The vowel merger of [ɛ] and [ɪ] in Tidewater Virginia dialect

Yuichi Todaka

The present study investigated (1) the vowel merger of [ɪ] and [ɛ] before the nasal [n] and (2) a recent rotation pattern of the vowel [ɪ] using young and old Norfolk residents in Virginia. It was found that the vowel merger is still considered to be an important dialect marker even among young people. In addition, the target vowel [ɪ] produced by the young subjects in general moved farther backward in the F2 dimension, which contradicts the rotation pattern of the *Southern Vowel Shift* (Labov, 1996, 1997). Based on the present and Todaka's (2000, 2001) studies, it is speculated that the backward movement of the vowel [ɪ] might be accounted for by the principle of sufficient perceptual separation.

key words : Southern Vowel Shift, sufficient perceptual separation, F1, F2, vowel space

1. Introduction

Recent sociolinguistic studies of linguistic change in progress has found rapid development of sound changes in most urbanized areas of North America, leading to increased dialect diversity (Labov, 1996). According to Labov (1991, 1996, 1997) and Wolfram and Schilling-Estes (1998), the United States can be divided into three major dialect regions: (1) the Inland North; (2) the South; and (3) the West. In those regions, the major expanding vowel patterns are actively forming the landscape of the country, and the sound changes affecting American English show clear and distinct dialect boundaries, delineating areas with a high degree of internal homogeneity.

The prototypical phonetic features of each dialect has been extensively studied, and the following are some of the phonetic features of the dialects in the South. The summary is based on Small's (1999) description of the Southern American English vowels.

Concerning the front vowels, [ɪ] may be produced as [i] when followed by [ʃ]. For instance, "fish" is pronounced as [fiʃ] instead of being produced as [fɪʃ]. On the other hand, [i] may be pronounced as [ɪ] when it precedes [ɪ]. So, "feel" may be produced as

produced as [fɪl]. [ɛ] may become the diphthong [eɪ] before [g]. Thus, "egg" is produced as [eɪg]. In addition, the vowel [ɛ] is often raised and articulated as [ɪ] when followed by the nasal [n]. In other words, the vowels [ɪ] and [ɛ] merge so that the two vowels are pronounced the same. The words such as "pen" and "pin" are both produced as [pɪn].

Regarding the back vowels, [ʊ] may be pronounced as [u] when it precedes [ʃ]. [ɔ] is sometimes lowered to [a] in words with the rhotic diphthong [ɔr]. Thus, "Florida" is pronounced as [flarɪdə].

As for the central vowels, [ɜr] is sometimes produced as [ʌ] in words that are spelled "orr" or "urr" such as "worry". [ʌ], on the other hand, becomes [ʊ] in stressed syllables containing the "ul" sequence. "result" is therefore pronounced as [rɪzʊlt].

The monophthongization of some diphthongs is also a prominent characteristic of the Southern dialects. For instance, [aɪ] and [ɔɪ] are often pronounced as [a:] and [ɔ:] respectively. Words such as "fire" and "spoil" are thus produced as [fa:r] and [spɔ:l].

Misono and Hirasaka (1997a, b) investigated another common phonetic feature — southern drawl. Though the vowel prolongation varied depending on individual informants, words, and/or phonetic environments, the prolongation made the monophthongs [ɛ] and [æ] diphthongize so that words such as "egg" and "ant" are pronounced as [ɛæ] and [æ:] respectively.

Misono and Hirasaka (ibid) also reported that consonant dropping in clusters was observed not only in the case of final consonant clusters but was also observed in the case of middle consonant clusters. Therefore, they concluded that the simplification of consonant cluster configurations is indeed one of the Southern dialect phonetic features.

Tidewater Virginia, being one of the Southern dialect regions, includes the Eastern shore and the coastal plains region (Tresidder, 1941, 1943). A typical Tidewater speech examined in the past is the pronunciation of the diphthong /aʊ/. Greet and Meloney (1930) report that among educated people, 'house' is phonetically realized as [heʊs] or [heʊs], and 'town', 'ground',and 'cow' are realized as [tæʊn], [græʊn], and [kæʊ] respectively. In other words, the pronunciation of the diphthong /aʊ/ has three variants phonetically, and its realizations are governed by a simple phonological rule. That is, when the diphthong is followed by a voiceless consonant, it is phonetically realized as [əʊ] or [eʊ]. Otherwise, it is realized as [æʊ].

Todaka (2000) examined the phonetic variants of the nucleus of the diphthong /au/ using young and old Tidewater Virginia dialect speakers. He found that there was a

noticeable difference between the male and female speakers in the young and old groups in voiceless environments. In both groups the percentages of [æ] tokens found among the female subjects were more than twice the ones found among the male counterparts. Moreover, the difference was bigger between the male and female subjects in the young group. This means that the preference of [a] to [æ] for men and that of [æ] to [a] for women in voiceless environments reported in Frazer's (1994) study still holds true in this dialect. In addition, it is interesting to note that 29% (except for 'shout') of the old female (not male) subjects pronounced the nucleus of the diphthong in voiceless environments as [ə]. This prototypical pronunciation, which was once a dialect marker, is no longer used by the young speakers, and it might have become passe'.

