

# Acquisition of /ɯ/ and /ʌ/ Variation by Mobile Kyungsang Korean and Seoul Korean Speakers

Yoojin Kang

(Georgetown University)

**Kang, Yoojin (2022). Acquisition of /ɯ/ and /ʌ/ variation by mobile Kyungsang Korean and Seoul Korean speakers.** *The Linguistic Association of Korea Journal*, 30(2), 49-70. This study examines the /ɯ/ and /ʌ/ merger in North Kyungsang Korean in the speech of speakers who were born in Seoul and later moved to North Kyungsang after the age of 20 and the /ɯ/ and /ʌ/ contrast in Seoul Korean in the speech of speakers who were born in North Kyungsang and later moved to Seoul as adults. This study focuses on stylistic variation in the use of a new dialect feature in two contexts: Word list and conversational interview. Moreover, this study addresses how various extralinguistic factors, including gender, length of stay in a new region, language attitudes and awareness of the /ɯ/ and /ʌ/ variation, affect mobile speakers' linguistic behavior. The major finding is that both groups of mobile speakers produce a distinction between /ɯ/ and /ʌ/ in word list and interview speech, and there is no appreciable shift in vowel quality in these two contexts.

**Key Words:** second dialect acquisition, /ɯ/ and /ʌ/ merger, /ɯ/ and /ʌ/contrast, change over the lifespan, mobile adults

## 1. Introduction

This study examines the acquisition of a second dialect (D2) by mobile speakers relocating between two regions, one urban and characterized by a prestigious dialect, and one rural, whose dialect is stigmatized. The study of second dialect acquisition (SDA) is a

new focus in sociolinguistic research. Mobile speakers were purposely excluded from early dialectology research; dialectologists focused on the speech of nonmobile, older, rural, male speakers, whose speech was seen as unaffected by contact with other varieties. Since then, however, scholars have acknowledged that dialect contact itself is a phenomenon worth studying and that the outcomes of contact may enable researchers to answer linguistic and social questions.

Previous research on SDA has focused on either long-term SDA by mobile children (Chambers, 1992; Payne, 1980) or long-term SDA by mobile adults who have moved within-nation from a rural region to a more urban region (Bortoni-Ricardo, 1985; Kerswill, 1994). For example, in her seminal study of child SDA, Payne (1980) examined the children of twelve transported families moving to Philadelphia from elsewhere. Payne investigated the five phonetic variables, including the fronting of the nucleus of /aw/ to [æ], the raising of the nucleus of /oy/ to [u], the centralization of the nucleus of /ay/ before voiceless obstruents, and the fronting and centralization of the nuclei of /ow/ and /uw/ except before /l/. The results on the acquisition of these five variables showed that all variables except /aw/ were acquired completely by more than half of the out-of-state children, and only a small number of children failed to acquire the variables.

One of the influential studies of adult SDA is Kerswill (1994) which explored the acquisition of the Bergen dialect among speakers of the rural Stril dialects who had moved to the city of Bergen, Norway. Kerswill examined whether there were correlations between social factors and the acquisition of schwa-lowering and that of twenty-three lexical and morphological variables. The results showed that there was a significant correlation between attitudes toward the first dialect (D1) and the overall percentage of use of D1 variants. Speakers who had positive attitudes toward the D1 maintained lexical and morphosyntactic D1 features rather than acquired the new dialect features.

What is not yet clear is reciprocal mobility between nation-states whose dialect differences are accommodated on a single continuum of standardness. The present study fills a gap in the literature by investigating the acquisition of the /w/ and /ʌ/ merger by people who have moved from Seoul to North Kyungsang province and the acquisition of the /w/ and /ʌ/ contrast by people who have moved from North Kyungsang province to Seoul.

## 2. Methods

### 2.1. Participants

Thirty-two speakers of North Kyungsang Korean (henceforth, NKK), born and grew up in North Kyungsang province, who moved to Seoul after the age of 20, (henceforth, Kyungsang-in-Seoul speaker) and thirty speakers of Seoul Korean (henceforth, SK), born and grew up in Seoul who moved to North Kyungsang province after the age of 20, (henceforth, Seoul-in-Kyungsang speaker), were recruited for this study. The speakers were stratified according to gender and length of stay in the D2 region (Figure 1). Participants were recruited via online posts on social media sites. All participants were compensated a KRW ₩30,000 Korea Starbucks gift card for their participation in this study.

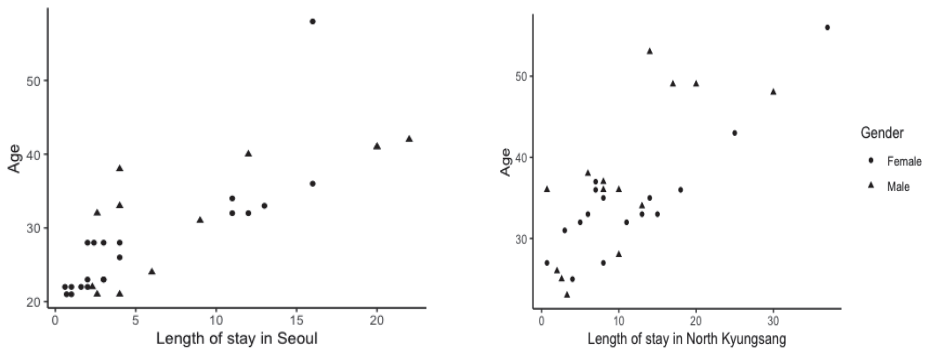


Figure 1. Dot plots showing the mobile speakers according to gender, length of stay in the D2 regions, and age

