmentation with *-imyen/lamyen*, the percentages of LH.LL, LH.HL and LL.HL are 47%, 47% and 6%, respectively; however, in resyllabified segmentation, the percentages of LH.LL, LH.HL and LL.HL are 14%, 61% and 25%, respectively, and therefore the LH.HL pattern becomes dominant, and the LL.HL becomes secondary.

For younger Kyungsang speakers, while LH2 with *-imyen/lamyen* shows consistent results across two segmentation conditions, that with *-i/ka* showed changed dominant and secondary accent patterns. In rime-only segmentation with *-i/ka*, the percentages of LL.H, LH.L, and LH.H are 5%, 53% and 35%, respectively; however, in resyllabified segmentation, the percentages of LL.H, LH.L and LH.H are 30%, 38% and 25%, respectively. Therefore, while LH.L stays dominant, LL.H becomes a secondary pattern instead of LH.H.

6. 2. 2. 1. 6. Summary and discussion of elicited accent patterns in Kyungsang Korean

The purpose of the current chapter was to examine whether the underlying distinction in lexical pitch accent of Kyungsang Korean is maintained by both younger and older generations. To test this, I observed the elicited accent patterns between older and younger Kyungsang speakers for the monosyllabic H1, R, and H2 classes and the disyllabic HL, HH, LH1 and LH2 classes with four suffixes which differ in their number of syllables and underlying tones. The present results section reported the dominant and secondary accent patterns for each accent class between the two generations of Kyungsang.

Figures 6. 17 and 6. 18[28] summarize the elicited accent patterns for each accent class averaged across the four suffixes, clearly illustrating the proportion of dominant and secondary accent patterns. *Others* in Figures 6. 17 and 6. 18 include random accent variations and glottalized tokens. In what follows, I will briefly discuss the age variation for the dominant accent patterns, general tendency of the secondary accent pattern, and report inter-talker variations through the secondary accent patterns.

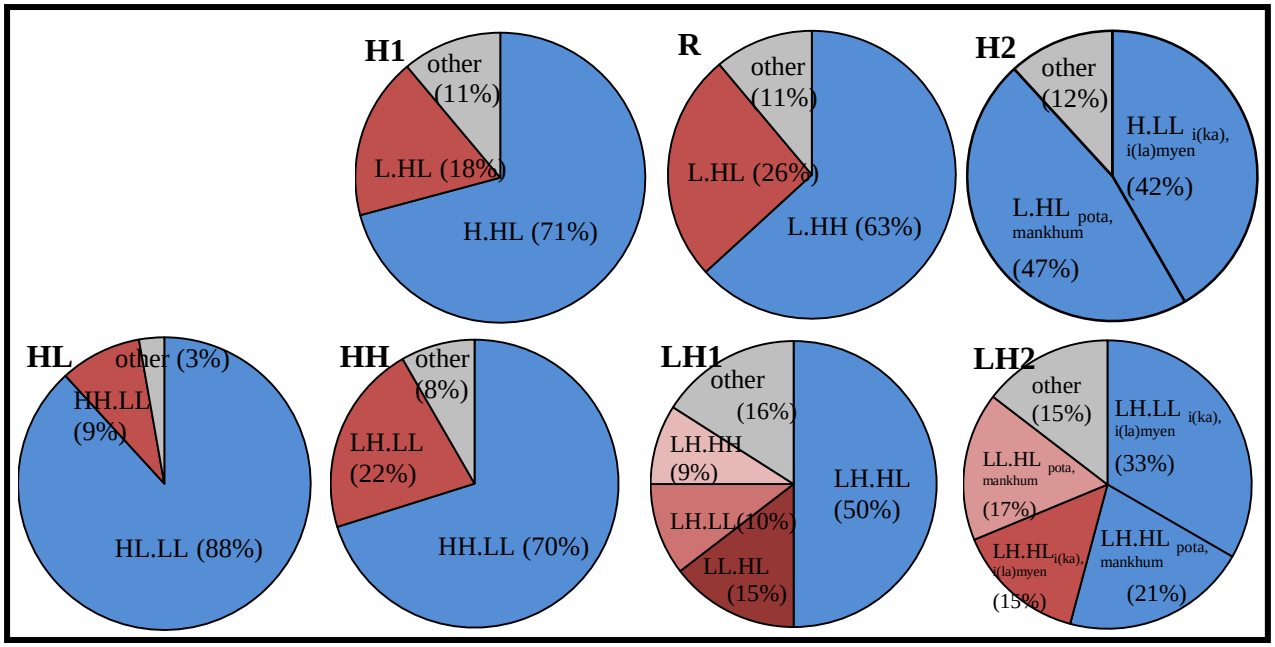

Figure 6. 17. Proportion of dominant (blue) and secondary (dark/light red) accent patterns for each accent class across suffix types for older Kyungsang speakers.

[28] The percentage value next to an accent pattern indicates proportion of the pattern among all word stimuli produced by all subjects in each age group. For example, 71% for the H.HL pattern in H1 of older Kyungsang speakers was obtained by 102/144*100 = 71 where 144 is the total number of words used to elicit responses and 102 is the number of H.HL responses. The total number of stimuli for each accent class is 144 (2 words × 2 repetitions × 4 suffixes × 9 subjects) and 160 (2 words × 2 repetitions × 4 suffixes × 10 subjects) for older and younger Kyungsang groups, respectively.

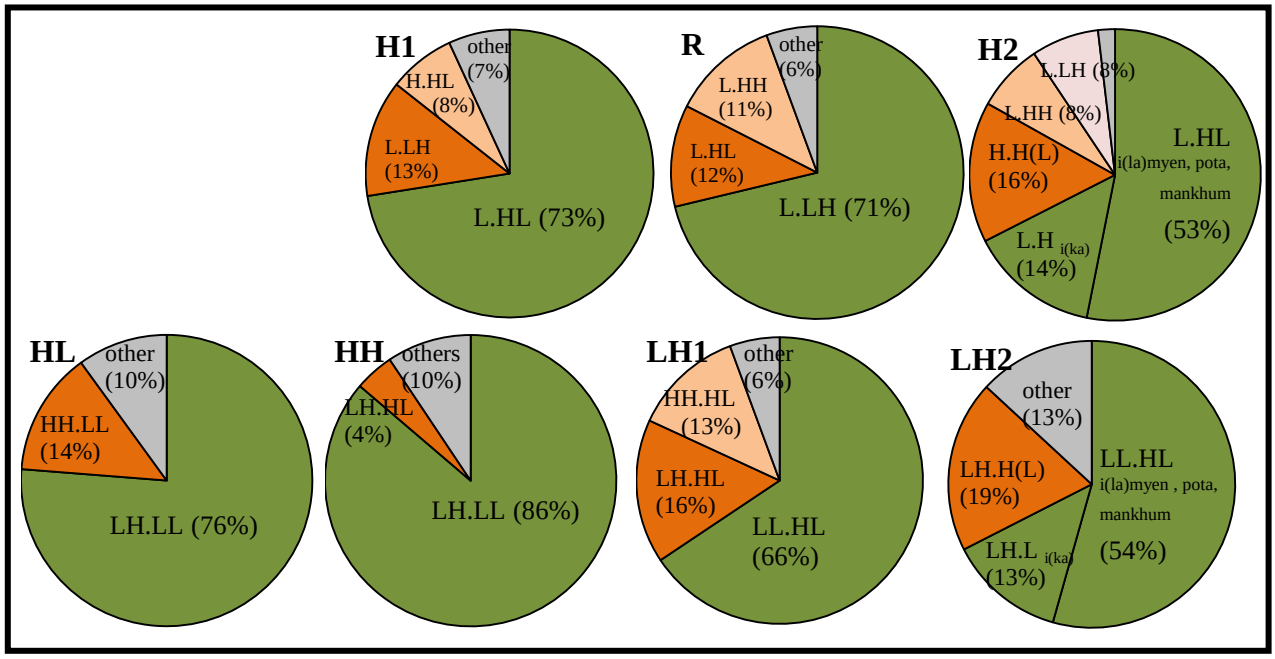

Figure 6. 18. Proportion of dominant (green) and secondary (dark/ light orange) accent patterns for each accent class across suffix types for younger Kyungsang speakers.

Figures 6. 17 and 6. 18 show that the dominant accent patterns comprising the largest proportion among all elicited patterns exceed at least 50% for each accent class, which is true for both older and younger Kyungsang groups. This indicates that tonal patterns systematically differ by the difference in tonal classes. Table 6. 15 summarizes the dominant patterns from older and younger Kyungsang speakers, which are organized according to parallels of accent patterns between mono- and disyllabic nouns.

			H1		R		H2	
			older	younger	older	younger	older	younger
Mono-syllabic	isolation		H	H	LH	LH	H	H
	-i(ka)		H.H	L.H	L.H	L.H	H.L	L.H
	-i(la)myen		H.HL	L.HL	L.HH	L.LH	H.LL	L.HL
	-pota		H.HL	L.HL	L.HH	L.LH	L.HL	L.HL
	-mankhum		H.HL	L.HL	L.HH	L.LH	L.HL	L.HL
		HL		**HH**		**LH1**		**LH2**
		older	younger	older	younger	older	younger	older	younger
Disyllabic	isolation	HL	LH	HH	LH	LH	LH	LH	LH
	-i(ka)	HL.L	LH.L	HH.L	LH.L	LH.H	LL.H	LH.L	LH.L
	-i(la)myen	HL.LL	LH.LL	HH.LL	LH.LL	LH.HL	LL.HL	LH.LL	LL.HL
	-pota	HL.LL	LH.LL	HH.LL	LH.LL	LH.HL	LL.HL	LH.HL	LL.HL
	-mankhum	HL.LL	LH.LL	HH.LL	LH.LL	LH.HL	LL.HL	LH.HL	LL.HL

Table 6. 15. Summary of dominant accent patterns between older and younger Kyungsang speakers for monosyllabic and disyllabic nouns with suffixation.

Older Kyungsang speakers' dominant accent patterns are consistent with the reported pattern from previous research in Table 6. 3 (except the monosyllabic rising class with -*mankhum*), which empirically verifies the reported lexical pitch accent pattern in South Kyungsang Korean. In Table 6. 15, we might note the important aspects for the lexical pitch accent of older Kyungsang generation as follows.

a. There are four parallels between monosyllabic and disyllabic nouns: 1) HL – a high tone on the first syllable of a disyllabic word, 2) H1/HH – high tones on the first and the available second syllables, 3) R/LH1 – high tones on the second and the available third syllables, 4) H2/LH2 – a high tone only on the last syllable of a monosyllabic or a disyllabic stem with -*i/ka* and -*imyen/lamyen* suffixes; a high tone on the first syllable of -*pota* and -*mankhum* suffixes.

b. There are high tones occurring on two consecutive syllables (e.g., HH.LL, LH.HL).

c. Either the first or the second syllable of a phonological word has a high tone, and two initial low tones are not seen.

d. There are tonal variations for the monosyllabic H2 and disyllabic LH2 classes. The variations occur by suffix type: while a high tone occurs on the last syllable of a root with the suffixes *-i/ka* and *-imyen/laymen*, a high tone occurs on the first syllable of the suffixes *-pota* and *-mankhum.*

While the dominant accent patterns from older Kyungsang speakers are consistent with the previously reported patterns, those from younger speakers are different from the reported patterns and from the present older Kyungsang speakers. Some noteworthy age differences in Table 6. 15 are listed below.

e. While there are four parallels between monosyllabic and disyllabic nouns for older Kyungsang speakers, there are three parallels for younger Kyungsang speakers: 1) HL/H1/HH – a high tone on the second syllable, 2) R/LH1 – a high tone on the available third syllable (if there is no available third syllable, a high tone occurs on the last syllable), 3) H2/LH2 – a high tone on the second syllable for two-syllable and three-syllable words; a high tone on the third syllable for four-syllable words.

f. Compared to the accent pattern of older Kyungsang speakers, a high tone is shifted one syllable rightwards for the younger Kyungsang generation across all accent classes. For example, the first-syllable high tone for older Kyungsang becomes the second-syllable high tone (e.g., HL.LL → LH.LL), and the second-syllable high tone becomes the third-syllable high tone (e.g., LH.LL → LL.HL).

g. While older Kyungsang has high tones occurring on two consecutive syllables, younger Kyungsang does not (e.g., HH.LL → LH.LL, LH.HL → LL.HL).

h. For the H2 and LH2 classes, while older Kyungsang showed tonal variations by suffix type, younger speakers do not have those kinds of variations.

Three major age differences are worth discussing: 1) one-syllable shifted high tone, 2) loss of high tones occurring on two consecutive syllables, and 3) absence of accent variation by suffixes for the H2/LH2 class.

First of all, the one-syllable shifted high tone and loss of two consecutive high tones for younger Kyungsang speakers are primarily responsible for the age difference in the lexical pitch accent systems of Kyungsang Korean. These two changes are reflected throughout the entire accent classes for younger Kyungsang speakers, and make the older and younger Kyungsang speakers have different accent restrictions.

