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The FOOT-STRUT vowels in Manchester: Evidence for the diachronic precursor to the split?

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Abstract
This study presents a large-scale investigation of sociolinguistic variation in the phonetic realisation and phonemic status of FOOT and STRUT in Manchester English. As a Northern dialect of English, Manchester speakers typically lack the distinction between the FOOT and STRUT vowels, such that 'stud' and 'stood' are homophones. The data in the present study reveal that, despite the vast majority of speakers having no difference in production and perception, there is variation both in the phonemic status and the phonetic realisation of the two vowel classes within the speech community.

The study is based on the acoustic analysis of a sample of 123 speakers stratified by age, gender, socio-economic status, and ethnicity, recorded in sociolinguistic interviews, supplemented with wordlist reading and minimal-pair tests. Our approach to the analysis considers the vowel classes both as one phoneme, and as the two split lexical sets. The acoustic measurements reveal that tokens in the STRUT category show a monotonic pattern of social class stratification, with higher social classes showing higher F1 values, i.e., having a lower tongue position.

The minimal-pair tests of the FOOT-STRUT distinction reveal that although for most speakers there is no phonemic distinction, for 8 speakers in the two highest socio-economic levels in the sample, the two vowels do form separate categories. This is confirmed by the acoustic measurements of their vowel tokens: there is clear phonetic separation between the two vocalic categories in phonetic space.

Interestingly, even when these 8 speakers are removed from the sample, regression analysis shows that for the sample as a whole, vowel category (i.e., STRUT vs. FOOT) continues to have a significant effect, with STRUT tokens having a higher F1 mean (lower tongue position). This holds in cases where there is complete overlap between the two vowels in phonetic space. We explore the possibility that this may be due to the different phonological environment in which the two vowel classes tend to be found and that it may shed light on the underlying mechanisms of the historical split between the two vowel classes in the south of England.

The FOOT-STRUT vowels in Manchester: Evidence for the diachronic precursor to the split?

Maciej Baranowski and Danielle Turton*

1 Introduction

For most speakers of English, the words in pairs such as *could-cud, put-putt, look-luck, stood-stud*, etc. are not homophones, as the vowels are different, represented by Wells' (1982) key words FOOT and STRUT, respectively. In England, the phonemic status of the FOOT-STRUT vowel classes represents an established North-South divide whereby there is a phonemic distinction in the South of England but only one phoneme in the North, phonetically realized as the higher of the two vowels, i.e. FOOT in other dialects of English (Orton et al. 1962–71, Wells 1982).

A comparison of the *Survey of English Dialects* (Orton et al. 1962–71) records with the results of recent work by Britain et al (2016) and by MacKenzie, Turton, and Bailey (2014) suggests that the phonemic distinction may be spreading slowly, with the one-phoneme area becoming smaller and with more speakers within the area displaying a distinction. There is some indication that middle-class speakers may have a lower tongue position for the STRUT vowel class in comparison with the working classes; there also seems to be less rounding of the FOOT-STRUT vowel in the North nowadays than in the past.

The lack of distinction in the North of England is a reflex an earlier stage in the history of English where there was only one phoneme in all dialects. The presence of a phonemic distinction in the South of England is due to a split of Middle English short /u/ that occurred sometime between the 15th and 17th centuries, with the first explicit report of a distinction dating from the 1640s (Lass 2000: 89). The vowel first unrounded and then lowered to /ʌ/ in some words, e.g. *cut, but, strut* (Figure 1). However, in other words, such as *put* or *butcher*, the vowel remained high and rounded. Another source of lexical items for the new STRUT class were words spelt with *-oo-*. In some of them, such as *blood*, the vowel (long /u:/) became short and joined the new STRUT class. In others, such as *good*, the vowel became short after the split and joined the FOOT class (Wells 1982: 197). Yet others, such as *mood*, retained a long vowel and never entered either of the short vowel classes.

The lexical distribution of the two vowels is not quite predictable, i.e., there does not seem to be a clear rule predicting which word has which vowel. There are certain tendencies, e.g., the rounded variant /ʊ/ tends to follow labials e.g. *put, full*, and the unrounded variant /ʌ/ tends to occur elsewhere e.g. *cut, dull,* but there are many exceptions, e.g. *putt, but, pun*, etc.

