Session 5aSCb: Production and Perception II: The Speech Segment (Poster Session)

5aSCb32. Exploring vowel mergers in northeast Ohio.
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The northeast corner of Ohio, as listed on dialect area maps, contains the boundaries of several dialect regions. This study compared perception and production for speakers from northeast Ohio and surrounding areas who merge and do not merge back vowels before /l/ in words such as "pool, pull, pole, dull." Acoustic formant analysis indicated a lowered and fronted vowel, as expected, for speakers and listeners who merge some or all of these types of words but different patterns of merging were seen. Formant values were compared with values in "Luke" and "look." Perceptually, preliminary results indicate that the merged vowel is ambiguous and different from either vowel before a velar consonant. Listeners who merge and do not merge displayed different patterns of perception.

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INTRODUCTION

Northeastern Ohio lies at the intersection of several recognized dialect areas. To the east, the Western Pennsylvania dialect continues into the Youngstown, Ohio area. To the north, the Inland North dialect area includes Cleveland, Ohio and an undetermined area south. To the west and south, the Midland dialect occurs and includes Columbus, Ohio. Vowel changes as well as conditioned and unconditioned mergers have traditionally been used as defining characteristics of dialect areas but little is known about this area of intersection or the boundaries of dialects in this area.

One conditioned merger reported for several dialect areas is the merger of high back vowels before final /l/. Labov, et al (2006), and Thomas (2001) report that the vowels in ‘fool’ and ‘full’ are merged in western Pennsylvania around Pittsburg and in Salt Lake City, although Faber and Di Paolo (1995) report this merger in Utah. Authors of the previous studies noted above suggest that tense and lax vowels may be merging in English before /l/. Faber and Di Paolo (1990) and Labov, et al (2006), found that the resulting vowel in the merged words was usually lax. Labov, et al (2006), suggested that the merger may be related to the high degree of vocalization of final /l/ in western Pennsylvania.

An ongoing study seeks to map current production results for /u/, /ʊ/, /oʊ/, and /ʌ/ before final /l/ in northeast Ohio and surrounding areas in order to better understand geographic details of the evolving vowel system of American English. In addition, production and perception aspects of merged vowels are being examined. In this part of the study, a method for comparing speakers who merge and speakers who do not conditionally merge vowels before word final /l/ was explored. Listeners who merge and do not merge some or all of the vowels categorized words produced by speakers who merge and do not merge some or all of the vowels. Would, for example, those who merge ‘pool’ and ‘pull’ correctly identify the intended words when these words were produced by other speakers who merge the vowels in these two words? Only the F1/F2 values for vowels produced by speakers and listeners were examined in this part, although other factors may influence categorization (Jacewicz, et al, 2011, Jacewicz & Fox, 2012).

METHODS

Speakers

Six speakers were recorded reading words containing /u/, /ʊ/, /oʊ/, and /ʌ/ before final /l/ using two different randomizations. The 12 words used in this part of the study were ‘Luke, look, fool, pool, tool, full, pull, bull, pole, toll, stroll, dull.’ (Other words were recorded for the larger study and will not be discussed here.) Words were recorded in a sound treated booth using a head mounted microphone (Shure model 10-A) connected to a microphone preamplifier (Symetrix, model SX202). The speakers were divided into two groups based on acoustic measurement of F1 and F2 at the vowel center in the words. The two groups will be referred to as SM (speakers who merge) and SN (speakers who do not merge).

Stimuli

There were a total of 216 stimuli (12 words X 6 speakers X 3 repetitions). Word productions were isolated and saved as digital files. Thirty milliseconds of silence was inserted before the beginning of each word. Stimuli were then normalized for peak intensity.

Listeners

Listeners were recruited for the study from among graduate and undergraduate students majoring in speech-language pathology at Kent State University who had taken at least one course in phonetic transcription. All listeners were first recorded reading the word list. Listeners then participated in the vowel identification study. Word productions by the listeners were collected in a sound treated booth using the method described for the SM and SN speakers. Listeners were divided into two groups based on acoustic measurement of F1 and F2 at the vowel center.
in the words. Results for ten listeners, five of whom merge some or all of the vowels (LM) and five of whom do not merge any of the vowels based on F1 and F2 measurements, were analyzed.