The percentages of [a] and [æ] tokens by the young male and female subjects were as follows: 76% for the male and 20.2% for the female subjects with respect to [a] and 24% for the male and 79.8% for the female subjects in the case of [æ]. Considering Frazer's (1994) findings in that [æ] was used much more frequently in free conversation, it can be speculated that (1) the prototypical Tidewater Virginia pronunciation, [əʊ], is no longer used by young people, and that (2) the sound change from [a] to [æ] is almost complete among young female speakers but is still in the transitional stages among the male counterparts.

Todaka (2001) investigated a recent sound change in the nucleus of the diphthong /ey/ in Tidewater Virginia dialect. Based upon acoustic analyses, no apparent differences in the F1 (%) dimension could be found when age and sex variables were taken into consideration. However, a notable difference was indeed found in the F2 (%) dimension. In other words, the target nucleus produced by the young male and female subjects moved farther forward in the vowel space.

As the nuclei of the diphthongs [aʊ] and [ey] in Tidewater Virginia dialect have been studied, it is interesting to examine another Southern dialect feature. The vowels [ɪ] and [ɛ] are usually pronounced as [ɪ] when the vowels are followed by the nasal [n], as mentioned earlier. In other words, is this prototypical marker of the Southern dialects still retained by young Tidewater Virginia dialect speakers? Todaka (2000) reports that the [əʊ] pronunciation, once a Tidewater Virginia marker, has been lost among young speakers. Therefore, it is possible to speculate that the merger of the two vowels might have been lost among the young.

In addition to the description of the Southern dialect phonetic features, recent studies (Labov, 1996, 1997) have revealed that there is one major systematic change taken place

in the American South. This change has been known as the Southern Vowel Shift. According to Labov (ibid), the short front vowels are moving upward, and it takes on the gliding character of long vowels. For instance, the vowel /e/ in 'bed' takes on a glide, becoming more like 'beyed' [beyed]. Meanwhile, the front long vowels (e.g., the vowels of 'beet' and 'late') are moving somewhat backward and downward, and the back vowels are moving forward.

If so, it is interesting to examine the recent rotation patterns of the Southern Vowel Shift by comparing its patterns between young and old speakers. It's been reported that young speakers tend to articulate vowels farther forward in the mouth (Dictionary of American Regional English, 1985: xlix).

The objectives of the present study are therefore twofold: (1) Do young speakers pronounce the vowels [ɪ] and [ɛ] before the nasal [n] the same? As mentioned earlier, the vowel merger in the nasal environment has been one of the distinct features of the Southern dialects; and (2) Can we find any differences in vowel production between young and old speakers? One of the major rotation of vowel patterns observed in the Southern Vowel Shift is that [ɪ] moves forward and upward replacing the vowel position formerly occupied by [i]. If so, it is expected that the vowel [ɪ] produced by young speakers moves farther forward and upward, provided that (1) both young and old speakers merge the two vowels as [ɪ] and that (2) the Southern Vowel Shift has already taken place among people living in this area.

2. Methods

2.1 Subjects

Two groups of subjects were asked to participate in the present study. All of the subjects in one group were 60 years or older, and they were the residents of an elderly home. The subjects in the other group were junior high school students at a private middle school. All of the subjects were born and raised in Norfolk, Virginia. 18 subjects - 11 females and 7 males - were in the old group, and 19 subjects - 7 females and 12 males - were in the young group. The following provides some information about the subjects (see table 1).

Table 1 Subject information

old subjects

subject	age	sex	race	education
1	71	male	black	HS
2	77	female	white	College
3	83	female	black	7th grade
4	68	female	black	HS
5	73	male	white	College
6	87	male	white	MA
7	91	female	white	6th grade
8	78	female	black	7th grade
9	66	male	black	College
10	82	male	white	HS
11	80	female	black	MA (teacher)
12	71	female	white	4th grade
13	69	female	white	7th grade
14	64	female	white	HS
15	66	female	black	2nd grade
16	77	female	black	HS
17	77	male	black	6th grade
18	100	female	black	HS

young subjects

subject	age	sex	race	education
20	13	female	white	JHS
21	12	female	white	JHS
22	12	male	white	JHS
23	13	female	white	JHS
24	13	male	white	JHS
25	12	male	white	JHS
26	13	male	black	JHS
27	12	female	white	JHS
28	13	male	black	JHS
29	12	female	white	JHS
30	12	female	black	JHS
31	14	male	white	JHS
32	16	male	white	JHS
33	13	male	white	JHS
34	13	male	white	JHS
35	13	female	white	JHS
36	15	male	white	JHS
37	14	male	white	JHS
38	15	male	white	JHS
39	14	male	white	JHS

