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London calling (or cooling?): Feature theory, phonetic variation, and phonological change

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Abstract

This article looks at the ongoing merger of /uː/ or /ɔː/ before tautosyllabic /l/, that is, words like *call(ing)* and *cool(ing)* in London English, the reasons for this merger and how it can be captured formally. It argues that the merger is the end point of a chain of phonological consequences of a phonetic process, the gradient fronting of /uː/, which leads to a reorganisation of the vowel system. The merger can thus only be understood by looking at the properties of London (Cockney) phonology and ongoing changes in this system. On the theoretical level, this article argues that underspecification in feature theory is crucial to understand the interaction between phonetic variation and phonological change, arguing that the vowel shifts in London English start out as phonetic changes along dimensions that are featurally underspecified. Underspecification thus provides a crucial link between phonological categories and phonetic gradience.

Keywords: phonology; distinctive features; vowel shift; London English; underspecification.

1. Introduction

The vowel system of Southern England is undergoing a number of changes (see e.g. Hawkins & Midgeley 2005, Harrington et al. 2000), many of which can be described as gradient and phonetic. This article will look at the *phonological* knock-on effects these changes can have, and how they can be captured formally, in terms of distinctive features. The effect we are looking at is illustrated in the title of this article: Words like *cool* and *call* (that is, words containing /uː/ or /ɔː/ before tautosyllabic /l/) appear to be homophonous in present-day London English, with this homophony increasingly extending to

morphologically derived forms such as *cooling* and *calling*. This article therefore also aims at making an empirical contribution in establishing whether *cool* and *call* are indeed homophones, and whether this neutralisation of contrast is indeed extended to derived forms like *cooling* and *calling*. We will argue that this is the case, which means that we also need to explain why this is happening. The main aim of this article is therefore to describe and to explain this ongoing change both descriptively and formally, on the basis of a small empirical study, which is a continuation of a study first discussed in Slight (2010), Uffmann & Slight (2010).

The remainder of this paper is organised as follows: Section 2 introduces the theoretical question: What is the relationship between categorical phonological features and gradient phonetic surface realisations, and why is this relationship problematic? I will propose a theory of features that addresses these problems in Section 3, which outlines the main theoretical contribution of this article, and briefly demonstrate how it works on an abstract example (a common type of vowel shift christened the Pattern 3 shift in Labov 1994), which will then be made more concrete by looking at a real-life variant of this shift, found in present-day Southern England (Section 4). Section 5 will introduce the study from which the data were gleaned, and the data are discussed in Section 6. We will see how a gradient phonetic process (the fronting of /uː/) gives rise to another gradient process (the conditioned backing of /uː/ before /l/), which phonologises, creating the neutralisation of *cool* and *call*, extends to morphologically derived forms, and ultimately creates a new phonological segment (a phoneme split), resulting in the reorganisation of the London English vowel system. These findings will be formalised and their implications will be discussed in Section 7. Open questions and ideas for further research will be discussed briefly in Section 8, which also concludes.

2. The phonetic correlates of phonological features

Ever since the *Sound Pattern of English* (SPE; Chomsky & Halle 1968) distinctive features have been understood to have two main functions: a phonological or classificatory function, identifying and grouping segments that form phonologically active classes (by being triggers or undergoers of some process) and a phonetic function, describing the articulatory make-up of a segment. Thus, a feature like [+voice] denotes sounds that are produced with vocal fold vibration (voicing), but also makes a class of segments denoted by this

feature available for phonological processes like voicing assimilation or final devoicing and can thus be used in the formulation of phonological rules or constraints.

While the question of how well these two functions align is as relevant as it is open (for discussion, see e.g. Anderson 1981, Mielke 2008), it is beyond the scope of this paper. We will for now assume that phonological features do have phonetic correlates, but this brings up a second question: How direct – and deterministic – is the link between features and phonetics? The answer from SPE is clear: Features are universal, and they map onto phonetics equally universally, a view defended in detail by Hale & Reiss (2008). Features have clearly defined articulatory targets, presumably invariable across varieties and languages, which also implies that the feature specifications of a segment can be read off the phonetic surface.

This view is at odds, however, with the finding that small-scale phonetic variation is pervasive, while the number of features is not only finite, but in fact quite small. Seemingly categorical processes may not be, as in cases of incomplete neutralisation (see e.g. Röttger et al. 2014 on incomplete final devoicing). Articulatory gestures, captured by binary features, may not show binary behaviour, but be gradient, as in Boyce et al.'s (1991) study of reduced and non-contrastive articulatory gestures. There is a wealth of sociophonetic variation (for an overview, see e.g. Labov 1994, 2001; Foulkes & Docherty 2006; or the contributions in Celata & Calamai 2014), where fine-grained phonetic differences index differences in social class, gender, or age (see, for example, the discussion in Foulkes & Docherty (2006) how the voicing contrast in Newcastle English stops is expressed in phonetically diverse ways, with different variants carrying different social meanings).

In addition, research has shown that non-phonological factors can influence the phonetic realisation of words or segments, e.g. lexical frequency effects (e.g. Gahl 2008; Lohmann 2018), morphological constituency (e.g. Plag et al. 2017), or other lexical item-specific phonetic 'quirks' (e.g. Pierrehumbert 2002; Drager 2011). In sum, there is a growing body of research that throws doubt on the idea that the phonology of a language fully determines the phonetic surface realisation of words and segments.

If we want to maintain a direct, transparent link between phonological representations and the phonetic surface, we thus either need to proliferate the number of features, as proposed by Hale & Reiss (2008), or to enhance phonological representations in some other way with phonetic detail, as proposed, for example in Flemming (1997) or Kirchner (1997). Such a move is at odds,

though, with a third function of features (beside the phonological and phonetic functions), namely the contrastive function: Features distinguish the contrastive phonological units of a language (and if we want to maintain a theory of universal features, we can extend this statement to the extent that features should encode all the contrasts found in the world's languages, and only those). This idea is behind theories of underspecification in phonology (for overviews, see Archangeli 1988; Dresher 2009), in which segments are specified only on those featural dimensions on which they contrast with other segments. Once we allow phonetic detail into phonological representations, we stop drawing a principled distinction between contrastive (phonemic) categories and non-contrastive (phonetic) implementation. This paper will defend the contrastive view of features, argue for underspecified representations, and make a proposal how this view is compatible with the richness of phonetic variation.

This conflict can be resolved once we accept that the idea of a transparent link between phonological representations (features) and phonetics is misguided but that phonetics does not deterministically and mechanistically interpret phonology. The idea of an autonomous phonetics is vigorously argued for in Kingston & Diehl (1994), who show that the phonetic interpretation of a phonological feature (they focus on the feature [voice]) can vary considerably, using a speaker's phonetic knowledge, to enhance contrast while minimising articulatory effort. The direct link between phonetics and phonology is also long disputed. Raphael (1972) and Kingston & Diehl (1994) demonstrate that single features can have multiple cues (they discuss [voice]), while Ladefoged (1980) shows convincingly that the phonological categories expressed by distinctive features do not map straightforwardly onto articulatory or acoustic phonetic parameters. Ladefoged's conclusion is not, however, that the feature sets proposed by phonologists are wrong. To the contrary, he encourages phonologists to give up trying to 'ground' their observations in phonetics but to embrace more abstract representations instead, focussing on the phonological properties of segments, which are then interpreted by a more complex (and autonomous) phonetics. This is the view that this paper will take and for which it will furnish evidence, by looking at a case of phonetic variation and change in Southern England (namely /u/-fronting) and the phonological ramifications of this process (phonological mergers and splits). Before discussing the data and my theoretical assumptions it is expedient to complement the hitherto very abstract discussion of features and their phonetic interpretation with a concrete example that will then segue into the discussion of Southern English.