### 2.2. /ɰ/ and /ʌ/ variation

NKK is characterized by an unconditioned merger of the central unrounded high vowel /ɰ/ and the low-mid back unrounded vowel /ʌ/, while speakers of SK make a distinction between /ɰ/ and /ʌ/. Merger of /ɰ/ and /ʌ/ in NKK is the type known as merger by approximation (Trudgill & Foxcroft, 1978). In this type of merger, one vowel remains in place while the other vowel shifts, as happened with the Greek mergers into /i/, or two vowels move towards each other, and the final vowel ends up

in an intermediate position such as the merger of /a/ and /ɑ/ in French (Labov, 1994). While much of the work on the NKK merger has shown that /ʉ/ moves to approximate /ʌ/ (Kim, 1986; Kwon, 2001), some studies found that both /ʉ/ and /ʌ/ move towards each other, ending up merged in an intermediate position (Jeong, 2008; Park, 2004).

### 2.3. Tasks

Each speaker participated in two different tasks to elicit different styles of speech: Conversational interview and word list. These two tasks are artificial strategies that enable researchers to control how much attention the speaker pays to their speech and test the hypothesis that the speaker will shift styles based primarily on the amount of attention they will pay to their own speech; in more formal styles (e.g. word list task), they will pay more attention, in more casual styles (e.g. interview) they will pay less attention (Labov, 1966).

Each participant had an audio-recorded conversational interview to elicit conversational speech. The format of the interview was left unstructured since the aim was to elicit natural conversational narratives. Since the interviews were open-ended, the time it took varied considerably; the longest interview lasted 51 minutes, the shortest, just 6 minutes, with an average of approximately 16 minutes. After the interview, participants were asked to read out loud containing twelve target words, including *geumul* 'net', *geurim* 'drawing', *geurae* 'yes', *eurieurihan* 'magnificent', *euseudaenda* 'boast', *utteumida* 'best', *geomul* 'tycoon', *geomi* 'spider' *georae* 'deal', *eokkae* 'shoulder', *eobu* 'fisher', and *eodum* 'darkness' (6 tokens for /ʉ/ and 6 tokens for /ʌ/). After completing these two tasks, I explained the /ʉ/ and /ʌ/ contrast in SK and the /ʉ/ and /ʌ/ merger in NKK and asked if the speakers were aware of this feature. Finally, the speakers completed a language attitude questionnaire to examine the effect of attitudes toward the D1 and D2 on the acquisition of the /ʉ/ and /ʌ/ variation.

The sound equipment used in this study is the Zoom H4N Pro recorder and Sennheiser Pro ME2-II microphones. Audio was recorded to 16-bit, 44.1 kHz wav files. Interviews were conducted by me in the participant's house, the author's home, or the participant's office. I used NKK when interviewing the Kyungsang-in-Seoul speakers, while I used SK when interviewing the Seoul-in-Kyungsang speakers to minimize interview effects. Data was collected from Feb to May 2021.

### 3. Results

#### 3.1. Word List

##### 3.1.1. Measurements

For measuring /w/ and /ʌ/, measurements of F1 and F2 were taken at vowel midpoint. Transcriptions of recordings were created in ELAN. Transcriptions of recordings were auto-aligned and segmented via the Montreal Forced Aligner, using a Korean Hangul pre-trained G2P model and pre-trained acoustic model. Measurement points were also manually checked for errors and, if necessary, corrected by two research assistants. Formant measurements were taken manually by me. To minimize physiological differences between speakers, the vowel formants were normalized using the Lobanov normalization method (Lobanov, 1971).

##### 3.1.2. Measuring Distributions of /w/ and /ʌ/

Overlap between /w/ and /ʌ/ was measured as Bhattacharyya's affinity, computed in R using the *kerneloverlap()* function in the *adehabitatHR* library for R. Bhattacharyya's affinity was introduced as an alternative to the Euclidean distance.

In the study of vowel mergers, Bhattacharyya's affinity measures the amount of overlap between distributions of points in two-dimensional space. Possible values for Bhattacharyya's affinity range from 0 (complete separation) to 1 (complete overlap).

##### 3.1.3. Word List Results

Figure 2 shows scatter plots of /w/ and /ʌ/ tokens for the Kyungsang-in-Seoul and Seoul-in-Kyungsang speakers. In Figure 2, both Kyungsang-in-Seoul and Seoul-in-

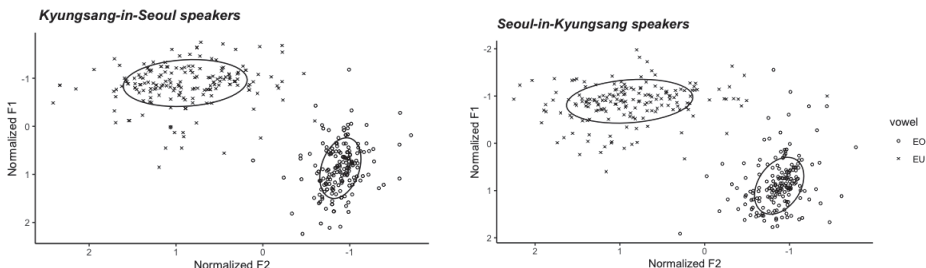


Figure 2. /w/ and /ʌ/ tokens for both mobile groups of speakers in the word list task

Kyungsang speakers show fairly constrained /ʌ/ tokens that separate from /ɯ/ tokens, with just a few tokens overlapping.

