# The Merger of *ey* /e/ and *ay* /ɛ/ of Seoul Korean

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## 1. Introduction

The number of Standard Seoul Korean vowel phonemes may vary from 7 to 10. Many linguists consider that there are 10 monophthong phonemes in Korean: /i, y, e, ɛ, ø, ɯ, ʌ, a, u, o/. The number of vowels may vary depending on whether linguists exclude only /y/ or both rounded front vowels /y, ø/ from the monophthong inventory, because these are likely to be pronounced as a diphthong with an on-glide: [wi] and [we], respectively (Sohn 1999: 156). Moreover, some linguists argue for the 7-vowel system, especially among young speakers (Shin 2000). Linguists who argue for the 7-vowel system claim that the two front vowels /e/ and /ɛ/ are not distinctive in their distribution but have merged to one

phoneme. This phenomenon is also reported in other dialects, for example, *Ceycwu*[1] dialect (Cho et al., 2001). In sum, the vowel system of Korean can be illustrated as below (Figure 1).

| | Front | | Back | |
|---|---|---|---|---|
| | Unrounded | Rounded | Unrounded | Rounded |
| High | i | (y) | ɯ | u |
| Mid | (e)/ɛ | (ø) | ʌ | o |
| Low | | | a | |

Figure 1. Korean vowel system

In the 7-vowel system, even those words containing ey /e/ or ay /ɛ/ in orthography are not likely to make minimal pairs in the spontaneous speech of most Korean speakers (Shin 2000). For the merger, Lee (1971) and Cho et al. (2001) point out that there should be variation by age, with younger speakers showing no distinction for these two vowels and older speakers showing the distinction or a partial progress. However, Shin (2000) and Silva and Jin (2008) report that this is a complete merger for most (Standard) Seoul Korean speakers and there is no difference among speakers by age or gender.

Lee (1995) examined this sound shift in production and comprehension and classified it as a 'near-merger', because some, usually older, speakers still can and actually do distinguish the vowels. Lee suggests that although there is a merger of /e/ and /ɛ/ in modern Seoul Korean,[2] it is still

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1) All Korean words are Romanized according to the Yale system.
2) In this study, /ɛ/ as in /kɛ/ 'dog' is in contrast to /e/ as in /ke/ 'crab' although

partial, even for some younger speakers, because these vowels do not overlap completely in acoustic analysis (e.g. F1 and F2), and young Seoul Korean speakers consistently differentiate these two vowels.

The methodology adopted in two of the previous studies (Lee, 1995; Hong, 1986) used a sentence reading task or a minimal pair to collect the data, while Lee (1971) was an impressionistic study. In a reading task, however, speech may be produced with hyper attention to differentiating these vowels from each other. In this sense, the methodology may have misled the participants, producing modified language data which does not occur in a natural discourse. If the claim that this phenomenon is a near-merger is based on this methodology using careful speech, it is hard to generalize such a claim to spontaneous speech behavior. Even though some speakers may show a clear distinction between these vowels, as was found with some articulate speakers, there is a strong tendency of real merger of these two vowels in a spontaneous speech context. The current study was developed in order to investigate the researcher's personal observation that Korean speakers may depend on other cues from the contexts to interpret the words containing these vowels. Sometimes speakers show a split-merger with the other front vowel, /i/. In this study, an acoustic analysis of Korean vowels was conducted to empirically test (1) whether Korean speakers differentiate /ɛ/ and /e/ in their spontaneous speech production, and (2) how differently these two vowels are realized in spontaneous speech.

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Lee transcribed it as a lower vowel /æ/.

## 2. Methodology

### 2.1 Subjects

The data for this study were collected from four native speakers of Seoul Korean aged from 24 to 31. They have resided in Hawaiʻi from 1;4 to 4;4 years, all of them having arrived in the United States at the age 20 or older. Three speakers (A, B, C) were female and one speaker (D) was male. According to the self report, all subjects were born and raised in the Seoul region. Hong (1987) suggested that age may be a variable in the completeness of the merger. The current study did not consider the age variable since those speakers who are claimed to have clear distinction in these two vowels in Hong's study are now in their eighties. Thus, no speakers of this age group were included in the present study.

