

## Gender difference in the sound change of lexical pitch accents of South Kyungsang Korean

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### ABSTRACT

Given a recent finding showing that female speakers of South Kyungsang Korean is undergoing a sound change of the lexical pitch accent, this study tested whether the change is also reflected for male speech. This study compared F0 scaling and timing properties of accent words produced by younger female and male speakers of South Kyungsang Korean. The results indicated clear gender-related differences, showing more distinct acoustic properties across the accent words for male production compared to females. Despite the better distinction, however, younger male speakers showed peak delay where the F0 peaks are located further to the right compared to conservative speakers' production. Therefore, it might be suggested that younger male speakers' accent productions are in between conservative and innovative phonetic forms.

**Keywords:** Kyungsang Korean, sound change, lexical pitch accent, gender effect

### 1. Introduction

The purpose of the present study is to examine if there is a gender difference for the recently observed sound change of the lexical pitch accent in South Kyungsang Korean (Lee & Jongman, 2015). Non-tonal Seoul Korean does not distinguish words using a pitch difference, whereas South Kyungsang Korean, a pitch accent language, contrasts High and Rising accents in monosyllabic words (e.g., *mwín* H 'eye', *mwün* R 'snow') and HH, HL and LH accents in disyllabic words (e.g., *káci* HH 'type', *káci* HL 'branch', *káci* LH 'eggplant'). Notably, a recent production study (Lee & Jongman 2015) demonstrated that the lexical pitch accent contrasts in the regional variety are not maintained consistently between younger and older generations, suggesting that the phonetic property of the lexical pitch is undergoing a sound change. Following Silva (2011) and

Lee (2008), Lee & Jongman (2015) suggested two external factors as the source of the change: (1) increased influence of Seoul Korean and (2) the prevailing linguistic ideology that has lent Seoul Korean a strong normative bias. Although Lee & Jongman (2015) illustrated the systematic phonetic difference between older and younger Kyungsang speakers, their observation was limited to female productions. Since the main goal of Lee & Jongman (2015) was to determine the presence or absence of generational differences in the phonetic realization of the lexical pitch accent, the researchers controlled the gender factor that could potentially be a variable. However, given the notion that female speakers are more innovative than male speakers in the process of sound change (Labov, 2001), it is worthwhile to address if the observed sound change pattern in Lee & Jongman (2015) is limited to female production or it spreads across genders. If we explore the consistency of the sound change between younger male and female speakers of South Kyungsang Korean, we would be able to determine which stage the change is in. Therefore, the current study aims to address how prevailing the sound change is in progress across genders. Given the difference of the lexical pitch accent between North and South Kyungsang Korean, the present study focuses only on the South Kyungsang variety.

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1.1. Lexical pitch accent of South Kyungsang Korean

The lexical pitch accents of South Kyungsang Korean have been well documented in terms of their phonetic characteristics as well as phonology (e.g., Ramsey, 1975; Chang, 2007, 2008; Schuh & Kim, 2007; Kim & Jun, 2009; Lee & Davis, 2009; Lee & Zhang, 2014). <Table 1> presents examples of the accent patterns for disyllabic nouns in word isolation and when suffixed with *-i(ka)* (nominative case marker).

Table 1: Pitch accent patterns for disyllabic noun roots when isolated and suffixed with *-i(ka)*.

	HL	HH	LH(H)	LH
<b>isolation</b>	HL	HH	LH	LH
<b>-i(ka)</b>	HL-L	HH-L	LH-H	LH-L

South Kyungsang Korean has HH, HL and LH accents in disyllables, when there is no suffix attached. Previous studies (e.g., Ramsey, 1975; Schuh & Kim, 2007; Chang, 2007, 2008; Lee & Davis, 2009; Lee & Zhang, 2014) noted that a phonological word consisting of fewer than three syllables should be expanded with suffixes to determine the underlying accent class. Specifically, adding suffixes reveals that there are two kinds of LHs, indicating that the neutralized tones in isolation actually belong to different underlying accent classes, as indicated in <Table 1>. To mark the neutralized accents in isolation, the present paper labels the LH accents simply as LH(H) and LH, respectively, according to their tonal behavior with suffixes.