Manchester is located in the North of England and is known to have a generally Northern sound system (Baranowski & Turton 2015), part of which is a lack of the FOOT-STRUT distinction. Given the suggestion that the distinction may be on the increase, the goal of the paper is to explore the phonemic status of the FOOT-STRUT vowel classes and their phonetic realization in Manchester. Is there any evidence of a split in Manchester's sound system or is there a complete lack of distinction, as one might expect in the North of England? Another question is whether there is a pattern of social stratification in terms of the distinction as well as the phonetic realization of the vowels. That is, regardless of whether speakers have the split, is the STRUT vowel lower (i.e., higher in F1) the higher the social class? For speakers without the split, does the FOOT-STRUT vowel show any social patterning in terms of its phonetic realization?

2 Methods

The study is based on a sample of 122 speakers native to the area stratified by age, gender, socioeconomic status, and ethnicity, recorded in sociolinguistic interviews, supplemented with wordlist reading and minimal-pair tests. There are 91 white British Mancunians, 18 Pakistani, and 13 Black Caribbean speakers in the sample. Social class is operationalized in terms of five occupational

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levels (1–5: lower-working, upper-working, lower-middle, middle-middle, and upper-middle).

Formant measurements of the informants' complete vowel systems are obtained in Praat (Boersma & Weenink 2011) by hand for 25 speakers and in the online FAVE suite (Rosenfelder et al. 2014) for 98 speakers (including 7653 tokens of STRUT and 4057 tokens of FOOT). Formant values are normalized using Lobonov's (1971) method and scaled back to Hz.

Minimal pairs tests were conducted for 112 speakers for two minimal pairs: *book-buck* and *crooks-crux*. The speakers were asked to read each pair and say if the two words sounded the same, close but not quite the same, or different in their most natural speech. Their production was judged by two local students and coded on a three-point scale 0-same, 1-close but not identical, and 2-different; the speakers' own perceptions of the contrast was coded using the same scale.

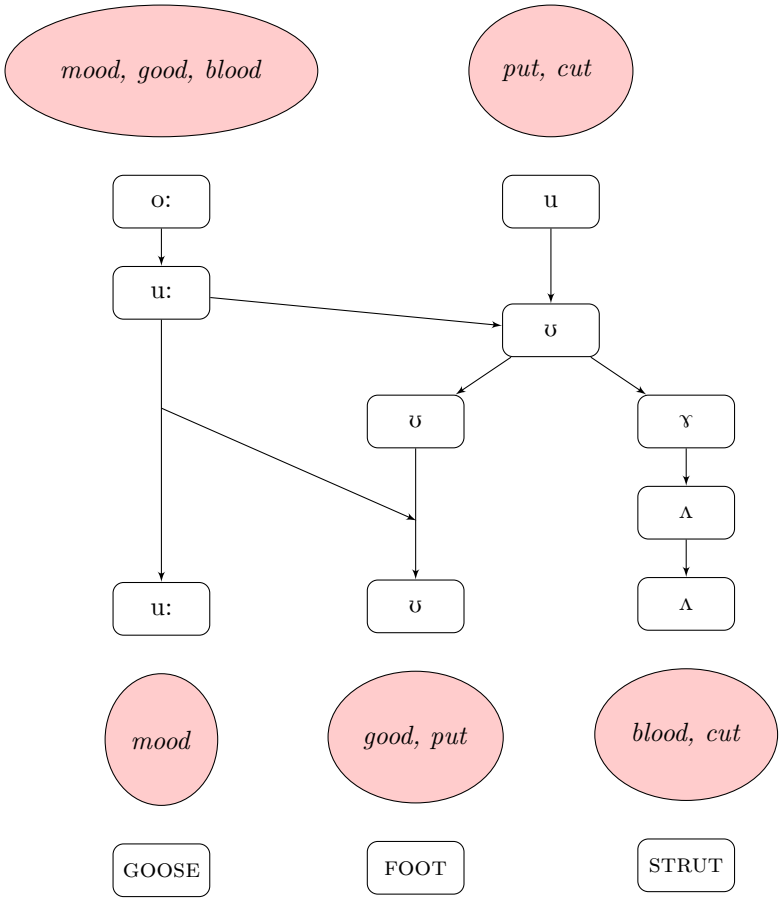

Figure 1: Historical development of the FOOT-STRUT split in the South of England.