### 2.2 Procedure

Vowels in faster and spontaneous speech are likely to be more centralized than those in slower and careful speech. In the present study, therefore, the methodology was designed to examine vowels in a spontaneous speech condition in order to illustrate the locus and the degree of merger of /e/ and /ɛ/ in natural production of Korean. A study using spontaneous speech is able to illustrate the vowel system in spontaneous speech more precisely, but it does risk forgoing the efficacy of

elicitation, since it is not easy to guarantee the production of enough target words. In order to address this issue, this study used a picture unscrambling task.

There were two sessions of each participant group of two Korean native speakers. Two different sets of 20 pictures each and a picture plotting board with 20 squares were provided to each participant. Each set consists of 9 target pictures and 9 distracters, which were selected by the researcher and proven to have no problem in their identification in a pilot test with a native speaker of Korean.

It was difficult to find complete minimal pairs having exactly the same phonological structures. Instead, the stimuli selected were words that contain these vowels at a word-initial position. The distracters selected shared some semantic features of the target stimuli. Eight sets of minimal pairs were selected for this study as follows:

(1) | *pay* | 'ship' | *peykay* | 'pillow' |
|---|---|---|---|
| *taynamwu* | 'bamboo' | *teymo* | 'demonstration' |
| *chayccik* | 'whip' | *chey* | 'sieve' |
| *caytteli* | 'ashtray' | *ceypi* | 'swallow' |
| *kay* | 'dog' | *key* | 'crab' |
| *haypalaki* | 'sunflower' | *heyllikhopthe* | 'helicopter' |
| *maymi* | 'cicada' | *meyttwuki* | 'grasshopper' |
| *nay sain* | 'my signature' | *ney sain* | 'your signature' |

The two participants for each session were asked to sit back to back facing their own picture plotting boards so that they

could not see each other's performance. Each participant was given the two different sets of 18 pictures which were cut apart. One of the participants was asked to arrange them on the plotting board in a random order and to describe to the partner how the pictures were arranged, in order to elicit spoken data from this speaker. The partner was asked to think aloud by repeating the phonetic form of the picture names, which ensures the other part of the data elicitation

After two sessions for spontaneous production with each set, participants were shown the target pictures of the minimal pairs with Korean transcription and asked to read the words three times. Words in minimal pairs were assigned to separate picture sets so that both participants would produce their speech spontaneously, without paying additional attention to distinguishing these vowels from each other, as they might have if both words in minimal pair were in the same set.

The speech data were recorded directly to PCs through a unidirectional microphone while the participants were performing the tasks in the Phonetics Lab at the University of Hawai'i. Their speeches were recorded at the sampling rate of 11,000 Hz.

## 2.3 Analysis

After the data was recorded, the words containing the target vowels /e/ and /ɛ/ were separated from the original discourse file, and the F1 and F2 of the target vowels were measured by

FFT (Fast Fourier Transform) analysis using PCquirer 6.0 or Praat. In addition, the formant frequencies of some clear samples of the other monophthongs were also measured in order to include them in a vowel chart. Figure 2 shows how the formant frequencies, F1 and F2, were measured at the mid-point of the vowels where a stable duration of formants is observed. This measurement was used to avoid measuring any transition of vowels when a vowel precedes or follows consonants with different places of articulation (Figure 2). All the formant frequencies were plotted on the vowel chart by Plot Formants June 98 and the general average of formant frequencies was illustrated by MS Excel or JPlotFormants.