Previous phonetic studies (e.g., Chang, 2007; Lee, 2008)<sup>2)</sup> reported that the lexical pitch accent contrast of Kyungsang Korean can be distinguished in terms of F0 durational and scaling properties as in other pitch accent languages (Bruce, 1977). F0 peak timing or F0 maximum duration indicates the duration from the onset of the prevocalic consonant to the point of the highest F0 value, while F0 minimum duration measures the duration from the onset of the prevocalic consonant to the point of the lowest F0 value before the highest F0 point. Regarding the F0 scaling property, the highest F0 value within a target word is measured as the peak F0 value, and the lowest before the peak F0 point would be measured for the lowest F0 value. The four acoustic properties vary across different accent

classes. For example, in Kyungsang’s disyllabic accents, the F0 peak of HL comes earliest and that of LH latest (i.e., HL < HH < LH). The F0 minimum duration also varies according to lexical pitch contrast, patterning ‘HL < HH < LH’. For the F0 scaling property, although the peak F0 values were not significantly different across pitch contrasts, the minimum F0 value in LH was lower than for the other two patterns (Lee 2008).

1.2. Generational differences

A recent production study, Lee & Jongman (2015), examined if the phonetic properties of pitch accents in Kyungsang Korean are observed consistent across ten female older (mean age = 66) and younger (mean age = 21) generations of Kyungsang speakers, and if younger Kyungsang speakers still maintain the pitch difference to distinguish words as older speakers do. The researchers hypothesized that if the non-tonal Seoul dialect has significantly influenced the lexical pitch in Kyungsang Korean over several decades through media or increased contact with Seoul speakers (Lee, 2008), younger Kyungsang speakers’ use of the pitch difference may not be as strong as that of the older Kyungsang speakers, and the F0 durational and F0 scaling properties across accent contrasts may pattern differently between the two generations of Kyungsang. To test the hypothesis, Lee & Jongman (2015) compared the phonetic properties of Kyungsang’s lexical pitch accents between older and younger generations. The examination was made for disyllabic nouns with and without the suffix *-i(ka)*. Lee & Jongman (2015) showed acoustic evidence for the diachronic sound change in the lexical pitch accent of Kyungsang Korean as in <Figure 1>, showing significant age-related differences in the F0 scaling and durational properties.

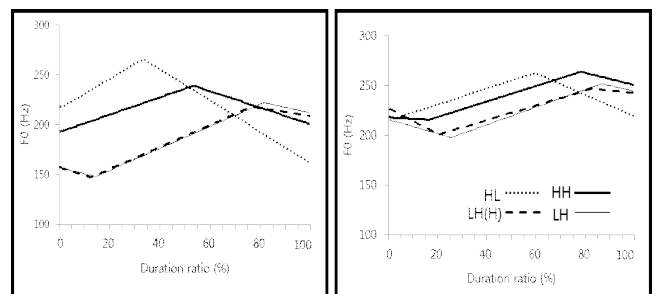


Figure 1. Schematized pitch contours of HH, HL, LH(H) and LH accent classes for older (left) and younger (right)

South Kyungsang Korean speakers.

(adapted from Lee & Jongman, 2015, p. 30)

2) Lee (2008) focused on North Kyungsang Korean. But given that both varieties have HH, HL and LH accent words with no suffix, this study refers the acoustic analysis in Lee (2008).

<Figure 1> shows two major findings in Lee & Jongman (2015). First, acoustic distinction was significantly reduced across accent words for the production of younger speakers; the differences in the F0 scaling and timing properties across contrastive accents are less distinct for younger than for older generations. Second, there was substantial peak delay; location of F0 peaks are placed further to the right for younger than for older speakers. Based on the generational difference, Lee & Jongman (2015) suggested that the phonetic forms of the lexical pitch accent of South Kyungsang Korean is undergoing a sound change.