2.1. Distinctive features and vowel shifts

A process that is diachronically fairly frequent and found historically in a number of languages is the centralisation or fronting of the high back vowel [u] to [ʉ ~ y] (see e.g. Labov 1994), a process that is also at heart of the subsequent discussion of Southern English. This process is gradient, and it illustrates the conflict discussed above between phonetic variation and phonological features quite well. A small number of vowel features carves up the phonetic space: [±high] and [±low] for vowel height, [±back] (and perhaps [±front]) for vowel backness, [±round] for lip rounding (plus [±ATR] as an ancillary feature). These features provide very coarse divisions of the vowel space – 3 degrees of height, 2 or 3 degrees of backness – contrasting with finer-grained phonetic variation.

So what happens phonologically when /u/ is fronted? In orthodox theory we would classify this vowel as [+high, +back, +round]. Does it lose its [+back] specification under fronting, and if so, at what point on the fronting continuum? More generally, which realisations of the vowel, when fronting and displaying variability, should we treat as phonologically equivalent or identical, and which ones as distinct? Does /u/ ever change its specifications on its journey to the front half of the vowel space? And if we treat a number of distinct realisations as phonologically the same, what does this mean for the phonetics-phonology interface and the idea that features have consistent phonetic interpretations?

Complicating the picture further, assume the language also has /o/, which does not front. This vowel, too, is [+back], but could we interpret the same feature specification [+back] as proper tongue backing (and a low F2) in one vowel /o/ but minimal or no backing in another vowel /u/? /o/ can also exacerbate the problem in another way: Both /u/ and /o/ are frequently involved in a chain shift, called the Pattern 3 chain shift by Labov (1994): As /u/ fronts, /o/ raises and eventually takes up the position vacated by /u/, schematically depicted in Figure 1 (historically, we find this shift, for example, in French and Swedish).

Now if /o/ takes up /u/'s original position, this means that /o/ should now have the feature specifications that originally defined /u/, namely [+high, +back, +round]. But then /u/ can no longer be phonologically [+back], as this would create two identically specified vowels, in other words, a merger. The phonological specification of /u/ must therefore have changed on its way to the front, to allow for the raising of /o/. How does this happen? At a more basic

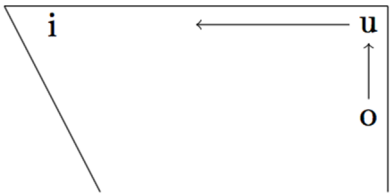


Figure 1. The Pattern 3 shift (Labov 1994).

level, if phonological feature specifications determine the phonetic realisation of segments, what would ever initiate such a chain shift or, in fact, any phonetic variation?

3. The formal proposal

At this point it is convenient to outline the assumptions on feature specifications this paper will make, based largely on the feature theory proposed in Uffmann (to appear), which synthesises a number of ideas and trends in current feature theory. We can then look at how this model would make sense of the Pattern 3 shift, which will then allow us to look at current changes in Southern English with a theoretical model in place to interpret and to explain the changes found there. Space does not permit a detailed motivation of these assumptions; the reader is referred to Uffmann (to appear). The subsequent discussion of Southern English will provide some of these motivations, though.

Broadly speaking, this model takes inspiration from two related but distinct 'schools' in feature theory: the relevance of contrast in phonology (Dresher 2009, Hall 2007) and 'substance-free phonology' (e.g. Morén 2003; Blaho 2008; Iosad 2012), with which it shares many core assumptions. Let me briefly summarise these assumptions now. Firstly, feature specifications are contrastive, in the sense of Dresher (2009): they denote contrast on some articulatory dimension. In addition, features are privative, not binary; that is, they are present or absent. In combination with contrastivity, this will generate minimal feature specifications (see e.g. Iosad 2012 for examples and discussion). These specifications remain minimal throughout the phonological derivation. There is no feature fill-in, no full specification at the interface to

phonology (*pace* traditional underspecification theory, e.g. Archangeli 1988). This presupposes an autonomous phonetics (Kingston & Diehl 1994), which can add articulatory specifications to a phonologically underspecified segment. These are inherently gradient, though. They may reflect cue enhancement or dispersion strategies (Hall 2011), or they are simply conventionalised. In this article I want to argue that this is also where sociophonetic variation comes into play: It is this non-contrastive information that can acquire social meaning. Underspecification can thus give rise to phonetic variation, while featural specifications define articulatory targets (see also Hall 2011; Ramsammy & Strycharczuk 2016).

Given these assumptions, how can we account for the Pattern 3 shift? Consider first /i/ and /u/: both are phonetically high vowels, so they can be classified as [high]. Given the assumption that segments are specified contrastively, we only need one additional feature to distinguish between the two. As /i/ has a clearly identifiable front phonetic target, let us specify /i/ as [high, front] (or [coronal]; I shall remain agnostic about appropriate labels in this article and use descriptive feature labels for convenience). Then /u/ is only [high] – more is not necessary from a contrastive viewpoint. As /u/ is not specified for backness, phonetic variation is possible, the actual amount of backness / F2-lowering being a matter of phonetic interpretation but not determined by a feature. Now assume that /o/ is just specified as [back] or [round], with no height specification (as features are privative and /i, u/ have already been specified as [high]). This in turn allows for phonetic variation along the height dimension.

What happens in the Pattern 3 shift could then be described as follows: Backness-underspecified /u/ starts to front; height-underspecified /o/ raises. The exact phonetic motivation initiating these shifts is of no interest to us here; it suffices to assume that the shift starts out with some phonetic bias, which is not kept in check by an underlying feature specification. Once the raising of /o/ exceeds a certain threshold and variation ceases, speakers may reanalyse it as a [high] vowel. The specifications of /u/, however, never change: it remains a [high] vowel underspecified for backness. The change is schematically depicted in (1).

(1) The Pattern 3 shift with underspecified features

	starting point			endpoint	
V1	[high, front]	[i]	>>	[high, front]	[i]
V2	[high]	[u]	>>	[high]	[y]
V3	[back]	[o]	>>	[high, back]	[u]

In phonological terms, the only change is that /o/ acquires an additional [high] specification. The vowel labelled V2 changes phonetically – it fronts from [u] to [y] – but phonologically nothing changes. Compare this to the traditional approach with binary features. Here /u/ is originally specified as [+high, +back] and has to become [−back] at some point because original /o/ will take up the specifications of original /u/, but it is far from clear how and when this would happen. Moreover, there is an additional complication: In the original system two features are sufficient, [±high] and [±back]. An additional feature [±round] is redundant ([α back] implies [α round]), but once the system changes into a system with a three-way-backness contrast (the endpoint of the Pattern 3 shift), an additional feature is necessary: If [+high +back] /u/ simply became [−back], it would be indistinguishable from /i/. Thus [round] stops being redundant and becomes an active feature at some point, but how this happens is unclear. (2) shows the alternative version of the shift, with traditional features.

(2) The Pattern 3 shift with traditional features

	starting point			endpoint	
V1	[+high, −back]	[i]	>>	[+high, −back, −round]	[i]
V2	[+high, +back]	[u]	>>	[+high, −back, +round]	[y]
V3	[−high, +back]	[o]	>>	[+high, +back, +round]	[u]

In sum, the Pattern 3 shift thus requires several categorical changes, and it is not clear what happens in the transition from one system to the other, while in the underspecification proposal all that needs to be stated is that /o/ acquires an additional [high] specification.

One reviewer raises an important objection, that the alleged advantage of privative contrastive specification vis-à-vis binary specifications may simply be due to the type of binary specifications I assumed, restricting myself to two features. They suggest an alternative set of binary specifications, and it is worth looking at the alternative sketched in the review briefly.