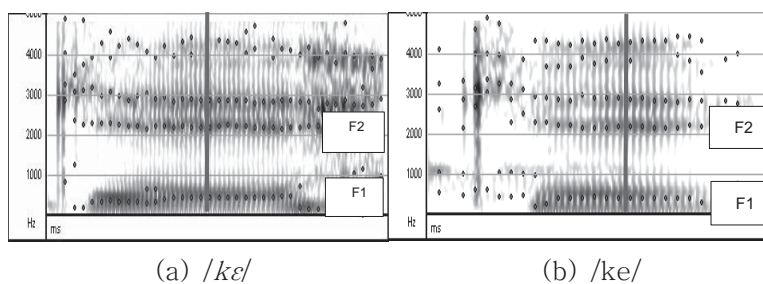(a) /kɛ/                    (b) /ke/

Figure 2. Spectrogram (speaker C)

Multiple mean comparisons by t-test were conducted by SPSS 9.0 so as to figure out the relative relationship between these two vowels. In order to check whether there is any change in vowel quality, t-tests between the formants of /e/ and /i/ were also analyzed. When performing t-tests, I

compared the minimal pairs with the same type of speech, i.e.,spontaneous speech or minimal pair repetition.

## 3. Results

Table 1 provides a comparison of the formant frequencies of English vowels produced by one adult male speaker, and those of Korean vowels produced by one adult male speaker and three adult female speakers.[3]

Table 1. Formant frequencies of English and Korean vowels

| English | Male | | Korean | Male (N=1) | | | Female (N=3) | | |
|---|---|---|---|---|---|---|---|---|---|
| | F1 | F2 | | N | F1 | F2 | N | F1 | F2 |
| /i/ | 280 | 2310 | /i/ | 21 | 371 | 2249 | 39 | 389 | 2497 |
| /I/ | 470 | 1710 | /e/ | 38 | 443 | 1874 | 130 | 478 | 2252 |
| /ɛ/ | 690 | 1640 | /ɛ/ | 52 | 444 | 1824 | 161 | 476 | 2255 |
| /æ/ | 650 | 1560 | /a/ | 9 | 528 | 1401 | 33 | 828 | 1715 |
| /a/ | 740 | 1500 | /ʌ/ | 6 | 448 | 1183 | 17 | 561 | 1435 |
| /o/[4] | 700 | 1260 | /ɯ/ | 7 | 373 | 1236 | 7 | 475 | 1690 |
| /ʊ/ | 480 | 1340 | /o/ | 6 | 394 | 794 | 21 | 385 | 874 |
| /u/ | 380 | 980 | /u/ | 2 | 355 | 852 | 14 | 391 | 1009 |

As seen in this table, both the male and female speakers of modern Seoul Korean in this study appear to articulate the F1

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3) I measured the frequencies of English vowels from the software Speech Production and Perception(Vowel Acoustic chapter, Folder #3: Measuring Formant Frequencies 6). Although the absolute numbers are different among vowels, formant frequencies of Korean vowels are represented by the average score of the whole vowels.

4) For the IPA font is not available, /o/ is used for the English unrounded mid back vowel.

and F2 of both /e/ and /ɛ/ at higher frequencies than those of English mid vowels /ɛ/ and /æ/.[5] The average frequencies of the formants of all target vowels are given in Table 2. The measurements were taken from the target words in minimal pairs as well as from other utterances produced during the elicitation.