First, an *accent merger* seems to result from these two changes, namely the one-syllable shifted high tone and the loss of two consecutive high tones. Specifically, the accent pattern for both HL and H1/HH is realized as a high tone on the second syllable across all suffix types within a phonological word for younger Kyungsang speakers. The identical accent patterns between HL and H1/HH indicate that younger Kyungsang speakers do not distinguish these two accent classes, suggesting an accent merger between HL and H1/HH classes. According to our observation, I speculate the following merger process. The one-syllable shifted high tone triggers the HL class to locate a high tone on the second syllable, resulting in LH; the loss of two consecutive high tones is related to the loss of an initial high tone for the H1/HH class, resulting in LH as well. That is, the accent merger is a consequence of these two major generational

changes in Kyungsang's nominal accent systems. Accordingly, this accent merger results in reducing the parallel accent patterns from four to three between mono- and disyllabic nouns.

In addition to the HL and H1/HH merger, the one-syllable shifted high tone and the loss of two consecutive high tones are observed for the R/LH1 and H2/LH2 classes, indicating that these two phenomena are applied to the entire lexical pitch accent system of younger Kyungsang speakers. For the R/LH1 class, while older Kyungsang speakers showed two high tones occurring on the second and third syllables, younger speakers showed a high tone only on the available third syllable. This leads to a similar speculation as H1/HH where the loss of two consecutive high tones for R/LH1 is related to the loss of a second high tone, resulting in LLH. As for the H2/LH2 class, the two phenomena, the one-syllable shifted high tone and the loss of two consecutive high tones, seem to be reflected somewhat differently compared to the other accent classes. First, while younger Kyungsang speakers systematically shift a high tone one syllable rightwards for the HL class across all suffixes, a high tone is selectively shifted for H2/LH2 with suffixes. Specifically, younger Kyungsang shows the shifted high tone for H2/LH2 with suffixes except H2 with *-pota* and *-mankhum* and LH2 with *-i/ka*, three of which consist of three syllables. Younger Kyungsang's H2 with *-i/ka* and *-imyen/laymen* showed the one-syllable shifted high tone (e.g., H.LL → L.HL); however, the high tone on the first syllable of the suffixes *-pota* and *-mankhum* does not shift rightwards, and therefore does not form L.LH. The disyllabic LH2 class with *-imyen/laymen* also showed the one-syllable shifted high tone (e.g., LH.LL → LL.HL); however, the disyllabic LH2 class with *-i/ka* does not show the shifted high tone, and remains unchanged (i.e., LH.L). Unlike the one-syllable shifted high tone that was selectively applied, the loss of two high tones is observed for H2/LH2 where LH2 with *-pota* or *-mankhum* reported a high tone only on the third syllable (e.g., LH.HL → LL.HL).

Second, as a consequence of the rightward accent shift and the loss of two high tones phenomena, some accent restrictions in Kyungsang Korean show differences between older and younger speakers. Specifically, while the two initial low tones are not seen among older Kyungsang speakers (i.e., *#LL), they are observed for younger speakers; in addition, while the first-syllable high tone is seen among older Kyungsang speakers (i.e., HL), it does not exist for younger speakers (i.e., *#H). Overall, the two major generational changes in Kyungsang's nominal accent system play a role not only in reducing the number of parallel accent patterns between mono- and disyllabic nouns due to the accent merger, but also re-shaping the entire nominal accent system for younger Kyungsang generations.

Another major age variation in Kyungsang's lexical pitch system is that while H2/LH2 by older Kyungsang showed tonal variations by suffix type, younger speakers did not show the same type of accent variation. Specifically, while H2/LH2 with *-i/ka* and *-imyen*/*laymen* is different from H2/LH2 with *-pota* and *-mankhum* for older Kyungsang speakers, younger Kyungsang speakers showed the consistent pattern across the disyllabic suffixes *-imyen/laymen*, *-pota* and *-mankhum*. Recall that Lee and Zhang (in press) proposed that while the suffix *-pota* has an underlying tone, *-i/ka* and *-imyen/lamyen* suffixes do not. Thus, the absence of tonal variations for younger Kyungsang speakers might suggest that suffixes lose their underlying tonal distinction. Notably, by losing the tonal distinction in suffixes, the accent patterns between LH1 and LH2 classes become similar for younger Kyungsang: these two disyllabic accent classes are distinct only when LH1 and LH2 are suffixed with *-i/ka*. In other words, the loss of tone in suffixes plays a role not only in losing tonal variations in H2/LH2, but also in weakening the contrast between LH1 and LH2.

To sum up, these findings in the current chapter suggest clear age variations in Kyungsang's lexical pitch accent system. Comparisons between older and younger Kyungsang speakers' nominal accent patterns indicated that 1) a high tone is shifted one syllable to the right, 2) two consecutive high tones do not occur for younger Kyungsang, and 3) there were no accent variations by suffixes for younger Kyungsang, indicating the loss of tone in suffixes. As consequences of these generational changes, younger Kyungsang speakers showed an accent merger between HL and H1/HH, reduced parallel accent patterns between mono- and disyllabic nouns, different accent restrictions (i.e. *#H), and weakened contrast between LH1 and LH2.

We now turn to the secondary accent patterns in Figures 6. 17 and 6. 18. A closer examination of tonal deviations may indicate the current stage of the generational change and a possible direction of the change in the accent system of Kyungsang Korean. Table 6. 16 compares the secondary patterns with the dominant pattern across the two generations of Kyungsang.

	Older Kyungsang		**Younger Kyungsang**	
	Dominant	*Secondary*	*Secondary*	*Dominant*
HL	HL.LL	HH.LL	HH.LL	LH.LL
H1	H.HL	L.HL	H.HL	L.HL
HH	HH.LL	LH.LL	LH.HL	LH.LL
R	L.HH	L.HL	L.HL, L.HH	L.LH
LH1	LH.HL	LL.HL, LH.LL, LH.HH$_{i(la)myen}$	LH.HL, HH.HL$_{i(ka)}$	LL.HL
H2	H.LL$_{i(ka),\ i(la)myen}$ L.HL$_{pota,\ mankhum}$	None	H.HL $_{i(ka)}$, L.HH$_{mankhum}$ L.LH$_{all\ suffixes}$	L.HL$_{all\ suffixes}$
LH2	LH.LL$_{i(ka),\ i(la)myen}$ LH.HL$_{pota,\ mankhum}$	LH.HL$_{i(ka),\ i(la)myen}$ LL.HL$_{pota,\ mankhum}$	LH.HL$_{all\ suffixes}$	LL.HL$_{all\ suffixes}$

Table 6. 16. Comparisons of dominant and secondary accent patterns between older and younger Kyungsang speakers.

In general, HL and H1/HH whose initial tones are high reported more systematic secondary accent patterns with no other variations compared to R/LH1 and H2/LH2 whose initial tones are low. This seems to suggest that the generational change occurs earlier for HL and H1/HH than for R/LH1 and H2/LH2. The secondary accent patterns in Table 6. 16 pertain to one of three cases: 1) a secondary accent pattern of one age group is comparable with a dominant accent pattern of the other age group (H1, HH, LH1, R, LH2), 2) a secondary accent pattern of one age group is comparable with a secondary pattern of the other age group (HL, R, LH2), 3) a secondary accent pattern is shared by dominant or secondary pattern across accent categories within an age group and between age groups (R-H2, LH1-LH2), 4) a secondary accent pattern does not seem to share a commonality with other tonal patterns (LH1, H2).

First, older Kyungsang's secondary patterns for H1, HH, LH1 and LH2 are consistent with younger Kyungsang's dominant accent patterns. That is, even the deviations produced by older speakers are not entirely random, but parallel the generational change that younger speakers go through. Specifically, older Kyungsang's secondary patterns for H1 and HH are identical with younger Kyungsang's dominant patterns without any other variations – a high tone occurs on the second syllable (i.e., LH.LL); older Kyungsang's secondary patterns for LH1 and LH2 are also somewhat consistent with younger Kyungsang's dominant patterns of LL.HL, though there are some other variations. These parallels between older Kyungsang's tonal deviations and generational changes indicated that the loss of two consecutive high tones seems to work in a similar way between older and younger Kyungsang speaker groups, particularly for H1 and HH whose initial tone is high. Thus, this might suggest that older Kyungsang speakers are also affected by the change in the pitch accent system, and the change is the same as younger Kyungsang speakers are undergoing. The opposite case that the younger Kyungsang's secondary

pattern is similar to the older Kyungsang's dominant patterns is observed for H1, R, LH1 and LH2. This might indicate that some accent patterns of younger Kyungsang speakers maintain the original property of the lexical pitch accent in (older speakers') Kyungsang Korean, and the change in younger Kyungsang's pitch accents may not be completed.

Second, we can see that both older and younger Kyungsang groups share the same secondary accent pattern for HL, R, and LH2. Among the three accent classes, the comparison of dominant and secondary patterns across HL, H1 and HH classes between older and younger Kyungsang speakers might imply a possible direction of the accent merger between HL and H1/HH. Specifically, some utterances of HL class words were produced as HH by both older and younger Kyungsang speakers. This may be understood as an interim step of shifting a high tone from the first to the second syllable, which eventually results in the merged LH form (i.e., HL → HH → LH). Assuming that the HL and H1/HH merger occurs sequentially, we may speculate a chain shift as seen in (3) for the accent merger: i) the H1/HH class loses the initial high tone, resulting in LH (HH → LH), ii) the HL class spreads the initial high tone first by equalizing F0 prominent across two syllable, resulting HH (HL → HH) , iii) then, the HH form, which is in the interim process of shifting its high tone to the right, loses its initial high tone, resulting in LH (HH → LH).

(3) HL → HH
HH → LH

This explains the sequence of the accent merger: younger Kyungsang's merged LH pattern might occur earlier for the HH class by losing its initial high tone, and at the same time younger Kyungsang's HL class may form an HH pattern in an effort to shift its initial high tone, and here the interim HH pattern sets the condition to lose its initial high tone. That is, the HL accent class

requiring two steps to form LH (i.e., spreading → losing) occurs later than the H1/HH class requiring only one step for the merged LH form (i.e., losing). Importantly, the different secondary patterns for HL and H1/HH among older Kyungsang speakers support this claim. The secondary pattern of HH for older Kyungsang's HL class might indicate that some older speakers start to change the HL accent into LH, but their secondary pattern of LH for the HH class indicates that they have already reached the completed LH form. Similarly, the secondary pattern of HH for younger Kyungsang's HL class might indicate that some younger speakers have not yet completed the change of HL accent into LH.

Third, a secondary accent pattern is shared by the dominant or secondary pattern across accent categories within an age group and between age groups. For example, for the monosyllabic rising class, the secondary pattern of L.HL in both older and younger Kyungsang groups is shared with younger Kyungsang's dominant L.HL pattern for the H2 class; for the LH1 class, the secondary pattern of LL.HL in the older Kyungsang group is shared by younger Kyungsang's dominant LL.HL pattern for the LH2 class. In other words, some accent patterns between R and H2 and between LH1 and LH2 are shared, which indicates a weakened accent contrast between the R/LH1 and H2/LH2 accents. That is, the R/LH1 and H2/LH2 accents tend to be merged. Given that the merger of these accent classes is on-going for the corresponding trisyllabic LHH1 and LHH2 accents where LHH2 is merged to LHH1 (Utsugi 2009), it is predicted that H2/LH2 would be merged to R/LH1. In Table 6. 15, note that the distinction between the disyllabic LH1 and LH2 classes among younger Kyungsang speakers is made only when these LH1 and LH2 are suffixed with *-i/ka*.

Finally, some secondary patterns such as HH.HL/LH.HH in LH1 and H.HL/L.HH in H2 do not share a commonality with other dominant and secondary patterns across generations

within the accent class. Difference in segment types across test words might be one possible reason, that is, so-called pitch heightening consonants might be related to these random deviations. For example, younger Kyungsang's HH.HL secondary pattern for the LH1 class tends to occur more frequently for the word *salam* 'person' than *papo* 'fool': the former begins with the fricative /s/, and the latter begins with the lenis stop /p/. The secondary HH.HL pattern was elicited for 21 words across the four suffixes and ten younger speakers (21/160*100 = 13%); eighteen HH.HL patterns were elicited from *salam* (across suffixes), and only three HH.HL patterns were elicited from *papo* (across suffixes). Similarly, younger Kyungsang's L.HH secondary pattern for the H2 class tends to occur more frequently with the suffix -*mankhum* than other syllables (in Figure 6. 12): the onset of the second syllable of -*mankhum* is the aspirated stop. That is, the word-initial fricative /s/ in *salam* seems to heighten the pitch of the first and second syllables for LH1 words with suffixes, forming HH.HL rather than the dominant LL.HL pattern; likewise, the aspirated stop in -*mankhum* seems to heighten the pitch of the last syllable for the H2 words with -*mankhum*, forming L.HH rather than the dominant L.HL pattern. Here, it is noted that the random deviations elicited for the older Kyungsang speakers do not seem related to the word-initial fricative /s/ and the aspirated stop in -*mankhum*; older Kyungsang's secondary LH.HH pattern (9%) was mostly elicited for the LH1 words with -*imyen/lamyen* (Figure 6. 10). Therefore, the age comparison of the random deviations might suggest that younger Kyungsang speakers are more affected by the difference in segments than older speakers, and this is also in line with the previous observation in the stop chapter (Chapter 3) where we saw that while younger Kyungsang speakers use F0 more for stop distinction, older speakers use F0 more for lexical pitch distinction.

