A typology of laterals in twelve English dialects

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Abstract: Allophonic patterns of variation in English laterals have been well studied in phonetics and phonology for decades, but establishing broad generalizations across varieties has proven challenging. In this study, we advance a typology of onset/coda lateral distinctions in English, using crowdsourced recordings from 95 speakers across twelve dialects of Anglo (UK) English. Results confirm the existence of dialects with and without onset/coda distinctions, and conditional inference trees are used to identity three main patterns in the data: (1) clear onsets and dark codas; (2) intermediate/dark onsets and dark codas, but with a positional distinction intact; (3) dark onsets and dark codas, with minimal or no distinctions between positions.

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1. Introduction

The majority of research on lateral consonants frames their production in terms of two broad variants: a more /i/-like 'clear' variant, and a more /u/-like 'dark' variant (Recasens, 2012). Clearer variants tend to show a raised and fronted tongue body, with a more simultaneous tip/dorsum articulation, and a lower F1 and higher F2 frequency. Darker variants tend to show a lowered and retracted tongue dorsum, with tongue dorsum retraction occurring prior to tip raising, and a higher F1 and lower F2 frequency (Ladefoged and Maddieson, 1996). There are two major factors in whether a lateral is produced as clear or dark. First, language and dialects substantially differ in the realisation of laterals, with some languages or dialects generally producing clearer /l/s (e.g. German, French) and others darker /l/s (e.g. Russian) (Recasens, 2012). Second, syllable position has a strong effect on laterals, with clearer realisations being more common in syllable onsets and darker realisations more common in syllable codas (Gick *et al.*, 2006; Sproat and Fujimura, 1993). These two factors inevitably interact. For instance, the tendency for syllable-initial and syllable-final laterals to differ from each other has been posited as a potential cross-linguistic universal (Gick *et al.*, 2006), so even in varieties with generally clearer or darker laterals, there is likely to be some degree of contrast between initial and final /l/.

The specific nature of initial∼final contrast is to some degree language- or dialect-specific, with some varieties showing phonetic effects of onsets versus codas, while others show an initial∼final contrast that is too big to be explained by phonetic effects alone. Recasens (2012) terms the former phonetic effects 'intrinsic' and the more distinct allophones 'extrinsic'. Many dialects of English display robust 'extrinsic' positional allophony, with notably clearer realisations syllable-initially and darker realisations syllable-finally. However, there are also dialects with dark /l/ in all contexts (Kirkham, 2017; Turton, 2017), clear /l/ in all contexts (Carter and Local, 2007), hyper-clear initial /l/s (Kirkham, 2017), and a variety of intermediate patterns (Kirkham *et al.*, 2019; Turton, 2017). While we can establish some broad generalizations across studies, there is a need for a comparative study of laterals in English dialects that utilise a comparable data collection method and set of materials. This will allow us to better establish the typology of initial∼final contrast in the English lateral system.

In this study, we address the above problem by examining initial∼final allophony in twelve dialects of Anglo English. Our twelve dialects represent a spread of geographical locations across England, including 6 Northern varieties (Leeds, Liverpool, Manchester, Newcastle, Sheffield, York), 4 Southern varieties (Bristol, London, Norwich, Peterborough) and 2 Midlands varieties (Birmingham, Nottingham). Northern varieties typically lack the clear/dark allophony found in the south of England (Wells, 1982, 370). For example, Leeds, Sheffield and Manchester are both reported to produce very dark /l/s in onsets and codas (Carter and Local, 2007; Kirkham, 2017), but recent evidence from Manchester suggests that working-class speakers may produce darker /l/s than middle-class speakers (Turton, 2014). Liverpool is reported to have a more intermediate realisation of onset /l/ (Kirkham *et al.*, 2019) but with positional differences intact (Turton, 2017). Newcastle differs from other northern varieties as it is widely recognised to show clear initial and final /l/s (Carter and

Local, 2007). The prototypical Standard Southern British English pattern is clear initial /l/ and dark final /l/ (Wells, 1982). Norwich is described as historically having clear /l/ in all positions, but is more recently described as following the typical SSBE pattern of clear initial and dark final /l/ (Trudgill, 1999). Midlands varieties are less well described, but show a tendency towards intermediate or dark /l/ in most positions and coda /l/ vocalisation (Hughes *et al.*, 2012).