Table 2. Average formant frequencies of /e/ and /ɛ/

|   | Total | | | Spontaneous speech | | | Minimal pair | | |
|---|---|---|---|---|---|---|---|---|---|
|   | N | F1 | F2 | N | F1 | F2 | N | F1 | F2 |
| A | 37 | 471 | 2338 | 15 | 472 | 2285 | 22 | 470 | 2374 |
|   | 46 | 457 | 2302 | 24 | 448 | 2200 | 22 | 468 | 2413 |
|   | 12 | 388 | 2581 |   |   |   |   |   |   |
| B | 53 | 508 | 2258 | 29 | 526 | 2232 | 24 | 487 | 2289 |
|   | 59 | 504 | 2243 | 34 | 517 | 2211 | 25 | 487 | 2287 |
|   | 15 | 406 | 2456 |   |   |   |   |   |   |
| C | 42 | 451 | 2168 | 26 | 457 | 2173 | 16 | 440 | 2161 |
|   | 58 | 461 | 2174 | 37 | 465 | 2159 | 21 | 453 | 2201 |
|   | 12 | 369 | 2464 |   |   |   |   |   |   |
| D | 38 | 443 | 1874 | 23 | 414 | 1899 | 15 | 465 | 1867 |
|   | 52 | 444 | 1824 | 28 | 434 | 1857 | 24 | 455 | 1785 |
|   | 21 | 371 | 2249 |   |   |   |   |   |   |

If /e/ should be distinguished from /ɛ/, its F1 must be lower but its F2 must be higher than those of /ɛ/. However, there is no significant difference between either F1 or F2 of /e/ and /ɛ/, and this is true in both spontaneous production in natural settings and careful production in minimal pair contexts. By contrast, all speakers produced both F1 and F2 of /e/ and /i/ in a significantly different way ($p < .05$).[6] Based on these results only, it is hard

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5) It is for this reason that /e/ rather than /ɛ/ is used in this study for the transcription of the mid-low front vowel *ay*.

to conclude that /e/ is distinct from /ɛ/ to these Seoul speakers. It is helpful to understand the vowel configuration in Korean, by comparing formant frequencies with those of English vowels.

The numeric data in Table 1 and Table 2 show that the average F1 and F2 of /e/ and /ɛ/ are very close to each other, which is one of the pieces of evidence that these two vowels are merged. It is interesting that these two vowels are overlapped even in the minimal pair contexts as well as in the spontaneous production.



a. Formant (Average)
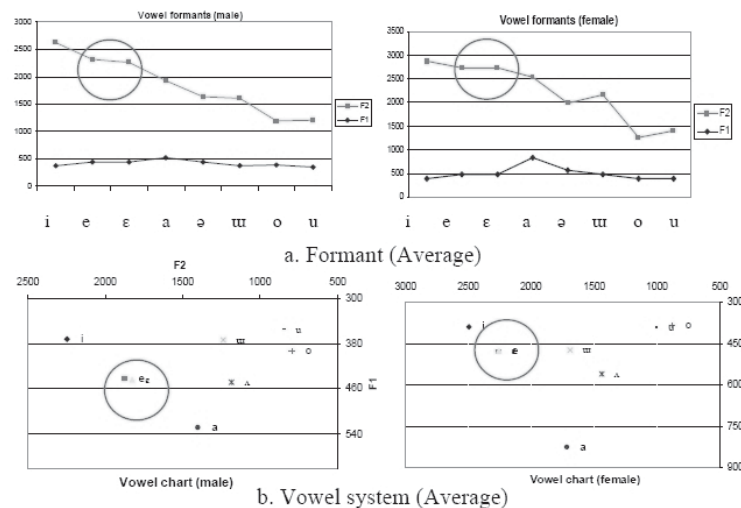
b. Vowel system (Average)

Figure 3. Vowels of Seoul Korean speakers (N=4)

Although there is a slight gender difference in the frequency values of the formants, Figure 3 visualizes the merger of these

6) I intentionally removed the cases of personal pronouns /ne/ which are clearly pronounced as /ni/ to my native speaker's judgment although these utterances did not affect the significance of the results. Also, I excluded the case in which the same word is pronounced as /nʌ/.

two vowels more clearly. The circled areas designate the articulatory locus of the target vowels. In Figure 3a, the formant frequencies of these two vowels are very similar to each other and there is a plateau between them in both male and female speech. Likewise, in Figure 3b, /e/ and /ɛ/ of the male speaker are located next to each other, while those of the female speakers are plotted on almost the same spot, and these two vowels are completely overlapped.