**Procedures**

Listeners heard the stimuli in a sound treated booth over headphones (Sennheiser, model 500). Stimuli were presented using SuperLab 4.5 software. Each listener categorized each stimulus three times in a different randomization each time. All randomizations were different for each listener. Listeners indicated which vowel they heard in each word using a response box labeled with IPA symbols for each vowel. Key words were affixed to the response box over the IPA symbol. Listeners heard and categorized a practice set of words not used in the study before beginning the listening task.

**Analysis**

Descriptive findings were calculated for perception/production correspondences. Two groups of speakers, speakers who merge (SM) and speakers who do not merge (SN) were used. Two groups of listeners, listeners who merge (LM) and listeners do not merge (LN) listened to words produced by the SM and SN speakers. Words were grouped by vowel and following consonant and included 3 /u/ words before /l/, 3 /ʊ/ words before /l/, 3 /oʊ/ words before /l/, 1 /ʌ/ word (dull), and two words with /u/ and /ʊ/ before final /k/ (Luke, look). The 3 word groups had 135 responses for each SM and SN speaker by LM and LN listeners and the single words had 45 responses for each of the 4 sets.

The following charts display the results. SM/LM indicates listeners who merge hearing speakers who merge. SM/LN indicates listeners who do not merge hearing speakers who merge. SN/LM indicates listeners who merge listening to speakers who do not merge. SN/LN indicates listeners who do not merge listening to speakers who do not merge. Merging, for the purpose of this study, means merging some or all of the vowels of interest in production.
RESULTS

Production

The merger of /u/ and /ʊ/ in words such as ‘pool’ and ‘pull,’ resulted, in this study, in a vowel used in both types of words that was lowered and fronted relative to the standard vowel quadrilateral and relative to these vowels in ‘Luke, look.’ When other vowels were merged into the set (such as /oʊ/), the three vowels were produced with close or overlapping F1 and F2 values. With these and earlier studied speakers, a variety of mergers was found and a variety of words with /uʊoʊʌ/ were merged. The patterns of mergers of vowels before /l/ included /uʊ, /oʊ, /o ʌ/, /ʊ, /uʊoʊ, /uʊʌ, and /uʊoʊʌ/. Because an increased number of mergers was found as productions were acoustically measured, speakers and listeners with varying patterns of merger were used in this exploratory study rather than speakers and listeners with a single pattern.

Perception

Overall, the listeners were able to perform the categorization task with 84% - 100% accuracy for categorization of the intended vowels in ‘Luke, look.’ Vowels before /l/ presented more difficulty.

Both listeners who merge (LM) and listeners do not merge (LN) confused SM /uʊ/. These vowels were the most variably identified, whether produced by SM or SN. Listeners who do not merge (LN) had less difficulty with /u/ words produced by speakers who do not merge (SN).

DISCUSSION

Production measurements for speakers and listeners and for other speakers in the larger study indicated that a lowered and fronted back vowel was used before /l/ when one or more of /uʊoʊ/ were merged. This vowel was separate in the vowel space from the /uʊ/ vowels in ‘Luke, look’. Those speakers who merge, for example, /uʊ/,
did not always merge these vowels in all of the /u o/ test words. Further examination of speakers from the northeast Ohio area and surrounding areas is necessary to delineate the types of mergers present in this area, the words affected by mergers and the boundaries of these mergers.

Perception results suggest that listeners who merge the same vowels as the speakers have difficulty categorizing the merged vowels. Listeners who do not merge any of the same vowels also have difficulty with the merged vowels, as expected. These vowels appear to be ambiguous, which may relate to the location of the merged vowel in the overall vowel space. That is, a merged vowel before /l/ (whether resulting from two or three vowels, and in whatever combination of vowels being merged) may not fall within the normal distribution of any of the unmerged vowels of American English. This may be the case only for vowels before /l/ or there may be other conditioning environments where the same type of ambiguous vowel may be emerging.

The method used to compare production and perception in this study was useful for revealing hitherto unreported patterns of conditioned vowel merger and their consequences for vowel categorization. Use of this method will also contribute to understanding the links between production and perception for all speech sounds.

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REFERENCES