### 1.3. Current study

The present study aims to determine if the observed generational difference in Lee & Jongman (2015) is present for male Kyungsang speakers consistent to females. Labov (2001) noted that female speakers are more innovative than male speakers in leading a sound change toward a standard variety. This is evidenced by previous acoustic studies (e.g., Baranowski, 2010, Kong et al., 2014). Baranowski (2010) observed that female speakers in South Carolina have more innovative merged pattern for /o/-/ɔ/ (i.e., *cot-caught* merger) than male speakers. Kong et al. (2014) also found that the affricate production in Korean is more fronted for females than for males, which might be considered more innovative. Consistent with the notion by Labov (2001), the empirical evidence regarding the gender-related difference in the speech production supports that females are more innovative than males in the process of sound change. Given this, the present study hypothesized that if the Kyungsang dialect shifts toward a standard variety under the influence of Seoul Korean, the phonetic realization of the lexical pitch accent for younger male Kyungsang speakers would be more similar to that for older speakers than that for younger females. In other words, if male Kyungsang speakers are indeed in the later stage in the sound change schedule, they would have more conservative accent patterns. On the other hand, if males are in a similar schedule of the sound change as female speakers, the phonetic form of younger male speakers would be similar to that of younger female speakers. To test the hypothesis regarding the gender-related phonetic variation, the current study compared the production of the lexical pitch accent between (younger) male and female Kyungsang speakers. Based on the acoustic finding in Lee & Jongman (2015), the current study particularly focused on examining (1) if the F0 scaling and duration properties across contrastive accents lack the distinction for male speakers,

consistent to female production, and (2) if male speakers also show the significant peak delay in the phonetic realization of accent words.

## 2. Methods

### 2.1 Participants

Ten Kyungsang speakers participated in the recording: five younger females (Mean = 21 years old, SD = 1.4) and five male speakers (Mean = 22 years old, SD = 2.3). Data of the five female speakers were a random subset that were analyzed in Lee & Jongman (2015). The participants were recruited in Pusan National University. All the participants were the native speakers of South Kyungsang Korean, and they were born and had been educated in the South Kyungsang area, near Pusan-city. All subjects gave informed consent and were paid for their participation.

### 2.2 Speech materials and procedure

<Table 2> shows the speech materials recorded in the current study. Two disyllabic nouns were selected for each of the four accent classes (HL, HH, LH(H) and LH). The selection of the materials was made considering the phonetic factors affecting tonal patterns. For example, the syllable structure of the materials were all CV.CV, and it is also avoided to have the aspirated or fortis consonants, so-called pitch raising consonants, so that the measures of F0 scaling and alignment are not affected by those factors.

Table 2: Recorded speech materials in the present study

<b>HL</b>	meli [mɛɾi] 'head'	molay [more] 'sand'
<b>HH</b>	mogi [mogi] 'mosquito'	moley [more] 'the day after tomorrow'
<b>LH(H)</b>	papo [pabo] 'a fool'	popay [pobe] 'treasure'
<b>LH</b>	tari [tari] 'a bridge'	namu [namu] 'tree'

Speakers produced each word in <Table 2> with two repetitions. Each target word was embedded in the sentential frame, *ice* \_\_\_\_ *cohta* 'Now, I like \_\_\_\_'. Speakers were asked to read the sentence with a randomized target word written in Korean orthography with a normal speech rate. The recording was made in a quiet places using a Marantz Digital Recorder

(PMD 671) and a SHURE head-mounted microphone, digitized at a 22050 Hz sampling rate. A total of 160 tokens were analyzed in the current study (2 words x 4 accent classes x 2 repetitions x 10 speakers).