The violin plot in Figure 3 represents the comparison of distributions across the two groups of mobile speakers. The boxplot elements show that the median Bhattacharyya's affinity for both Kyungsang-in-Seoul and Seoul-in-Kyungsang speakers is around 0.0, and the highest point density in violin plots for both groups is highly concentrated around the median, demonstrating that both Kyungsang-in-Seoul and Seoul-in-Kyungsang speakers show the complete distinction between /ɯ/ and /ʌ/ in word list speech. The Kyungsang-in-Seoul speakers have a mean Bhattacharyya's affinity of 0.07 (SD=0.12, max.=0.49, min.=0.0). In similar, The Seoul-in-Kyungsang speakers have a mean Bhattacharyya's affinity of 0.06 (SD=0.09, max.= 0.3, min.=0.0). This result suggests that the Kyungsang-in-Seoul speakers have acquired the SK-like /ɯ/ and /ʌ/ contrast after years spent in Seoul, while the Seoul-in-Kyungsang speakers have still maintained the /ɯ/ and /ʌ/ contrast after exposure to NKK.

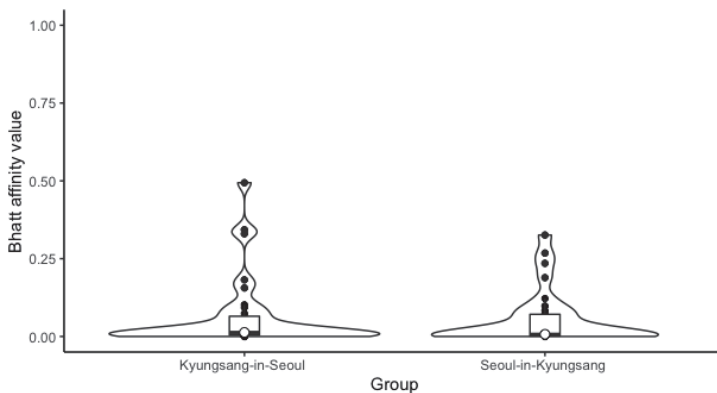


Figure 3. Combination of boxplot and violin plot of Bhattacharyya's affinity values for /ɯ/ and /ʌ/ by speaker group in the word list task

To analyze the extent to which variation in the realization of /ɯ/ and /ʌ/ is explained by extralinguistic factors, a linear regression analysis was conducted. The Bhattacharyya's affinity value was used as the dependent variable, while length of stay in a D2 region, language attitude score, gender, and speaker awareness of the /ɯ/ and /ʌ/ variation (yes, no) were entered as the independent variables.

The results of the regression analysis for the Kyungsang-in-Seoul speakers are summarized in Table 1. In Table 1, there is no significant relationship between the four extralinguistic factors and the Bhattacharyya's affinity values. Though there is no statistically significant relationship between the four extralinguistic factors and the Bhattacharyya's affinity scores, showing graphs plotting each of these factors against the Bhattacharyya's affinity score will either show that there really is no pattern, corroborating null results of statistics or they may show that for some factors there might be a relationship, though one that is not picked up by the statistics for some reason.

Table 1. Multiple linear regression analysis of Bhattacharyya's affinity for the Kyungsang-in-Seoul speakers in the word list task.

	Estimate	Standard error	t	p
Intercept	0.05	0.14	0.4	0.68
Attitude	0.00	0.00	0.03	0.97
Gender (Male)	0.02	0.04	0.49	0.62
Length of stay	-0.00	0.00	-1.53	0.13
Awareness (Yes)	0.04	0.04	0.93	0.35

Figure 4 presents the dot plot of the Bhattacharyya's affinity values by awareness of the D2 feature. 24 of the 32 Kyungsang-in-Seoul speakers are aware of this feature, while 8 of them are not aware of it. I expect that being aware of /ɰ/ and /ʌ/ contrast in SK makes Kyungsang-in-Seoul speakers more likely use it. In Figure 4, eight Kyungsang-in-Seoul speakers who are unaware of the distinction of /ɰ/ and /ʌ/ in SK show a high degree of distinction between the two vowels, having a mean Bhattacharyya's affinity value of 0.02 (SD=0.05, max.=0.16, min.=0.00), and twenty-four Kyungsang speakers who display a strong awareness of the difference also show a high degree of contrast, with a mean value of 0.08 (SD=0.13, max.=0.49, min.=0.00). Interestingly, KHM who is aware of the contrast of /ɰ/ and /ʌ/ in SK has the highest Bhattacharyya's affinity score of 0.49 - that is, the closer together their vowels are realized. Meanwhile, among the eight speakers who have the Bhattacharyya's affinity score of 0.00, three of them are aware of this feature, while five of them are not aware of it. These indicate that there is no clear connection between explicit awareness of a variable and production with respect to that variable.