2.2 Experimental Procedures

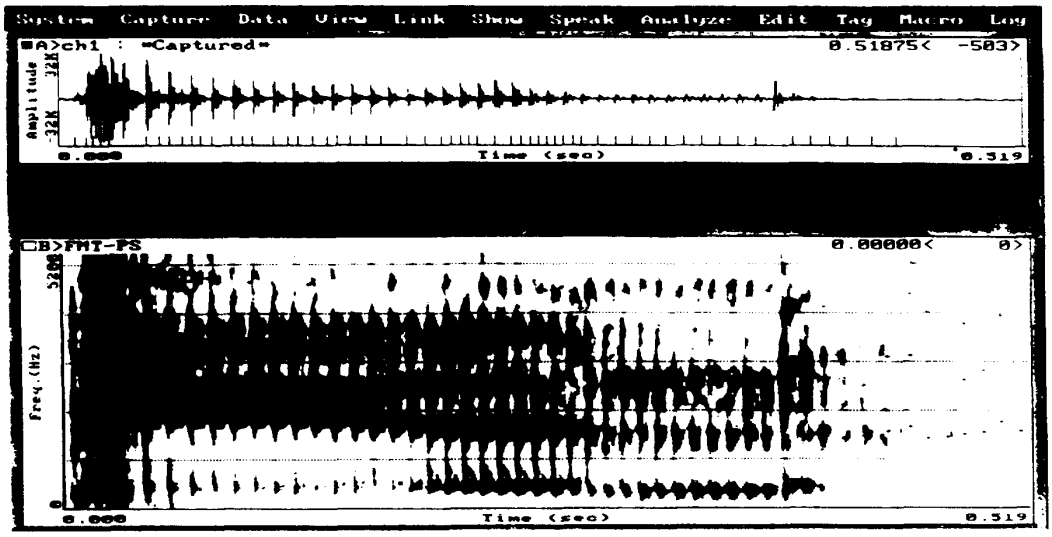
Recordings were made at each location (i.e., a home for the aged and a private middle school in Norfolk, Virginia) using a Panasonic microphone. The read material was preamplified and recorded on a Panasonic tape recorder. All of the subjects read a list of 65 words once at a normal speaking rate. There were 8 target words on the list. All the productions were digitized using a Kay Computerized Speech Lab (CSL).

Productions were digitized at a 12, 800 Hz sampling rate, which automatically set the low-pass filter to a cutoff frequency of 6-kHz. Impulse markers (i.e., mark each glottal pulse for pitch- synchronous formant extraction) were first inserted into each waveform, and pich-synchronous LPC derived formant histories were superimposed on the formants. F1, F2, and F4 were obtained using the formant history information.

As formants produced by different individuals vary because of their anatomical differences such as the size of resonating cavities, it is therefore important to extract such physiological differences when conducting a study of sound change taken place in a particular dialect. As the subjects of this study consisted of people in two age-groups, we decided to take the average frequency of the fourth formants as an indicator of an individual's head size and then expressed the values of the first and second formants as the percentages of the mean fourth formant (Ladeforged, 1993: 213). The fourth formant values of all the target words were obtained using the method mentioned above, and the first and second formant values in frequency were then converted to the percentages of the mean fourth formant value in frequency. Then, the obtained first and second formant values in percent of each word were plotted in a figure in a way that the percentages of the first formants of all the subjects in producing a target word would be shown on the ordinate (the vertical axis) and the percentages of the second formants would be shown on the abscissa (the horizontal axis).

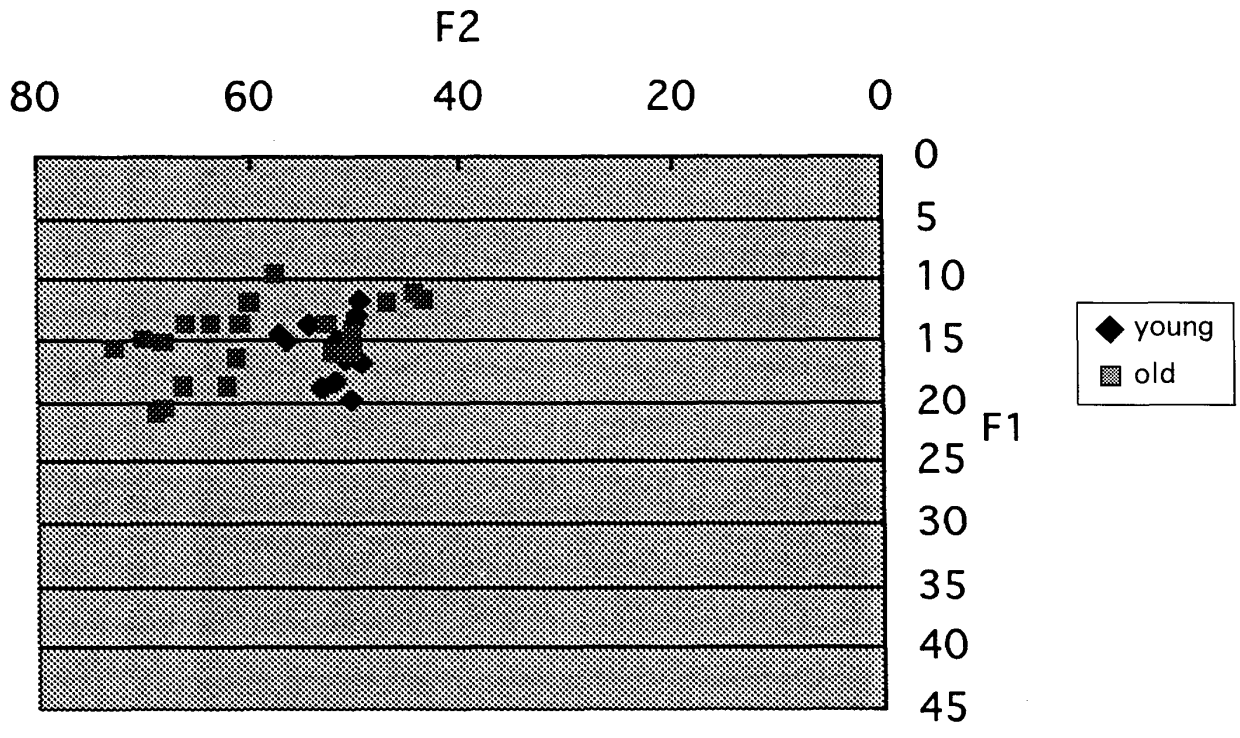
The following indicates the waveform of the word 'bin' in the top window and the corresponding wideband spectrogram in the lower window. The horizontal lines on the formants are the formant histories.