The reviewer suggests the following set of specifications that they argue could also capture the Pattern 3 shift: [i] is [+high, +front], [u] is [+high, −front], [o] is [−high, +back]. There are two important points here, in my opinion. Firstly, the reviewer adopts the general underspecification approach: There are three features, but every segment is specified for only two features; [u] is not specified for [±back], for example. The main premise of this article,

that phonetic change is licensed by the absence of feature specifications, owing to contrastive underspecification, is thus retained. Secondly, for the approach to work only positive feature values should have a defined phonetic target. Negative values are simply interpreted as not being the positive value. Thus, a [−back] specification does not define a target, say a front realisation, as in the alternative sketched in (2), it only means 'not [+back]', and therefore a negative specification allows phonetic variation. In effect, then, the alleged alternative reduces to a notational variant of my proposal, assuming that only [+F] specifications define articulatory targets and that segments may not be specified for a feature. The reviewer merely shows that this proposal can, in principle, be translated into a binary framework. There is one difference, however: The alternative proposal introduces a de facto ternary distinction. Segments can be [+F], [−F] or remain underspecified for [F]. What is unspecified in my proposal is either [−F] or remains underspecified in the alternative proposal, but the function of this additional distinction remains unclear and in fact seems superfluous. In sum, while we can capture underspecification effects (here: phonetic variability) within a binary framework, the privative feature approach captures these effects more straightforwardly and more parsimoniously.

The same reviewer raises another point worth a short discussion and clarification: What happens to the traditional feature [round] in my proposal? And if there is no such feature in my specifications, where does lip rounding on vowels originate? There are two answers here.

The first answer is that if lip rounding is not an active phonological feature it can still exist as a phonetic enhancement in the sense of Hall (2011). Lip rounding enhances the feature [back] as it has a similar acoustic correlate (lowering of F2). With variable backness of [u] we would therefore also predict variable rounding – which is what we find in English, discussed in the remainder of this article. This also means that the coarticulatory lip rounding found on adjacent consonants is not a phonological process but also part of the enhancement strategy.

The second answer is that the feature that is distinctive for [o] in this model may indeed be [labial] or [round]. As I stated earlier in this section, I remain agnostic as to which feature is best used to distinguish [o] from the others. It may be [back], with lip rounding as an enhancement, or it may be [round], with tongue backing as a phonetic enhancement. Both features are not necessary from a contrastive perspective, however, and thus one feature is predicted to be phonologically inactive. Whether contrast in a given language is better analysed as a backness or a rounding contrast will depend on the language and

the clues that are given by the phonological behaviour of the segments in question.

There is one final point I want to raise in this section in support of the analysis proposed here. The traditional assumption is that features have invariable phonetic correlates. How are changing and intermediate systems represented then, for example, a system with a centralised /u/ and half-raised /o/? And if feature values define phonetic targets, how can phonetic variation and drift occur in the first place? The proposal that variation and change occur along underspecified dimensions offers a solution. The question remains, though, if this is merely a formal trick, a clever way of using underspecification to deal with variation and change, or whether there is evidence for this proposal. This is the point at which we are turning to the main topic of this article, variation and change in Southern England. We will see that a phonetic shift similar to the Pattern 3 shift is taking place, and we will also see that this shift has phonological consequences that can be explained by assuming precisely the feature specifications just proposed to account for the Pattern 3 shift.

4. /uː/ fronting and backing in Southern England

There is an ongoing vowel shift in Southern England, affecting a large part of the vowel inventory, involving a counterclockwise shift of many vowels (see e.g. Bjelakovic 2016; Chladkova & Hamann 2011; Fabricius 2007; Harrington et al 2008; Hawkins & Midgley 2005; Wikström 2013 for aspects of this shift), although many details of this shift are still unclear, as is the connection between the individual shifts. The probably most salient aspect of this shift involves the fronting of the high back vowels /uː, ʊ, əʊ/. The fronting of /uː/ (also known as the GOOSE vowel since Wells 1982) is the best-known of these and not limited to Southern England but found in many communities (for the US, see e.g. Labov et al. 2006, for Australia, Cox 1999). The fronting of /ʊ, əʊ/ (the FOOT and GOAT vowels) seems specific to the English South, however. Additionally, this fronting of the high back vowels is accompanied by some raising of the back vowels /ɔː, ɒ/ (the THOUGHT and LOT vowels), although this seems variable, and there is, to my knowledge, no conclusive research on this shift. Figure 2 shows a typical outcome of this shift, the vowel system of a young Londoner based on a recording I made in 2010. Note in particular the position of /uː, ʊ/, which are not just centralised but phonetically front, especially /uː/, which is fairly close to /iː/ (the FLEECE vowel) – and this is by no

means a particularly extreme case of fronting among my recordings but indicates a typical level of vowel fronting. The analyses of young RP speakers in Hawkins & Midgley (2005) and young working class females in Southern England in Torgersen & Kerswill (2004) show similar degrees of fronting. In addition note the position of /ɔː/, which is almost as high as /iː, uː/. The vowel system in Figure 2 thus approximates Labov's Pattern 3 shift, with /uː/ fronting and /ɔː/ raising.

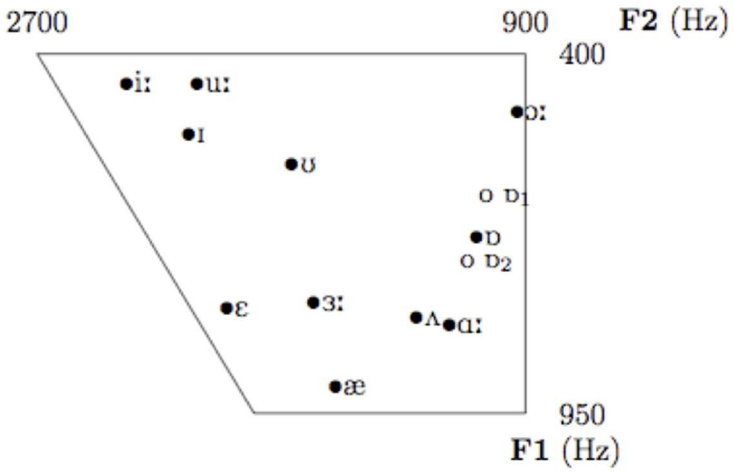


Figure 2. A shifted vowel system (f, born 1990, London).

The traditional IPA labels are rather misleading in the shifted system: Does it make sense to still talk of /uː/ and /ɔː/? (3) suggests new labels: [yː] for the GOOSE vowel, reflecting its realisation as a front vowel, and [oː] or [ʊː] for THOUGHT, reflecting different degrees of raising. I will continue to use the traditional IPA symbols /uː, ɔː/ for the sake of convenience, but the reader should be aware that phonetically they are quite distinct vowels now. Slashes // and brackets [] will also indicate whether I am referring to the traditional label/category or the actual phonetic realisation of a vowel. Alternatively, I will refer to the dialectological labels FLEECE, GOOSE, THOUGHT, to avoid reference to diachronically motivated but synchronically problematic labels.

(3) The shifted vowels; suggestion for IPA symbols

label	old	new
FLEECE	[iː]	[iː]
GOOSE	[uː]	[yː]
THOUGHT	[ɔː]	[oː ~ ʊː]

Again, the shift seen in Figure 2 invites the question whether it reflects a change in phonetic realisation only or whether it is indicative of a phonological change as well. Just looking at the surface realisation of the vowels, it suggests that a two-way backness distinction among the high vowels (between FLEECE /iː/ and GOOSE /uː/) may have become a three-way distinction (between FLEECE, GOOSE, and THOUGHT). Coming back to the discussion in the previous section, it also raises the question of what the feature specifications of these vowels are (and what they were pre-shifting), and, if the feature specifications changed, when they did so, given that the shift is gradient in nature. The phonetic realisation of these vowels in itself does not provide a clear answer, unless we cling to the assumption that the phonetic realisation of features is automatic and invariant, as in Hale & Reiss (2008). A solution to this conundrum can be found if we move away from phonetic surface realisations but start looking at the phonological behaviour of the vowels. Does the shift have phonological consequences? It is these phonological effects that provide evidence for changing feature specifications.

