

Ses1-P Perceptual sensitivity to dialectal and generational variations in vowels



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OBJECTIVE

There is a significant cross-dialectal variation in regional vowel systems of American English [1, 2].

The nature and amount of formant dynamics in vowels vary across dialects and within each regional variety as a function of speaker generation (which represents an active process of sound change) and gender [3].

To what extent is the acoustic information in vowels sufficient to allow listeners recognize and/or identify regional accents?

When exposed to a significant level of cross-generational variation in speech signals containing exemplars from their own and a different dialect, can listeners accurately differentiate speaker dialects?

METHODS

Stimulus tokens. 12 American English vowels /i, ɪ, e, ɛ, æ, a, u, ʊ, ai, o, u, ə/ produced in *hVd* context in isolation.

Speakers. Productions of 120 speakers were selected from a large corpus of regional variation in American English [3].

• 60 speakers from Western North Carolina (Southern English);

• 60 speakers from Wisconsin (Midwestern English);

• 3 generations within each dialect (old adults, 66-91 y.o.; young adults, 35-50 y.o., children, 8-12 y.o.);

• 20 speakers within each dialect and each generation (10 males, 10 females).

Acoustic measurements. Frequencies of the first three formants (F1, F2 and F3) sampled at the 20-35-50-65-80% points in the vowel (to estimate dynamic formant movement); vowel duration; LPC analysis with a 25-ms wide Hanning window.

Identification task. The experiment was conducted at Western Carolina University in Cullowhee, NC (15 listeners), and at the University of Wisconsin-Madison, WI (15 listeners).

Procedure. The listeners heard one word at a time and decided if the word was produced by a WI or a NC speaker.

• 720 tokens (3 randomized blocks x 240 tokens each);

• 2 response choices: "Wisconsin" and "North Carolina;"

• Only one repetition of a given stimulus was allowed;

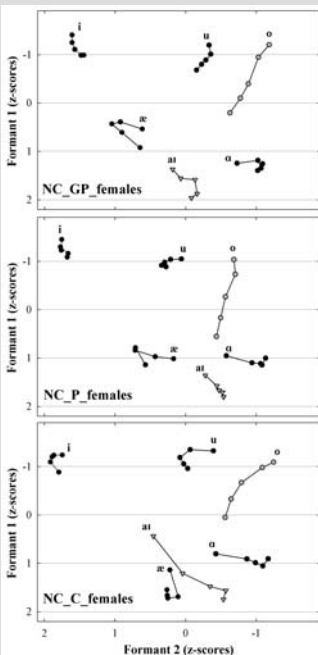
• Experiment controlled by a custom Matlab program.

Data analysis. ID responses (hits, misses, correct rejections and false alarms) were converted to d-prime (d') values. d' values provide a measure of sensitivity to dialect variation while eliminating response bias.

Correct WI responses to WI tokens were "hits" and incorrect WI responses to NC tokens were "false alarms."

1

Southern vowels (NC)



Dynamic formant pattern and dispersion of /i, æ, a, o, u, ai/ produced in isolation (*heed, had, hod, hoed, who'd, hide*) by North Carolina females.

For each vowel, lines connect 5 points from 20% to 80% (symbols are placed next to the 80% point).

Phonetic characteristics

Grandparents (GP) (66-91 y.o) and **Parents (P)** (35-50 y.o.) generations:

/i/ - centralized

/æ/ - undergoes sound change (lowering and backing in the vowel space); represents "Southern breaking"

/ai/ - produced as a monophthong

/a/ - undergoes sound change (raising in the vowel space)

/u/ - very fronted

/o/ - diphthongized

Children (C) (8-12 y.o.):

/i/ - undergoes fronting

/æ/ - undergoes further lowering and backing)