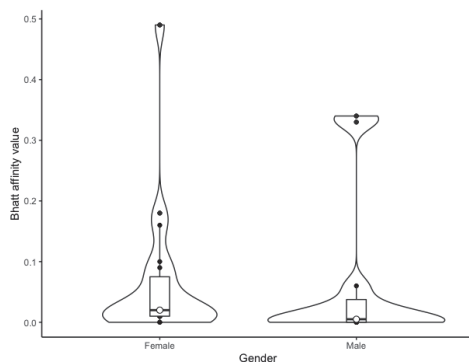


Figure 6. Combination of boxplot and violin plot of Bhattacharyya’s affinity values for /ʷ/ and /ʌ/ by gender in the word list task

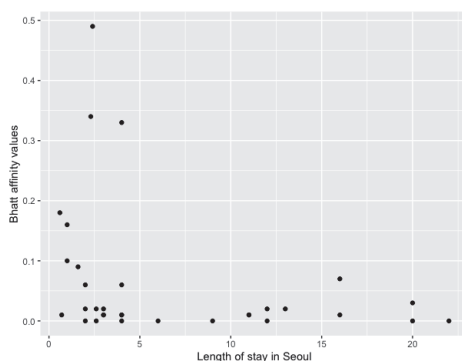


Figure 7. Each Kyungsang-in-Seoul speaker’s Bhattacharyya’s affinity values plotted against length of stay in Seoul in the word list task

min.=0.00), and speakers with a negative attitude toward SK have a mean Bhattacharyya’s affinity of 0.06 (SD = 0.1, max.=0.34, min.=0.00). In Figure 5, the speaker with the lowest attitude score has a great degree of separation, having a Bhattacharyya’s affinity of 0.03, and the speaker with the highest attitude score also shows a distinction, with a Bhattacharyya’s affinity of 0.18. Moreover, one notable aspect of this figure is that the speaker with the highest Bhattacharyya’s affinity of 0.49 has a fairly high attitude score of 41. Taken together, these results might indicate that attitudes toward SK do not affect the acquisition of the distinction.

The violin plot in Figure 6 illustrates the comparison of distributions between female

Kyungsang-in-Seoul speakers' Bhattacharyya's affinity scores and male Kyungsang-in-Seoul speakers' scores. I expect that female Kyungsang-in-Seoul speakers will show more distinction than male Kyungsang-in-Seoul speakers. The boxplot elements show that the median Bhattacharyya's affinity for both female and male speakers is around 0.0, and the highest point density in the violin plots for both groups is highly concentrated around the median, suggesting that both female and male Kyungsang-in-Seoul speakers show the complete distinction between /ɰ/ and /ʌ/ in word list speech.

In Figure 7, each Kyungsang-in-Seoul speaker's Bhattacharyya's affinity values are plotted against length of stay in Seoul. My expectation is that the longer the Kyungsang-in-Seoul speakers have lived in Seoul, the more they will produce the SK-like contrast of /ɰ/ and /ʌ/. Speakers who have lived in Seoul for less than 10 years have a mean Bhattacharyya's affinity of 0.09 (SD=0.14, max.=0.49, min.=0.00), and those who have lived in Seoul for more than 10 years have a mean value of 0.02 (SD=0.2, max.=0.07, min.=0.00). In Figure 7, it is interesting that even speakers who have lived in Seoul for a very brief time show an almost complete distinction, suggesting that some Kyungsang-in-Seoul speakers have acquired the Seoul-like contrast in a very short time. Another interesting result in this graph is that the few speakers who do show more merger with higher Bhattacharyya's affinity scores have all been in Seoul less than five years, and anyone who has been in Seoul longer has definitely shown the contrast, which indicates that length of stay may be influential, in that some Kyungsang-in-Seoul speakers cannot help but produce the contrast if they have been in Seoul a few years.

Like what was found for the Kyungsang-in-Seoul speakers' productions, there is no significant relationship between the extralinguistic factors and the Bhattacharyya's affinity scores (Table 2). To show that there really is no pattern corroborating null results of regression, graphs plotting each of these extralinguistic factors against the Bhattacharyya's affinity scores are provided in Figures 8-11.

Table 2. Multiple linear regression analysis of Bhattacharyya's affinity for the Seoul-in-Kyungsang speakers in the word list task

	Estimate	Standard error	t	p
Intercept	-0.04	0.13	-0.29	0.77
Attitude	0.00	0.00	0.98	0.33
Gender (Male)	-0.04	0.03	-1.35	0.19
Length of stay	0.00	0.00	0.9	0.37
Awareness (Yes)	-0.03	0.04	-0.94	0.35

Figure 8 shows the Seoul-in-Kyungsang speakers' Bhattacharyya's affinity value according to awareness of /ʷ/ and /ʌ/ merger in NKK. 14 of the 26 Seoul-in-Kyungsang speakers display an awareness that there is a merger between /ʷ/ and /ʌ/ in NKK, whereas 12 of them are unaware of the difference. I expect that being aware of /ʷ/ and /ʌ/ merger in NKK will make Seoul-in-Kyungsang speakers less likely use it. However, contrary to my expectation, the 12 speakers who are unaware of the difference display a high amount of contrast between the two vowels, with a mean Bhattacharyya's affinity value of 0.09 (SD= 0.11, max.=0.3, min.=0.00), and the 14 speakers who are aware of the difference also have a lower mean Bhattacharyya's affinity value of 0.03 (SD=0.06, max.=0.24, min.=0.00). Moreover, speaker OYK who is unaware of the difference has the highest mean Bhattacharyya's affinity value of 0.3, and among the 12 speakers who have the Bhattacharyya's affinity score of 0.00, seven of them are aware of this feature, and five of them are not aware of it. These suggest that conscious awareness of the merger in NKK did not affect whether the Seoul-in-Kyungsang speakers realize the merger in their speech in the word list context.

