

# Resistance to phonetic change in York, Northern England

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## 1 Introduction

This paper reports on a sound-change in progress in York, Northern England. The change in question involves the fronting of the tense back vowels /u/ and /o/, which is of particular interest due to its prevalence across varieties of English. This change has been documented in North America (Baranowski, 2008; Hall-Lew, 2009), Australia (Cox, 1999), New Zealand (Easton & Bauer, 2000) and in the United Kingdom (Kerswill & Williams, 2005), as well as in typologically-unrelated languages (e.g. Swedish, Proto-Southern Yiddish, Albanian, Akha (see Labov, 1994). Surveying previous work reveals a number of generalizations regarding the phonological patterning of these changes:

1. Back vowel fronting involves the generalization of synchronic fronting processes across phonetic environments.
2. /o/ fronting typically only occurs in dialects where there is evidence of /u/ fronting.
3. In varieties where both vowels are fronting, the nucleus of /u/ remains more advanced in F2 space than that of /o/.

The first of these generalizations refers to the fact that back vowels are fronted in post-alveolar contexts as a consequence of consonant-on-vowel coarticulation. Change in these vowels tends to involve productions in non-fronting contexts moving forward, while productions in conditioning environments remain relatively constant. This pattern, reported in e.g. Durian, (2014); Harrington et al., (2006) and Hall-Lew (2011), can be taken as evidence of a process of perceptual reanalysis, where learners' failure to compensate for coarticulation leads to their production targets shifting toward highly-frequent coarticulatory allophones (Ohala, 1993).

The second generalization was first noted in Labov, Ash and Boberg (2005). Surveying the relationship between /o/ and /u/ fronting In North America, they demonstrate that North American dialects of English can be divided into three groups – those that front /u/ alone, those that front both /u/ and /o/, and those that front neither. In no cases do they find a variety where /o/ fronts in the absence of /u/. In principle, such a pattern could arise simply due to historical accident – if /u/ fronting began first, followed independently by /o/ fronting, then it would still be possible to observe this apparent implication relationship between the two vowels. However, the third generalization listed above suggests otherwise – there appears to be a bias toward maintaining preserving the phonetic relationship between the two vowels, whereby the nucleus of /o/ never advances beyond that of /u/. This evidence has lead to the proposal that change in /o/ and /u/ is a parallel shift, either driven by pressures toward preserving symmetry in the vowel space (Martinet, 1952), or due to the vowels' shared membership in a phonological class (Fruehwald, 2013).

While these patterns are well-attested for North American dialects, and to some extent in RP (Harrington, 2007, 2008), there is some debate as to whether northern dialects of British English are exceptional with regard to these patterns. For example, it has been claimed that /o/ fronting occurs in the absence of /u/ fronting in Bradford, West Yorkshire (Watt & Tillotson, 2001). A potential reason for this might be related to dynamic properties of the back vowels in these dialects – the variable diphthongization of /o/ is widely cited as a key shibboleth of Northern/Southern regional identity in Britain. Since the interaction of fronting and diphthongization may produce a wide range of realizational possibilities for these vowels, it is reasonable to hypothesize that dynamic properties of /o/ and /u/ may play a role in the sociolinguistic distribution of this change, resulting in outcomes which contrast patterns identified in other varieties. In light of this, the present study presents evidence for ongoing back vowel fronting in the northern English city of York. In doing so, it seeks to answer the following questions:

1. To what extent does the fronting of /o/ and /u/ in this community reflect previous generalizations regarding back vowel fronting?
2. How do dynamic properties of /o/ and /u/ influence the sociolinguistic trajectory of these changes?

## 2 Data & Methods

### 2.1 Data

Data are taken from a corpus of production data collected from 52 individuals born between 1930 and 2000. Speakers were recruited using convenience sampling, as is typical in variationist sociolinguistic work. Table 1 provides the speakers' basic demographic information.

Birth year	Female	Male
1935-1960	7	5
1961-1980	8	11
1981-2000	10	11

**Table 1:** Characteristics of the speaker sample

The data include a) a 100-item wordlist, including 15 tokens of each vowel in a range of phonetic environments plus fillers; b) a map task (Anderson et al., 1991) using a selection of words from the word list and c) a sociolinguistic interview, including a range of questions relevant to the speakers' social background and identity with regard to York and the north of England.