4.1. /uː/-fronting and coda /l/

At this point we are coming to the main topic of this article and the change referred to in the title. The fronting of /uː/ is not uniform across all contexts. In fact, it is blocked (or reversed) before coda /l/ (see also Hughes et al. 2012 for Northern English). Thus while *coop* and *two* have a fronted [yː], *cool* and *tool* retain a back [uː] (even though the exact degree of backing is unclear and is part of the present study). This backing is limited to tautosyllabic coda /l/, though; words like *hooligan*, where the /l/ is in the onset of the subsequent syllable, have fronted [yː]. There is a phonetic explanation for this backing. In Southern England coda /l/ is not only velarised but commonly vocalised (see e.g. Wells 1982, Johnson & Britain 2007), that is, realised as a vocoid [ʊ ~ ɤ].[1]

[1] The exact phonetic realisation of this vocalised /l/ still awaits detailed phonetic analysis, and the choice of IPA symbol varies between authors.

This back vowel then has a coarticulatory effect on the preceding vowel. Cue enhancement may also play a role: The perceptual cues of vocalised /l/ weakened, the backing of /uː/ serves as an additional cue for the perception of /l/.

A first question to ask then is how categorical (or how gradient) this backing is. Is it merely a coarticulatory effect, or has it phonologised, and if it has phonologised, how do we express this process formally (in terms of features)? There is also a second question: As THOUGHT has raised, the realisations of pairs like *call – cool*, *tall – tool* or *fall – fool* become very similar (raised /ɔː/ vs. non-fronted /uː/), perhaps even homophonous. And this is the motivation for the present study, which is an extension of an earlier study (Slight 2010): are *call* and *cool* homophones,[2] at least for some speakers? Then what about derived words like *calling* and *cooling*? More specifically, do words like *cooling* show pre-/l/ backing? The /l/ is no longer in coda position (*coo.ling*), thus also not vocalised, and we may therefore expect a front realisation of /uː/. In fact, Turton (2017) finds that resyllabified /l/ before a morpheme boundary behaves phonetically just like morpheme-internal intervocalic /l/ in Southern English varieties, with no velarisation; there is thus no phonetic reason for backing /uː/ in this position. On the other hand we may find a paradigm uniformity effect, in which morphologically related forms keep the same phonological shapes even if a phonological process should disrupt this uniformity. And while Slight (2010) had a descriptive focus, I also want to add the question of how the patterns found can be analysed formally, especially with respect to the questions regarding feature theory discussed in Sections 2, 3. Let us thus come to the present study.

5. Investigating the *call-cool* merger

This study is an extension and continuation of an earlier study (Slight 2010; Uffmann & Slight 2010), investigating what we will from now on call the *call-cool* merger. While the original study contained 12 speakers, it now contains 20 (all female, mostly younger), 10 from London and 10 from the surrounding Home Counties, recorded between 2010 and 2014. The study consists of two reading tasks, a short story containing many of the pairs in question (/uː/ and /ɔː/ before /l/), designed by Slight (2010), and a word list. For the analysis,

[2] From now on, *call* and *cool* will be used as shorthand keywords for the sets of words that have /uː/ or /ɔː/ before /l/.

sound files were imported into Praat (Boersma 2001), and F1 and F2 in a stable portion of the mid-section of the vowel were measured. This article will focus on (a) the story reading task (although I will make a few comments about the word list results in §8.2) and (b) London speakers (with some comments on Home Counties speakers in §8.1). From the story reading task Slight (2010) originally measured 4 tokens each of *call*, *cool*, *calling*, *cooling* words and of words with /ɔː/ that does not stand before /l/ (henceforth *caught* words), plus two tokens each of /iː/ and /uː/ in non-pre-/l/ contexts (let us call them *keep* and *coop* words) each. In the newer data set, which I collected, numbers were increased to 5 tokens of each category. The study thus cannot claim to be a comprehensive variationist or sociophonetic study, which remains a desideratum, but it can identify existing patterns and suggest diachronic developments which will have to be tested in a subsequent larger study. As we will see, there are robust main findings even with such a limited database, which warrant an analysis and explanation.

Regarding the realisation of *call* and *cool* words, I consider three possible outcomes, following Slight (2010), Uffmann & Slight (2010):

1. ***Approximation*** (no merger): Even though *call* and *cool* are phonetically similar, they remain distinct: *call* ≠ *cool*. If this is the case, there is the follow-up question whether the backing of /uː/ before /l/ is categorical (and therefore presumably phonological) or gradient (phonetic).

2. ***Neutralisation***: *Call* and *cool* are homophones; the difference between /uː/ and /ɔː/ is thus neutralised before coda /l/. If /l/ resyllabifies into an onset due to affixation, the two are again distinct however, and *calling* and *cooling* are not homophones. Thus, *call* = *cool* but *calling* ≠ *cooling*.

3. ***Merger***: *Call* and *cool* are homophones, and so are morphologically related forms such as *calling* and *cooling.* I am calling this a merger instead of neutralisation as such an outcome would suggest that homophony, rather than just being the effect of a phonological process of neutralisation, is starting to lexicalise. The failure of *call* and *cool* to disambiguate after suffixation and resyllabification suggests that they may have identical underlying forms.

Regarding /uː/ and /ɔː/ in all other contexts – the *coop* and *caught* words – I am assuming that /uː/ in *coop* has a more front realisation than in *cool* (as *cool*

is backed), while I do not expect to find any differences in vowel quality between *caught* and *call* words, besides possible weak coarticulatory effects. Let us now look at some results to see how the predictions are borne out by the data.

6. Results

Let us start with a summary of the main findings in Slight (2010). These suggest that all three of the possible outcomes are in fact attested, and they suggest a diachronic development from approximation via neutralisation to a merger (exemplified by three speakers in Figure 3). While the oldest speaker in the sample, born in the 1930s, shows approximation, only the youngest speakers show the merger, while the neutralisation pattern is found among both middle-aged and younger speakers. In the whole dataset of 10 speakers, 6 have a merger, all of them younger, while 3 show a neutralisation pattern (2 of them middle-aged) and 1 – the oldest – only approximation. Let us now take a closer look at the three speakers in Figure 3. For all speakers three distinct categories were coded: general /iː, uː, ɔː/ (the *keep, coop, caught* words), /ɔː/ before /l/ (the *call* words), and two types of /uː/ before /l/ (the *cool* and *cooling* words). As there was never any distinction between *call* and *calling* words, these two categories were pooled into one.

The oldest speaker (Figure 3a) shows the most complex pattern. Consider first instances of /uː/. We find centralised *coop* (circles); *cooling* words (stars) are less centralised, and *cool* words ('+') are phonetically back. Their realisation overlaps with that of *call* ('x') and *caught* (diamonds) but remains distinct. Note the overall degree of variation in backness (F2) for /u/: in all three subsets F2 varies considerably. I take this as evidence of gradient phonetic backing (and fronting). *Coop* words are most front (but vary), *cooling* words are a bit more back (possibly due to the general lowering effect of /l/ on F2), and *cool* words are furthest back, approximating *call/caught* words.

Next consider the middle aged speaker in Figure 3b, where we can discern three clearly separate categories: *coop* words (most front), *cooling* words with an intermediate F2 value, and *cool* words, which are back and identical with both *call* and *caught* words in F1 and F2. This is the neutralisation pattern: *cool* and *call* are neutralised, but the morphologically related *cooling* words remain distinct, displaying moderate (phonetic) backing vis-à-vis *coop* words.