Overall, the parallels between secondary pattern and the generational change indicate that i) a similar change occurs for some older speakers as well as younger speakers, ii) the merger between HL and HH happens by the chain shift in (3), and the shared accent patterns across R/LH1 and H2/LH2 indicate iii) the tendency of accent merger between the two classes.

For a detailed observation, Tables 6. 17 and 6. 18 present the elicited secondary accent patterns for each individual. *Kso* and *ksy* in Tables 6. 17 and 6. 18 indicate a Kyungsang Older and a Kyungsang Younger speaker, respectively. The percentage right next to *kso* (or *ksy*) indicates the proportion of all secondary accent patterns over the total 112 test words (2 words * 2 repetitions * 4 suffixes * 7 accent classes).

Across individuals and test words, nine older Kyungsang speakers reported an average of 20% of secondary patterns with a standard deviation of 12. Table 6. 17 shows that *kso1, kso5, kso7* and *kso9* speakers elicited more secondary patterns compared to other speakers, showing over 20%. Among these four speakers, *kso9* particularly produced more secondary patterns (i.e., 43%) across accent classes. The secondary accent patterns from *kso9* tend to be similar to those of younger Kyungsang's dominant/secondary patterns.

	HL	H1/HH		R/LH1		H2/LH2	
	Disyl.	Monosyl.	Disyl.	Monosyl.	Disyl.	Monosyl.	Disyl.
	$HH.LL_{9\%}$	$L.HL_{18\%}$	$LH.LL_{22\%}$	$L.HL_{26\%}$	1) $LL.HL_{15\%}$ 2) $LH.LL_{10\%}$ 3) $LH.HH_{9\%}$	None	$LH.HL_{15\%}$ i(ka), i(la)myen $LL.HL_{17\%}$ pota, mankhum
kso1-26%	19% (3/16)	25% (4/16)	19% (3/16)	31% (5/16)	1) 19% (3/16) 2) 6% (1/16) 3) 0% (0/16)		19% (3/16) 44% (7/16)
kso2-10%	0% (0/16)	0% (0/16)	6% (1/16)	19% (3/16)	1) 6% (1/16) 2) 13% (2/16) 3) 6% (1/16)		13% (2/16) 6% (1/16)
kso3-6%	0% (0/16)	0% (0/16)	0% (0/16)	13% (2/16)	1) 0% (0/16) 2) 13% (2/16) 3) 6% (1/16)		13% (2/16) 0% (0/16)
kso4-15%	0% (0/16)	6% (1/16)	25% (4/16)	13% (2/16)	1) 6% (1/16) 2) 0% (0/16) 3) 13% (2/16)		19% (3/16) 25% (4/16)
kso5-30%	19% (3/16)	25% (4/16)	13% (2/16)	25% (4/16)	1) 63% (10/16) 2) 0% (0/16) 3) 0% (0/16)		38% (6/16) 31% (5/16)
kso6-10%	0% (0/16)	6% (1/16)	0% (0/16)	19% (3/16)	1) 6% (1/16) 2) 35% (4/16) 3) 13% (2/16)		0% (0/16) 0% (0/16)
kso7-29%	13% (2/16)	19% (3/16)	50% (8/16)	44% (7/16)	1) 0% (0/16) 2) 31% (5/16) 3) 31% (5/16)		19% (3/16) 0% (0/16)
kso8-13%	0% (0/16)	6% (1/16)	19% (3/16)	38% (6/16)	1) 13% (2/16) 2) 0% (0/16) 3) 13% (2/16)		0% (0/16) 6% (1/16)
kso9-43%	38% (6/16)	63% (10/16)	63% (10/16)	63% (10/16)	1) 19% (3/16) 2) 6% (1/16) 3) 0% (0/16)		13% (2/16) 38% (6/16)

Table 6. 17. Summary of secondary accent patterns for older Kyungsang speakers for HL, H1/HH, R/LH1 and H2/LH2 classes.

Across individuals and test words, ten younger Kyungsang speakers reported an average of 20% of secondary patterns with a standard deviation of 6. Among the ten younger speakers, *ksy3*, *ksy4*, *ksy6*, *ksy7* and *ksy10* reported over 20% of secondary patterns as seen in Table 6. 18. Unlike the older Kyungsang group, however, the overall proportion of secondary patterns from younger speakers is less variable, meaning that each younger speaker contributed to the observed secondary accent patterns to a similar extent.

	HL	H1/HH		R/LH1		H2/LH2	
	Disyl.	Monosyl.	Disyl.	Monosyl.	Disyl.	Monosyl.	Disyl.
	HH.LL$_{14\%}$	1) L.LH$_{13\%}$ 2) H.HL$_{8\%}$	LH.HL$_{4\%}$	1) L.HL$_{12\%}$ 2) L.HH$_{11\%}$	1) LH.HL$_{16\%}$ 2) HH.HL$_{13\%}$	1) H.HL$_{16\%}$ 2) L.HH$_{8\%}$ 3) L.LH$_{8\%}$	LH.HL$_{19\%}$
ksy1-10%	13% (2/16)	1) 19% (3/16) 2) 0% (0/16)	0% (0/16)	1) 6% (1/16) 2) 0% (0/16)	1) 6% (1/16) 2) 0% (0/16)	1) 6% (1/16) 2) 0% (0/16) 3) 19% (3/16)	0% (0/16)
ksy2-16%	0% (0/16)	1) 0% (0/16) 2) 6% (1/16)	6% (1/16)	1) 0% (0/16) 2) 6% (1/16)	1) 0% (0/16) 2) 44% (7/16)	1) 13% (2/16) 2) 6% (1/16) 3) 6% (1/16)	25% (4/16)
ksy3-28%	38% (6/16)	1) 0% (0/16) 2) 13% (2/16)	0% (0/16)	1) 38% (6/16) 2) 19% (3/16)	1) 0% (0/16) 2) 25% (4/16)	1) 38% (6/16) 2) 0% (0/16) 3) 0% (0/16)	25% (4/16)
ksy4-26%	31% (5/16)	1) 0% (0/16) 2) 0% (0/16)	0% (0/16)	1) 38% (6/16) 2) 13% (2/16)	1) 38% (6/16) 2) 0% (0/16)	1) 6% (1/16) 2) 19% (3/16) 3) 13% (2/16)	25% (4/16)
ksy5-15%	6% (1/16)	1) 25% (4/16) 2) 19% (3/16)	6% (1/16)	1) 13% (2/16) 2) 6% (1/16)	1) 0% (0/16) 2) 0% (0/16)	1) 6% (1/16) 2) 0% (0/16) 3) 6% (1/16)	19% (3/16)
ksy6-21%	6% (1/16)	1) 31% (5/16) 2) 13% (2/16)	19% (3/16)	1) 0% (0/16) 2) 6% (1/16)	1) 0% (0/16) 2) 13% (2/16)	1) 25% (4/16) 2) 0% (0/16) 3) 13% (2/16)	19% (3/16)
ksy7-22%	0% (0/16)	1) 31% (5/16) 2) 0% (0/16)	0% (0/16)	1) 6% (1/16) 2) 31% (5/16)	1) 31% (5/16) 2) 6% (1/16)	1) 6% (1/16) 2) 6% (1/16) 3) 6% (1/16)	31% (5/16)
ksy8-19%	13% (2/16)	1) 6% (1/16) 2) 6% (1/16)	0% (0/16)	1) 0% (0/16) 2) 0% (0/16)	1) 50% (8/16) 2) 6% (1/16)	1) 31% (5/16) 2) 19% (3/16) 3) 0% (0/16)	0% (0/16)
ksy9-16%	19% (3/16)	1) 13% (2/16) 2) 6% (1/16)	0% (0/16)	1) 0% (0/16) 2) 19% (3/16)	1) 25% (4/16) 2) 0% (0/16)	1) 6% (1/16) 2) 0% (0/16) 3) 6% (1/16)	19% (3/16)
ksy10-28%	13% (2/16)	1) 6% (1/16) 2) 13% (2/16)	13% (2/16)	1) 19% (3/16) 2) 13% (2/16)	1) 13% (2/16) 2) 31% (5/16)	1) 19% (3/16) 2) 25% (4/16) 3) 6% (1/16)	25% (4/16)

Table 6. 18. Summary of secondary accent patterns for younger Kyungsang speakers for each accent class.

6. 2. 2. 2. Prosodic patterns of Seoul Korean

This section provides a result of the prosodic pattern in non-tonal Seoul Korean. Since the underlying LHLH pattern varies with the number of syllables of APs for Seoul Korean, subsections provide the result according to the number of syllables. F0 tracings and measured

mean F0 in each syllable show how the prosodic pattern of Seoul Korean is realized for test words differing in their number of syllables.

Although Seoul Korean is not expected to show an effect of lexical tones in its prosodic pattern, the current section examined the prosodic pattern of Seoul Korean according to Kyungsang's tonal classification instead of averaging all test words. Separating out test words according to Kyungsang's tonal classes made it possible to closely examine Seoul's prosodic pattern by initial segment types which were proposed as a factor affecting underlying prosodic patterns of Seoul Korean by Jun (1998).

6. 2. 2. 2. 1. Two-syllable words

Figure 6. 19 and Table 6. 19 present F0 contours and mean F0 in each syllable, respectively, for two-syllable words between older and younger Seoul speakers. Monosyllabic stems suffixed with a monosyllabic suffix (*-i/ka)* were examined for two-syllable words.

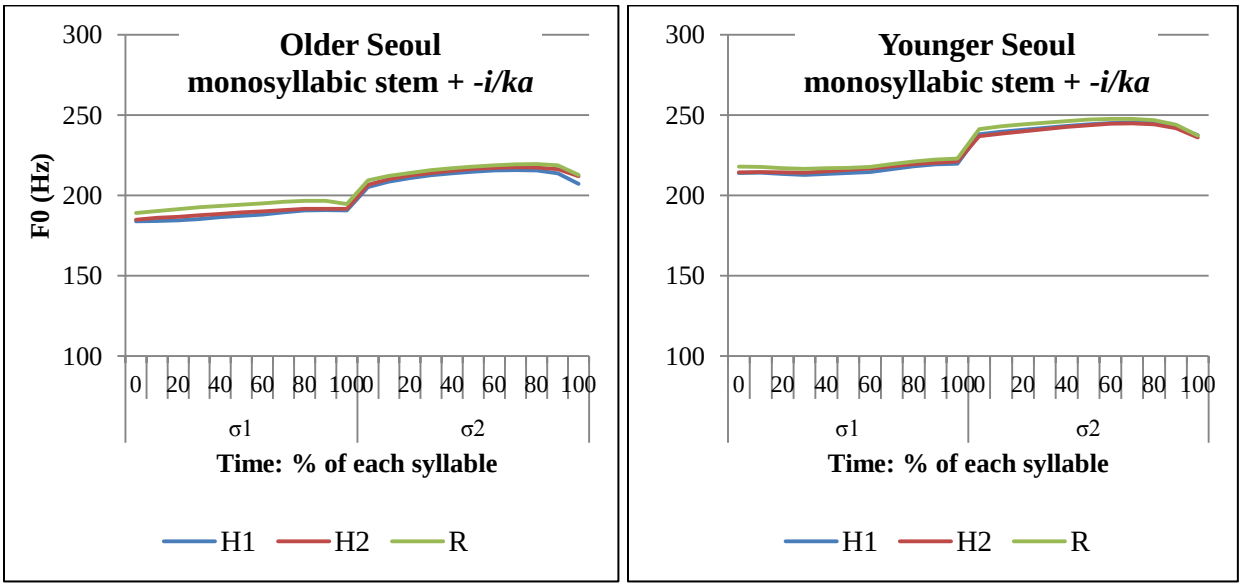

Figure 6. 19. F0 contours of two-syllable words by Kyungsang's monosyllabic accent classes between older and younger Seoul speakers.

	Older Seoul		Younger Seoul	
	σ1	σ2	σ1	σ2
H1	188 (22)	213 (26)	215 (13)	242 (12)
H2	189 (24)	214 (25)	217 (13)	241 (14)
Rising	194 (27)	216 (28)	219 (12)	245(12)
MEAN	**190 (24)**	**214 (26)**	**217 (13)**	**243 (13)**

Table 6. 19. Mean F0 (Hz) in each syllable for two-syllable words by Kyungsang's monosyllabic accent classes between older and younger Seoul speakers (standard deviation in parentheses).

For the two-syllable words produced by Seoul speakers, it is noted that the first syllable has a lower F0 than the second syllable, and this is true across Kyungsang's monosyllabic H1, H2 and rising lexical tones and across older and younger Seoul speakers. Across the three Kyungsang monosyllabic tonal classes, F0 of the second syllable is 24 Hz and 26 Hz greater than F0 of the first syllable for older and younger speaker groups, respectively. This observation indicates that two-syllable words in Seoul Korean have a low tone on the first syllable and a high tone on the second syllable, forming a LH prosodic pattern, and that this pattern is not related to Kyungsang's lexical tone.