### 2.2 Measurement

Vowels were segmented from the first to the last glottal pulse visible in the spectrogram, and measurements of F1, F2 and F3 were taken at 20 equidistant points along the vowel trajectory. The present analysis will focus on F2 trajectories, which provide a relatively reliable reflection of the degree of fronting. Measurements were normalized using the modified Watt & Fabricius normalization method (Watt & Fabricius, 2002), using the mean midpoint values of /a/ and /ɪ/, measured from

4 tokens per vowel per speaker, as reference points. The formant values provided in the present analyses are of the form  $F^n/S(F^n)$ , i.e. the ratio of the measured frequency in Hz to the centroid frequency of that formant for the speaker being analyzed.

### 2.3 Statistical analysis

Typical sociophonetic studies have relied on the analysis of single points of the vowel trajectory (either at a fixed percentage of the token, or based on the analyst's identification of a 'steady-state' target), or summary measures of trajectory length (e.g. ). The limitation of these approaches is that they may miss crucial aspects of fine-grained temporal variation in vowel realizations. In order to avoid these pitfalls, the results presented in the following sections use the statistical technique of *Generalized Additive Modeling*, which allow vowel tokens to be summarized as smooth functions of time. Winter & Wieling (2016) give a concise summary of the application of such models to time-varying linguistic data. Their key relevance of such models to the present study is that they allow the analyst to capture potentially non-linear changes in the dynamic properties of vowels, without enforcing any a priori assumptions about the shape of vowel trajectory and trajectory of change. The models presented in this paper predict normalized F2 as a function of time, plus the variables listed below:

Variable	Form
Phonetic environment	/o/: ow owN Tow Jow /u/: Juw Tuw Kuw uwL
Log duration	Continuous
Speaker year of birth	Continuous (1935-2000)
Speaker gender	M/F
Speaker level of education	1=Secondary only 2=Higher education 3=Postgraduate/ professional training

**Table 2:** Variables tested

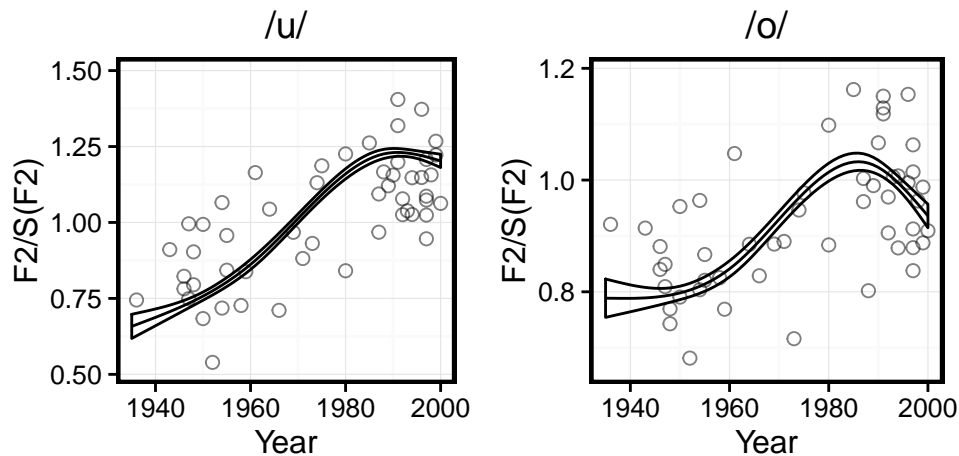
The baseline models included constant terms for linguistic factors and their smooth interactions with time. Random smooths were included for each speaker, allowing the model to account for individual variation in vowel production. The influence of non-linguistic factors was tested by performing a Chi-square test on models including those factors and ones with only linguistic factors. The results of the analysis are presented below:

[Table 3: model selection]

### 3 Evidence of /o/ and /u/ fronting in York

Figure 1 visualizes the main effect of speaker year of birth on the second formant of /o/ and /u/. At this stage, the analysis will focus on estimates taken at the vowel midpoint (50%) – see section 6 for a detailed discussion of the role of dynamic variation. The results demonstrate that the F2 midpoint of both vowels is reliably higher

with increasing speaker year of birth, providing apparent-time evidence that both vowels have undergone fronting over the past 60 years. Change in /u/ appears to have proceeded in a slightly more regular fashion than change in /o/, evidenced in the slightly tighter clustering of speaker means around the model predictions in Figure 1 – a model including linguistic factors and speaker year of birth explains 57% of the variation in /u/ F2, but only 23% of variation in /o/. The smooth functions estimated by the GAM analysis are roughly s-shaped, consistent with established findings on the temporal dynamics of linguistic change (e.g. Labov, xxxx). Having presented evidence of /u/ and /o/ fronting in this variety, the following section will explore the extent to which this change conforms to previous generalizations regarding back vowel fronting.