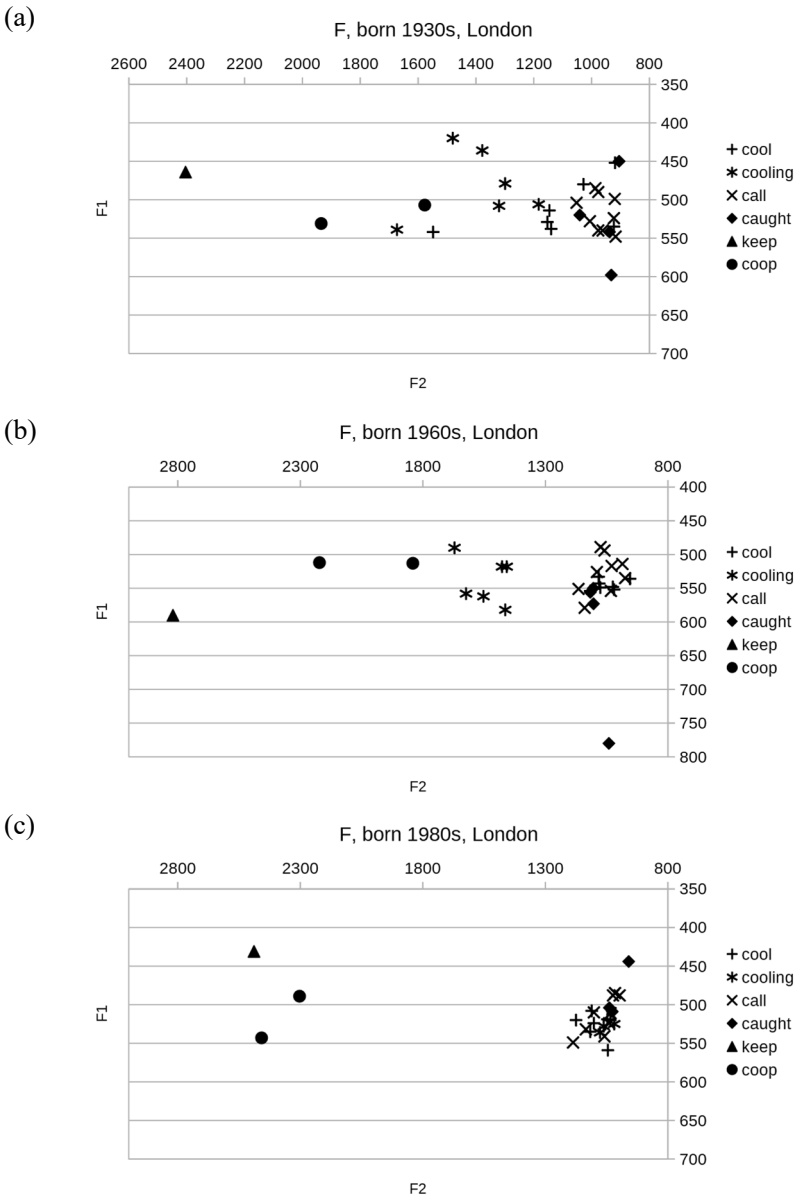


Figure 3. High vowels in three generations of London speakers (adapted from Slight 2010): (a) older speaker, (b) middle-aged, (c) young. Variation in x- and y-axes is intentional, to create similarly sized vowel spaces, in the absence of normalisation.

Finally, Figure 3c shows a younger speaker with the now prevalent merger pattern. Here, we find only two categories, the *coop* words, which are properly front (compare the instance of *keep*, triangle) and one category in the back, comprising *call*, *caught*, *cool*, and *cooling* words, all with near-identical F1/F2 values.

Going beyond the summary of Slight's (2010) findings, now consider Figure 4, which shows a variant of the merger pattern that I found in two of the additionally recorded speakers (both young London females) where *call* and *cool/cooling* are also merged, but the *caught* words (diamonds) form a distinct, lower category. This creates a puzzle: How can a distinct category emerge, in which *call/cool* are distinct from *caught*? We have so far only seen evidence of a merger, but the pattern found in Figure 4 suggests the existence of an additional split (a *call-caught* split). Put differently, Figure 3b/c show a pattern where *cool* words are pulled into the *call/caught* set. Figure 4, however, suggests *cool* words setting up a new category and then incorporating the *call* words from the *caught* set.

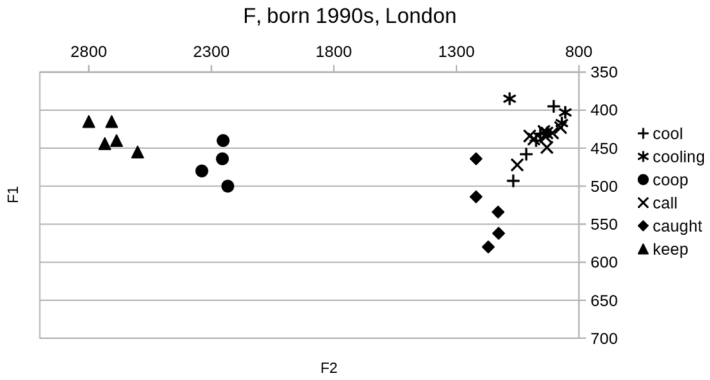


Figure 4. High vowels and the *call-caught* split (young London speaker).

These findings raise several questions that a formal analysis needs to address:

1. How can we analyse the backing of /u:/ before /l/ as a phonological process?

2. Why does this lead to neutralisation with /ɔː/?

3. How can the *call-caught* split emerge from this neutralisation pattern?

In what follows I want to show that a minimalist theory of privative features, as outlined in §3, can account for all three questions elegantly when also taking into account other ongoing changes in London phonology. Theories of full feature specification or models in which phonological categories are enhanced with phonetic detail cannot account for the same changes as straightforwardly, however. Crucially, I will assume the vowel specifications suggested in the discussion of the Pattern 3 shift, assume that the gradual fronting of /uː/ is phonetic in nature (/uː/ being underspecified for backness), but that fronting opens up the possibility for the creation of a new category of high, back vowel, and that the merger with /ɔː/ is a necessary consequence that follows from independent facts of London (Cockney) phonology. Let us now look at this argument in detail.

7. Analysis

To recap the argument made in §3, I suggest the following contrastive specifications for the triplet /iː, uː, ɔː/: /iː/ is specified as [high, front], /uː/ is a [high] vowel underspecified for backness, and /ɔː/ is a [back] vowel underspecified for height.[3] Attested phonetic variation in (Southern) English motivates these minimal specifications further. Across accents, /iː/ is a high front vowel, displaying very little phonetic variation, thus justifying its specifications as [high, front]. /uː/ shows varying degrees of fronting but is consistently high, and /ɔː/ shows considerable variation in height, evidenced also by the tradition of using the IPA symbol /ɔː/, suggesting a low-mid vowel, even though the vowel is mid-high for most Southern speakers nowadays (see e.g. Hawkins & Midgeley 2005), while being consistently back and rounded. For all speakers I analysed /ɔː/ had the lowest F2 of all vowels. Now how does this help us explain the changes in London English?

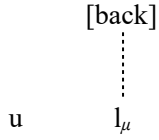
[3] As stated in §3, I shall remain agnostic here as to whether [back] or [round/labial] is the more appropriate feature to describe this contrast. Further research may well shed light on this question and suggest a more definitive answer, In this article, I will use [back] as a convenient label.

7.1. /uː/-backing

To begin, consider the backing of /uː/ before coda-/l/. In a traditional, conservative, feature analysis this backing poses a riddle. If /uː/ is phonologically still [+high, +back] (as for example in Chladkova & Hamann 2011) and the fronting is merely a matter of phonetic implementation, /uː/ still being relatively back vis-à-vis /iː/, what process or feature could make it more back? Thus, the existence of a phonological backing process would require that /uː/ has shed its [+back] specification, raising the question how and when this happened. Put differently, the fact that there is a phonological process of backing /uː/ before /l/ implies that /uː/ cannot be phonologically [+back], which supports the privative analysis proposed in this paper.

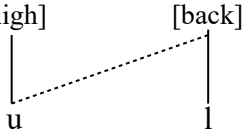
But first to the question of why /l/ causes backing, and why only coda-/l/ causes backing. The explanation is that /l/ in codas is velarised or vocalised as a back vowel [ʊ ~ ɤ], which I assume involves the positional addition of a [back] feature to a coda or moraic /l/, as in (4).