### 2.3 Measurements

The current study examined the acoustic properties of the lexical pitch accent, namely F0 minimum and maximum values for F0 scaling properties and F0 minimum and maximum duration for F0 durational properties. For the analytic comparability, this study followed the measurement used in Lee & Jongman (2015). Regarding F0 scaling properties, F0 minimum and maximum values were first measured in Hertz, and then converted to semitones to minimize inter-speaker variability. Peak and the lowest F0 pitch values were measured as the F0 maximum and minimum values, respectively, using “Move cursor to minimum (or maximum) pitch” function in Praat. For F0 timing properties, the F0 minimum duration was measured from the onset of the pitch to the point of the lowest F0 value before peak, and the F0 maximum duration was measured from the onset to the peak point. In an effort to normalize the measured duration, it were first measured in milliseconds, and later converted into a ratio (%) by dividing each of the duration measures by the entire target item duration. Thus, the duration ratio expresses the point where F0 minimum or maximum occurs as a percentage of the entire target duration (see Lee & Jongman, 2015 for more explanation).

### 2.4 Analysis

The acoustic data were assessed in a series of ANOVAs in R (R Development Core Team 2015) using the ezANOVA() function of the ez package (4.2-2) (Lawrence, 2013). Four dependent variables included 1) F0 minimum value, 2) F0 maximum value, 3) F0 minimum duration, and 4) F0 maximum duration. Two-way ANOVAs included a within-subjects factor of Accent Class (HL, HH, LH(H), LH), and a between-subjects factor of Gender (male, female). Pairwise comparisons for Accent Class were conducted separately for each gender group with the bonferroni correction; p-values less than 0.05 were considered significant. Data from ten older female speakers adapted in Lee & Jongman (2015) are also provided in the present result and discussion sections as a reference for the conservative pattern.

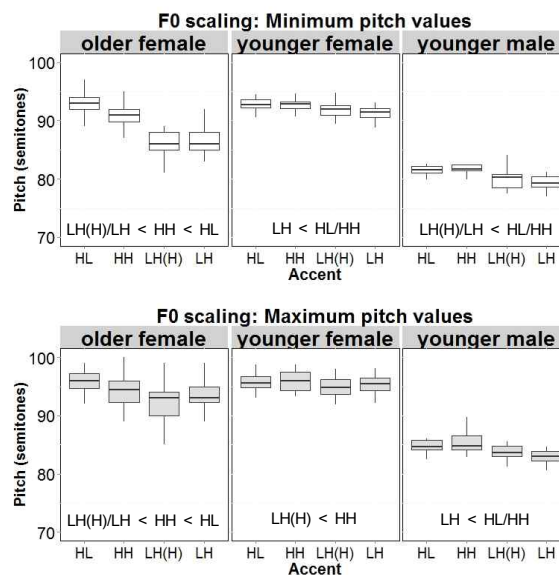


Figure 2. Distribution of F0 minimum (upper) and maximum (bottom) value (semitones) for disyllabic accents across older female (left), younger female (middle) and younger male (right) Kyungsang speakers.

## 3. Results

### 3.1. F0 scaling: F0 minimum and maximum values

The measurement results for the F0 scaling properties are presented in <Figure 2>. Regarding the F0 minimum value, a two-way ANOVA (Accent Class by Gender) reported significant main effects of Accent Class ( $F(3, 24) = 65.78, p < 0.01$ ) and Gender ( $F(1, 8) = 77.17, p < 0.01$ ); the effect of Gender is expected to result from the intrinsic F0 difference between male and female voice, having lower F0 for males than for females (Pépiot, 2014). Notably, the significant interaction of Accent Class by Gender ( $F(3, 24) = 6.17, p < 0.05$ ) indicates that the F0 minimum value across the four accent classes are realized differently between younger female and male Kyungsang speakers. Pairwise comparisons with bonferroni correction showed that for females the F0 minimum value is significantly different only between LH and HL (LH < HL) and between LH and HH (LH < HH). But for male speakers, it is significantly greater for HL/HH than for LH(H)/LH. That is, while only two accent pairs are distinct for younger females, four accent pairs are distinct for males speakers.