3 Results and Discussion

For most speakers in the sample, there is no distinction between FOOT and STRUT, confirming the status of Manchester as a Northern dialect. This lack of distinction is seen in speakers of all generations, such as Alan K., aged 68 (Figure 2), and Keith T., aged 21 (Figure 3). This general trend is confirmed by the minimal pair test results for the whole sample presented in Figure 4: for the vast majority of speakers, the words in the pair *book-buck* sound identical, both in their perception and

their actual production.[†1]

There are, however, some speakers for whom there is a clear distinction, both in their own perception and in their production, which is unexpected for a Northern dialect of English. Those speakers tend to be concentrated in the highest social classes, i.e., class 5 (upper middle) in Figure 4. It is a new finding as far as Manchester is concerned in that it has not been reported before, but this does not seem to be a recent development in the community, as the distinction is found in some of the oldest speakers in the sample, such as Matthew P., 66 (Figure 5). At the same time, it is worth noting that that there are upper-middle-class speakers who have no distinction, either in minimal pair tests or in their spontaneous speech, just like the rest of the community, some of whom are in their early 20s, such as Paul M., 22 (Figure 6).

It is not surprising that the (somewhat exceptional) speakers with a FOOT-STRUT distinction in Manchester should belong to the highest-status social group. Previous research, e.g., Sankoff (2004), has shown that Northerners who have moved to the South become aware of the distinction and can acquire it even in adulthood, though often not perfectly. Upper middle class Mancunians tend to have a substantial amount of contact with the South, either through family ties, university education, or travel, and are therefore more likely to acquire the distinction than the other social groups in Manchester. Similarly, upper-middle class Mancunians have been found to be leading the fronting of GOAT in Manchester, a feature external to the dialect brought to Manchester from the South of England (Baranowski 2017).

The distinction seen for some speakers in the minimal pair tests is confirmed by the acoustic measurements: those upper-middle class speakers who report and produce a distinction in a minimal pair test, also display a clear phonetic difference between the two vowel classes in their acoustics—FOOT being higher than STRUT—both in formal elicitations and in spontaneous speech, such as Matthew P. (Figure 5) Mike T., and Wendy J. (Figure 7).