(4) Velarisation/vocalisation of /l/



Assuming that /uː/ is specified only as [high], this yields a representation in which a vowel unspecified for backness precedes a [back] segment, which can now have a coarticulatory effect on the underspecified vowel, yielding the variable backing we saw, for example, in the oldest speaker in the sample (Figure 3a). Subsequent generations of speakers then phonologise this phonetic effect by positing a spreading process, whereby the inserted [back] feature spreads to the underlyingly underspecified vowel, as in (5). As a result, backing is no longer gradient but categorical, as found with all the younger speakers in the sample.

(5) Spreading of [back] to /uː/



This spreading creates a [high, back] segment and therefore a derived three-way surface contrast in the high vowel series: There is [high, front] /iː/, [high] /uː/ (realised as a centralised/fronted vowel [ʉː ~ yː]) and the derived [high, back] /uː/ before /l/, i.e. [uː]. Assuming an underlyingly underspecified vowel /uː/, which follows from contrastive underspecification with privative features, backing before /l/ thus involves the addition of [back]. No additional changes have to be assumed, and neither do we need to posit a diachronic change in the specification of /uː/ as it fronts. Rather, this fronting is phonetic. Once the default realisation of this vowel is front or central, the phonetic effect of backing for /l/ becomes more salient, inviting reanalysis of this backing as a phonological process of spreading or assimilation.

7.2. Neutralisation

While this analysis can explain the backing of /uː/ and the creation of an additional phonological category (a [high, back] vowel), it cannot explain why this would lead to neutralisation with /ɔː/, which I assumed so far to be specified only as [back], reflecting its variable height, and it does not explain why this neutralisation emerged in London.

I propose that another process found in London English is responsible for this neutralisation. According to Wells (1982) there is a process in this variety whereby /ɔː/ in closed syllables is raised, generating a surface vowel contrast between forms such as *saw* [sɔː] but *sword* [sʊːd ~ soʊd]. Assuming that this process of closed syllable raising involves the addition of a [high] specification to underlyingly [back] /ɔː/, there are now two ways of creating a surface [high, back] segment, either by adding [high] to a [back] vowel (closed syllable raising) or by adding [back] to a [high] vowel (pre-/l/ backing). The neutralisation of *call* and *cool* can therefore be explained straightforwardly as a consequence of the phonological system of London English: The phonologisation of /uː/ backing, in this view, necessarily results in neutralisation, as the segment created is featurally identical to raised /ɔː/. For this it is necessary to have sufficiently abstract feature specifications, however. If phonetic detail were part of phonological representations, the neutralisation of *call* and *cool* would be accidental, and an explanation of this neutralisation would have to be sought elsewhere.

Consider Figure 5 for further support, showing F1/F2 measurements of a young Londoner who has closed syllable raising. This speaker is not from the

set of 20 speakers recorded for this study but is from a different, later recording.[4] Here, the set of *caught* words is further subdivided into a set of *caught* words (closed syllables) and a set of *caw* words (open syllables). The *caw* words (shaded diamonds) are realised with a consistently higher F1 than the *call/caught* words, which for this speaker are identical with *cool* words. Figure 5 thus demonstrates the categorical nature of closed syllable raising and the identity of raised /ɔː/ and backed /uː/. This raises two related questions. Firstly, how does this neutralisation pattern – the creation of two identical segments via two distinct processes – give way to the merger that we find among young speakers? Secondly, why is the *caw/caught* distinction in Figure 5 absent from other speakers (see e.g. Figure 3c for a young speaker where all the *caught* words cluster together)? I want to suggest now that the two points are related.

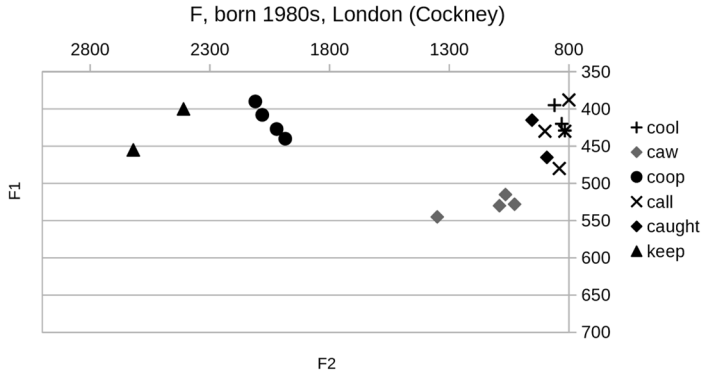


Figure 5. Closed syllable raising and the *cool-call* merger in a young London speaker.

7.3. Merger

While it may be tempting to treat the extension of the neutralisation pattern to derived forms such as *cooling* and *calling* purely as a case of paradigm

[4] Closed syllable raising was not taken into account in the original study but only discovered afterwards as an explanation of the patterns found, and thus there are no systematic data in this set. Evidence was taken from additional recordings, some of the same speakers, after the discovery. Hence, the open/closed syllable distinction is not marked in Figures 3–4.

uniformity, where a phonological pattern is extended across a morphological paradigm, I do not think that it is a sufficient explanation, as it cannot account for the splitting pattern found in Figure 4 (where *call=cool* but *caught* is distinct) and for the point just raised, the absence of closed syllable raising among younger speakers.

I would argue instead that this absence is part of a broader development, the ongoing loss of Cockney features from London phonology (see e.g. Cheshire at al. 2011). The speaker in Figure 5 is indeed the only younger speaker in my sample of recordings from London who retains closed syllable raising (among other Cockney features), while there is no trace of this process among the younger speakers in this study (the oldest speaker in Figure 3a, by the way, also has this raising process, evidenced here by the relatively large variation in height in the *caught* set). In addition, other typical Cockney features are also absent from most of my younger speakers, for example the Cockney Diphthong Shift (Wells 1982) whereby /iː > eɪ > aɪ > ɒɪ/.

If closed syllable raising is no longer present in the phonology of younger speakers, however, this means that the original motivation for neutralisation also disappears. If there is no raising, pre-/l/ backing should not create a phonologically identical segment. It creates a [high, back] segment whereas the underlying specification for /ɔː/ is just [back]. On the other hand, learners do have robust phonetic evidence that *call* and *cool* are homophones, while also being exposed to variation regarding *cooling* words, which provide evidence for a process of /uː/-backing. If the phonological system does not provide an explanation for this homophony (as an effect of neutralisation), learners will have to assume an underlying [high, back] category with which the *cool* words can neutralise. Learners therefore need to modify the underlying representations of *cool*, *call*, *caught* words, and there are two straightforward ways of doing so:

1. Maintaining the neutralisation pattern: The straightforward option for maintaining the neutralisation pattern is to classify all *call/caught* words as underlyingly [high] rather than assuming a raising process for a subset of these words (those with a coda). If *call* is underlyingly [high, back], backing of /uː/ will create neutralisation. Paradigm uniformity and lexical diffusion can then over time generate lexical (underlying) homophones. An effect of this reanalysis of *call/caught* words is that variation in height will disappear and the vowel is invariably phonetically high, which is what we find in a number of speakers. Consider for example the vowel system

in Figure 2 again, which was shown to illustrate the vowel shift in general. For this speaker, the F1 of /ɔː/ is almost as low as that of /iː, uː/. We find a similar raising for the speakers in Figure 3b,c. Labov's Pattern 3 shift thus is completed for these speakers: /uː/ has fronted and /ɔː/ has raised to a phonologically [high] vowel.

