Modeling Geographic Variation in Pronunciation of United Kingdom English

How are British accents distributed across the UK?

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Objective

The goal of this study is to model geographic variation of UK pronunciation based on the pronunciation of the vowel /aɪ/. Thousands of tokens of the vowel in the word 'five' were mined from the Audio British National Corpus and compared across seventeen regions of the UK. This study was designed with an expectation of a spectrum of dialects existing across the country with monophthongal realizations (/i/ as in 'feeve') primarily found in the North, i.e., some Scottish varieties, and more diphthongization (/aɪ/ as in 'five') occurring in the South.

Methodology

Data Mining

- 8,567 tokens of 'five' were retrieved from the BNC.
- "Bad data" was excluded (whispery, overlapping, or exceptionally high-pitched speech), yielding 1,773 tokens to manually trim and analyze.

Functional Data Analysis (see fig. 1)

- Orthogonal cubic polynomials were fitted to each F1 and F2 track.
- Tokens with slopes that lined up with expectations (falling F1 and rising F2 values) were included in the study, yielding 1,049 tokens total.

Modal Analysis (see fig. 2)

- Speaker medians for each word were binned and then modally plotted in increments of 50 Hz for F1 Max and 100 Hz for F2 Min.
- Distinct areas of high vowel quality concentration suggest that our dataset of /aɪ/ F1 Max and F2 Min values is bimodal.

Geographic Analysis (see figs. 3, 4)

- Distance from Orkney (northernmost location) was established as an independent variable.
- For each location, median geographic coordinates were loaded, and Distance from Orkney calculated.
- A correlation was found between Distance from Orkney and F2 Min.

Acknowledgements

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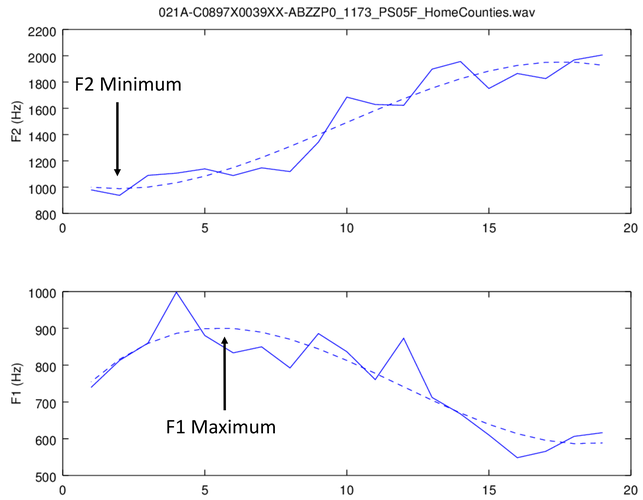

Fig. 1: F1 and F2 frequencies of the vocalic portion (/aɪ/ and transition into the /v/) of a representative token of 'five'. Solid line: observed data; dashed line: cubic polynomial of the form $y = a_1x^3 + a_2x^2 + a_3x + a_4$. Coefficients represent amount of ~-shaped wiggle, breadth of curvature, slope (steepness and direction), and average height, respectively.

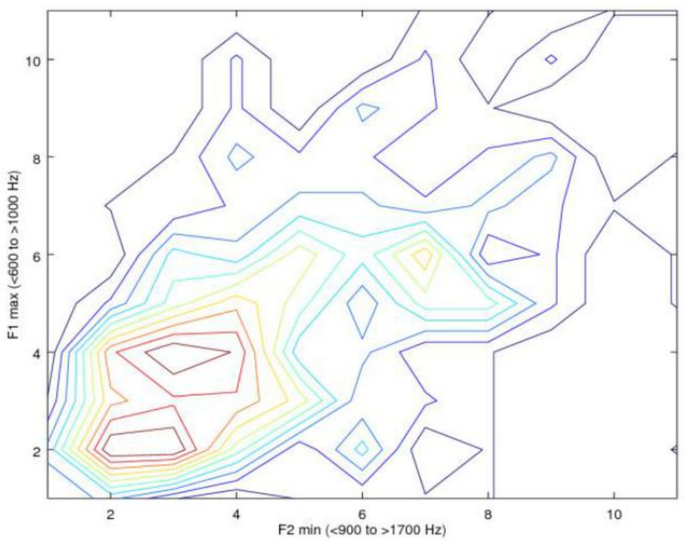

Fig. 2: The contour map of 'five' speakers' median frequencies illustrates clusters of F1/F2 values and suggests a multimodal distribution of vowel qualities.