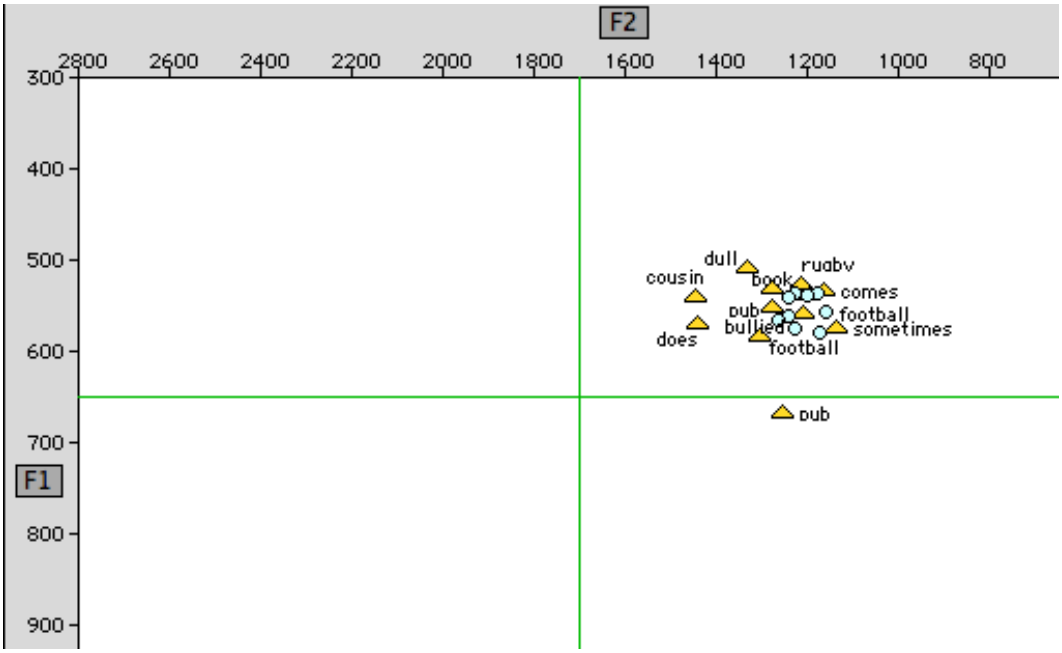

Figure 2: Alan K., 68, Lower Working Class.

[1]There are four speakers over the age of 65 in the sample who have long /u:/ in words such as *book* and *look*, which is a traditional feature found in the North-West, so that words such as *book* and *buck* do not rhyme for them; those speakers have been excluded from the minimal pair test results.

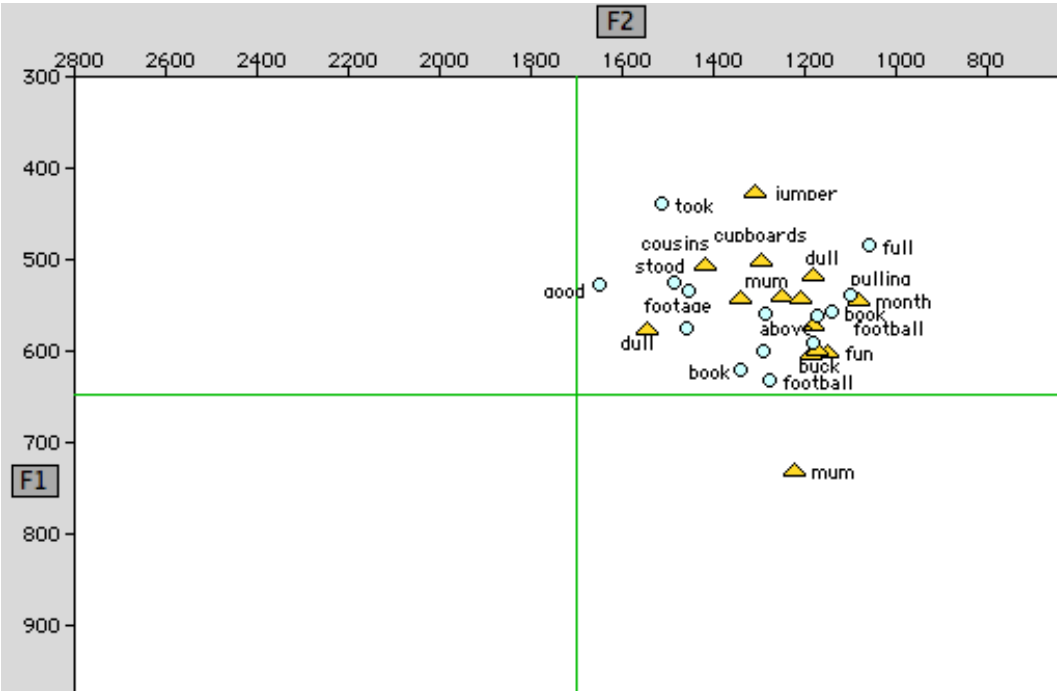

Figure 3: Keith T., 21, Lower Working Class.