2. Alternatively, the existing allophonic split between a plain [back] vowel and a raised [high, back] vowel can be reanalysed, which is what we see in the vowel system shown in Figure 4, where we found separate categories for *caught* vs *call/cool* vowels. In this case the non-high variant is kept for all instances of /ɔː/ except those before /l/ (the *call* words). Note that the speaker in Figure 4 has a markedly lower realisation of *caught* words than the speakers in Figures 2, 3a–b; this supports the idea that *caught* words are not [high] for this subset of speakers. The *call* words, however, form a new category of underlyingly [high, back] vowels, incorporating the *cool* vowels. The originally allophonic distinction found in open vs. closed syllables is thus reanalysed as a phonemic distinction in which the *call/cool* words form a separate category, a new (though still marginal) phoneme. The generalisation that *call/cool* words are homophonous, even though the *cool* words are possibly derived from backing, can then be maintained, but at the 'cost' of setting up a new phoneme category.

The consequences of both types of reanalysis triggered by the need to account for the *call-cool* merger in the absence of a motivation for the raising of *call* (loss of closed syllable raising) are fairly dramatic. In both cases the two-way backness opposition defining the high vowels becomes a three-way opposition; in the second type of reanalysis we are, in addition, dealing with a phoneme split. (6) summarises the changes.

The original system is one with a three-way phonemic distinction between a [high, front] /iː/, a [high] /uː/ and a [back] /ɔː/, which has a [high, back] allophone, owing to closed syllable raising. When the *cool-call* contrast is neutralised, *cool* words also enter the (derived) [high, back] category. In both merger scenarios, *cooling* then also joins this category. In the pure merger, all instances of /ɔː/ are reanalysed as [high, back]. In the merger-cum-split scenario, the distinction between [back] and [high, back] is reanalysed, and the *caught* and *caw* words neutralise, while the [high, back] category comprises only pre-/l/ vowels.

(6) The changes as feature reanalyses (derived contrasts in *italics*)

<table>
<tr><td></td><td>Trad. London</td><td>Neutralisation</td><td>Merger</td><td>Merger+Split</td></tr>
<tr><td>keep</td><td>[high, front]</td><td>[high, front]</td><td>[high, front]</td><td>[high, front]</td></tr>
<tr><td>coop</td><td rowspan="3">[high]</td><td rowspan="2">[high]</td><td>[high]</td><td>[high]</td></tr>
<tr><td>cooling</td><td rowspan="4">[high, back]</td></tr>
<tr><td>cool</td><td rowspan="3">[high, back]</td><td rowspan="4">[high, back]</td></tr>
<tr><td>call</td><td rowspan="2">[high, back]</td></tr>
<tr><td>caught</td><td rowspan="2">[back]</td></tr>
<tr><td>caw</td><td>[back]</td><td>[back]</td></tr>
</table>

7.4. Evidence for a split

The final question I want to discuss is if there is additional evidence for this reanalysis, involving a three-way backness distinction in the high vowel series and a potential vowel split and therefore for the phonemicisation of the *coop-cool* difference.

The hallmark property of a phoneme split is the emergence of minimal pairs and a loss of predictability where which segment is found. Do we have evidence for this? The occurrence of the high back vowel seems fully predictable: It occurs only before coda /l/ and in morphologically related words (*call – cooling – cooler* or *fool – foolish*). It is these morphologically complex words, however, that provide evidence for an emergent split.

While morphological complexity is a largely binary issue for an analyst, there is evidence that in language processing morphological complexity is a rather gradient concept (see e.g. Hay & Baayen 2005): more transparent forms are also more likely to be analysed as complex. We can thus predict that transparently complex forms such as *cooler*, *foolish*, *schooling* retain the back variant [u:] from the base form, while less transparently complex words (for example, multiply affixed words, words with less productive and less frequent derivational affixes) may behave like monomorphemic words and choose the fronted variant [y:] or show variation.

A systematic survey of such forms is still a lacuna, but anecdotal observations and an informal survey with undergraduate students conducted at the University of Sussex in 2010 suggest that such variation is indeed found. Informants were evenly split with respect to the pronunciation of *unruly*, some preferring the fronted variant, some preferring a back [uː], and a similar result can be obtained for *coolant*. Most strikingly, many younger speakers report a minimal pair for the word *ruler*: The transparent form 'someone who rules' has back [uː], while the comparatively opaque 'measuring device' has fronted [yː], thus seems to be treated like a monomorphemic word. Forms like these indicate that we are dealing with an emergent phoneme split here, as the distribution of [uː] and [yː] is no longer fully predictable.

In fact, this emergent '*ruler* split' mirrors an older and better described split, known as the *goat* split or *wholly-holy* split, affecting the vowel /əʊ/, reported for London English in Wells (1982), Harris (1990) but found more widely now. The distribution and the motivation are essentially the same as for the *ruler* split: the GOAT vowel /əʊ/ fronts but retains a back variant [ɔʊ] before coda /l/, as in (7).

(7) The /əʊ/ allophony

goat	[gəʊt]	goal	[gɔʊl]
poke	[pəʊk]	pole	[pɔʊl]

As with the *ruler*-split, the back variant is retained in derived forms, as shown in (8):

(8) Surface contrast between [əʊ] and [ɔʊ]

holy	[həʊli]	wholly	[hɔʊli]	(whole+ly)
polar	[pəʊlə]	roller	[rɔʊlə]	(roll+er)

Again, morphological complexity seems to be a gradient issue. Note the form in (8) *polar*, which is morphologically complex (with the 'level 1' suffix *-al/ -ar*) but fails to undergo backing for most speakers. Again, an informal survey among my students gleaned several words displaying variation, among them *Polish* and *holey* 'having many holes', whose pronunciation vacillates between that of *holy* and that of *wholly*. In addition, a small number of words has back [ɔʊ] despite not being morphologically complex, for example *molar*, which has [ɔʊ] for all speakers surveyed, even though it is not morphologically complex, and even though phonologically similar (but complex) *polar* has [əʊ];

roly-poly also has the back variant in both vowels. Although described as an allophonic split by Harris (1990), we thus have evidence for the *holy-wholly* split having phonemicised. The *ruler* split essentially recapitulates the same split in the high vowel series, motivated by the same combination of processes, the fronting of back vowels and the suspension of fronting before tautosyllabic /l/.

7.5. Summary and discussion

At this point we should summarise the findings and analysis thus far before turning to some open questions and concluding. In essence, we see that a process, which starts as gradual phonetic change (the fronting of /uː/), can have profound phonological consequences. First, the gradient backing before coda /l/ phonologises, and this gives rise to neutralisation, merger, and ultimately the reorganisation of part of the Southern English phoneme system, also involving a split. As the originally back phonemes /uː, əʊ/ centralise, a new set of back phonemes emerge, although they are still highly marginal. The changes are depicted schematically in (9).

(9) The changes in the Southern English vowel system: summary

Old system:		New system:		
iː	uː	iː	yː	uː
eɪ	əʊ	eɪ	əʏ	ɔʊ
	ɔː			(ɔː)

In formal terms, we expressed the changes in terms of a theory of privative features, which are contrastively minimally specified. In the old system with a two-way backness contrast, this means that front vowels are specified as [front] while phonetically back vowels remain underspecified, opening up the possibility for centralisation. As backing before coda /l/ phonologises, this creates a new [back] segment, yielding a three-way contrast between [front], [back] and underspecified vowels (the new system). The vowels undergoing fronting, however, never change in terms of their feature specifications. They remain underspecified throughout the change. They start out as phonetically back, presumably an effect of dispersion (see Hall 2011 for how dispersion can act as a purely phonetic optimisation process on contrastively specified

segments), but as they are fronting (again, a mere matter of phonetic implementation) they open up space for the creation of phonologically back segments.

Is it necessary, though, to appeal to privative features and contrastive underspecification to model these changes? This brings us back to the initial discussion about distinctive features, their link to phonetics and crucially the conflict between a small number of categorical distinctions, expressed by features, and the richness of phonetic variation. One attempt to reconcile this conflict is to assume that phonological representations contain phonetic detail. If we follow this route, we can account for the gradient vowel shifts phonologically by adding this information directly to the underlying phonological representation, which contains concrete articulatory or acoustic targets. However, the emergent categorical effects – the merger of *call* and *cool* when *cool* backs before coda /l/ and, for some speakers, the phoneme split between *cool/call* words on the one hand and *caught* words on the other cannot be accounted for, only via stipulation. If phonological representations are also gradient, why should a phonological process result in categorical outcomes, and why should *call* and *cool* neutralise?