Figure 1 Waveform and the corresponding wideband spectrogram of the word 'bin'



In addition, the following figure shows the relationship between the values of the first and second formants in percent of the vowels in the words " bin " and "Ben" produced by the young and old female subjects.

Figure 2 Comparison of F1/F2 (%) between the subjects in the two-age groups



2.3 Reading material

A list of 65 words on which 8 target words were included was made. The words used for data analyses were: (1) bin; (2) pin; (3) kin; (4) win; (5) Ben; (6) pen; (7) Ken; and (8) when. All of the subjects were instructed to read the list of 65 words at a normal speaking rate. Before each recording, the subjects were asked to read the words as they would normally pronounce them.

3. Results and discussion

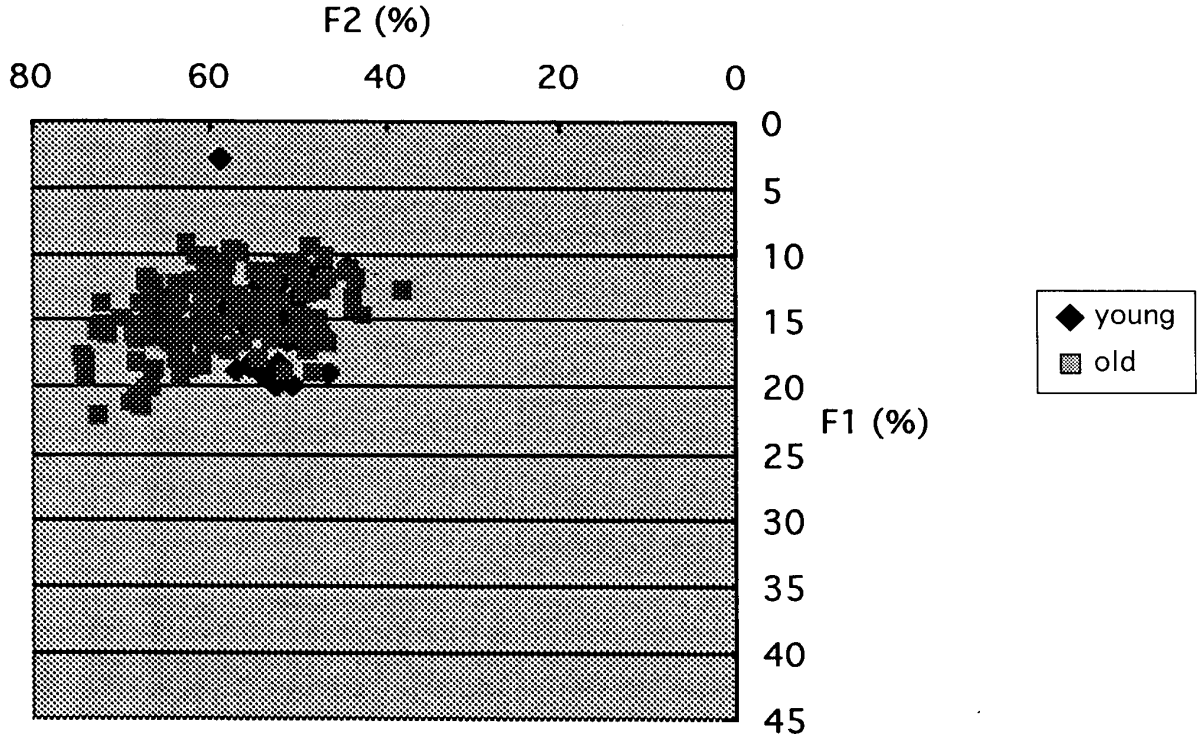
3.1 Analyses of the F1 and F2 values in percent of all the target words in terms of the age factor.

We examined the frequency of use in percent of the vowel merger among the subjects in the two-age groups by calculating the values of the F1 and F2 in percent of all the target words in terms of the age factor. From this analysis, we found that 96% and 86% of the young and old subjects merged the two vowels respectively.

Based upon the above findings, it can be said that the vowel merger has not been lost among the young subjects, but in fact the young subjects continue to use this Southern dialect feature. As mentioned earlier, Todaka (2000) reports that the vowel [əʊ], once a dialect marker of this region, has been lost. This means that the vowel merger is still considered to be an important southern dialect marker for Tidewater Virginia speakers.

Next, the F1 and F2 values in percent of all the target words were calculated for each subject and then were plotted in terms of the age variable. The following figure shows the F1 and F2 values in percent of all the words produced by the young and old subjects.