6. 2. 2. 2. 2. Three-syllable words

Figures 6. 20–6. 21 and Tables 6. 20–6. 21 present F0 contours and mean F0 in each syllable, respectively, for three-syllable words between older and younger Seoul speakers. Figure 6. 20 and Table 6. 20 show the results for monosyllabic stems suffixed with a disyllabic suffix (*-pota*).

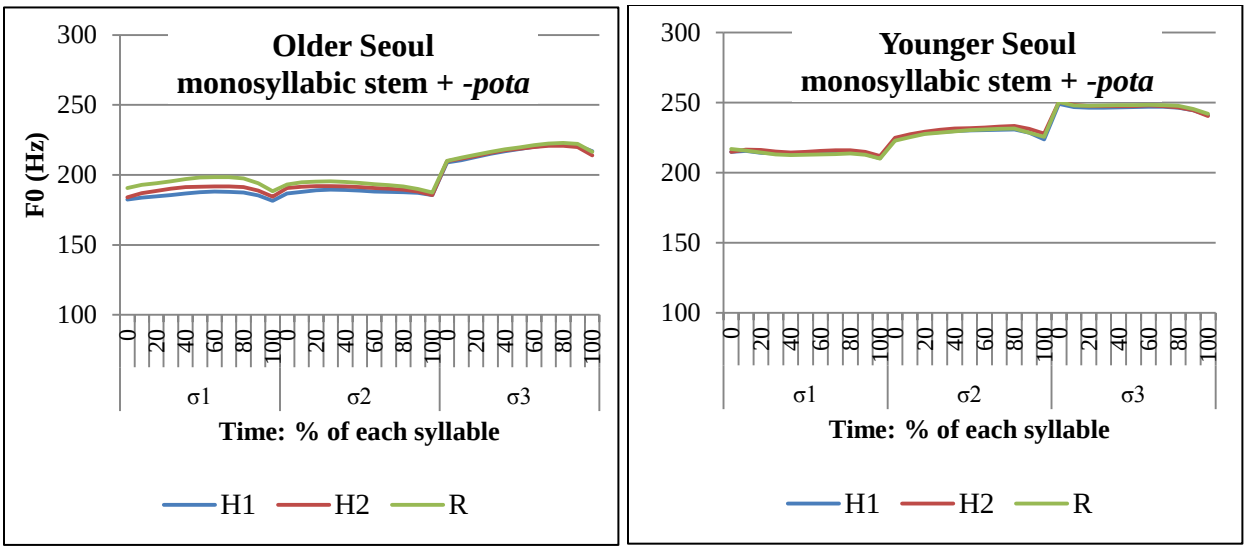

Figure 6. 20. F0 contours of three-syllable words (monosyllabic stem suffixed with *-pota*) by Kyungsang's accent classes for older and younger Seoul speakers.

	Older Seoul			Younger Seoul		
	σ1	σ2	σ3	σ1	σ2	σ3
H1	185 (22)	188 (25)	217 (24)	214 (10)	228 (17)	247 (10)
H2	190 (26)	191 (27)	216 (25)	215 (10)	230 (17)	248 (11)
Rising	197 (29)	195 (26)	219 (27)	214 (9)	228 (17)	248 (10)
MEAN	**191 (26)**	**191 (26)**	**217 (25)**	**214 (10)**	**229 (17)**	**248 (10)**

Table 6. 20. Mean F0 (Hz) in each syllable for three-syllable words by Kyungsang's monosyllabic accent classes between older and younger Seoul speakers (standard deviation in parentheses).

For the three-syllable words consisting of monosyllabic stems with the suffix *-pota*, the third syllable always has a higher mean F0 than the first and the second syllables, and the second syllable generally has a higher mean F0 than the first syllable. Across the three Kyungsang monosyllabic tonal classes, the mean F0 difference between the third and the first syllables is 26 Hz for older Seoul speakers and 34 Hz for younger Seoul speakers; the mean F0 difference

between the third and the second syllable is 26 Hz for older speakers and 19 Hz for younger speakers. While both older and younger Seoul speakers show the final-rising accent pattern, the F0 difference between the first and second syllables is different between the two generations: the mean F0 difference between the first and the second syllables is 0 Hz for older Seoul speakers and 15 Hz for younger Seoul speakers.

Figure 6. 21 and Table 6. 21 show the results for disyllabic stems suffixed with a monosyllabic suffix (-*i/ka*).

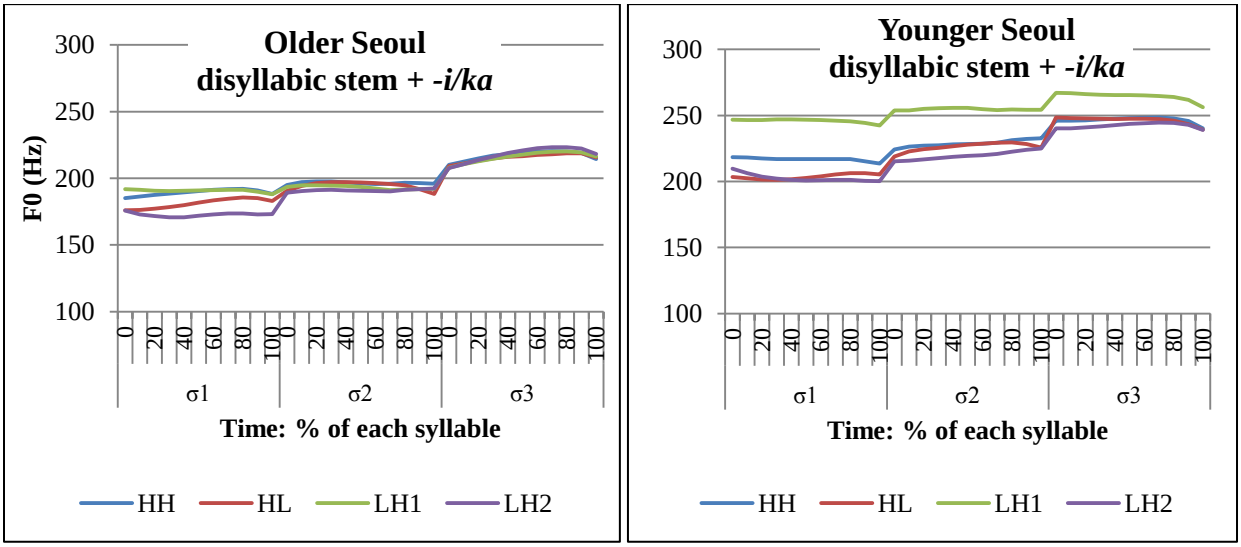

Figure 6. 21. F0 contours of three-syllable words (disyllabic stem suffixed with -*i/ka*) by Kyungsang's accent classes for older and younger Seoul speakers.

	Older Seoul			Younger Seoul		
	σ1	σ2	σ3	σ1	σ2	σ3
HH	189 (21)	196 (22)	217 (19)	217 (11)	228 (17)	247 (14)
HL	181 (20)	195 (23)	216 (21)	204 (13)	226 (20)	247 (15)
LH1	190 (22)	192 (24)	215 (18)	246 (12)	255 (16)	265 (14)
LH2	173 (20)	190 (23)	218 (20)	204 (12)	220 (17)	243 (14)
MEAN	**183 (21)**	**193 (23)**	**216 (20)**	**218 (12)**	**232 (18)**	**251 (14)**

Table 6. 21. Mean F0 (Hz) in each syllable for three-syllable words by Kyungsang's disyllabic accent classes between older and younger Seoul speakers (standard deviation in parentheses).

The highest mean F0 value for the third syllable is also observed for the three-syllable words consisting of disyllabic stems with the suffix *-i/ka*. Across Kyungsang's disyllabic HL, HH, LH1 and LH2 accent classes, the mean F0 difference between the third and the first syllables is 33 Hz for both older and younger Seoul speakers; the mean F0 difference between the third and the second syllable is 23 Hz for and 19 Hz for older and younger Seoul speakers, respectively; the mean F0 difference between the first and the second syllables is 10 Hz for older Seoul speakers and 14 Hz for younger Seoul speakers.

In Figure 6. 21, it is noted that disyllabic LH1 words with *-i/ka* have a higher F0 than other words particularly for younger Seoul speakers. Table 6. 21 shows that the mean F0 difference between the third and the first syllable for LH1 with *-i/ka* is only 19 Hz, while the average mean F0 difference between the two syllables was 33 Hz for younger Seoul. The small F0 difference across syllables for LH1 words may be due to the fact that Kyungsang's LH1 words include *salam* 'a person' whose phrase-initial segment is featured by [+stiff vocal cords][29],

[29] The current dissertation follows Jun (1993) where the obstruent /s/ is considered 'aspirated'.

which was proposed to elicit relatively high F0 by Jun (1993). On the other hand, the other disyllabic words in HL, HH and LH2 do not have a word with a phrase-initial segment containing [+stiff vocal cords] feature (see Tables 6. 5 and 6. 6 in the current chapter for test words). Figure 6. 22 shows the F0 tracing for LH1 words with *-i/ka* (i.e., *salam-i* 'a person-nom.', *papo-ka* 'a fool-nom.') between older and younger Seoul speakers.

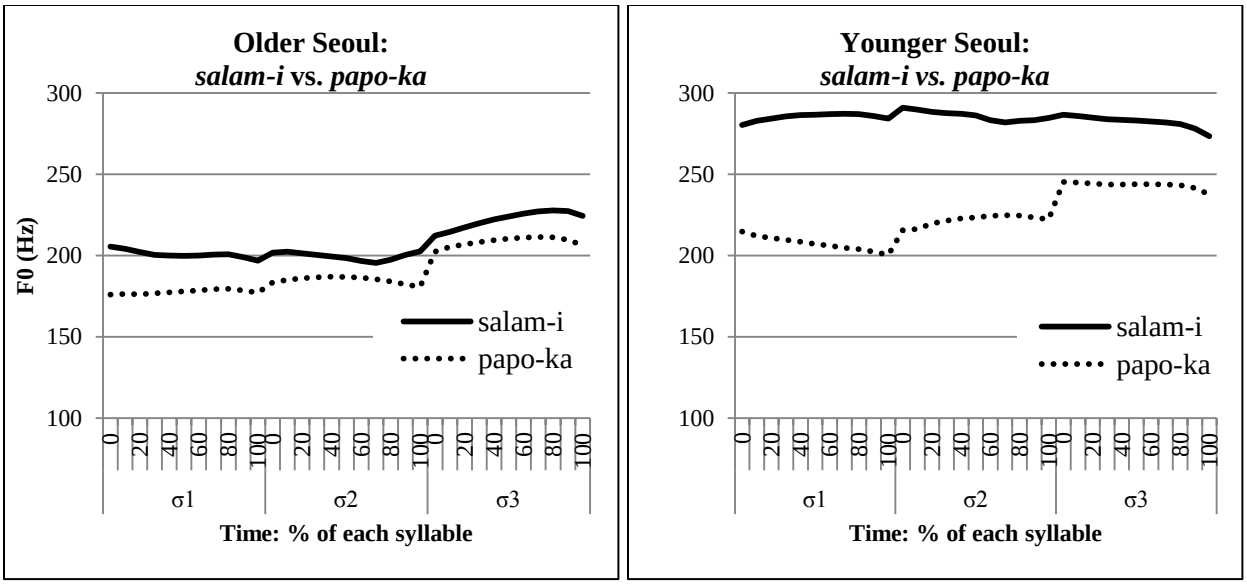

Figure 6. 22. F0 contours of *salam-i* and *papo-ka* between older and younger Seoul speakers.

Figure 6. 22 (right) indicates different prosodic patterns between *salam-i* and *papo-ka* for younger Seoul speakers; while *salam-i* shows a comparable F0 across the three syllables, *papo-ka* elicits a phrase-final rising pattern. In addition to the F0 tracing, the mean F0 in each syllable for *salam-i* was 285 Hz (SD = 16), 288 Hz (SD = 15) and 285 Hz (SD = 14) averaged across ten younger Seoul speakers. This suggests that while younger Seoul speakers' *papo-ka* starting with [−stiff vocal cords] elicits a LLH pattern, *salam-i* whose initial segment is [+stiff vocal cords] indeed forms a HHH prosodic pattern as proposed by Jun (1998). For older speakers, on the other hand, Figure 6. 22 (left) shows that although overall F0 in *salam-i* is higher compared to

papo-ka, the F0 contours themselves pattern similarly between the two words, both of which elicit a phrase-final rising pattern. In fact, mean F0 in each syllable for *salam-i* was 201 Hz (SD = 30), 200 Hz (SD = 28), and 222 Hz (SD = 23) averaged across ten older Seoul speakers: there is almost no difference in F0 between the first and second syllable, but F0 of the third syllable is about 20 Hz higher than the preceding syllables. This suggests that older Seoul speakers' *salam-i* seems closer to LLH despite the laryngeal feature.