2. Methods

Our data comes from the English Dialects App corpus (Leemann *et al.*, 2018), which contains data from crowdsourced smartphone recordings by speakers from across the United Kingdom. Participants were instructed to record themselves in a quiet place, to hold their device approximately 15 cm from their mouth, and to speak in the way they would talk to friends from home. All recordings were then saved as 44.1 kHz WAV files with 16-bit quantization.

The sub-sample of the corpus used for this study focuses on 95 Anglo English speakers from 6 Northern varieties (Leeds, Liverpool, Manchester, Newcastle, Sheffield, York), 4 Southern varieties (Bristol, London, Norwich, Peterborough) and 2 Midlands varieties (Birmingham, Nottingham). The dialects were chosen on the basis of having high-quality and comparable data for 6–10 speakers per region. We defined this as follows: good quality audio recordings with no obvious noise or distortion; within the age range of 18–30; born in the UK; no detectable non-native accent features; sounds like a plausible native speaker from the self-reported dialect region (i.e. there was not any obvious misreporting of the speaker's dialect). We do not focus on speaker gender in the present analysis, but there was an average of 3.83 female and 4 male speakers per dialect. The majority (74.5%) of our speakers were university-educated, making them more likely to constitute a middle-class sample.

All speakers recorded themselves reading the passage 'The boy who cried wolf', resulting in roughly one minute of speech per speaker. The passage was automatically segmented using a custom HTK-based forced aligner (Strycharczuk *et al.*, 2019). Segmentation was checked and manually adjusted by paid student research assistants using Praat (Boersma and Weenink, 2020), with segmentation based on a steady state of F2 in the lateral, thereby excluding formant transitions into and out of the surrounding vowels. 20 tokens were excluded from the data due to formant estimation uncertainty that remained after manual correction. In total, we report data on 1120 tokens of onset/coda laterals, with a range of 72–122 tokens per dialect and 35–62 tokens per dialect*position combination. F1 and F2 were extracted from a 25 ms Gaussian window centred on the temporal midpoint of the labelled lateral interval. Formant estimation was conducted using Praat's LPC Burg method, set to find 5 formants up to a ceiling of 5500 Hz. While laterals are highly dynamic segments, previous research also shows that midpoint measures of the lateral steady-state are a reasonable approximation of lateral quality and can show positional and group differences comparable with those seen in dynamic measures (Carter and Local, 2007; Kirkham *et al.*, 2019).

Our analysis focuses on two measures. The first is Euclidean distance of median z-scored F1 and F2 values between initial and final /l/, which we calculated separately for each speaker. This gives us a single value representing difference in four-dimensional space between initial and final /l/ in joint F1∼F2 space. The second measure is F2–F1 in Hertz for each token, which we use as a proxy for absolute clearness/darkness in /l/, while also permitting some degree of between-speaker normalization (Kirkham, 2017; Sproat and Fujimura, 1993). Our statistical modelling uses conditional inference trees in order to (1) examine the effects of dialect on initial∼final contrast using the Euclidean distance measure; and (2) examine the effects of position and dialect on absolute clearness/darkness of /l/ using the F2–F1 measure. Conditional inference trees are a classification and regression technique, which test whether each variable has a significant association with the outcome variable (Breiman, 2001). It finds the predictor that is most strongly associated with the outcome variable and performs a binary split on this variable, after which it then tests the effect of the next most significant predictor within each category of this binary split, until all significant levels are exhausted. Our analyses were carried out using R (R Core Team, 2018), using the party package (Borkovec and Madin, 2019) for conditional inference trees, and ggplot2 (Wickham, 2016) and ggparty (Hothorn *et al.*, 2006) for visualizations. All analysis code and further documentation of the data sample is available online at: `https://osf.io/mvjw3/`.

3. Results

Figure 1 shows the initial∼final distance in F1∼F2 space for each dialect. Leeds and Sheffield occupy the lower end of the scale, showing a much smaller initial∼final contrast than other dialects. In contrast, Peterborough, Norwich and Newcastle show the biggest difference between initial and final /l/. So far, these patterns are largely as predicted, but there are some unexpected findings. Manchester is typically considered to have dark /l/s in all contexts, but its initial∼final contrast lies in the middle of the overall range between dialects. Bristol is also generally considered to show a more southern pattern, with clear onsets and vocalised codas, but the data here show a smaller initial∼final contrast for this dialect.

