## Defining accent features in urban Northern English vowel systems

A large body of sociolinguistic work relies on the existence of speech communities defined by their geographic location, such as 'Liverpool English'. Such terms implicitly suggest that speakers from Liverpool share a set of accent features to the exclusion of other localities. While this is a highly intuitive notion, defining such features is non-trivial, because ongoing sound changes make them a moving target. In this study, we propose a systematic bottom-up approach to identifying local vowel features, using a large corpus of crowdsourced audio data, and machine learning.

Our study is based on audio data from 113 speakers, representing five largest Northern cities: Leeds ($N$ =28), Liverpool ($N$ =19), Manchester ($N$ =25), Sheffield ($N$ =19) and Newcastle upon Tyne ($N$ =22). Each speaker recorded themselves on a mobile phone reading the story *The Boy Who Cried Wolf*, and submitted the recording via the English Dialect App [3]. The recordings were selected based on their quality (no multiple talkers, no background noise, etc.). They were then forced aligned, with boundaries manually corrected as required. In each recording, we identified one token for each English vowel keyword, as defined by [5]. In addition, we also included the GOOSE vowel before /l/ (keyword FOOL), which is known to involve a variable allophony pattern in the North [4].

We extracted F1 and F2 measurements for all vowels, using a Praat script with adjusted settings for male and female speakers. Midpoint measurements were taken for monophthongs, whereas onglide (20% of vowel duration) and offglide (80%) were measured for diphthongs. The formants were Lobanov-normalised within speaker.

The purpose of our analysis was to determine relative importance of each variable (i.e. each vowel measurement) for identifying each city. We illustrate this, using Liverpool as an example. We fitted a series of random forest models, based on 1000 bootstrapped samples with equal number of Liverpool and non-Liverpool speakers. The forests were trained to distinguish the two classes based on all the available vowel measurements. For each iteration, we extracted relative variable importance, using the `party` package in R [1].

We visualised the distributions of relative variable importance, as exemplified in Figure 1 for the ten most highly ranked Liverpool features. Two most important features, in this case, were midpoint F1 in lettER and the midpoint F2 in FOOL. According to forest predictions, speakers were more likely to be identified as being from Liverpool, if they had a lowered lettER vowel and a relative fronted variant of FOOL. We applied the same analysis to the remaining cities, identifying predictive features for each of them. Table 1 summarises the top-ranking features for each city.

By and large, the features that contribute most to identifying each city are not the ones traditional descriptions focus on. We argue that this is because many traditional features tend to be salient, and as such, they may be subject to considerable socially-induced inter-speaker variation. We discuss this proposal within the framework of stereotypes, markers and indicators [2]. We also consider classification accuracy in the context of dialect levelling in the North.
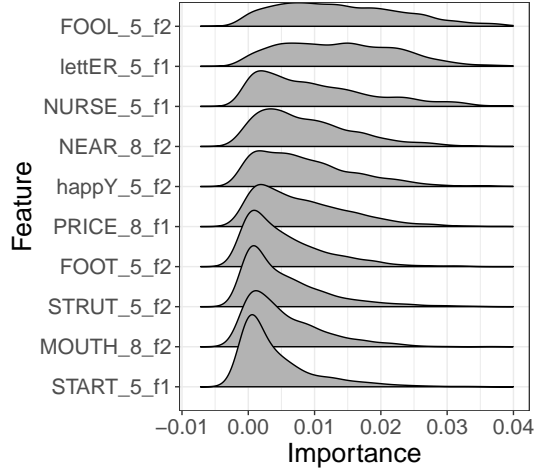
Figure 1: Relative variable importance of the ten most highly ranked features for identifying Liverpool speakers. Each feature is coded as keyword, followed by measurement time point (2=onglide, 5=midpoint, 8=offglide), and the measurement taken (F1 or F2)

Table 1: Vowel features with the largest relative importance for classifying each city

| City | Feature |
|------|---------|
| Leeds | NORTH midpoint F1 |
| | START midpoint F1 |
| Liverpool | FOOL midpoint F2 |
| | lettER midpoint F1 |
| Manchester | NEAR onglide F1 |
| | lettER midpoint F1 |
| | CHOICE offglide F1 |
| Sheffield | LOT midpoint F2 |
| | NEAR onglide F1 |
| Newcastle | KIT midpoint F2 |
| | STRUT midpoint F2 |

**References** [1] Torsten Hothorn, Kurt Hornik, and Achim Zeileis. "Unbiased Recursive Partitioning: A Conditional Inference Framework". In: *Journal of Computational and Graphical Statistics* 15.3 (2006). [2] William Labov. *Sociolinguistic patterns*. Oxford: Blackwell, 1972. [3] Adrian Leemann, Marie-José Kolly, and David Britain. "The English Dialects App: The creation of a crowdsourced dialect corpus". In: *Ampersand* 5 (2018). [4] Danielle Turton and Maciej Baranowski. "Absence of a blocking r[ɤ ɫ]?: the presence of /u/-fronting before /l/ in Manchester". Paper presented at 10th UK Language Variation & Change, York. 2015. [5] J.C. Wells. *Accents of English. 3 vols.* Cambridge: Cambridge University Press, 1982.