Overall, the observation for 'monosyllabic stems with *-pota*' and 'disyllabic stem with *-i/ka*' indicates that three-syllable words in Seoul Korean have a phrase-final rising prosodic pattern (i.e., LLH) with the exception of younger speakers' *salam-i* (i.e., HHH). In the two generations of Seoul speakers, the greater F0 for the third syllable than the preceding two syllables shaped either an LLH or LHH prosodic pattern. The initial segment effect for the word *salam-i* was found only for younger speakers, not for older Seoul speakers.

6. 2. 2. 2. 3. Four-syllable words

Figure 6. 23 and Table 6. 22 show F0 contours and mean F0 in each syllable, respectively, for four-syllable words between older and younger Seoul speakers. Disyllabic stems suffixed with a disyllabic suffix (*-pota*) were examined in this section.

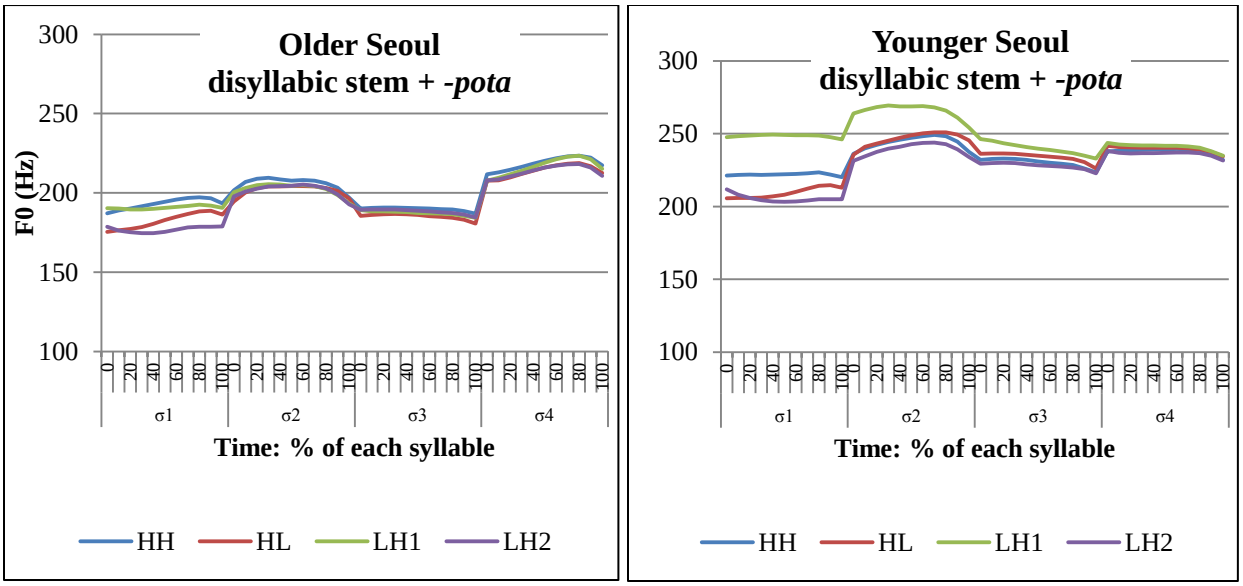

Figure 6. 23. F0 contours of four-syllable words by Kyungsang's accent classes between older and younger Seoul speakers.

	Older Seoul				Younger Seoul			
	σ1	σ2	σ3	σ4	σ1	σ2	σ3	σ4
HH	193 (26)	206 (30)	190 (26)	218 (28)	223 (10)	244 (11)	231 (19)	239 (10)
HL	182 (26)	202 (32)	185 (25)	214 (26)	209 (12)	246 (14)	234 (19)	240 (12)
LH1	189 (23)	201 (26)	185 (25)	215 (26)	249 (13)	266 (16)	241 (19)	241 (11)
LH2	177 (23)	201 (30)	188 (25)	214 (25)	206 (12)	239 (13)	228 (17)	237 (11)
MEAN	**185 (25)**	**203 (30)**	**187 (25)**	**215 (26)**	**222 (12)**	**249 (14)**	**234 (19)**	**239 (11)**

Table 6. 22. Mean F0 (Hz) in each syllable for four-syllable words by Kyungsang's disyllabic accent classes between older and younger Seoul speakers (standard deviation in parentheses).

Across the four Kyungsang disyllabic accent classes, the second and the fourth syllables have a higher F0 than the first and the third syllables, and this is true for both older and younger Seoul speakers. This indicates that the prosodic pattern of four-syllable words in Seoul Korean is LHLH as proposed by Jun (1993, 1998).

As observed in the previous section, the F0 contour of LH1 with *-pota* is higher than those of other words among younger Seoul speakers. Recall that test words according to Kyungsang's LH1 accent have *salam* with the phrase-initial [+stiff vocal cords] feature, which possibly explains the greater F0. A separate examination was made for *salam-pota* 'than a person'. Figure 6. 24 shows the F0 tracing for LH1 words with *-pota* (i.e., *salam-pota* 'than a person', *papo-pota* 'than a fool') between older and younger Seoul speakers.

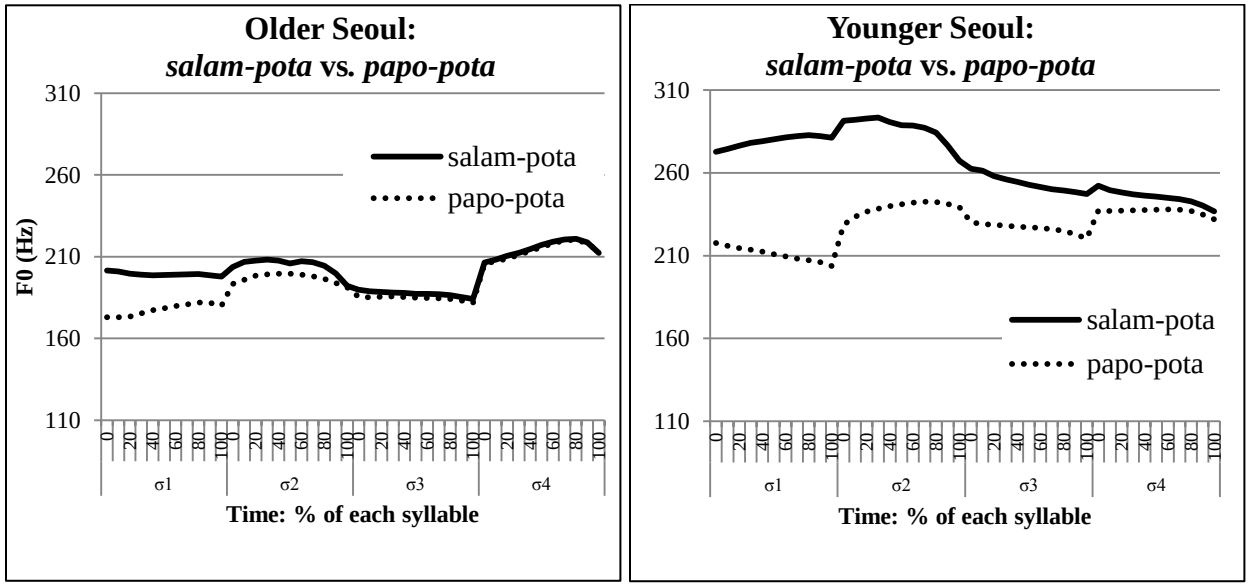

Figure 6. 24. F0 contours of *salam-pota* and *papo-pota* between older and younger Seoul speakers.

Figure 6. 24 shows an age difference regarding the word *salam.* Specifically, while *salam-pota* shows a phrase-final rising pattern for older Seoul speakers, it does not for younger Seoul speakers; mean F0 values in each syllable of *salam-pota* were σ1-199 Hz (SD=26), σ2-205 Hz (SD=27), σ3-187 Hz (SD=21), σ4-215 Hz (SD=25) for older speakers; those for younger speakers were σ1-286 Hz (SD=19), σ2-293 Hz (SD=22), σ3-253 Hz (SD=23) and σ4-245 Hz (SD=12). The measured F0 indicates that younger Seoul speakers have the lowest F0 for the

final syllable among the four syllables. This pattern was observed for seven younger Seoul speakers, and only three reported a higher F0 for the final syllable than the preceding syllable. On the other hand, all ten older Seoul speakers reported a higher F0 for the final syllable than the preceding third syllable. These observations suggest prosodic patterns of HHL**H** and HHL**L**[30] for older and younger Seoul speakers for *salam-pota*, respectively.

6. 2. 2. 2. 4. Summary and discussion of prosodic patterns in Seoul Korean

We examined prosodic patterns in Seoul Korean. This empirical observation was done in order to compare the accent patterns between Seoul and Kyungsang Korean and thereby to determine whether the accent of Kyungsang Korean becomes similar to that of non-lexical pitch accent Seoul Korean.

The present results were generally consistent with reported prosodic patterns for Seoul Korean by Jun (1993, 1998). Jun (1993, 1998) proposed that while an underlying LHLH pattern is realized on each syllable for four-syllable words, some of the tones in the underlying LHLH pattern are undershot for phonological words with two or three syllables, resulting in LH and LLH (or LHH). Three major replicated findings in the present Seoul data are as follows. First, the present results showed that the basic prosodic pattern of Seoul Korean is a LH rising pattern for both older and younger generations. Second, while four-syllable words showed the LHLH pattern, LLH and LH patterns were examined for three-syllable and two-syllable words,

[30] One might argue LHLH for older Seoul and LHLL for younger Seoul based on the lower F0 in the first syllable than the second syllable. However, based on the overall higher F0 in the initial two syllables of *salam* than of *papo,* this dissertation indicates high tones across the first two syllables of *salam*.

respectively. Third, we saw that when the phrase-initial segment had a [+stiff vocal cords] feature (i.e., /s/ in *salam* 'a person'), the initial syllable showed a high F0 and therefore the tonal patterns of a phrase were HHH or HHLH. This seems to support the role of the initial segment in determining the tonal pattern of an accentual phrase.

In addition to replicating these findings, we observed some age differences regarding the word *salam*. For *salam-i* with three syllables, while younger Seoul speakers reported HHH, older Seoul speakers showed LLH despite the laryngeal feature of /s/. For *salam-pota* with four syllables, while older Seoul speakers elicited HHLH showing a phrase-final rising pattern, younger Seoul speakers showed HHLL, lowering its tone at the last syllable of the phrase. The current dissertation will not discuss details regarding these empirically observed age differences in the prosody of Seoul Korean, focusing on the primary goal of this study. However, at least two issues seem to require further consideration. First, it seems premature to claim that the phrase-initial segment /s/ causes the age difference because the effects of age variation are not consistent between *salam-i* and *salam-pota*; for *salam-i* the age variation came from the phrase-initial segment /s/, but the age variation showed up as the absence/presence of the phrase-final rising pattern for *salam-pota*. Second, if age variation is related to /s/, it should also be clarified whether age variation is true for other obstruents as well to see the validity of the role of the laryngeal [+stiff vocal cords] feature.

6. 2. 3. General discussion

The primary goal of this chapter was to test whether younger Kyungsang generations retain the same lexical pitch accent system as the older generation and to determine whether diachronic sound change occurs in the pitch accent system. Empirical observation focused on

the nominal pitch accent system, and examined the full range of accent patterns in nouns with suffixes. In this section, I will first highlight some major findings, and then discuss implications regarding generational differences in the pitch system of Kyungsang Korean.

The two crucial changes in the accent system for younger Kyungsang speakers are that younger Kyungsang speakers shift a high tone rightwards, and they lose two consecutive high tones compared to older Kyungsang. These two generational changes result in merging HL and H1/HH classes, and accordingly reducing tonal parallel patterns compared to older Kyungsang speakers. Also, the two changes are applied to the entire accent system of younger Kyungsang speakers, showing the changes in the R/LH1 and H2/LH2 classes. As a consequence of the two changes in the entire accent system, two initial low tones that do not exist for older Kyungsang are seen for younger Kyungsang, and an initial high tone that exists for older Kyungsang is not observed for younger Kyungsang. Finally, younger Kyungsang does not have tonal variations by suffixes for the H2/LH2 class, indicating the loss of a tonal distinction in suffixes. The loss of tonal distinction in suffixes results in weakening the accent contrast between LH1 and LH2.

These generational changes tend to parallel secondary patterns for some older Kyungsang speakers, indicating that the similar change also occurs for older generations. In particular, the tonal deviations for HL and H1/HH suggest a possible chain shift where we can speculate a sequence of the accent merger between the two classes. Finally, the shared deviations across R/LH1 and H2/LH2 indicate the direction of the accent merger.

These empirical findings indicate that the lexical pitch accent pattern exhibited in the production of the older generation is not maintained by the younger generation, and thus suggest that a sound change occurs in the phonology of the lexical pitch accent as well as in the phonetics (Chapter 5). Notably, all the changes in the younger Kyungsang generation arguably

suggest that the pitch accent system becomes simpler in terms of 1) the reduction of the tonal parallels between mono- and disyllabic nouns, and 2) the loss of a tonal distinction in suffixes. Then, the question arises as to what makes the pitch system simpler. I would like to argue for an external motivation rather than an internal factor for the change in the lexical pitch system based on 1) the accent merger between HL and H1/HH both of which become LH and 2) the similarity of prosodic patterns between Seoul and younger Kyungsang speakers.