A similar ANOVA result was reported for the F0 maximum value. There were significant main effects of Accent Class ( $F(3, 24) = 19.91, p < 0.01$ ), Gender ( $F(1, 8) = 51.35, p < 0.01$ ) and a significant interaction of Accent Class by Gender ( $F(3,$

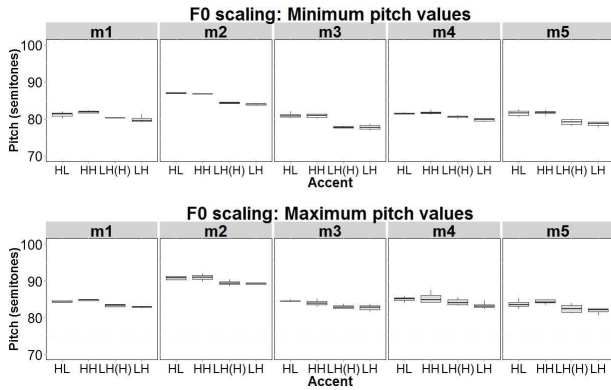


Figure 3. Individual data of F0 minimum (upper) and maximum (bottom) value (semitones) for disyllabic accents for five young male speakers.

24) = 3.22,  $p < 0.05$ ). Pairwise comparisons on the F0 maximum value showed that while only a single comparison between HH and LH(H) was significant for females (HH > LH(H)), the comparisons between HL/HH and LH were significantly different (HL/HH > LH) for male speakers. Finally, <Figure 3> illustrates that the F0 scaling property is consistent across individuals in general; that is, the F0 minimum value of the ‘HL/HH > LH(H)/LH’ pattern and the F0 maximum value of the ‘LH < HL/HH’ pattern are pretty much comparable across the five male speakers.

Overall, it can be summarized that the F0 scaling properties of accent word productions are more distinct for male speakers than females. However, the visual inspection comparing older females to younger male speakers shows that the overall F0 difference is less clear for males compared to older speakers. Specifically, in <Figure 2> the interquartile range between HL and HH is better separate for older female speakers than younger males. Therefore, it can be concluded that younger male Kyungsang speakers have weakened F0 scaling distinction, but not as weak as females do.

3.2. F0 alignment: F0 minimum and maximum duration

The measurement results for the F0 duration properties are presented in <Figure 4>. For the F0 minimum duration, a two-way ANOVA (Accent Class by Gender) reported a significant main effect of Accent Class ( $F(3, 24) = 6.19, p < 0.01$ ) and an interaction between Accent Class and Gender ( $F(1, 8) = 5.84, p < 0.01$ ), but no main effect of Gender ( $F(1, 8) = 0.15, p = 0.71$ ). The significant interaction indicates the gender-related variation in the duration properties contrasting the

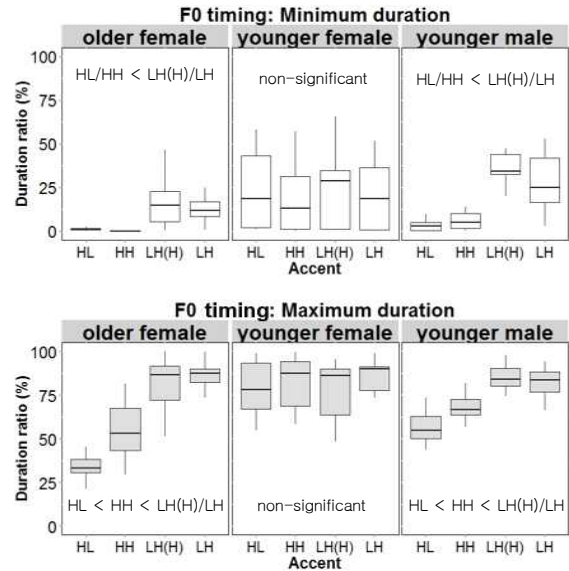


Figure 4. Distribution of F0 minimum (upper) and maximum (bottom) duration ratio (%) for disyllabic accents across older female (left), younger female (middle) and male (right) Kyungsang speakers.