Figure 3 Comparison of F1/F2 (%) of all the target words produced by the young and old subjects

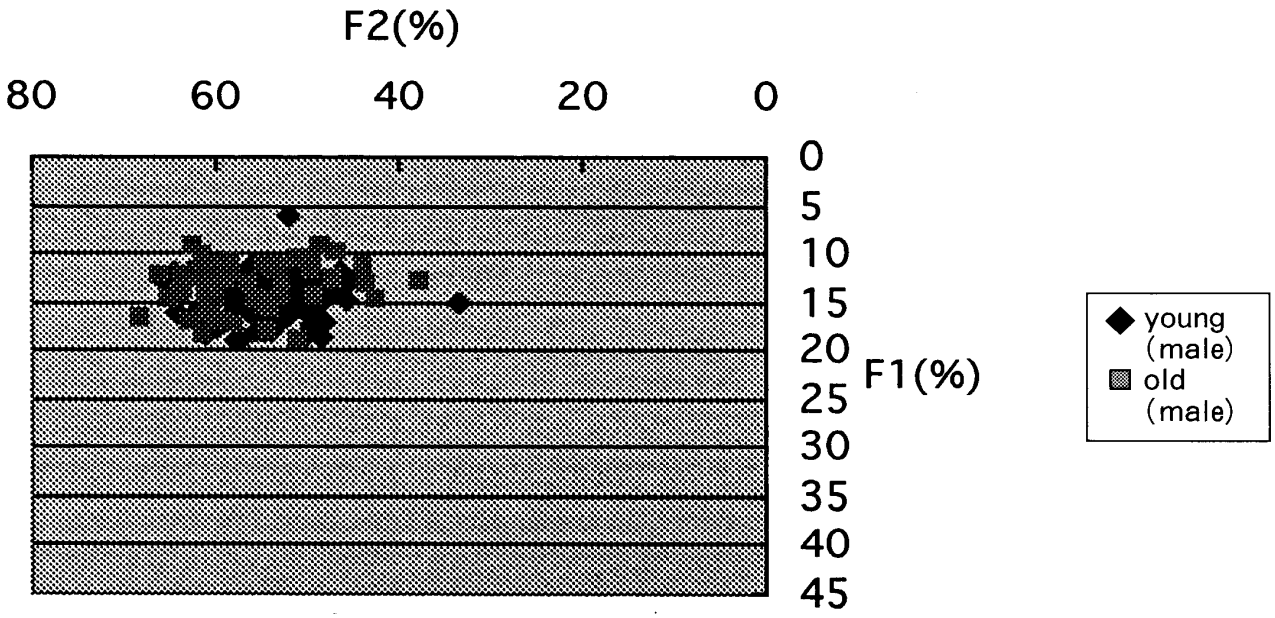


As seen from the figure, a clear difference can be observed when all the target words were compared in terms of the age variable. In other words, the F2 values in percent of the old subjects in general scattered toward the front dimension when compared with those of the young counterparts. This means that the target vowel produced by the young subjects moved farther *backward* in the vowel space, which contradicts the expected movement reported by the vowel rotation pattern (Labov 1996, 1997). It is however important to consider another variable, sex, as women are reported to be the leading edge of sound changes (Frazer, 1994). Thus, the next section deals with the comparison of the F1 and F2 values in percent vis-a'-vis the age and sex variables.

3.2 Analyses of the F1 and F2 values in percent of all the target words in terms of the age and sex factors.

Figure 4 indicates the comparison of the F1 and F2 values in percent of all the target words between the male subjects in the two-age groups.

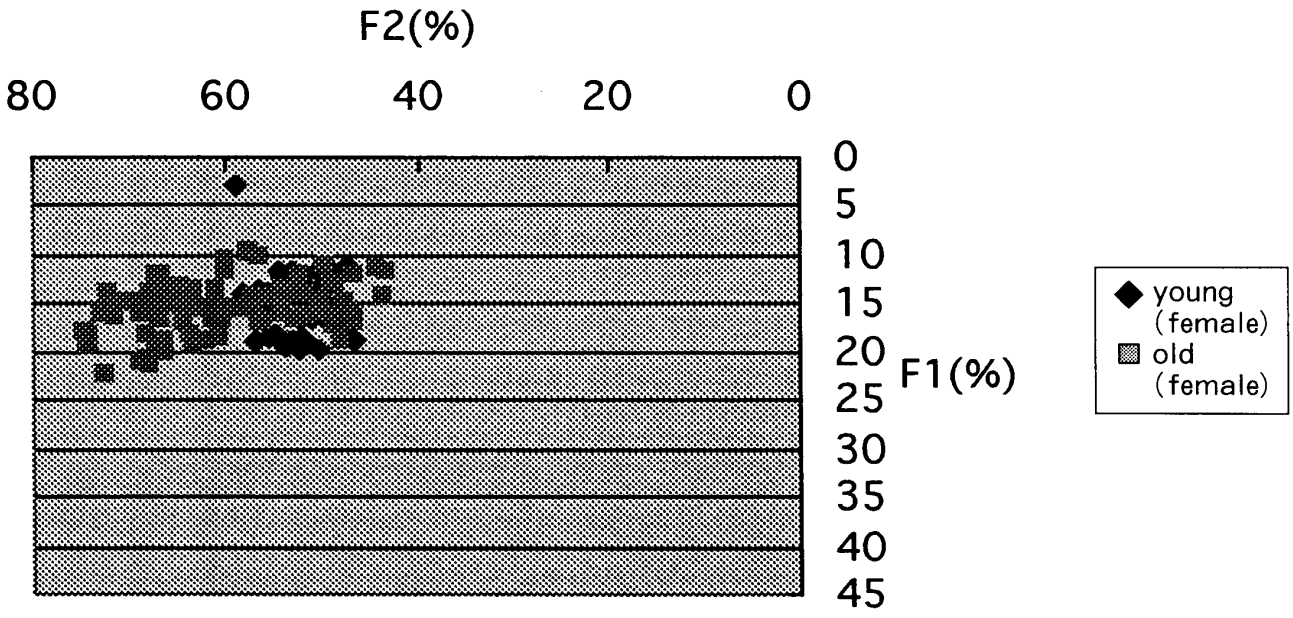
Figure 4 Comparison of F1/F2 (%) of all the target words produced by the male subjects in the two-age groups