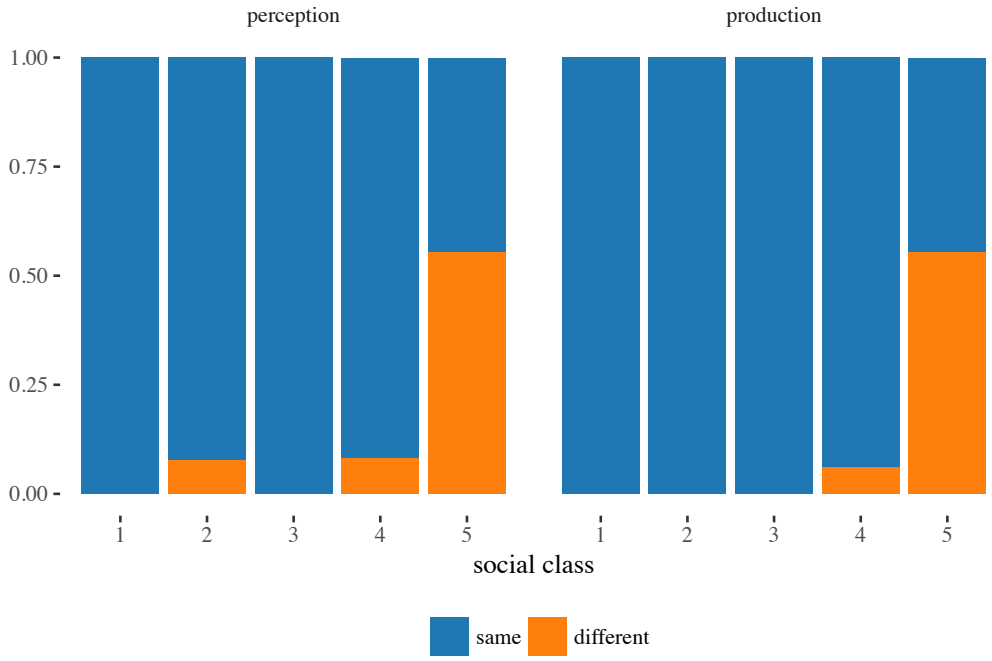

Figure 4: Minimal-pair tests: *book* and *buck*; proportion of speakers with and without a distinction (excluding long [u:] speakers).

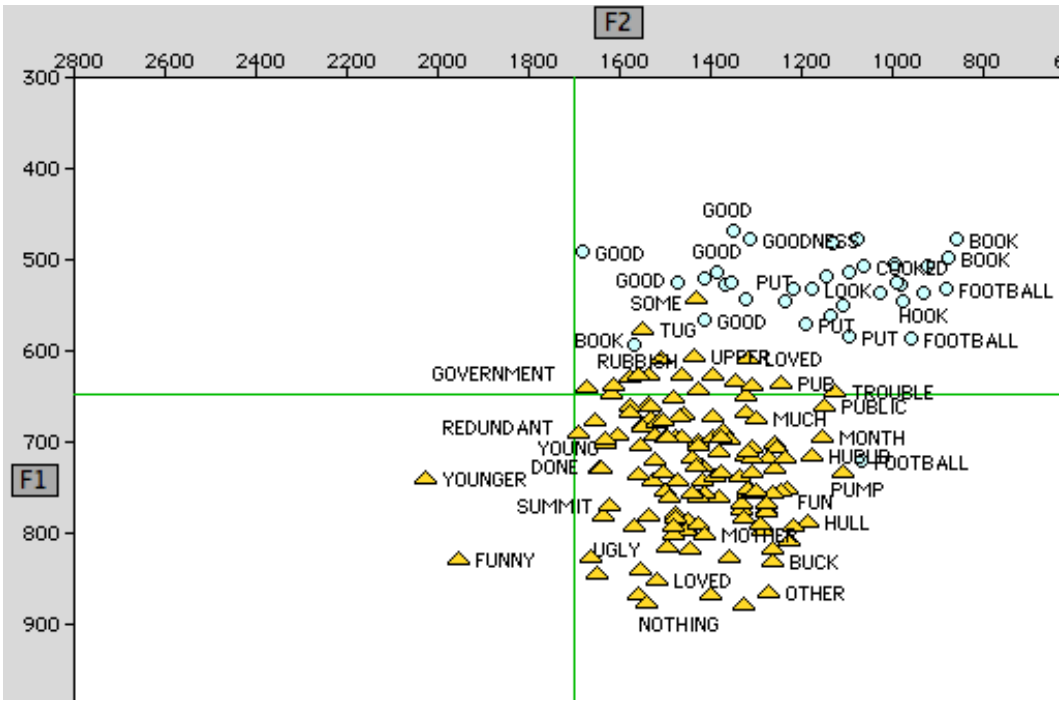

Figure 5: Matthew P., 66, Upper Middle Class.