four accent classes. Further pairwise comparisons with bonferroni correction were conducted separately for each of the male and female speaker groups. For female speakers, none of the comparisons across accent classes was significant at  $p > 0.05$ , suggesting that female Kyungsang speakers do not make the accent distinction using the F0 minimum duration. For male Kyungsang speakers, on the other hand, the acoustic dimension was significantly different between HL/HH and LH/LH(H), being longer for LH/LH(H) than for HL/HH. Note that the results for younger male speakers are comparable with those for older speakers reported in Lee & Jongman (2015). This suggests that younger male speakers preserve more conservative accent patterns than younger females.

A similar result was reported for the F0 maximum duration measure. A two-way ANOVA (Accent Class by Gender) reported a significant main effect of Accent Class ( $F(3, 24) = 5.58, p < 0.01$ ) and an interaction between Accent Class and Gender ( $F(3, 24) = 7.60, p < 0.01$ ), but no main effect of Gender ( $F(1, 8) = 1.79, p = 0.22$ ). Given the significant interaction of Accent Class by Gender, separate pairwise comparisons with bonferroni correction were conducted on the F0 maximum duration. For younger female speakers, the F0 maximum duration was not significantly different across the four accent words, reporting  $p > 0.05$  for all comparisons. But for male speakers, it was longest for LH(H)/LH, intermediate for HH, and shortest for HL,

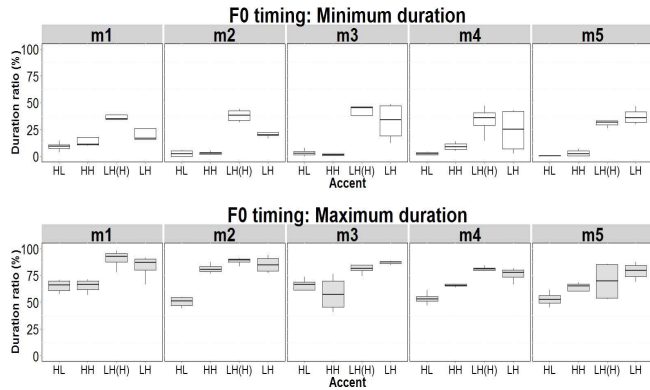


Figure 5. Individual data of F0 minimum (upper) and maximum (bottom) duration ratio (%) for disyllabic accents for five young male speakers.

consistent with older female speakers observed in the previous study (Lee & Jongman, 2015).

Finally, there was a noticeable individual variation on the durational measure as seen in <Figure 5>. While the F0 maximum duration between HH and HL is comparable for some subjects (male subjects #1, #3), it is longer for HH than HL for the others (male subjects #2, #4, #5). In other words, while the male subjects #1 and #3 have the similar pattern to younger female speakers, the other three subjects are more similar to older speakers.

Overall, the durational measures show that younger male speakers pattern differently from younger females; males make better durational distinction across accent words than females. Importantly, although the acoustic distinction across accent words is well maintained for male Kyungsang speakers, having the consistent pattern with older speakers, <Figure 4> shows that F0 peaks are placed more further to the right for males compared to older speakers. Specifically, for the HL accent words, while the interquartile range is shorter than 50% for older female speakers, it is longer than 50% for younger male speakers. The peaks for other accent classes also tend to delay, although the delay is not as robust as the HL words. Combining the observation, it is said that the durational properties of accent words produced by younger male speakers might be similar to those by older females speaker in the sense that the four accent classes were well distinct. But those may also be considered innovative patterns in terms of the peak delay that younger female speakers have.