That the generational changes are driven by an internal motivation seem less likely considering that the accent merger occurred in the younger Kyungsang speakers. I reason that if the merger is driven by internal or phonetic pressure, the HH class is more likely to be merged into the HL class in the sense that a more prominent tone (HL: high-falling) tends to absorb a less prominent one (HH: high-level) (Liu 2009). However, in the case of the tone merger for younger Kyungsang speakers, the merged accent category forms a new LH class, neither HL nor HH. Here, by being merged as LH, the accent distinction across entire classes becomes weaker particularly in isolation: for younger speakers, all disyllabic nouns in isolation are realized as LH. For example, the words *káci* (HL) 'type', *kácí* (HH) 'branch' and *kací* (LH) 'eggplant' are all realized as a LH pattern among younger Kyungsang speakers. As discussed in the vowel chapter (Chapter 2), the phonetic motivation for sound change is presumably to make a sufficiently large contrast. However, the merged LH form results in non-distinguishable segmental homonyms in isolation, and therefore it seems unlikely that internal pressure is related to weakening accent contrasts. Thus, the accent merger among younger Kyungsang speakers would appear to indicate that the generational change in the pitch system of Kyungsang Korean does not occur due to an internal pressure.

Instead, I argue that an external factor drives the change. Specifically, based on the similar prosodic structure of younger Kyungsang and Seoul utterances, I argue that the prosody of Seoul Korean affects the re-formation of Kyungsang's lexical accent system. In Section 5. 2. 2. 2, the prosodic patterns of Seoul Korean were LH, LLH, and LHLH where initial syllables always had low tones except the phrase-initial [s], which is consistent with Jun (1993, 1998). That is, the lexical high tone occurring on the initial syllable is a unique feature in Kyungsang Korean as compared to Seoul. However, recall that younger Kyungsang speakers in the present chapter also did not show the initial high tone in their prosody patterns across all types of noun stems + suffixes combinations (see Table 6. 15). The loss of an initial high tone among younger Kyungsang speakers suggests that they may re-form their prosody structure similar to the prosody of Seoul Korean. H.-S. Lee (2008) also reported that the younger Kyungsang generation used a rising intonation consistent with Seoul speakers in marking their question sentences, while older generations of Kyungsang used a low or falling intonation for a question. To explain these changes in sentence intonation, H.-S. Lee (2008) noted the increased exposure to Seoul Korean among younger Kyungsang generations, and their negative attitude toward the non-standard varieties of Korean. Consistent with H.-S. Lee (2008), I argue that under the prevailing linguistic ideology, younger Kyungsang speakers may feel stigmatized for their initial high tone, and they try to minimize the high pitch on the initial syllable to reduce the F0 prominence in their utterances. In addition to the linguistic ideology, younger Kyungsang speakers have been more exposed to the standard variety of Korean than older generations, and the increased exposure to the target dialect may facilitate more rapid accommodation. That is, the linguistic ideology and the increased exposure to Seoul Korean might function simultaneously as external pressure and facilitator for younger speakers. Importantly, the

findings in the current chapter suggest that the influence of Seoul Korean affects younger Kyungsang generations' lexical accents not only at the surface phonetic level, but also at the underlying phonological level.

A subsequent question is how the prosody of younger Kyungsang speakers becomes more similar to that of Seoul speakers, and how the prosody of younger Kyungsang speakers becomes different from that of older Kyungsang speakers. As seen earlier, for younger Kyungsang speakers pitch accent patterns systematically differ by lexical items in different accent categories. Although the lexical pitch accent distinctions are reduced due to the merger between HL and H1/HH classes, distinct pitch accent patterns remain across 1) HL/H1/HH, 2) LH1 and 3) LH2. These accent classes are revealed when stems are expanded with suffixes. In other words, while younger Kyungsang generations do not maintain the accent system in the same way as older generations, younger speakers still retain the *lexically* determined pitch accents. That is, Kyungsang Korean is still a lexical pitch accent language, and is different from Seoul Korean where the LH, LLH, and LHLH accent patterns are determined *prosodically*. Overall, the tonal pattern of younger Kyungsang speakers becomes simpler compared to that of older Kyungsang speakers, and it becomes more similar to that of Seoul Korean. Despite the simplicity and similarity, however, Kyungsang Korean is still distinct in terms of maintaining lexical accent contrasts. Therefore, it might be said that the diachronic sound change in the lexical pitch accent of Kyungsang Korean is ongoing by adapting the prosodic feature from Seoul Korean, and by keeping its lexical accent property. In earlier *vowel* (Chapter 2) and *fricative* (Chapter 4) chapters of this dissertation, I showed that younger Kyungsang speakers now have the same phonemic vowel and fricative distinctions as Seoul Korean speakers do. Younger Kyungsang's retaining lexical pitch, but its changing segmental distinctions seem

consistent with the notion by Chambers (1995: 197) saying that, *"Whenever segmental and prosodic elements are involved in change, prosodic elements are likely to lag behind segmental ones. The reason for this is that prosodic features have primacy in the acquisition schedule. They are acquired very early, as shown by the fact that infants recognize adult prosodic patterns at two or three months and can mimic them as early as six months (Crystal 1979). "*

In the following section, I will provide a theoretical analysis for the lexical pitch accent patterns of younger Kyungsang speakers, focusing on their dominant pitch patterns. We will see how Optimality Theory accounts for the pitch systems between younger and older Kyungsang generations.

6. 3. Phonological analysis

6. 3. 1. Observation and underlying representations

From the generational comparison for the dominant pitch patterns in Table 6. 15, we can draw the following theoretical implications.

First, while older Kyungsang's four parallels between mono- and disyllabic nouns under suffixation indicate four underlying tones, younger Kyungsang's three parallels indicate three underlying tones. Second, according to Lee and Zhang (in press), the decision for the underlying tone is made based on the location of the underlying H and the presence or absence of a spreading property that spreads its H tone to the right. In this sense, the one-syllable shifted high tone and the loss of two consecutive high tones observed for younger Kyungsang speakers might be reflected as a one-syllable shifted underlying H and loss of spreading property in the H. Third, while older Kyungsang generations have the high ranked *#LL and a low ranked *#H constraints to prevent illegal tonal sequences, the rank of these two constraints should be

reversed for younger Kyungsang speakers. Fourth, the absence of tonal variations by suffixes indicates that younger Kyungsang speakers lose underlying suffixal tones, which also does not require constraints regarding a suffix tone. Considering these theoretic changes, I would like to suggest the underlying tones for the younger Kyungsang generation as follows. Table 6. 23 presents the nominal lexical accent patterns for the younger Kyungsang generation. The underlying representation for the older Kyungsang generation proposed in Lee and Zhang (in press) is provided in Table 6. 4 in Section 6. 1. 1. 2.

		H1	**R**	**H2**
Monosyllables	Isolation	H	R	H
	Mono_suffix: *-i/ka*	L-H	L-H	L-H
	Di_suffix: *-imyen/lamyen*	L-HL	L-LH	L-HL
	Di_suffix: *-pota*	L-HL	L-LH	L-HL
	Di_suffix: *-mankhum*	L-HL	L-LH	L-HL
		HL/HH	**LH1**	**LH2**
Disyllables	Isolation	LH	LH	LH
	Mono_suffix: *-i/ka*	LH-L	LL-H	LH-L
	Di_suffix: *-imyen/lamyen*	LH-LL	LL-HL	LL-HL
	Di_suffix: *-pota*	LH-LL	LL-HL	LL-HL
	Di_suffix: *-mankhum*	LH-LL	LL-HL	LL-HL

Table 6. 23. Nominal pitch accent patterns of monosyllabic and disyllabic nouns under suffixation for the younger Kyungsang generation. A morpheme boundary is marked with '-'.

The accent classes HL and H1/HH are merged for younger Kyungsang speakers, and thus we need only one underlying representation for these accent classes. The present phonetic data

showed that the H tone occurs only on the second syllable of a phonological word regardless of suffix type, and the rest of the syllables take low (L) tones. In addition, the H tone does not occur across two consecutive syllables, indicating the loss of spreading property in the H tone, and this means that we no longer need the (+) diacritic as in H^+ to mark the spreading property as proposed by Lee and Zhang (in press). Considering these observations for HL/H1/HH, I suggest *pen-initial-H* where the underlying H tone with no spreading property is pre-linked to the second syllable in the input. However, for the monosyllabic H1 without suffixation, the H tone inevitably occurs on the sole monosyllabic root, which contrasts with the pen-initial-H analysis. A similar issue arises for the monosyllabic rising accent. Importantly, although there is no available second syllable for the monosyllabic H1 to locate the underlying pen-initial-H, the H tone must be somewhere in the tonal domain according to tonal culminativity. Like other pitch accent languages, the lexical accent of Kyungsang Korean is culminative, that is, there should be a single point of peak prominence in an accent domain (Schuh and Kim 2007, Evans ms, Lee and Zhang ms). This issue might be solved if we take the mora (μ) as an accent-bearing unit. Specifically, the pen-initial-H tone can appear for a monosyllabic noun consisting of two moras, and the underlying H tone linked to the pen-initial mora would surface at the right edge of the monosyllables. The F0 peak at the right edge occurring for younger Kyungsang speakers is also empirically observed through the generational difference of F0 peak point (F0 maximum duration) in the monosyllabic nouns in Chapter 5. Chapter 5 showed that the F0 peak occurs later within the H1 monosyllabic nouns for younger than older Kyungsang speakers: while peak F0 (F0 maximum duration) occurs at the 50% point of the H1 monosyllabic noun for older Kyungsang speakers, it occurs at the 75% point for younger Kyungsang speakers. Therefore, the mora analysis is applied for those cases in which there is no syllable available to bear an

underlying H tone. Except for these cases (i.e., monosyllabic H1, R and disyllabic LH1), moras are equivalent to the syllables.

For the monosyllabic rising and disyllabic LH1, the H tone occurs only on the third syllable within a phonological word. The H tone does not occur across two consecutive syllables, indicating the absence of the spreading property in the H tone. If there is no available third syllable in the case of monosyllabic R and disyllabic LH1 nouns without suffixation, the H tone occurs on the monosyllable and on the second syllable for the monosyllabic and disyllabic roots, respectively. These observations lead to the phonological analysis of the *third-mora-H* underlying tone. The previous pen-initial-H analysis for HL/H1/HH locates its H on the second mora, while this third-mora-H places its H on the third mora. In other words, the third-mora-H tone occurs for a monosyllabic rising word consisting of three moras, and the underlying H tone prelinked to the third mora would surface at the right edge of the monosyllable. The observation in Chapter 5 seems consistent with this hypothetical claim, reporting that the F0 peak point occurs significantly later for R than for H1 among younger Kyungsang speakers: F0 peak point is at 75% and 84% of monosyllabic H1 and R words, respectively.

For the monosyllabic H2 and disyllabic LH2, the H tone occurs either on the second syllable or on the third syllable. These alternative patterns are decided according to the number of syllables. If a phonological word consists of more than four syllables, the H tone occurs on the third syllable; if a phonological word consists of less than three syllables, the H tone occurs on the second syllable. Note that the H2/LH2 class is distinct from R/LH1 that showed a consistent H tone on the third syllable as long as there is an available syllable. The tonal variations in H2/LH2 lead to the underlying *Toneless* class, consistent with Schuh and Kim (2007) and Lee and Zhang (in press). That is, the surface tone in this toneless class is a default

tone that appears to prevent bad tonal sequences as consequences of markedness constraint interactions. Although the toneless analysis is consistent with previous analyses proposed for older Kyungsang speakers (Schuh & Kim (2007), Lee & Zhang (in press)), the loss of suffix tones among younger Kyungsang speakers is a generational change for this toneless class. While the previous analyses for older Kyungsang speakers predicted the surface tonal pattern by interacting suffixal tones and constraints, the surface tonal patterns for younger Kyungsang's toneless class are derived solely by constraint interactions. According to these observations, I propose the following underlying representations to account for the nominal pitch accents of the younger Kyungsang generation summarized in Table 6. 24. The previous analysis in Lee and Zhang (in press) is also provided in Table 6. 24 for the generational comparison.

In the current analysis for the younger Kyungsang generation, the HL/H1/HH class has an H tone prelinked to the peninitial mora; the analysis for the older Kyungsang generation requires two underlying tonal classes to account for each of HL and H1/HH where the former has an H tone prelinked to the penultimate mora, and the latter has an H tone prelinked to the initial mora that spreads its H to the right. The younger Kyungsang generation retains the R/LH1 class where an H tone is prelinked to the third mora; for the older Kyungsang generation the H tone is prelinked to the peninitial mora and spreads to the right. The younger Kyungsang generation also preserves the toneless class that does not have a prelinked underlying H tone in the input. Consistent with the older Kyungsang generation, the surface tonal pattern is derived by constraint interactions. However, the loss of suffixal tone and generational changes in constraints results in different surface pitch patterns between older and younger generations of Kyungsang.