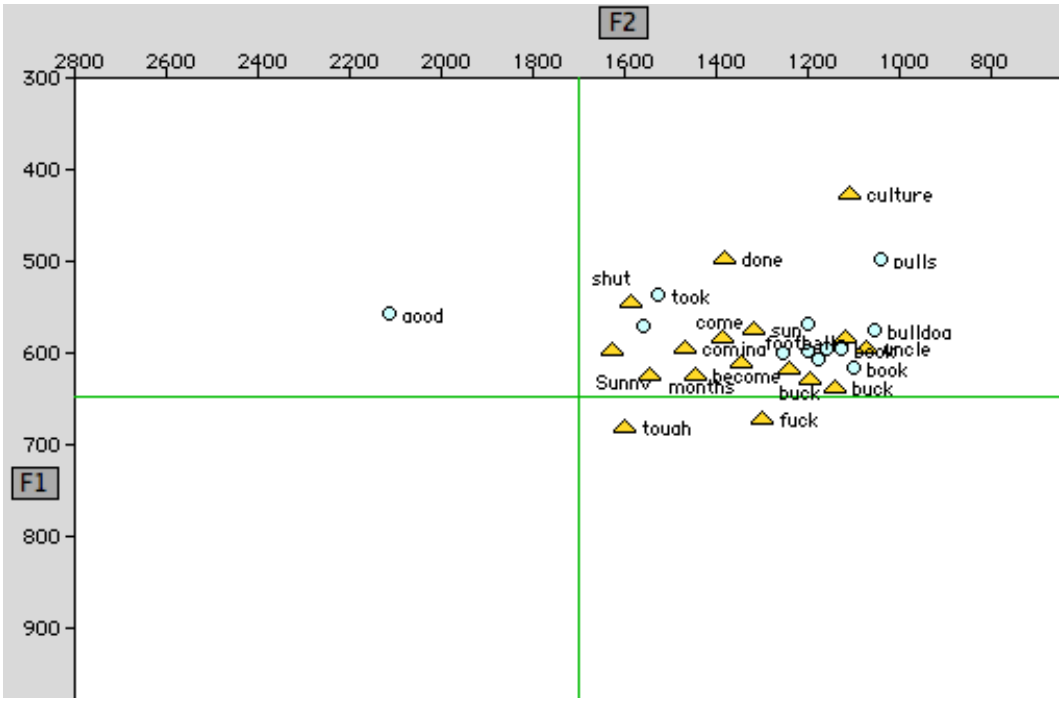

Figure 6: Paul, M. 22, Upper Middle Class.

Figure 7 juxtaposes three upper-middle class speakers with a distinction in minimal pair tests with Wilma L., another upper-middle class speaker, who has no minimal-pair distinction in either her perception or production. The vowel plots demonstrate that there is much less phonetic separation between the two vowel classes in the speech of Wilma L. in comparison with the three other speakers in Figure 5, which is not surprising given that those first three speakers have a phonemic distinction. However, the figure also shows that the two vowel classes do not overlap completely in phonetic space for Wilma L, that is, the mean F1 of FOOT words is significantly lower (i.e., the vowel being higher phonetically) than the mean F1 of STRUT words in her speech. Interestingly, this is the case for most speakers in the sample: the vowel in STRUT words tends to be produced lower in the mouth than the vowel in FOOT words (though there may be partial overlap in F1/F2 space), regardless of the minimal pair test results. In other words, while the phonetic difference present in the speech of speakers who report and produce a distinction in minimal pair tests is unsurprising, it is interesting, and indeed intriguing, that that even for speakers for whom there is no distinction in minimal pair tests (i.e., most speakers), there is a consistent phonetic difference between the two vowel classes.