#### 4. Discussion and Conclusion

Under the notion that female speakers are more innovative than male speakers in the process of sound change (Labov, 2001), the present study tested if the identical generational difference in the phonetics of the lexical pitch accent pattern of South Kyungsang Korean observed in Lee & Jongman (2015) is also seen for younger male speakers. To determine this, the present study examined gender differences for the lexical pitch accent words of South Kyungsang Korean. <Table 3> and <Table 4> present the result summary of the pairwise comparison for F0 scaling and duration properties, respectively.

Table 3: Summary of pairwise comparisons for F0 scaling properties

	F0 min. value	F0 max. value
older females (Lee & Jongman, 2015)	LH/LH(H)<HH<HL	LH/LH(H)<HH<HL
younger males	LH/LH(H)<HH/HL	LH < HH/HL
younger females	LH < HH/HL	LH(H) < HH

Table 4: Summary of pairwise comparisons for F0 duration properties

	F0 min. duration	F0 max. duration
older females (Lee & Jongman, 2015)	HL/HH<LH/LH(H)	HL<HH<LH/LH(H)
younger males	not significant	not significant
younger females	HL/HH<LH/LH(H)	HL<HH<LH/LH(H)

Regarding the F0 scaling measures, younger male Kyungsang speakers showed a few more significant comparisons across the four contrastive accent words compared to younger females. The observation suggests that while the F0 scaling properties for the accent contrasts are less distinct for younger male speakers compared to those for older female speakers, the acoustic dimension functions better for males than for females. Summarizing the finding of the F0 duration property, there were clear gender-related differences. Younger male speakers showed the significantly distinct durational measures with the identical duration pattern to older female speakers. This might suggest that the lexical pitch accent production is more conservative for male speakers than for females. However, despite the durational distinction, younger male speakers showed peak delay where the F0 peaks are located further to the right compared to older females speakers' production. Combining all of the observations, it might be suggested that younger male speakers' accent

productions are in between conservative and innovative phonetic forms, and they are behind in terms of the schedule of the sound change. The speculation is visualized in <Figure 6> where F0 contours are schematized based on F0 scaling and duration properties across ages and genders. <Figure 6> shows some gradation in the phonetic variation related to ages and genders: older females have the most distinct F0 contours, followed by younger males and females.

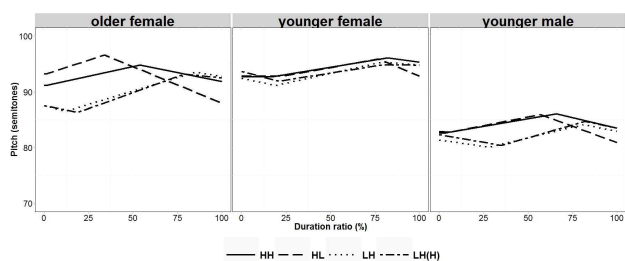


Figure 6. Schematized pitch contours of HH, HL, LH(H) and LH accent classes for older female (left), younger female (middle) and younger male (right) South Kyungsang Korean speakers. (older female data were adapted from Lee & Jongman, 2015, p. 30)

The findings related to gender-associated variation might have two implications. First, the phonetic forms of the accent by younger male Kyungsang speakers can be considered to be lagged behind in the schedule of the sound change and in the interim stage toward the innovative patterns that younger females now have. This supports the notion that a sound change in a language is led by females. Accordingly, along with Baranowski (2010) and Kong et al. (2014) which confirmed the notion at segmental levels, the present study also provides additional evidence for the notion at a suprasegmental level, namely lexical pitch accents. The other implication is that a set of steps that a sound change of a language is undergoing is shared by a language community across genders. That is, despite the different schedule of the sound change across genders in the present observation, the process or the orderly steps of the change seems to be shared by male and female speakers. Specifically, the younger male speakers tend to delay the F0 peaks as younger females do. The peak delay is one of the more distinctive characteristics that the sound change of the pitch accent in South Kyungsang has. In other words, although individual may have different degree of variations in the process of the sound change, the variation may not be entirely random, but rather could be explained by whether it is more innovative or not. A further

investigation regarding individuals' accent variation would allow to confirm the suggestion.

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psycholinguistics