/ai/ - produced as a diphthong

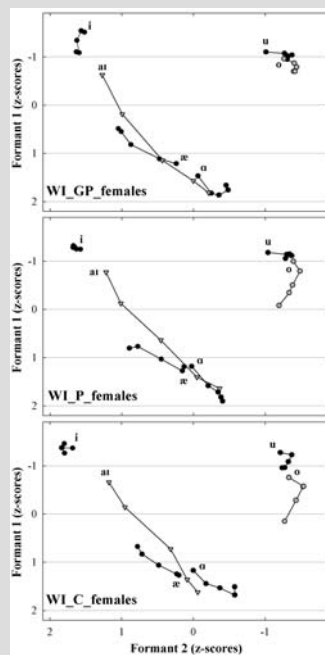
/a/ - greater formant movement

/u/ - very fronted

/o/ - undergoes backing in the vowel space

2

Midwestern vowels (WI)



Dynamic formant pattern and dispersion of /i, æ, a, o, u, ai/ produced in isolation (*heed, had, hod, hoed, who'd, hide*) by Wisconsin females.

Phonetic characteristics

Grandparents (GP) (66-91 y.o) and **Parents (P)** (35-50 y.o.) generations:

/æ/ - represents "Northern breaking"

/ai/ - produced as a diphthong

/a/ - very low

/u/ - far back

/o/ - approximates the position of /u/

/u/ - monophthongized.

Children (C) (8-12 y.o.)

/æ/ - undergoes lowering

/ai/ - produced as a diphthong

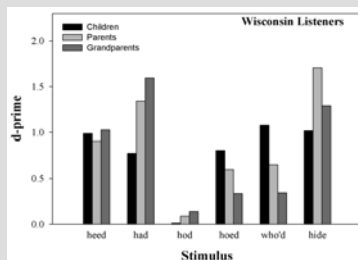
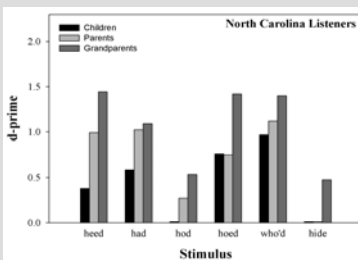
/a/ - greater formant movement; raising in the vowel space

/u/ - far back

/o/ - undergoes lowering and backing in the vowel space.

3

Listener sensitivity to dialect variation



Reference note: Higher d' values denote greater sensitivity; typical values are up to 2.0; 69% correct for both NC and WI trials corresponds to a d' of 1.0.

North Carolina listeners

/u/ in *who'd* - the highest sensitivity

/ai/ in *hide* - the lowest sensitivity

/i, æ, o/ - relatively high sensitivity to GP vowels, somewhat lower to P and the lowest to C (except for /o/).

/a/ in *hod* - low sensitivity; generational differences

Wisconsin listeners

/ai/ in *hide* - the highest sensitivity

/a/ in *hod* - the lowest sensitivity

/æ/ in *had* - very good identification of dialect membership and cross-generational change

/i, u, o/ - moderate sensitivity; perception of cross-generational differences in *who'd* and *hoed*

CONCLUSIONS

- We examined overall sensitivity of both NC and WI listeners to all 720 exemplars presented for dialect identification. The results indicate that the cross-generational differences among vowels resulting from sound change over time do significantly influence listeners' decisions about the dialect of the speaker.
- Sensitivity to cross-generational variations differs as a function of listener dialect. This leads us to the conclusion that the ability to determine dialect membership is an interaction between the dialect-specific structure of the perceptual vowel spaces of the listeners and the acoustic differences in the vowels in the two dialects.
- Different vowel categories provide different amounts of information for the listeners to make the dialect distinction. It is notable that untrained listeners demonstrated dialect sensitivity while hearing a single monosyllabic word.

References

- [1] Labov, W., Ash, S., and Boberg, C. (2006). *Atlas of North American English: Phonetics, phonology and sound change*. Berlin, Germany: Mouton de Gruyter.
- [2] Fox, R. A. and Jacewicz, E. (2009). "Cross-dialectal variation in formant dynamics of American English vowels." *J. Acoust. Soc. Am.* 126, 2603-2618.
- [3] Jacewicz, E., Fox, R. A., and Salmons, J. (2011). "Cross-generational vowel change in American English." *Language Variation and Change*, 23: 45-86.

Acknowledgments

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