Older Kyungsang			Younger Kyungsang	
Underlying representation	**Accent patterns**	**Example words**	**Accent patterns**	**Underlying representation**
H | μμ# (penult-H)	HL	*kewul* ‘mirror’ (HL)	LH	H | #μμ (pen-initial-H)
	HL-L	*kewul-i*	LH-L	
	HL-LL	*kewul-imyen*	LH-LL	
	HL-LL	*kewul-pota*	LH-LL	
H^+ | #μ (initial-H with spreading)	H	*nwun* ‘eye’ (H1)	H	
	H-H	*nwun-i*	LH-L	
	H-HL	*nwun-imyen*	LH-LL	
	H-HL	*nwun-pota*	LH-LL	
	HH	*kunul* ‘shade’ (HH)	LH	
	HH-L	*kunul-i*	LH-L	
	HH-LL	*kunul-imyen*	LH-LL	
	HH-LL	*kunul-pota*	LH-LL	
H^+ | #μμ (pen-initial-H with spreading)	R	*nwun* ‘snow’ (R)	R	H | #μμμ (third-mora-H)
	L-H	*nwun-i*	L-H	
	L-HH	*nwun-imyen*	L-LH	
	L-HH	*nwun-pota*	L-LH	
	LH	*salam* ‘person’ (LH1)	LH	
	LH-H	*salam-i*	LL-H	
	LH-HL	*salam-imyen*	LL-HL	
	LH-HL	*salam-pota*	LL-HL	
Toneless	H	*mun* ‘door’ (H2)	H	Toneless
	H-L	*mun-i*	L-H	
	H-LL	*mun-imyen*	L-HL	
	L-HL	*mun-pota*	L-HL	
	LH	*palam* ‘wind’ (LH2)	LH	
	LH-L	*palam-i*	LH-L	
	LH-LL	*palam-imyen*	LL-HL	
	LH-HL	*palam-pota*	LL-HL	

Table 6. 24. Underlying representations for the nominal pitch accents in older (left) and younger (right) Kyungsang generations.

6. 3. 2. Constraints

This section proposes constraints to account for the pitch accent system of younger Kyungsang generations, and discusses generational changes in the constraints. The constraints proposed by Lee and Zhang (in press) are first briefly reviewed to see how the constraints work for the pitch pattern of older Kyungsang, and I then suggest the constraints reflecting the observed age variations in the accent system of South Kyungsang Korean. The ranked constraints for the accent system of the older Kyungsang generation are provided in (4).

(4) Constraint ranking for the accent system of the older Kyungsang generation (Lee and Zhang, accepted)

MAX-ROOT(H), MAX-ROOT(Association), SPREAD(H^+), CULMINATIVITY, *#LL

|

MAX-SUFFIX(H), MAX-SUFFIX(Association), DEP(H), DEP(Association)

|

*SUFFIX-H

|

*INITIAL-H

For the accent system of the older Kyungsang generation, the undominated constraints, MAX-ROOT(H), MAX-ROOT(Association), SPREAD(H^+), CULMINATIVITY, and *#LL, work crucially to make the pitch patterns surface. MAX-ROOT(H) and MAX-ROOT(Association) preserve the underlyingly prelinked H tone and association line in the input of the root to the output form of the root. If H^+ (H tone with spreading property) is associated with a mora in the

input, a spread H from H^+ is associated with the following available mora. CULMINATIVITY works in two ways: CULMINATIVITY makes only one underlying tone in the root surface, when both root and suffix have underlying tones, and CULMINATIVITY prevents words in the toneless class from ending up with no H for the case of a toneless root with a toneless suffix. MAX-SUFFIX(H) and MAX-SUFFIX(Association) works with suffixal tones, preserving an underlying H and its association line in suffixes. Low ranked *SUFFIX-H and *INITIAL-H constraints work for deriving a proper default H tone for words in the toneless class, preferring a candidate without an H tone in a suffix and on an initial syllable.

For the accent system of the younger Kyungsang generation, the distinction between root and suffix tones is no longer needed according to the loss of underlying tone in suffixes. Any constraints that treat underlying tones of a root and a suffix separately are not required. Therefore, MAX-ROOT(H, Assoc.) and MAX-SUFFIX(H, Assoc.) constraints might become MAX (H) and MAX(Assoc.) defined in (5) and (6), and the *SUFFIX-H constraint is simply removed.

(5) MAX (H): An H tone in the input must have a corresponding H tone in the output.

(6) MAX (Assoc.): An association line in the input must have a corresponding association line in the output.

The underlying peninitial-H and the third-mora-H prelinked to the input mora can be derived by these undominated MAX(H) and MAX(Assoc.) constraints without the need to specify root and suffix distinction.

The loss of the spreading H^+ underlying tone is another generational change, suggesting the dispensability of the SPREAD(H^+) constraint. The undominated constraint *#LL for older Kyungsang speakers should also be removed according to the generational change shifting a high

tone to the right, which consequently allows two initial low tones for younger speakers. Instead, the low ranked *INITIAL-H for the older generation should be ranked high for younger speakers. This undominated *INITIAL-H constraint is in line with the prosody property of Seoul Korean, reflecting the influence of Seoul Korean on the accent system of the younger Kyungsang generation. High ranked *INITIAL-H and CULMINATIVITY properly dock the default H for words in the toneless class. CULMINATIVITY forces to dock the default H somewhere in a phonological word, and a candidate with the default H on the initial syllable violates *INITIAL-H, and thus loses. Additional *FINAL-H and ALIGN-R defined in (7) make the default H tone for the toneless words surface.

(7) ALIGN-R (H, PHONOLOGICAL WORD): every H tone must be aligned with the right edge of a phonological word.

The *FINAL-H and ALIGN-R constraints reflect L% in Kyungsang Korean (Cho 1996) and the rightward accent shift in the present observation, respectively. *FINAL-H » ALIGN-R docks the default H to the right edge as much as possible, but prevents an H tone on the final syllable. These proposed constraints are ranked as in (8).

(8) Constraint ranking for the accent system of the younger Kyungsang generation:

MAX(H), MAX(Association), CULMINATIVITY, *INITIAL-H

|

*FINAL-H

|

ALIGN-R

6. 4. Conclusion

The current chapter tested whether the underlying distinction in the accent system of South Kyungsang Korean is maintained by younger generations as well as older generations. The findings of this chapter indicated on-going sound change in the lexical pitch accent system of Kyungsang Korean not only in the surface phonetic form, but also at the underlying phonological level. The generational comparison suggested that the lexical pitch accent system of Kyungsang becomes simpler, showing a reduced underlying accent contrast and the loss of suffixal tone in the younger generation. The dialectal comparison indicated that the diachronic change in the accent system of Kyungsang might be affected by the prosody of Seoul Korean, showing the similarity in the prosodic pattern between Seoul speakers and younger Kyungsang generations. Despite the simplicity and similarity, however, the prosody of Kyungsang Korean is still distinct from Seoul Korean in the sense that the accent pattern of Kyungsang is lexically determined and that of Seoul is prosodically determined. Therefore, it is concluded that the sound change in the prosody of Kyungsang Korean is ongoing by retaining some of its prosodic features and by adapting the prosodic feature of a target dialect.

Although the findings in the current chapter clearly indicated how the pitch accent system of Kyungsang Korean is diachronically changing, there are still remaining issues.

First, the accent deviations particularly for R/LH1 and H2/LH2 need to be further explored. The more tonal variations for these accent classes may indicate another accent merger, and therefore the examination of these accent deviations may provide us with a clue to the possible direction of a sound change.

Second, it is worthwhile to test the observed accent merger in longer words. The accent merger between the disyllabic HL and H1/HH classes leads us to the subsequent question

whether the merger happened for the trisyllabic LHL and HHL. Importantly, testing the merger with longer words will allow us to see if the proposed underlying representation is applicable across all nouns regardless of the number of syllables.

Third, a perception study will confirm the accent merger between HL and H1/HH. Despite the same tonal pattern between HL and H1/HH, the phonetic property looks different as seen in Figure 6. 25. Although a high tone occurs on the second syllable for both the disyllabic HL and HH classes, the second syllable high tone is at a plateau for HH, but it is at the left edge for HL. A perception test can tell if this is indeed a merger, near merger, or false merger.

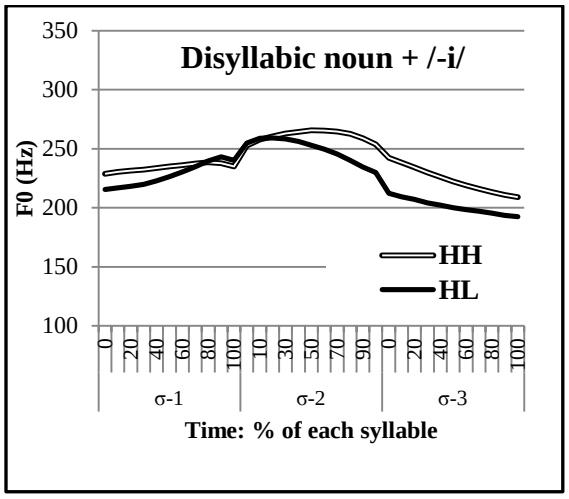

Figure 6. 25. F0 contours of the disyllabic HL and HH suffixed with /-i/ for younger Kyungsang speakers.

CHAPTER 7 CONCLUSION

This dissertation investigated diachronic sound change in the South Kyungsang dialect of Korean by testing whether the phonetic uniqueness of Kyungsang Korean compared to standard Seoul Korean is maintained by younger speakers as well as older speakers. This dissertation reported generational differences for the phonetic characteristics of vowels (Chapter 2), stop consonants (Chapter 3), fricatives (Chapter 4), and lexical pitch accent (Chapters 5 and 6) in South Kyungsang Korean. The main findings in the current dissertation are summarized in Table 7. 1.

The acoustic study of vowels (Chapter 2) provided evidence of diachronic change in the vowel system of Kyungsang Korean. Measures of formant frequencies 1–3 showed that while /ʌ/ and /ɨ/ vowels are acoustically less distinct in their height (F1) and backness (F2) for older speakers, the two vowels are well distinguished in these two acoustic parameters for younger Kyungsang speakers. This suggested that the merged /ʌ/ and /ɨ/ vowels for older Kyungsang speakers are split among younger speakers. A generational difference in vowels was observed for Seoul Korean in which the distinct /ɛ/ and /e/ vowels for older Seoul speakers are merged for younger speakers. As a consequence of the diachronic change in Kyungsang (split of /ʌ/ and /ɨ/) and Seoul (merger of /ɛ/ and /e/) Korean, younger Kyungsang speakers do not retain the six vowels as do older Kyungsang speakers, but they have seven vowels like the younger Seoul speakers.

<table>
<tr><th rowspan="2"></th><th colspan="2">Kyungsang</th><th colspan="2">Seoul</th></tr>
<tr><th>Older</th><th>Younger</th><th>Older</th><th>Younger</th></tr>
<tr><td rowspan="2">Vowels</td><td>• 6 vowels
• less distinct ‘ɨ and ʌ’
• i, e, a, ɨ, o, u</td><td>• 7 vowels
• vowel split of ‘ɨ and ʌ’
• i, e, a, ʌ, ɨ, o, u</td><td>• 8 vowels
• retention of ‘e and ɛ’
• i, e, ɛ, a, ʌ, ɨ, o, u</td><td>• 7 vowels
• merger between ‘e and ɛ’
• i, e, a, ʌ, ɨ, o, u</td></tr>
<tr></tr>
<tr><td rowspan="2">Stops</td><td>• Classification accuracy:
VOT (90%) >
H1-H2 (64%) > F0 (42%)</td><td>• Classification accuracy:
VOT (84%) >
H1-H2 (60%) = F0 (60%)</td><td>• Classification accuracy:
VOT (97%) >
H1-H2 (62%) > F0 (57%)</td><td>• Classification accuracy:
F0 (87%) > VOT (76%) > H1-H2 (48%)</td></tr>
<tr><td colspan="4">• Diachronic change in Seoul: weakened role of VOT, but strengthened F0 for stop contrast for younger Seoul
• Diachronic change in Kyungsang: increased role of F0 for stop, but reduced role of F0 for lexical pitch distinction for younger Kyungsang</td></tr>
<tr><td rowspan="2">Fricatives</td><td>• Classification accuracy:
Frication dur. - 66%
Center of gravity -72%
H1-H2 -77%, F0 -50%</td><td>• Classification accuracy:
Frication dur. - 84%
Center of gravity - 90%
H1-H2 - 84%, F0 - 47%</td><td>• Classification accuracy:
Frication dur. - 84%
Center of gravity - 90%
H1-H2 - 90%, F0 - 47%</td><td>• Classification accuracy:
Frication dur. - 95%
Center of gravity - 90%
H1-H2 - 75%, F0 - 50%</td></tr>
<tr><td colspan="4">• The two-way fricative contrast is less distinct for older Kyungsang based on lower classification accuracy of frication duration and center of gravity, whereas the two acoustic parameters reliably distinguish the two fricatives for younger Kyungsang.
• While the non-fortis /s/ of older Kyungsang lacks the aspiration feature, that of younger Kyungsang does not.</td></tr>
<tr><td>Lexical Pitch</td><td colspan="2">• Spectral and temporal F0 properties across contrastive accents are less distinct for younger than older Kyungsang.
• F0 peak shifts rightwards for younger Kyungsang, resulting in the loss of F0 peak in the first syllable for younger Kyungsang.
• The generational change results in simpler pitch accent patterns for younger Kyungsang.</td><td colspan="2">• The accent structure of Seoul Korean is identical across words, showing the phrase-final rising pattern (LH) for both younger and older speakers.</td></tr>
</table>

Table 7. 1. Summary of the main findings in this dissertation. Classification accuracy for stops and fricatives was obtained from discriminant analyses.