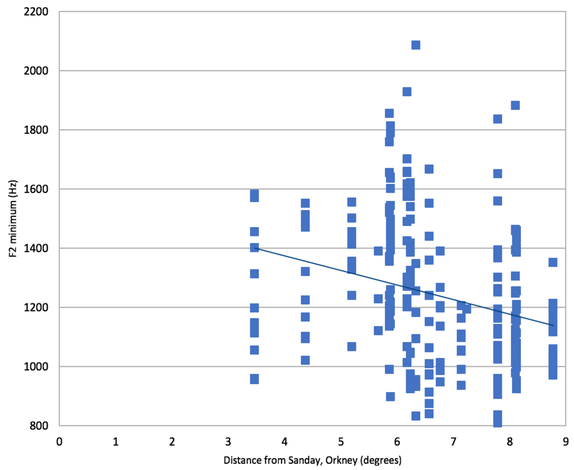

Fig. 3: The F2 minimum variable is significantly correlated with Distance from Orkney:
(N= 229, "p = .000," 1-tailed). The North-to-South decline in F2 minimum indicates successive lowering of the vowel, from [i:] to [eI] to [aI], illustrating the historical "Great Vowel Shift" mapped out in UK geography.

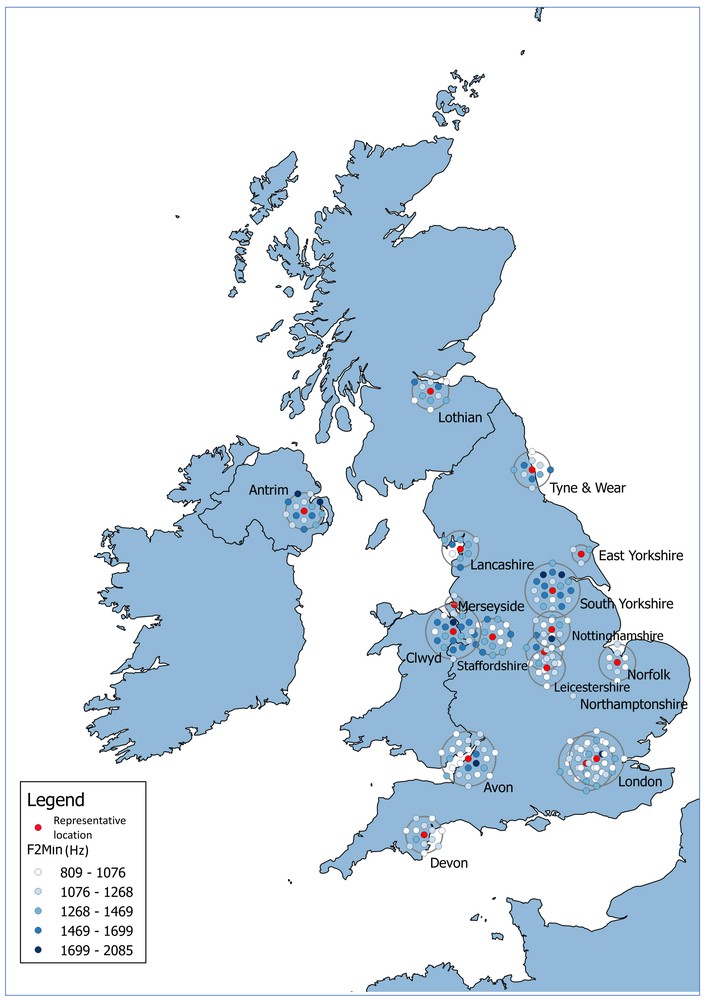

Fig. 4: This map illustrates the geographic distribution of 230 'five' speaker's average F2 Min values across seventeen representative locations in the UK. While these values are not the same at any location, the increase in proportion of lighter colored points as latitude decreases suggests that F2 Min values are continuous across the space and not sharply bounded as by isoglosses.

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