The individual distribution of each vowel in spontaneous speech production is delineated in the formant plot provided by JPlotFormants. As in Figure 3, the circled areas on each diagram show that there is no distinction in the production of these two vowels both in spontaneous speech and in the minimal pair contrast. The individual locus for the front vowels on the basis of formant values can be illustrated as in Figure 4.



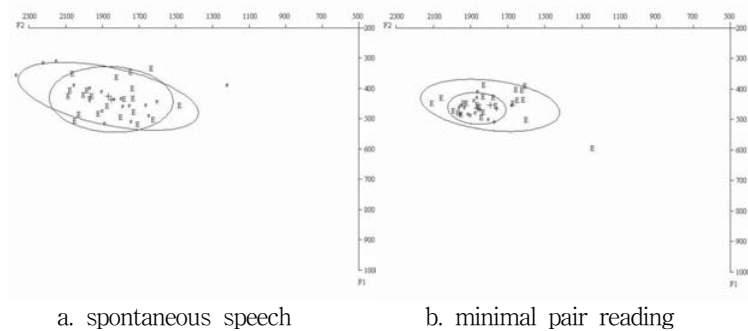a. spontaneous speech            b. minimal pair reading
Figure 4. Front vowels (Speaker D: male)

These findings suggest that SK speakers do not distinguish these vowels acoustically. The results indicate that the merger

of the two mid front vowels is likely to be complete merger in the current study. This is consistent with Silva and Jin′s (2008) recent study that suggests that the merger ″appears to be complete in this community.″

As a result of this merger, some orthographic minimal pairs have the same pronunciation for these Korean speakers. For instance, native speakers of Korean mistakenly use *ey* as in *ccikey* for *ay* as in *ccikay* 'stew.' If two vowels have merged for the sake of efficiency, speakers must adopt other means to distinguish minimal pairs containing these vowels. Korean speakers with the minimum number of vowels in their vowel system are likely to develop several strategies to avoid ambiguity. First, longer modification phrases may be used to specify the object. For example, when speakers intend to distinguish *key* 'crab' clearly from *kay* 'dog', they may modify the noun with a short additional remark. For instance, two participants in this study paraphrased *key* 'crab' as 'a crab which lives on the sea shore' or 'which walks sideways.' Second, it is likely that speakers of Korean dialects change the quality of vowels. As Hong (1986) hypothesizes, this merger in Seoul dialects may be influenced by southern dialects, in which /e/ is slightly raised to be a high front vowel. For example, based on my personal observation, *key* /ke/ is distinguished from *kay* /kɛ/ by pronouncing it as [ki] in *Cenla* (Southwestern) dialect and [k'i] in *Kyengsang* (Southeastern) dialect. This is similar to the raising of vowels of personal pronouns even in the spontaneous speech of most Korean dialects. That is, the vowel /e/ of *ney* 'your; you' and *chey*

'his/her/its; he/she/it', is phonetically realized as /i/ in most spontaneous speech,[7] whereas this is not the case for *nay* 'my; I.'

In this sense, Shin's (2000: 104-105) argument that the merger also influences the orthography seems plausible. In regard to the lack of phonemic contrast of these two vowels, Shin argues that the confusion of *ey* and *ay* in spoken language may also be responsible for the errors of many native speakers in distinguishing *ey* and *ay* in writing. For instance, it is frequently found that *ni* is used for *ney* 'your; your' as in *ni ilum* 'your name' or *ni-ka* 'you-NOM' in lyrics of pop music or a variety of web documents.[8]

The results also imply that these two vowels need not be distinguished in the speaking of Korean as a Foreign Language, as is pointed out by Silva and Jin (2008). The confusion of *ey* and *ay*, however, is one of the common errors found in the writing by second language (L2) learners of Korean. Following are some examples of errors by L2 learners of Korean:

(2) a. *cikum-un* **cay**-*ka manh.i khessciman*

　　　'although I am grown up much now'

　　b. *kuphantay yeng.e-nun mos ha*-ko

　　　'although I was in a hurry, I couldn't speak English, and'

　　c. *yakwu-nun silh-e hantey-yo*

　　　'It is said that he hates baseball.'