Figure 9 illustrates each Seoul-in-Kyungsang speaker according to attitude scores and the Bhattacharyya's affinity values. I hypothesize that the more the speakers have a positive attitude toward NKK, the more they will produce the merger of /ʷ/ and /ʌ/. Again, to see if there is an interesting trend, participants are assigned a negative attitude toward NKK or a positive attitude toward NKK based on their attitude scores. Thirteen

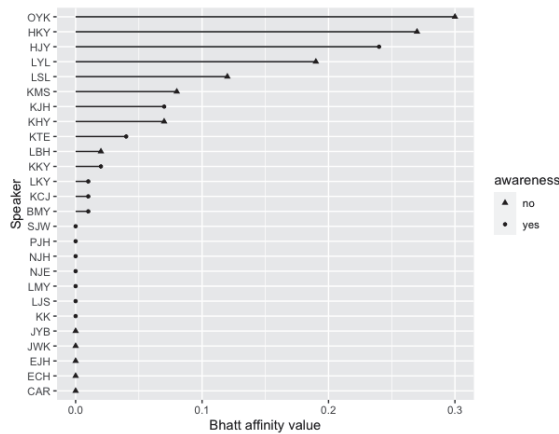


Figure 8. A dot plot showing Seoul-in-Kyungsang speakers' Bhattacharyya's affinity value according to awareness of /ʷ/ and /ʌ/ merger in the word list task

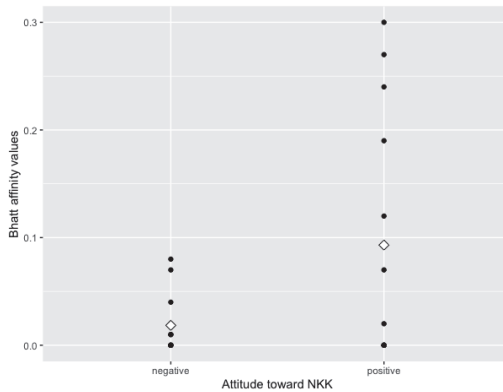


Figure 9. Each Seoul-in-Kyungsang speaker's Bhattacharyya's affinity value plotted against attitude score in the word list task.

speakers who are considered to have a positive attitude toward NKK have a mean Bhattacharyya's affinity of 0.09 (SD=0.12, max.=0.24, min.=0.00), and thirteen speakers who are considered to have a negative attitude toward NKK have a mean Bhattacharyya's affinity of 0.02 (SD=0.03, max.=0.08, min.=0.00). Though there is no great difference between the means of these two groups, what is interesting in Figure 9 is that all speakers with a negative attitude toward NKK have a mean Bhattacharyya's affinity below 0.1, and speakers who have a mean Bhattacharyya's affinity over 0.2 have a positive attitude toward NKK. These results indicate that a positive attitude towards NKK is a necessary but not a sufficient condition for realizing the merger of /w/ and /ʌ/.

Figure 10 presents Seoul-in-Kyungsang speakers' length of stay in North Kyungsang plotted against their Bhattacharyya's affinity value. I expect that the longer the speakers have lived in Kyungsang, the more they will use the NKK-like /w/ and /ʌ/ merger. Speakers who have lived in North Kyungsang for less than 10 years have a mean Bhattacharyya's affinity of 0.05 (SD=0.1, max.=0.3, min.=0.00), and those who have lived in North Kyungsang for more than 10 years have a mean value of 0.06 (SD=0.08, max.=0.27, min.=0.00). In Figure 10, it is notable that the speaker who has the highest mean Bhattacharyya's affinity value of 0.3 has lived in North Kyungsang only for seven months. This might be related to the fact that this speaker has a positive attitude toward NKK, having an attitude score of 39.

Figure 11 presents the violin plot of Bhattacharyya's affinity values for /w/ and /ʌ/ by gender. My expectation is that female Seoul-in-Kyungsang speakers will produce the



## 3.2. Interview

### 3.2.1. Acoustic Analysis

From interview speech data, tokens of words from the /w/ and /ʌ/ classes were extracted. Measurement points for the interview data were taken in the same way as for the word list data. Conversational tokens of 527 /w/ and 260 tokens of /ʌ/ were collected from 32 Kyungsang-in-Seoul speakers, and 237 tokens of /w/ and 217 tokens of /ʌ/ were collected from 27 Seoul-in-Kyungsang speakers<sup>1)</sup> for measurement. Each token was also coded for preceding material (consonant or word boundary), preceding place, and following place.

Only about a half of the speakers have both /w/ and /ʌ/ tokens in their interview speech, and the rest of them have either /w/ or /ʌ/ tokens. Since Bhattacharyya's affinity requires at least five tokens per word class, it cannot calculate the values for tokens elicited in the interview. To deal with this problem and to be able to analyze data from more speakers, I look at the positioning of each individual vowel rather than contrast per se: That is, rather than running mixed effects regression analysis of F1 for all tokens and including a term for vowel class, I run an analysis of F1 for /ʌ/ and see how the position of that vowel varies for speakers according to both linguistic and social factors. In such an analysis, I can examine whether their /ʌ/ is more SK-like or more NKK-like even if a speaker does not have any tokens of /w/. Then, I do the same for F2 of /ʌ/ and also for F1 and F2 of /w/.

### 3.2.2. Interview Results

For the 32 Kyungsang-in-Seoul speakers, 37% of the /ʌ/ tokens are tokens of *Seoul* words, and for the 27 Seoul-in-Kyungsang speakers, 28% of them are tokens of *Seoul* words. To get a sense of whether *Seoul* words are patterning differently, I separate out tokens of *Seoul* and *OtherEO* words. Figure 12 plots the F1 and F2 of tokens of *Seoul*, tokens of *OtherEO*, and tokens of /w/ for both mobile groups. These plots will show whether /w/ and /ʌ/ words are different and more importantly whether *Seoul* is appreciably different from *OtherEO* words.