The phonetic difference is seen not only in the highest-status groups, but throughout the socio-economic spectrum of the community, including the working classes, who show no distinction in minimal pair tests. Figure 8 presents the F1 means of the two vowel classes for all five socio-economic levels, excluding those speakers with a distinction in minimal pair tests, i.e., it only includes speakers who report and produce no distinction. It shows that even for those speakers, there is a small but consistent phonetics difference for all social classes in the community in the expected direction, i.e., with STRUT being lower than FOOT. Although the phonetic difference is relatively small for the lower social classes, the height difference is still significant in that social group, with STRUT being lower than FOOT by some 22 Hz. A similar result of a phonetic difference in the same direction between the two vowel classes has been found in Nottingham (Braber & Flynn 2015), another Northern dialect with a single phoneme historically.

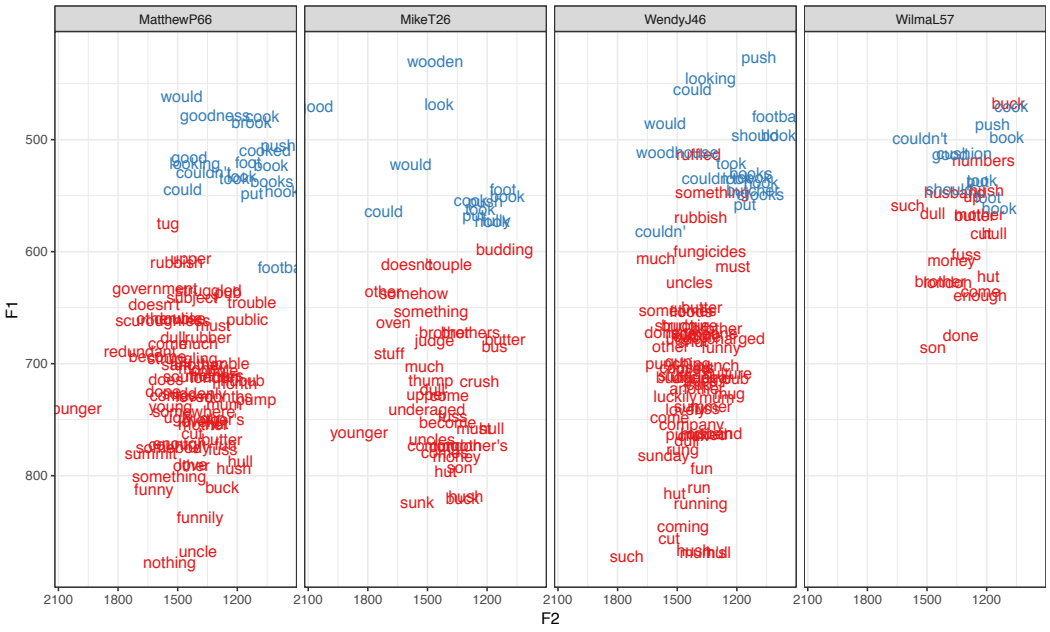

Figure 7: FOOT-STRUT vowels in F1/F2 space: Upper-middle-class speakers.