Based upon the distribution of the F1 and F2 values in percent of the male subjects in the two-age groups, no apparent difference can be found. In other words, the difference in the F2 dimension observed in the above section was not found in the case of the male subjects.

The next figure shows the comparison of the F1 and F2 values in percent of all the target words produced by the female subjects in the two-age groups.

Figure 5 Comparison of F1/F2 (%) of all the target words produced by the female subjects in the two-age groups

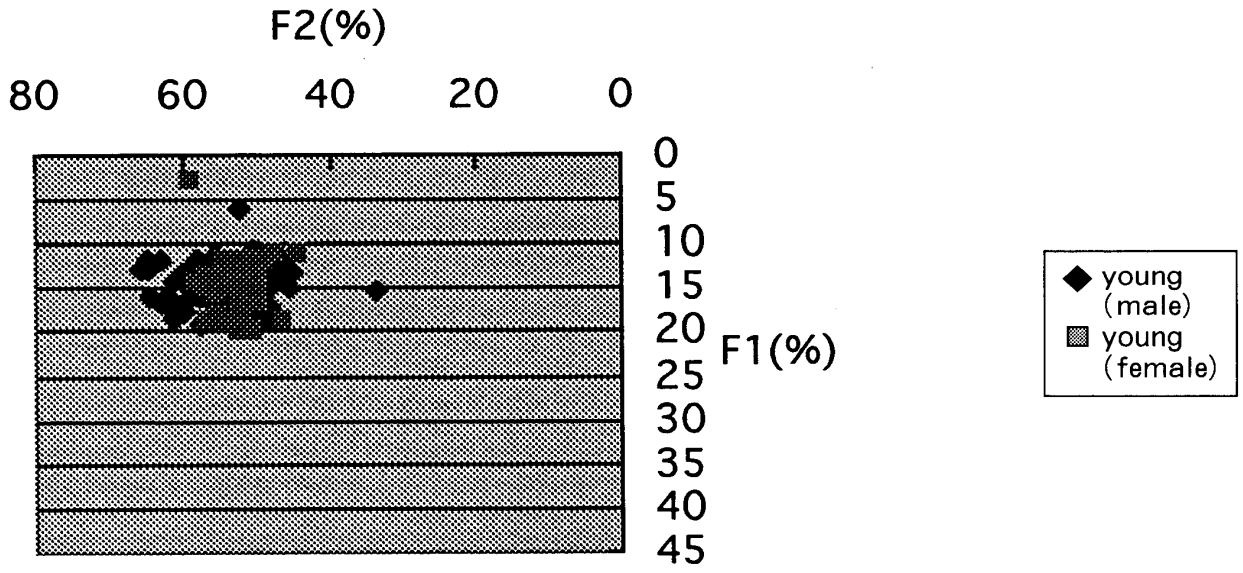


As seen above, we can find a noticeable difference between the female subjects in the two-age groups. That is, the target vowel produced by the old female subjects is much more forward in the F2 dimension. This means that the target vowel produced by the young female subjects moved much farther *backward* in the vowel space when compared with the one pronounced by the old counterparts. This finding corresponds to the one found in Figure 3.

Considering the above results , it can be said that the observed difference was in fact due to the difference in vowel articulation between the female subjects in the two-age groups. It is because no apparent difference was found between the male subjects in the two-age groups. It is however important to note that the observed difference was the opposite to the expected rotation pattern reported by Labov (1996, 1997).

The next figure shows the comparison of the F1 and F2 values in percent of all the target words between the male and female subjects in the young group.