In Figure 12, though there are a handful of /w/ tokens encroaching into /ʌ/ space,

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1) Among the 30 Seoul-in-Kyungsang speakers, conversational tokens were collected from 27 speakers because three of the participants refused to participate in the interview due to the spread of the COVID-19 pandemic at time of interview.

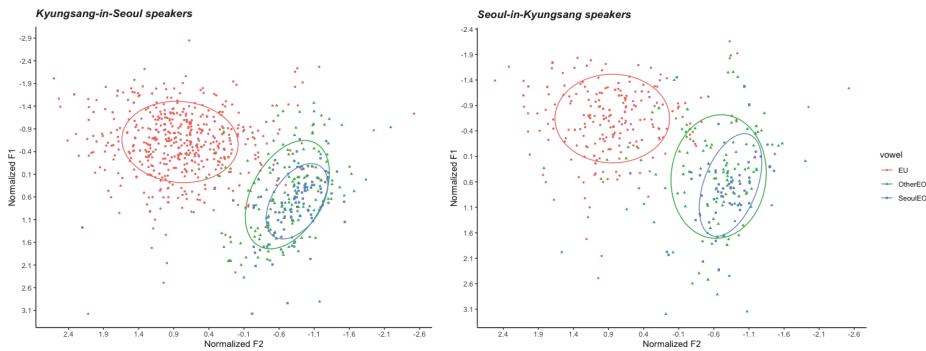


Figure 12. Tokens of /ʷ/ and /ʌ/ for both mobile groups in the interview

the Kyungsang-in-Seoul speakers show a fairly tightly constrained /ʌ/ class that separates from /ʷ/. Meanwhile, across the Kyungsang-in-Seoul speakers, about 30% of the *OtherEO* words have an F1 less than 0, whereas only about 9% of the *Seoul* are less than 0 (Figure 12). Approximately 35% of the *OtherEO* tokens have an F2 greater than -0.5, while 15% of the *Seoul* tokens are greater than -0.5. Meanwhile, the Seoul-in-Kyungsang speakers also show separate distributions of /ʷ/ and /ʌ/ only with a handful of /ʷ/ tokens overlapping. Across the Seoul-in-Kyungsang speakers, approximately 30% of the *OtherEO* words have an F1 less than 0, while 16% of the *Seoul* tokens are less than 0. About 30% of the *OtherEO* words are greater than -0.5, whereas 14% of the *Seoul* tokens are greater than -0.5. These results indicate that for both Kyungsang-in-Seoul and Seoul-in-Kyungsang speakers, high frequency *Seoul* is realized in a lower and backer position than *OtherEO* words in the vowel space.

To explore to what extent extralinguistic factors affect /ʷ/ and /ʌ/ variation, a multiple linear regression analysis was used, entering normalized F1 for /ʌ/, normalized F2 for /ʌ/, normalized F1 for /ʷ/, and normalized F2 for /ʷ/ for each participant as a dependent variable and length of stay in a D2 region, language attitude score, gender, and speaker awareness of the variable (yes, no) were used as the independent variables.

Tables 3-4 show the results of /ʌ/ for the Kyungsang-in-Seoul speakers. 19 of the 32 Kyungsang-in-Seoul speakers have /ʌ/ tokens in their interview speech. Attitude toward SK ( $p=0.00$ ) and length of stay in Seoul ( $p=0.00$ ) significantly predict the Kyungsang-in-Seoul speakers' F2 for /ʌ/ (Table 4). The negative estimated effect of the attitude suggests that Kyungsang-in-Seoul speakers who have a positive attitude toward SK have backer /ʌ/ words in the vowel space, indicating that their /ʌ/ is more SK-like. Moreover,

Table 3. Multiple linear regression analysis of F1 for /ʌ/ for the Kyungsang-in-Seoul speakers in the interview

	Estimate	Standard error	<i>t</i>	<i>p</i>
Intercept	0.3	0.37	0.82	0.41
Attitude	0.01	0.01	1.24	0.22
Awareness (Yes)	0.03	0.13	0.23	0.82
Gender (Male)	0.05	0.11	0.49	0.63
Length of stay	-0.01	0.01	-0.99	0.32

Table 4. Multiple linear regression analysis of F2 for /ʌ/ for the Kyungsang-in-Seoul speakers in the interview

	Estimate	Standard error	<i>t</i>	<i>p</i>
Intercept	0.12	0.2	0.59	0.56
Attitude	-0.01	0.00	-3.01	0.00***
Awareness (Yes)	0.05	0.07	0.71	0.48
Gender (Male)	-0.12	0.06	-1.97	0.06
Length of stay	-0.03	0.01	-3.99	0.00***

the negative coefficient for length of stay indicates that the longer the Kyungsang-in-Seoul speakers have lived in Seoul, the backer their /ʌ/ words in the vowel space, having SK-like /ʌ/ words. None of the extralinguistic factors significantly predict the Kyungsang-in-Seoul speakers' F1 for /ʌ/ (Table 3).

Tables 5-6 show the results of /w/ for the Kyungsang-in-Seoul speakers. 31 Kyungsang-in-Seoul speakers have /w/ tokens in their interview speech. None of the extralinguistic factors significantly predict the Kyungsang-in-Seoul speakers' F1 and F2 for /w/. Though length of stay does not reach significance, the p-value for length of stay is near-significant for F1 ( $p=0.08$ ). The estimate effect of the length of stay suggests that for each extra year spent in Seoul, there is a correlated 0.01 decrease in F1, having SK-like higher /w/ words.