Chapter 3, the acoustic study of stop consonants, examined if younger Kyungsang speakers distinguish the three-way laryngeal contrast among voiceless stops similarly to older Kyungsang speakers or to Seoul speakers. Measures of VOT, F0 and H1-H2 in the following vowel showed that younger Kyungsang speakers rely more on F0, but less on VOT than older Kyungsang speakers to distinguish the stops. Instead of the increased role of F0 as a function of laryngeal distinction, F0 was less important for the lexical pitch accent contrast among younger Kyungsang speakers. This suggested that younger Kyungsang speakers tend to minimize the role of F0 for the lexical pitch accent distinction, but they maximize it for the laryngeal distinction. The increased importance of F0 for the laryngeal distinction is in line with the diachronic change in stops of Seoul Korean in which the role of VOT is reduced for younger Seoul speakers, but that of F0 is increased. The generational and dialectal comparison suggested that the three-way laryngeal contrast in the speech of the younger Kyungsang speakers is made approximate the speech of younger Seoul speakers.

Chapter 4 presented acoustic evidence of diachronic change in the fricatives of Kyungsang Korean. Measures of frication/aspiration duration, center of gravity, F0 and H1-H2 in the following vowel showed that while the non-fortis /s/ and the fortis /s'/ are less distinct or merged for older Kyungsang speakers, the two fricatives are well distinguished by younger Kyungsang speakers. For older Kyungsang speakers, the smaller aspiration proportion and higher center of gravity for the non-fortis /s/ suggested that the less distinct fricatives are related to lack of aspiration for /s/. For younger Kyungsang speakers, on the other hand, the aspiration proportion and center of gravity distinguish the two fricatives in the same way as for Seoul speakers. As a consequence of the generational change in the fricative of Kyungsang Korean, it

can be said that younger Kyungsang speakers have the same consonant inventory as Seoul speakers.

The current dissertation provided acoustic evidence for diachronic sound change in the lexical pitch accent of Kyungsang Korean (Chapters 5 and 6). The generational change in the lexical pitch accent was noted not only for the surface phonetic form, but also for the underlying form.

Chapter 5 showed that the F0 spectral and temporal properties that characterize contrastive lexical accents are different between older and younger Kyungsang generations. For older Kyungsang speakers, the peak F0 value was higher for the monosyllabic H class than R, and highest for the disyllabic HL class, followed by HH and LH. For younger Kyungsang speakers, however, F0 peak was not different across monosyllabic (H vs. R) and disyllabic (HL vs. HH vs. LH) accent classes. For F0 temporal characteristics, F0 peak occurs earlier for the monosyllabic H class than R, and earliest for HL, followed by HH and LH. However, for younger Kyungsang speakers, although the pattern of the F0 peak points itself was similar to the pattern for older speakers (i.e., H < R, HL < HH < LH), F0 peak always occurred later for younger than older Kyungsang speakers. That is, F0 peak shifted rightwards for all accent classes. As a consequence of this rightward accent shift, no high peak occurs on the first syllable for younger Kyungsang speakers. Therefore, all disyllabic nouns showed an F0 peak on the second syllable, and all monosyllabic nouns showed an F0 peak on the right edge. This final rising accent pattern observed for younger Kyungsang speakers is consistent with the accent pattern in Seoul Korean where the phrase-final rising pattern (i.e., LH) is prosodically determined. These acoustic findings suggested that i) younger Kyungsang speakers do not retain the same surface forms for the lexical pitch accents as older Kyungsang speakers, indicating the

diachronic change in the prosody of Kyungsang Korean, and ii) the prosody of younger Kyungsang speakers becomes similar to that of Seoul speakers.

Chapter 6 examined the generational change for the underlying lexical tones in Kyungsang Korean. Elicited accent patterns for monosyllabic and disyllabic nouns under suffixation showed that the underlying lexical tones for older Kyungsang speakers were not maintained by younger speakers. Due to i) the accent merger between HL and H1/HH, ii) the loss of suffix tone, and iii) weakened accent contrasts, the nominal pitch accent system of younger Kyungsang speakers is simpler than that of older speakers. The generational change suggested three underlying accent classes for the nominal pitch accent system of younger Kyungsang speakers, which is different from that of older speakers having four underlying accent classes. The comparison of the accent pattern between younger Kyungsang and Seoul speakers suggested that the prosody of younger Kyungsang speakers is similar to that of Seoul Korean in terms of the absence of a high tone on the initial syllable across all accent classes. Overall, the nominal pitch accent system of younger Kyungsang speakers becomes simpler compared to that of older Kyungsang speakers, and similar to that of Seoul speakers. Despite the simplicity and similarity, however, the pitch system of younger Kyungsang speakers is distinct from Seoul Korean in terms of maintaining the three underlying accent classes. Therefore, it was concluded that the sound change in the lexical pitch accent of Kyungsang Korean occurs by adopting the prosodic feature from Seoul Korean, and by keeping its own lexical accent.

This dissertation explored whether the phonetics and phonology of Kyungsang Korean are retained by both younger and older Kyungsang generations. Given the situation where 1) the exposure to Seoul Korean has increased among Kyungsang speakers, and 2) Korean ideology provides Seoul Korean with strong prestige, it was hypothesized that the phonetics and

phonology of Kyungsang Korean would become similar to those of Seoul Korean because the increased exposure to Seoul Korean might provide an optimal linguistic setting for younger Kyungsang speakers who favorably imitate the phonetic property of the standard Seoul dialect. This dissertation reported generational differences for the acoustic properties of vowels, consonants and lexical pitch accents in Kyungsang Korean, suggesting diachronic sound change of the South Kyungsang dialect of Korean in both segmental and suprasegmental levels. Importantly, younger Kyungsang speakers share the same consonant and vowel inventories as (younger) Seoul speakers, and they also share the prosodic features with Seoul speakers. This direction of the sound change suggested that the phonetics and phonology of Kyungsang Korean are re-formed to approximate Seoul Korean.

The observed sound change pattern in Kyungsang Korean in this dissertation is explained by the notion *"dialect differences are the result of isolation and the lack of communication"* (Labov 1974). Recall that the older participants in this dissertation were born before 1950, and the influx of populations from other regions to the Kyungsang region started in the 1970s. That is, when the older Kyungsang participants were in their childhood and adolescence (i.e., 1950s – 1970s), the contact with Seoul speakers (or other regional dialect speakers) was less for the older speakers than for the younger participants born in the 1980s or 1990s. Therefore, it can be assumed that the phonetics and phonology of Kyungsang Korean as distinct from Seoul Korean could be maintained for older Kyungsang generations because of their less contact or lack of communication with Seoul speakers. On the other hand, the increased exposure to Seoul Korean for the following generations of Kyungsang speakers has provided them with a different linguistic environment, and this changed linguistic environment made it possible for Kyungsang speakers to accommodate their speech to be similar to Seoul speech. To conclude, the linguistic

homogeneity of Kyungsang Korean is not maintained as a result of different linguistic settings between older and younger Kyungsang generations.

Along with the exposure to Seoul Korean, I argue that Korean ideology has played a role in reducing the homogeneity of Kyungsang Korean and increasing its similarity to Seoul Korean. As stated in Chapter 1, Korean ideology provides the standard Seoul dialect with prestige, and stigmatizes regional dialects. Accordingly, the ideology might motivate younger Kyungsang speakers to imitate Seoul speech, but to avoid Kyungsang speech. The Cholla[31] region (southwest) is geographically close to the South Kyungsang region. Based on the ease of access across the two regions, one can expect phonetic accommodation between Cholla and Kyungsang speakers. However, the present generational change in Kyungsang Korean observed in this dissertation shows that the phonetics and phonology of Kyungsang Korean are indeed shifting towards those of Seoul Korean. Therefore, it is concluded that along with the increased exposure to Seoul Korean, another external social factor, the Korean ideology, has motivated the re-formation of the phonetics and phonology of Kyungsang Korean to be similar to Seoul Korean, rather than other regional dialects.

The findings in this dissertation provided a clear picture about whether and how the phonetics and phonology of Kyungsang Korean have changed. To further understand the diachronic sound change in Kyungsang Korean, there are a number of future directions in which this dissertation can be extended.

First, as indicated in Munro, Derwing and Flege (1999) and Evans and Iverson (2007), dialect change or acquisition can be reflected in perception as well as production. Therefore, a

[31] The Cholla dialect of Korean is distinct from Seoul or Kyungsang Korean in terms of vocabulary, verb ending, and prosody at the accentual phrase.

perception study testing the difference in the speech of younger and older Kyungsang speakers may provide additional evidence for the sound change in Kyungsang Korean and a comprehensive phonetic model of the language.

Second, this dissertation suggested that the two social factors (i.e., the increased exposure to Seoul Korean, and Korean ideology) have motivated the diachronic sound change in Kyungsang Korean. In a model of language change, accommodation among talkers is considered important (Trudgill 1986), and experimental studies have demonstrated that the phonetic accommodation is also affected by social and psychological factors such as the relationship between interlocutors and attitude towards talkers (e.g., Babel 2009, 2010; Pardo, Gibbons, Suppes & Krauss 2012). Therefore, as a future study, if we investigate phonetic and perceptual accommodation as a result of exposure to a different dialect or language ideology in the laboratory, we would be able to develop a fine-grained model of the relationship between phonetic accommodation and dialect change.

Third, along with Kyungsang Korean, Hamkyung dialects of Korean spoken in the north eastern part of Korea have retained the lexical pitch accent from Middle Korean (Ramsey 1975; Sohn 1999; Schuh & Kim 2006, 2007). The lexical pitch accent preserved in Hamkyung Korean is due to massive migration of Kyungsang speakers during the early Chosun dynasty period (15th century) (Sohn 1999). The pitch systems of Kyungsang and Hamkyung Korean tend to correspond regularly, but the two dialects of Korean are currently in different linguistic situations in which Hamkyung is more conservative than Seoul in terms of less influence of Seoul Korean. Therefore, it will be of interest to compare generational differences in phonetics between Kyungsang and Hamkyung Korean to see the effect of different linguistic setting on generation changes in the two dialects of Korean.

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APPENDIX

< Questionnaire >

1. Year of birth: **2. Place of birth:** **3. Gender:**
4. Current language: 1) South Kyungsang Korean 2) Seoul Korean
5. City of residence:

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6. Parents' dialects: Mother: Father:

7. What is your father's highest level of education?
1) Elementary school 2) Middle school 3) High school 4) College

8. What is your mother's highest level of education?
1) Elementary school 2) Middle school 3) High school 4) College

9. Parents' occupations: Mother: Father:

10. What is your parents' income level (per year)?
1) less than $20,000 2) $20,000–$40,000 3) $40,000–$60,000 4) more than $60,000

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11. What is your highest level of education?
1) Elementary school 2) Middle school 3) High school 4) College

12. For how many years have you been educated in the current dialect region?
1) 6 years 2) 9 years 3) 12 years 4) _____ years

13. Have you been stayed or educated in other dialect region? If you have, in which dialect regions have you stayed? And for how long have you stayed there?
1) No, I have not. 2) Yes, I have. (region: i) _____, ii)_____ , for how long: i)_____, ii)_____)

14. [1] Do you have work experiences in the past? [2] Currently, what do you do for a living?
1) No, I have never worked.
2-1) Yes, I have an experience of working. I have worked as _____ for _____years.
2-2) Yes, I have an experience of working. I have worked as _____ for _____years.
3) I have been working as _____ for _____.

15. Do you think that you speak really like a Kyungsang speaker? Please indicate the scale below.
1) Yes, I strongly speak the Kyungsang dialect.
2) Yes, I somewhat speak the Kyungsang dialect, but it is not strong.
3) No, although I grew up and was educated in Kyungsang region, my dialect is more close to Seoul (standard Korean) dialect.

16. What do you think of your using Kyungsang dialect?
1) I like my using KS dialect. 2) I don't like my using KS dialect. 3) I am neutral about my dialect.

17. How do you feel about yourself using Kyungsang dialect when you talked with a *Seoul* speaker?
1) I hesitate to use Kyungsang dialect, and try to make it as Seoul-like as possible.
2) I feel cool to use Kyungsang dialect.
3) I feel okay to use the Kyungsang dialect with a Seoul speaker.