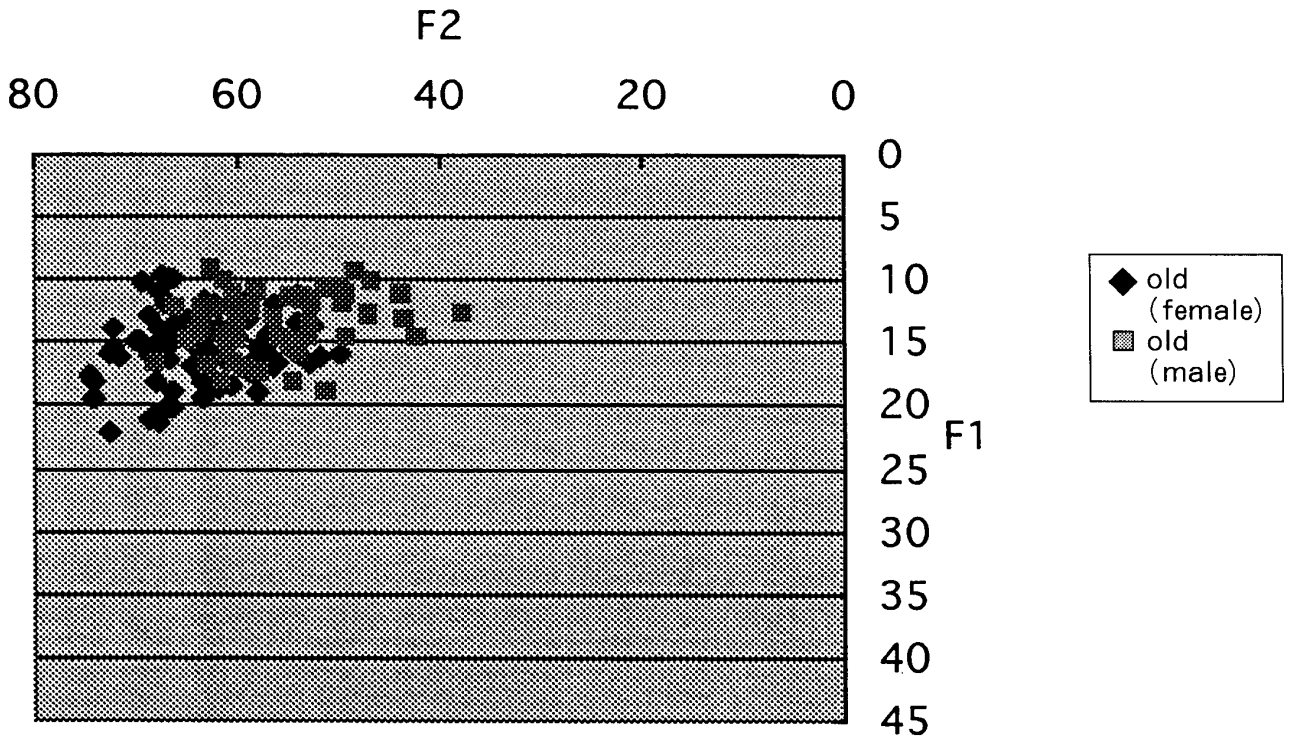
Figure 6 Comparison of F1/F2 (%) of all the target words produced by the male and female subjects in the young group.



From the figure, only a small difference can be observed between the male and female subjects in the young group. In other words, the young male and female subjects produced the vowel similarly.

Figure 7 indicates the comparison of the F1 and F2 values in percent of all the target words between the male and female subjects in the old group.

Figure 7 Comparison of F1/F2 (%) of all the target words produced by the male and female subjects in the old group



We can find a notable difference in the F2 dimension between the male and female subjects in the old group. In other words, the target vowel produced by the female subjects moved farther forward than the one by the male counterparts in the vowel space.

Having considered all the acoustic data, it can be said that the observed differences between the subjects in the two-age groups were indeed due to the production differences between the old female subjects and the young (i.e., both male and female) subjects. That is, a prominent difference was found between the subjects in the two-age groups even though no apparent distinction was found between the male subjects in the two-age groups. This denotes that the male subjects in the old group pronounced the target vowel in the same way that the male subjects in the young group did. This seems to disagree with the expected notion of women being the leading edge of sound change in dialects as no clear difference could be found between the male and the female subjects in the young group. In addition, the movement should have been toward the *forward* dimension in the vowel space if we consider the growing tendency among the young to produce vowels farther forward in the mouth. However, the opposite result was found.

Based upon the present findings and Todaka's (2000, 2001) findings, the following can

be speculated: (1) no Southern Vowel Shift has taken place among residents in Norfolk, Virginia; and (2) the observed differences might be accounted for by the principle of sufficient perceptual separation between vowels.

Concerning the first issue, Todaka (2000, 2001) investigated the rotation patterns of the nuclei of the diphthongs [au] and [ey] produced by the young and old subjects. He found that the nucleus of the diphthong [au] produced by the young female subjects moved farther forward when compared with the one by the old counterparts. In addition, the nucleus of the diphthong [ey] pronounced by both the male and female subjects in the young group moved farther forward in the vowel space. These movements however contradict the expected rotation patterns reported by Labov (1996, 1997). Todaka (ibid) therefore speculated that the observed movements might be accounted for by the fact that the Southern Vowel Shift had not taken place among people living in this area. Wolfram and Schilling-Estes (1998) report that sound changes in Southern dialects are more advanced in rural areas than metropolitan areas. Since Norfolk is a relatively large city in which one of the biggest naval bases is located, it is now confirmed that the Southern Vowel Shift had not taken place in this area when the recordings were made.