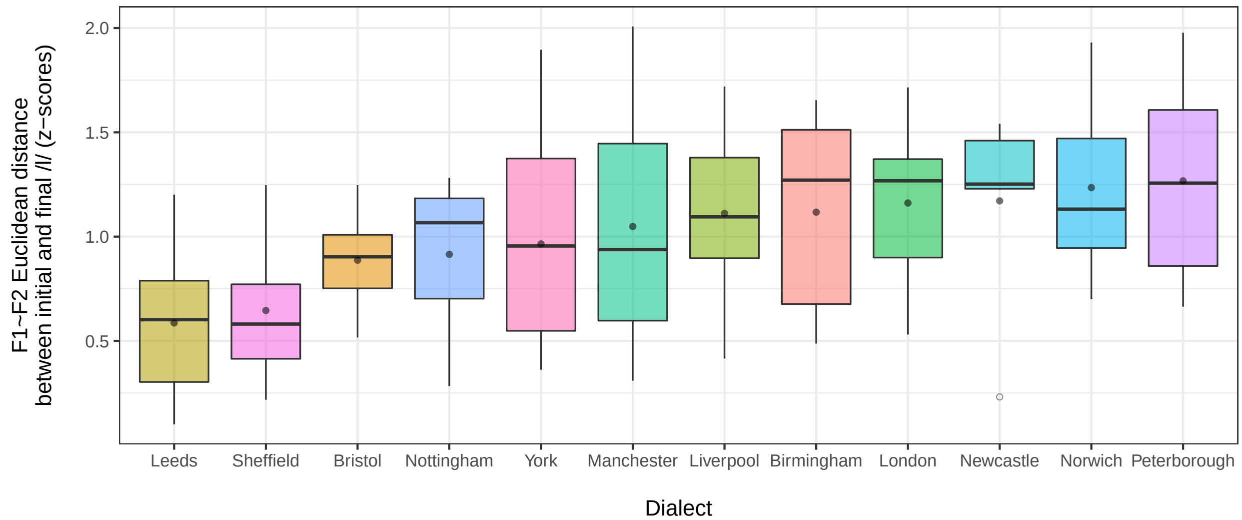

Fig. 1. Boxplot of Euclidean distance between *z*-scored F1∼F2 in initial /l/ and *z*-scored F1∼F2 in final /l/ for each dialect. Dialects are ordered by mean value from left to right, with the mean values indicated by the filled dots. The whiskers represent the maximum value for each dialect up to 1.5*interquartile range. (colour online).

In order to observe more holistic geographical patterns, we also plot the data on a map in Figure 2. Each circle represents one speaker, with the data scaled between 0 (smaller initial∼final distance) and 1 (larger initial∼final distance). The map shows that northern dialects generally have a smaller initial∼final contrast, with Sheffield and Leeds showing consistently small initial∼final differences across speakers, while Liverpool, Manchester and York show greater between-speaker variability. While it may be tempting to correlate initial∼final distance with northerness, this is highly problematised by Newcastle, which is the most northern city in our data yet has a large initial∼final distance.