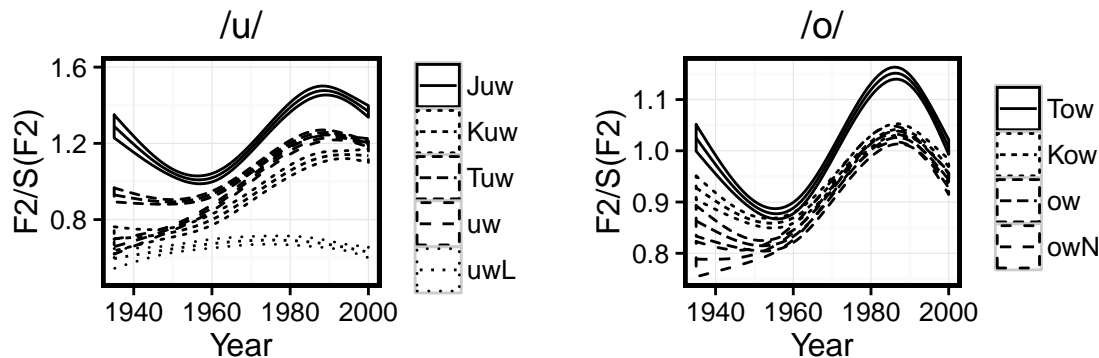
**Figure 1:** Evidence of /o/ and /u/ fronting

#### 4 The coarticulatory basis of /u/ and /o/ fronting

Figure x demonstrates the role of coarticulation in conditioning back vowel fronting in this variety. In both cases, a pattern of co-articulatory variation is present at the onset of the change, which reduces as the change progresses. This pattern is most noticeable in the case of /u/ (left panel). For the oldest speakers in the sample, /u/ is produced with a phonetically fronted variant following a palatal or coronal consonant (e.g. in *june* and *two*), and with a back variant in all other contexts. The change takes place primarily in the non-phonetically fronting contexts, meaning that the youngest speakers in the sample produce forms such as *food* and *noon* with the fronted variant which was previously restricted to postcoronal and post-palatal environments. A similar, but less striking pattern is evident in /o/: the difference between phonetically conditioning and non-conditioning environments is much smaller among the youngest speakers in the sample, suggesting that change in this vowel involves the effect of coarticulation decreasing over time. The data for /u/ also provide evidence of the early phonologization of back pre-/l/ environments (c.f. Fruehwald, 2013), which are reliably distinct from the other environments at the earliest stages in the change, and show no evidence of fronting.

Taken together, these results demonstrate that back vowel fronting in York ad-

heres to the first generalization discussed in the introduction of this paper. As has been reported in other varieties of English, the coarticulatory fronting of /u/ and /o/ appears to provide a source for diachronic change, evidence in the weakening of the coarticulatory effects on these vowels as these changes progress.



**Figure 2:** Changes in the phonetic conditioning of /o/ and /u/ fronting.

## 5 /o/ and /u/ fronting as a parallel shift

### 5.1 Temporal relationship

### 5.2 Within-speaker relationship

## 6 The role of vowel dynamics

## 7 Evaluating a sociolinguistic explanation

### 7.1 References

Please use LSA style: name (year or (Name year). Formulations with author names like "... as Ladefoged (2003) showed that ..." are acceptable, but not "as shown in [Ladefoged, 2003]" or "as shown in (Ladefoged [6])". See Section 4 for more on references.

## 8 Format of references

Monographs such as Fant (1960) consist of author(s) last name(s), initial of the first name(s), year of publication, title in italics, location of the publication, and publisher. The names of multiple authors are separated by commas listed in the sequence last name, comma, initial(s) of the first name(s) (cf. the examples Beattie *et al.* 1982, Peterson & Barney 1952).

Contributions to volumes, e.g. Stevens (1999), follow the convention that the title of the volume is in italics, but not the title of the contribution. Book editors should appear after the book title, followed by page numbers, place of publication, and publisher.

Journal articles should be handled in the same way as contributions to volumes, except that the title of the journal is in italics and the editors are not listed. Longer names of well-known journals can be abbreviated (e.g. Peterson & Barney 1952).

Articles in conference proceedings such as Ladefoged (2003) are referenced in the same way as journal articles. The word *proceedings* can be abbreviated and the

location should be mentioned after the name of the conference. Here, abbreviations of well-known conferences are possible.

## References

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