Tables 7-8 present the results of /ʌ/ for the Seoul-in-Kyungsang speakers. 15 of the 32 Kyungsang-in-Seoul speakers have /ʌ/ tokens in their interview speech. As shown in Table 8, there is a significant relationship between gender and Seoul-in-Kyungsang speakers' F2 for /ʌ/ ( $p = 0.02$ ). The coefficient for the gender indicates that male Seoul-in-Kyungsang speakers produce fronter /ʌ/ words, suggesting that male speakers' /ʌ/ is



Table 5. Multiple linear regression analysis of F1 for /w/ for the Kyungsang-in-Seoul speakers in the interview

	Estimate	Standard error	<i>t</i>	<i>p</i>
Intercept	-0.4	0.23	-1.75	0.08
Attitude	0.00	0.01	-0.86	0.39
Awareness (Yes)	0.05	0.07	0.8	0.42
Gender (Male)	0.06	0.08	0.76	0.45
Length of stay	-0.01	0.01	-1.76	0.08

Table 6. Multiple linear regression analysis of F2 for /w/ for the Kyungsang-in-Seoul speakers in the interview

	Estimate	Standard error	<i>t</i>	<i>p</i>
Intercept	0.97	0.22	4.52	0.00
Attitude	0.00	0.00	0.6	0.55
Awareness (Yes)	-0.08	0.06	-1.17	0.24
Gender (Male)	-0.05	0.07	-0.73	0.46
Length of stay	0.00	0.01	0.88	0.38

Table 7. Multiple linear regression analysis of F1 for /ʌ/ for the Seoul-in-Kyungsang speakers in the interview.

	Estimate	Standard error	<i>t</i>	<i>p</i>
Intercept	-0.45	0.56	-0.8	0.43
Attitude	0.02	0.01	1.14	0.26
Awareness (Yes)	0.25	0.14	1.77	0.08
Gender (Male)	-0.14	0.14	-0.99	0.32
Length of stay	0.01	0.01	1.49	0.14

Table 8. Multiple linear regression analysis of F2 for /ʌ/ for the Seoul-in-Kyungsang speakers in the interview

	Estimate	Standard error	<i>t</i>	<i>p</i>
Intercept	-0.14	0.32	-0.44	0.66
Attitude	-0.01	0.01	-0.88	0.38
Awareness (Yes)	-0.1	0.08	-1.3	0.2
Gender (Male)	0.19	0.08	2.36	0.02*
Length of stay	-0.01	0.00	-1.08	0.28

more NKK-like. Though none of the extralinguistic factors significantly predict the Seoul-in-Kyungsang speakers' F1 for /ʌ/ (Table 7), awareness of /w/ and /ʌ/ variation is near significant ( $p = 0.08$ ). The positive coefficient for the awareness suggests that Seoul-in-Kyungsang speakers who are aware that NKK is characterized by the merger between /w/ and /ʌ/ produce lower /ʌ/ words, having SK-like /ʌ/ words.

Tables 9-10 present the results of /w/ for the Seoul-in-Kyungsang speakers. 16 Seoul-in-Kyungsang speakers have /w/ tokens in their interview speech. There is a significant relationship between awareness and Seoul-in-Kyungsang speakers' F1 for /w/ ( $p=0.05$ ). The negative estimated effect of the awareness indicates that Seoul-in-Kyungsang speakers who display an awareness of the /w/ and /ʌ/ merger in NKK produce higher /w/ words, suggesting that these speakers' /w/ is more SK-like. Attitude, gender, and length of stay do not significantly predict Seoul-in-Kyungsang speakers' F1 for /w/.

With respect to Seoul-in-Kyungsang speakers' F2 for /w/, Table 10 shows that length of stay significantly predicts Seoul-in-Kyungsang speakers' F2 for /w/ ( $p=0.01$ ). The negative coefficient for the length of stay variable suggests that the longer the Seoul-in-Kyungsang speakers have lived in North Kyungsang province, the backer their /w/ words in the vowel space, having NKK-like /w/ words.

Table 9. Multiple linear regression analysis of F1 for /w/ for the Seoul-in-Kyungsang speakers in the interview

	Estimate	Standard error	<i>t</i>	<i>p</i>
Intercept	0.36	0.66	0.55	0.59
Attitude	-0.02	0.02	-1.56	0.12
Awareness (Yes)	-0.34	0.17	-1.97	0.05*
Gender (Male)	0.09	0.12	0.78	0.44
Length of stay	0.00	0.01	p0.28	0.78

Table 10. Multiple linear regression analysis of F2 for /w/ for the Seoul-in-Kyungsang speakers in the interview

	Estimate	Standard error	<i>t</i>	<i>p</i>
Intercept	0.89	0.61	1.46	0.15
Attitude	0.01	0.01	0.92	0.36
Awareness (Yes)	-0.12	0.16	-0.75	0.46
Gender (Male)	0.12	0.11	1.13	0.26
Length of stay	-0.02	0.01	-2.71	0.01**

## 4. Discussion and Conclusion

This study examines the /ɯ/ and /ʌ/ variation in the speech of mobile speakers who were born in Kyungsang province and moved to Seoul after the age of 20 and that of speakers who were born in Seoul and moved to Kyungsang province after the age of 20.