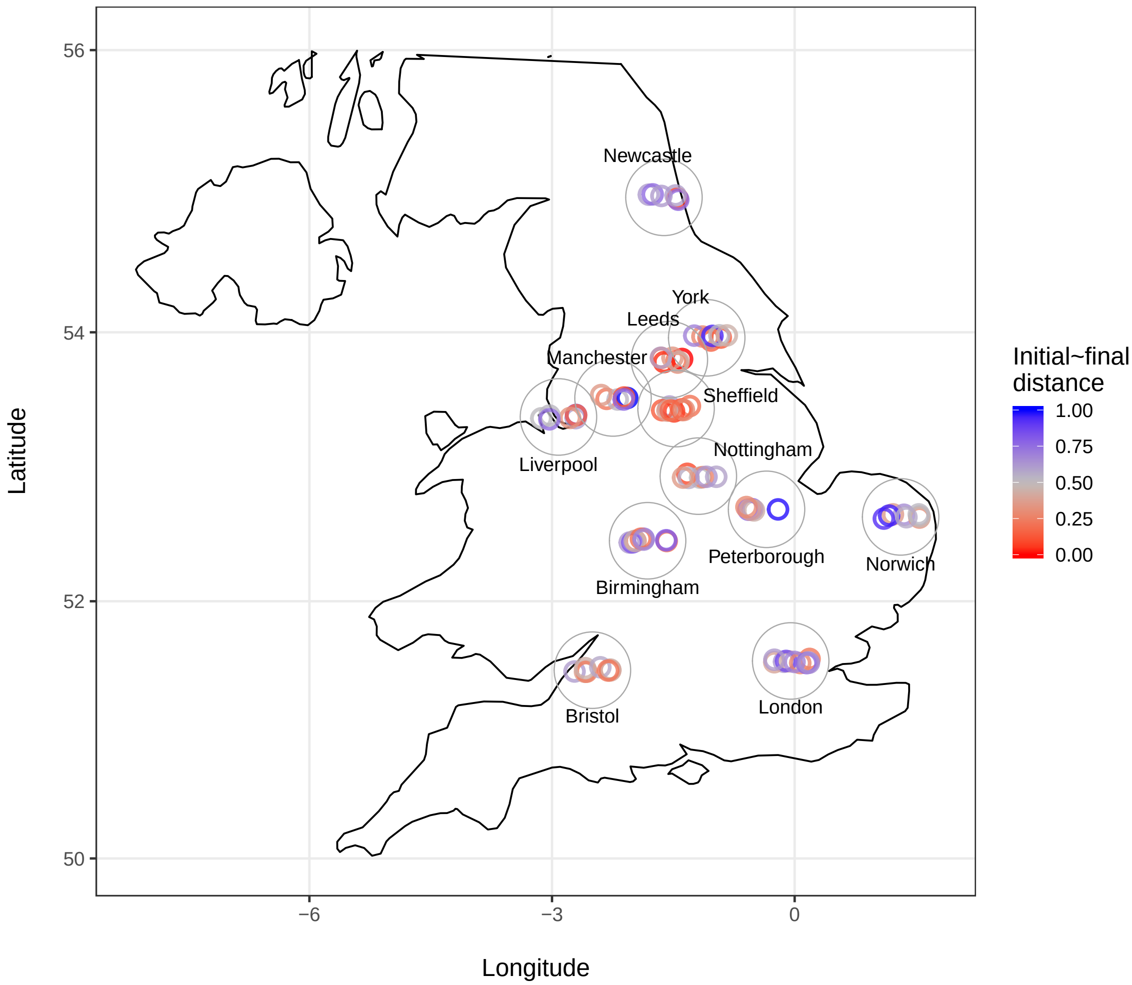

Fig. 2. A map of the lower half of the UK, showing Euclidean distance between z-scored F1∼F2 in initial /l/ and z-scored F1/F2 in final /l/ for each dialect. Each circle represents one speaker, with the data scaled between 0 and 1. (colour online).

The conditional inference tree in panel (A) of Figure 3 models the effects of dialect on initial∼final distance in F1∼F2 space. Dialect is a significant predictor of initial∼final distance (p = .043), with the binary split in the data confirming that Leeds and Sheffield are distinct from all other dialects in producing a smaller difference between initial and final /l/. All other dialects cluster together. However, this only tells us about the size of the difference between initial and final /l/, but not necessarily about the relative clearness and darkness of /l/ in each dialect, which we investigate next.

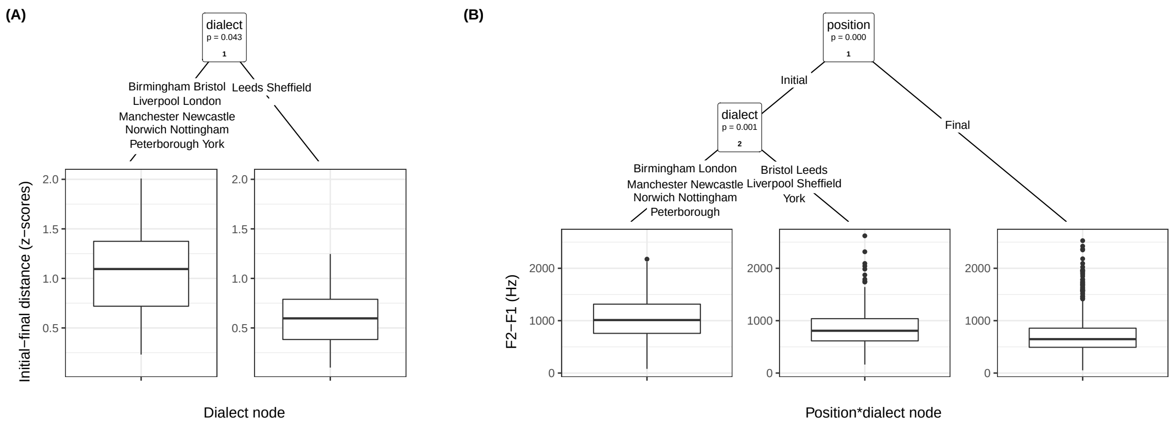

Fig. 3. Conditional inference tree of the effect of (A) dialect on initial∼final distance in z-scored F1∼F2 space; (B) position and dialect on F2–F1 (Hz).