Regarding the second inference, it can be said that listeners need sufficient perceptual separation between vowels in order to auditorily distinguish them (Ladefoged, 1993). Since the nucleus of the diphthong [ey] moved forward within the vowel space, it might have been inevitable to find the vowel [ɪ] in the backward dimension if listeners' perspectives are taken into consideration. If the vowel [ɪ] were also found in the forward dimension, it would be difficult to auditorily distinguish the vowel [ɪ] from the nucleus of the diphthong [ey] as not enough perceptual separation could be obtained. The backward movement observed in the present study might therefore be a trade-off between the forward and backward movements of vowel articulation. In other words, there is a growing tendency for young speakers to produce vowels farther forward in the mouth; however, the principle of sufficient perceptual separation prevents certain vowels from being pronounced in the forward position. That is, not enough perceptual separation between the nucleus of the diphthong [ey] and the vowel [ɪ] could be kept if the vowel [ɪ] moved forward. If so, it is important to investigate the basic principles upon which the forward and backward movements of individual vowels are based. It is however beyond the scope of the present study.

4. Conclusion

The objectives of the present study were twofold: (1) Do young speakers pronounce the vowels [ɪ] and [ɛ] before the nasal [n] the same? As mentioned earlier, the vowel merger in the nasal environment has been one of the distinct features of the Southern dialects; and (2) Can we find any differences in vowel production between young and old speakers? One of the major rotation of vowel patterns observed in the Southern Vowel Shift is that the vowel [ɪ] moves upward replacing the vowel position formerly occupied by [i]. If so, it was expected that the vowel [ɪ] produced by the young speakers moved farther upward and forward, provided that (1) both the young and old speakers merged the two target vowels as [ɪ] and that (2) the Southern Vowel Shift had already taken place.

Concerning the first question, the frequency of use in percent of the vowel merger was calculated for the subjects in the two-age groups. It was found that almost all the young subjects pronounced the vowels [ɪ] and [ɛ] before the nasal [n] the same. This indicates that the vowel merger is still considered to be an important social marker even for young Tidewater Virginia dialect speakers. As Todaka (2000) reports that the pronunciation of [aʊ] as [əʊ] has been lost as a traditional Tidewater Virginia dialect marker, it is therefore important to investigate the underlying determining factors in the retention or loss of the distinctive dialect markers in the future.

Regarding the second question, several acoustic analyses were conducted. When all the F1 and F2 values in percent were compared between the subjects in the two-age groups, it was found that the target vowel produced by the old subjects in general moved farther forward in the F2 dimension. It was however found that the observed difference was not due to the difference in pronunciation between the subjects in the two-age groups. Contrary to our expectations, no apparent difference was found between the male subjects in the two-age groups. The observed difference was in fact due to the difference in vowel production between the old female subjects and the young subjects. The target vowel produced by the old female subjects was found farther forward in the vowel space when compared with the one by the young male and female subjects.

The above findings disagree with the notion that women are the leading edge of sound change in dialects when the rotation of vowel patterns reported by the Southern Vowel Shift is considered. The vowel [ɪ] should have moved upward and been fronted. In other words, the target vowel produced by the young female subjects should have moved

upward and been fronted. However, the opposite result was found, as mentioned earlier.

The apparent discrepancy might be due to the fact that the Southern Vowel Shift had not taken place in this area. Todaka (2001) reports that the nucleus of the diphthong [ey] produced by the same young male and female subjects was more fronted than the one produced by the old counterparts, which also contradicts the expected rotation movements of the Southern Vowel Shift. Since sound changes in the South are found to be more advanced in rural areas than metropolitan areas, it is therefore confirmed that the Southern Vowel Shift has not taken place among residents in Norfolk, Virginia.

It is however important to consider the reason for the observed movement in the present study. As mentioned earlier, the target vowel [ɪ] produced by the young male and female subjects moved farther backward in the vowel space. This is the complete antithesis of the finding that young speakers tend to pronounce vowels farther forward in the mouth. A closer examination of the findings of the present and of Todaka's (2000, 2001) studies however provides us with a possible interpretation of the inconsistency.

It's been reported that listeners need sufficient perceptual separation between vowels in order for them to be able to distinguish each vowel (Ladefoged, 1993). If so, the forward movement of the nucleus of the diphthong [ey] observed in Todaka (2001) prevents the vowel [ɪ] from moving in the same direction because of the principle of sufficient perceptual separation. It is however difficult to speculate the reason why [ɪ], not the nucleus of the diphthong [ey], moved backward in the vowel space. Further studies are therefore needed to investigate the determining force(s) in the vowel movements.

In conclusion, the present study examined (1) the merger of [ɪ] and [ɛ] before the nasal [n] and (2) a recent rotation pattern of the vowel [ɪ]. It is however important to mention that the equal number of male and female subjects in the two-age groups was not used in the present study. In addition, the young subjects in the present study attend a private middle school. In other words, the production data obtained by the young subjects in the present study might not have been representative samples of the pronunciation ordinarily used by young people living in Norfolk, Virginia. Furthermore, other important variables such as ethnicity, social class (see Schilling-Estes and Wolfram, 1996 and Hufines, 1986 for discussions) were not considered.

Having mentioned some of the limitations of the present study, we still believe that the present study can serve as a foundation on which further studies of Tidewater Virginia dialect are based. In addition, we look forward to the as yet unpredictable advances that will be made in Tidewater Virginia dialect during the next few years.

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