In the word list task, the Kyungsang-in-Seoul speakers as a group show a great completion between /ɯ/ and /ʌ/ in the vowel space, having a mean Bhattacharyya's affinity score of 0.07. The Seoul-in-Kyungsang speakers as a group also show a great degree of distinction between /ɯ/ and /ʌ/, having a mean Bhattacharyya's affinity of 0.06. With respect to the effect of extralinguistic factors, there is no significant relationship between the four extralinguistic factors and the Bhattacharyya's affinity values for both groups in the word list task. These suggest that regardless of gender, length of stay in the D2 region, awareness of the D2 feature, and attitude toward the D1 and D2, both Kyungsang-in-Seoul and Seoul-in-Kyungsang speakers produce a distinction between /ɯ/ and /ʌ/ in word list speech.

It is difficult to assess and compare the degree of the contrast across tasks because it cannot calculate the Bhattacharyya's affinity values for tokens elicited in the interview task. However, the plots of /ɯ/ and /ʌ/ tokens for the interview task show that both groups produce a quality distinction between /ɯ/ and /ʌ/, with just a handful of /ɯ/ tokens encroaching into /ʌ/ space in conversational speech, indicating that there is no appreciable shift in vowel quality between these two tasks.

One interesting aspect in the interview results is the behavior of tokens of *Seoul*, which occur with high frequency accounting for 37 % of the Kyungsang-in-Seoul speakers' /ʌ/ tokens and for 28 % of the Seoul-in-Kyungsang speakers' /ʌ/ tokens in conversational speech. Across the Kyungsang-in-Seoul and Seoul-in-Kyungsang speakers, high-frequency *Seoul* is realized in a lower and backer position than *OtherEO* words in the vowel space. This result can be partly explained by the nature of underlying representations in usage-based models. In the usage-based theories, each instance of a word is stored in memory, retaining fine phonetic details. These remembered tokens or exemplars are stored as a whole, without decoding into strings of phonemes. Exemplars that are sufficiently similar, such as those including the same sequence of segments, those produced by the same speaker, or those produced in the same contexts, cluster together in a network-like high-dimensional phonetic space. Another important premise of usage-based models is that frequently heard tokens will be updated more often than

rarely heard tokens. Bybee (2002) argues that “since tokens of use map onto existing representation, high-frequency items grow strong and therefore are easier to access” (p. 28). On the other hand, the representational strength of infrequent words will be weakened, and thus those low-frequency words will become more difficult to access. This model thus predicts that the high-frequency *Seoul* will show signs of convergence toward the D2 earlier than the low-frequency *OtherEO* words. For the Kyung-sang-in-Seoul speakers, their *Seoul* tokens behave the way high frequency words are predicted to by usage-based theories; their *Seoul* tokens are more SK-like. However, the result that Seoul-in-Kyung-sang speakers’ *Seoul* tokens are more SK-like seems to contradict what a usage-based model predicts.

This puzzling behavior in terms of the usage-based perspective may be due to an extralinguistic reason. According to usage-based theory, the remembered exemplars are also associated with various social labels. When a particular social label is activated, exemplars tagged with that social label will be more likely chosen for production. In the conversational interview, the questions focused on the speakers’ experiences growing up in Seoul, adjusting to life in North Kyung-sang province, and their opinions about the people and language spoken in Kyung-sang province. Thus, the interview context in this study can be an identity-heavy context, and this results in the activation of Seoul Korean-labelled exemplars. Moreover, one of the interview questions was, “Do you now consider yourself as a Seoul Korean or as a Kyung-sang Korean?” 21 of the 27 Seoul-in-Kyung-sang speakers who responded to this question claimed to have a Seoul identity. Considering that the word Seoul itself is certainly associated with SK, it is possible that these Seoul-in-Kyung-sang speakers might desire to convey their Seoul identity by producing Seoul Korean-labelled *Seoul* words somewhat lower and backer than *otherEO* words.

With respect to linguistic complexity, acquiring the contrast between /w/ and /ʌ/ would be complex because what is one phoneme in NKK has to be changed to two phonemes in SK, while acquiring the merger between /w/ and /ʌ/ would be relatively simple. Thus, the overall result that the Seoul-in-Kyung-sang speakers as a group have largely maintained their contrast after moving to North Kyung-sang province, while the Kyung-sang-in-Seoul speakers as a group have acquired a new contrast is somewhat surprising because simple rules will be acquired faster and earlier than complex rules (Chambers, 1992). The overall pattern that Kyung-sang-in-Seoul speakers’ acquisition of the contrast and Seoul-in-Kyung-sang speakers’ lack of acquisition of the merger may be

related to the relative prestige associated with the SK variants. The result of the language attitude questionnaire supports this; both Kyungsang-in-Seoul and Seoul-in-Kyungsang speakers rate Seoul Korean to be more linguistically attractive and more high-status and competent, whereas they rate North Kyungsang Korean to be less linguistically attractive and low-status and less competent. Thus, it is possible that the SK-like contrast might be perceived as desirable, and the NKK-like merger might be perceived as a non-standard form by the speakers. This suggests that how prestige is even more important than complexity and even easy changes, such as the merger between /ɰ/ and /ʌ/ that the Seoul-in-Kyungsang speakers could make will not be made if it means losing prestige.

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Yoojin Kang

PhD Candidate

Department of Linguistics

School of Arts and Sciences

1421 37<sup>th</sup> St, NW

Washington, DC 20007, USA

Phone: 202-687-5956

Email: yk569@georgetown.edu

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