The conditional inference tree in panel (B) of Figure 3 examines the raw F2–F1 data in order to examine any differences in absolute clearness, particularly for onset /l/. We examine the unnormalised data because z-scoring would eliminate any differences in absolute clearness, as it expresses each token relative to each speaker's mean value. The plot shows that the most important binary split corresponds to a contrast between initial and final /l/ ($p < .0001$). This suggests that position is the strongest predictor in the data, with initial /l/ showing higher F2–F1 than final /l/. However, within initial tokens there is a further split between dialects (p = .001), with Bristol, Leeds, Liverpool, Sheffield and York all producing lower F2–F1 values in initial /l/ than Birmingham, London, Manchester, Newcastle, Norwich, Nottingham and Peterborough. This suggests that the former set of dialects produce a darker initial /l/ and the latter set of dialects produce a clearer initial /l/.

4. Conclusion

Our initial∼final distance results show that Leeds and Sheffield produce a very small initial∼final distinction in comparison to the other ten dialects. However, our analysis of the F2–F1 Hz data shows that within the group of dialects that do show positional contrast, there is a further distinction between dialects that are more likely to produce darker initial /l/s (Bristol, Liverpool and York, in addition to Leeds and Sheffield) versus those that are more likely to produce clearer initial /l/s (Birmingham, London, Manchester, Newcastle, Norwich, Nottingham, Peterborough).

These patterns broadly confirm previous community-scale studies of specific varieties. The majority of northern cities show darker /l/s, with the exception of Newcastle, which shows clearer /l/s as predicted. However, there are some surprising exceptions to this, such as Manchester not being in the darker /l/ group. Turton (2014) finds that middle-class speakers in Manchester have clearer /l/s than working-class speakers, so our results are likely to reflect a more middle-class pattern for this dialect. At the same time, the fact that areas such as Sheffield and Leeds do remain firmly in the dark camp despite also containing speech from upwardly-mobile young people reflects one of two possible situations. The first is that /l/ variation is socially-stratified in Manchester but not in Leeds and Sheffield. The second is that Manchester is more susceptible to a potential change in progress towards clear initial /l/s in the middle classes due to changing demographic patterns. Such questions can be addressed with further sociolinguistic studies.

Another city that does not pattern as expected is Bristol. As a southern variety, we expected similarities with other southern varieties in terms of initial /l/ realisation and initial∼final contrast. One factor that could explain this is liquid polarity, whereby varieties with clearer laterals with show darker (i.e. more pharyngealized) rhotics, and vice versa (Carter and Local, 2007). Bristol is a rhotic dialect, so it is possible Bristol's clear rhotics may be matched by dark laterals across the board, thus explaining the patterns we see here. Although it is unlikely that the upwardly-mobile speakers in our sample are strongly rhotic, this may reflect a synchronic residue of a diachronic situation. It is cases like these where more detailed community studies of particular dialects will help to resolve these complex dynamics.

In his cross-linguistic typology, Recasens (2012) argues for a subdivision of clear versus dark /l/ varieties, as well as a distinction between intrinsic phonetic and extrinsic allophonic differences. Our English data largely supports this. Our analysis shows that for initial /l/ there is a distinction between clear, dark and intermediate dialects. In addition to this, there is a notable difference between intermediate/dark dialects in terms of whether or not they show substantial positional contrast between initial and final /l/. In summary, we find three distinct patterns across the twelve dialects, which leads us to propose the following typology for Anglo English laterals: (1) clear onsets and dark codas; (2) intermediate/dark onsets and dark codas, but with a positional distinction intact; (3) dark onsets and dark codas, with minimal or no distinctions between positions. Future research should seek to further investigate this typology in terms of the temporal dynamics of laterals and lateral-vowel coarticulation (Kirkham *et al.*, 2019; Recasens, 2012) and articulatory studies of initial∼final lateral gestures (Sproat and Fujimura, 1993; Turton, 2017). In addition, our findings have illuminated potential avenues for researchers in language variation and change and phonology to investigate further.

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