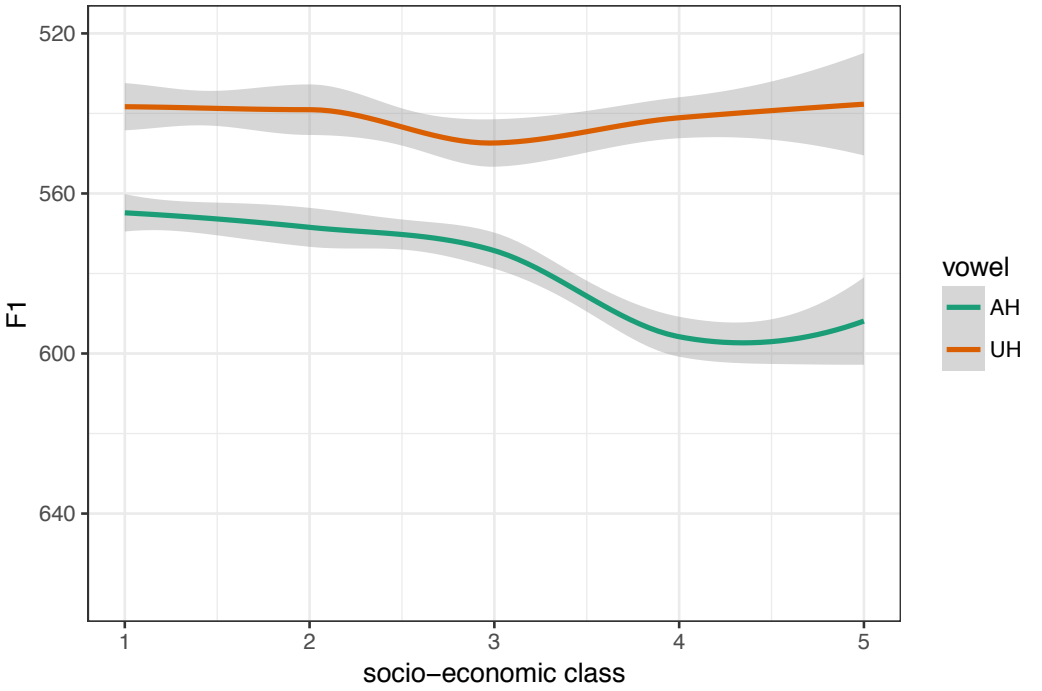

Figure 8: Height of both vowels across social classes (continuous) (split speakers removed); AH: STRUT, UH: FOOT.

One question that emerges immediately is whether the phonetic difference is evidence of a phonemic split (or perhaps a near-merger (Labov, Karen, and Miller 1991)) present in Manchester, contradicting the minimal pair test results (and indeed the established dialectological generalization about the North-South difference in England), or whether it is just evidence that the sounds surrounding the FOOT lexical set words vs. the STRUT lexical set words are having a phonetic effect on the vowel averages. We suggest that it is the latter, i.e. that the phonetic effect is driven by coarticulation with the surrounding consonants.

A mixed-effects analysis reveals that preceding and following sounds have significant effects on the height of the vowel in FOOT-STRUT words. For example, in terms of the manner of articulation, following nasals and liquids tend to promote a higher F1 (lower vowels). In terms of preceding sounds, voiceless labiodental and dental fricatives favor a higher F1 (lower vowel), whereas /w, p, b/ favor a lower F1 (higher vowel). A preliminary analysis of the frequency of surrounding consonants in FOOT-STRUT words in English, based on the SUBTLEX-UK corpus (van Heuven et al 2014pre), shows that FOOT-class words tend to have phonetic environments that favor a higher vowel, whereas STRUT-class words tend to have phonetic environments that favor a lower vowel. In other words, the preponderance of lowering environments in STRUT-class words and the preponderance of raising environments in FOOT-class words is what is causing the phonetic difference observed in the data in the same direction across the social spectrum of the community.

If that is the case, then the phonetic effects should be sufficient as an explanation of the phonetic difference. However, at the moment, vowel class (FOOT vs. STRUT) appears to remain a significant predictor of the height of the realization of the vowel. This may be because the phonetic effects on F1 are more complex than the predictors currently captured in our models. Ongoing work aims to address the issue of the optimal coding of these phonetic environments and their interactions with each other and with other linguistic and social factors.

4 Conclusions

Minimal pair tests suggest that, with the exception of a minority of middle class speakers, FOOT and STRUT represent one phoneme in Manchester. On the other hand, there is a consistent phonetic difference between the mean F1s of the two vowel classes even for those speakers who make no distinction in minimal pairs tests, i.e. most speakers. The difference is in the same direction as that found in most dialects of English, with STRUT being lower than FOOT, and it is found consistently across the socio-economic spectrum of the community. We suggest that this phonetic difference is driven by the phonetic environment in which the vowels occur, i.e. some complex combination of phonetic conditioning and articulatory factors, though further work is needed to determine the optimal modelling of this conditioning.

By exploring the current status and realization of the FOOT-STRUT vowels in Manchester, we may be able to use the present to explain the past: although the FOOT-STRUT split in the South of England was likely more complex than what these results suggests, they nevertheless allow us to see the phonetic grounding of the historical split.

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