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7) Occasionally, *ney* in *ney-ka* is realized as *ne-ka* in Seoul Korean.

8) It is also observed that the confusion is not limited to monophthongs *ey* and *ay* but extended to diphthongs containing *yey* /je/ as in *kyeyhoyk* 'plan', *unhye* 'grace' or *yayki* 'story, talking.'

    d. *pihayngki-ka meyksikho-lo naylyekal **ttey**-nun*

    'when the airplane was going down to Mexico'

When L2 learners of Korean notice that the complete merger of two Korean mid front vowels aggravates the discrepancy between pronunciation and orthography, they should pay more attention to the morpho-syntactic information, since they cannot take advantage of spelling pronunciation.

   Native Korean speakers lack the distinctions between these two vowels in production. This may be relevant to the low accuracy of native Korean speakers in discrimination and production of mid front vowel /ɛ/ and low front vowel /æ/ in English (Tsukata et al., 2003). It is noteworthy that the merger may affect the loanwords as well. In principle, according to the standard transcription rules for loanwords in Korean (National Institute of the Korean Language 2009), when the vowel of the original words is /e/ or /ɛ/, it is transcribed as 'ey' while /æ/ is transcribed as 'ay,' whose qualtiy is acoustically quite different from each other. Therefore, between /e/ in 'bay', /ɛ/ 'bed', and /æ/ in 'bad', which would be transliterated in Korean as pey.i, pey.tu, and pay.tu respectively. The different transliterations, however, do not guarantee the vowel distinction in written Korean as in the following examples of English-speaking learners of Korean.

  (3) a. *ho**thay**l* 'hotel'

     b. ***khaym**phesu* 'campus'

     c. *khen**seyp*** 'concept'

     d. ***theyk**si* 'taxi'

I expect that Korean-speaking English learners may have similar difficulties in distinguishing English words that they are used to as loanwords in Korean lexicon due to the lack of a distinction in the pronunciation of the Korean mid front vowels. This is a research topic that must be left for future study.

## 4. Concluding remarks

Although it has been argued that Korean mid front vowels are not completely merged, in the speech of modern Seoul Korean speakers, the two vowels /e/ and /ɛ/ do seem to be completely merged. In the current acoustic analysis, any negative evidence was not found to argue for a near merger instead of a complete real merger of these vowels. Until a new change begins, I suggest modern Seoul Korean speakers have seven monophthongs due to the complete merger of two mid front vowels. The limitation of this study lies in the small number of participants and that they are all in their twenties. Based on the findings in the current study, I suggest that the lack of a vowel distinction in speech which exists in orthography partially accounts for many spelling errors with *ey* and *ay* in L2 learners of Korean. This study leaves for future research the problem of identifying the general linguistic profile of the Korean phonemic system in a variety of Korean dialects and the speech of heritage and non-heritage Korean learners, a study that will have considerable pedagogical applications for the teaching of Korean as a second language.

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# The Merger of *ey* /e/ and *ay* /ɛ/ of Seoul Korean

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**Abstract**

   This study investigates whether modern Korean has experienced vowel shift by merging two adjacent vowels in spontaneous speech production. Lee (1995) suggests that the two mid front vowels *ey* /e/ and *ay* /ɛ/ are merging in modern Korean, but that the merger is only partial in both production and perception. The current study empirically investigates the spontaneous speech of four native Seoul Korean speakers. Results show that these speakers produce the two vowels with complete overlap of the resonances that define vowel quality. In other words, these two vowels occupy exactly the same range in the vowel chart, providing evidence for a complete merger of /e/ and /ɛ/ in spontaneous speech. The findings of this study suggest a possible explanation for the current linguistic behaviors of Korean speakers who show confusion between the two vowels in writing.