Conversely, a traditional set of fully specified binary features creates the opposite problem: While we may be able to account for categorical effects, given the categorical nature of traditional features, the phonetic changes become hard to handle. Why would a segment specified as [+back] start to centralise in the first place? And when (and why) would speakers decide to reanalyse this segment as [−back] at some point during the shift, as a necessary precondition for a backing rule to emerge? Again, we would have to resort to stipulations.

The underspecification account proposed in this article avoids both problems. Features are categorical, and they define clear phonetic (acoustic or articulatory) targets. Thus, categorical processes are possible via the addition of a feature. Here, addition of [back] to an underspecified vowel fixes its articulation as back/rounded. Phonetic variation is possible, however, because segments can be underspecified, that is, lack a defined phonetic target along some phonetic dimension. This is an advantage vis-à-vis traditional binary feature systems, which define precisely two targets along each phonetic dimension, expressed as [+X] and [−X]. Here, the lack of specification of the non-front member of the backness opposition allows this segment to vary in its phonetic realisation. This variation may be relatively free or random, but is usually fixed, but not in the phonology, but merely by convention in the phonetic

implementation of the segment. Thus, arbitrary variation in the backness of the vowel may at some point be suppressed as different variants acquire social meaning. More centralised realisations at the outset of the shift probably started to signify younger speech, which could then be used by younger speakers as a social marker, with subsequent generations shifting the phonetic target of the underspecified vowel further to the front. In sum, underspecification can therefore account for both gradient (phonetic) variation and categorical (phonological) changes, and this article has shown how such a model can be employed to explain the changes observed in London English.

8. Residual Issues

I would like to return very briefly to two issues now, which cannot be discussed in detail owing to lack of space, but which I brought up in the methodology section. Firstly, this paper has focussed on the changes in London, but we also recorded speakers from the Home Counties (the London commuter belt). What do they do? Secondly, I mentioned that the reading task, the data from which was used in this article, was also complemented by a wordlist. Do the results of the wordlist experiment converge with the reading task? To answer the two questions briefly, the Home Counties complicate the picture considerably, which is why I decided to leave them out of the present discussion. The main points are summarised below, however. The wordlist data also complicate the picture considerably, as a number of speakers do not behave identically in this task, and I will also outline some ideas as to why this is.

8.1. Home Counties speakers

Regarding the Home Counties, the data reveal that the merger is spreading to the London commuter belt, but that there is also considerable variation, which does not allow for any definitive statements yet. Among the 10 Home Counties speakers, we find speakers with very close yet still distinct realisations of *call* and *cool*, also in the younger generation, alongside speakers with merged realisations, but no speakers with an intermediate neutralisation stage. Here Slight (2010) makes an interesting observation, which also holds for speakers recorded since: For those speakers who have a merger, the phonetic space of the merged vowel (*cool/call/caught*) is considerably larger than for the London

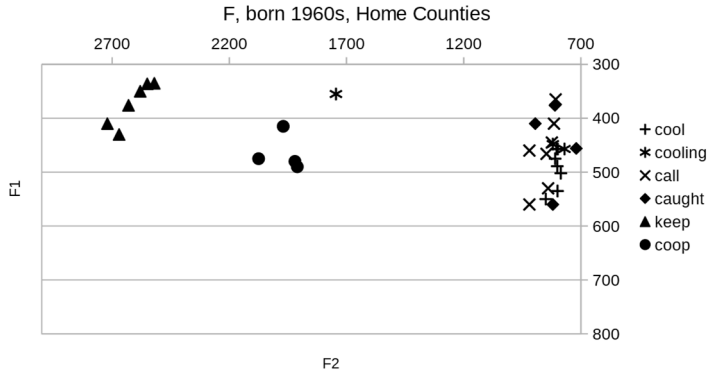


Figure 6: Home Counties speaker with a larger phonetic space for *caught/call/cool.*

speakers, with considerably more variation in height or F1, as evidenced by the speaker in Figure 6.

Slight (2010) remarks that contact-induced mergers are often realised as mergers by expansion (in the terminology of Labov 1994), which typically result in larger phonetic spaces, while an internally motivated merger is a merger by approximation, which, according to Harris (1985), who calls this merger by drift, also frequently go through a neutralisation phase before lexicalising. This is exactly the pattern we found in London, while the pattern found in the Home Counties is instead suggestive of a contact-induced merger by expansion, even though more data are needed to establish the details of how this merger proceeds.

While Slight focuses on the sociolinguistic aspects of the two merger types, the question that arises in the context of this article is how the difference in the two types of mergers should be expressed formally, and whether the model proposed here to account for the changes in London can also be fruitfully applied to shed light on why the Home Counties speakers seem to display a different type of merger. I propose that this is because speakers in the Home Counties adopt a pattern for which their native phonology does not provide a motivation. In particular, there is no [high, back] vowel category in their system, which, as we saw, is specific to Cockney. Yet they acquire the homophony of *call* and *cool*. The only way this can be accommodated for in their system

is by reclassifying the *cool* words as [back] (and not [high, back]), to yield a merger with *call/caught*. This also explains the lack of a neutralisation stage for the Home Counties speakers (as claimed by Slight). In addition, it explains the larger phonetic space of the merged vowels and possibly why mergers by expansion cover larger phonetic spaces in general: As the merged vowel is just [back], without any additional height specifications, it allows for more variation along the height dimension, compared to the corresponding London vowel, which is [high, back]. The variation itself is probably motivated by the existence of phonetically high exemplars, which Home Counties speakers encounter in London speech, and which can be accommodated for by their underlying vowel, which lacks height specifications. Hence, these speakers can expand their phonetic space and produce phonetically high tokens of /ɔː/, but crucially all instances of /ɔː/ will show this variation, not just instances of *call/cool*, as these words are not distinct from other words containing /ɔː/ (the *caught* set). This raises two questions: Firstly, are *call* and *cool* really lexically merged and underlyingly identical (we saw that the London pattern allows for ambiguity)? Secondly, is this difference in the vowel space really just a matter of phonetic implementation because the Home Counties vowel is phonologically underspecified vis-à-vis the London vowel ([high] vs [high, back])? The word list task offers some tentative answers to these questions.

8.2. Word lists

As mentioned in §5, the reading task was complemented with a word list task in Slight (2010). A detailed discussion of the results would go beyond the scope of this paper and is, in addition, not really conclusive, but nevertheless provides some insight. Word lists involve much greater metalinguistic awareness, they may reveal prescriptive norms or attitudes towards variants, and indeed for several speakers the vowel realisations in the word list task deviate from those in the reading passage, where they were not aware of the research question (the realisation of the *call* and *cool* vowels), which revealed itself in the word list task.[5] The subsequent discussion of differences in the word list realisations is largely based on Slight's (2010) insightful discussion; I will add my own comments at the end of this subsection.

[5] This greater awareness is also evidenced by the occasional occurrence of hesitations, self-corrections or words read with a question intonation, especially in the context of *cooling*-type words.

Regarding London speakers, Slight observes three patterns in the word list task. Firstly, several speakers do not show any conspicuous differences in the two tasks. More interesting are the speakers with deviant pronunciations. The middle-aged speaker shown in Figure 3b, who showed the neutralising pattern with distinct realisations of *cooling*, merges *cool* and *cooling* in the word list task, thereby probably showing awareness of the changing pronunciation norm. Two of the younger speakers, who had merged *cool* and *cooling* in the reading passage, kept the merger, but the phonetic space of the merged realisations is now expanded greatly along the F2 dimension (in backness). Slight interprets this as an unsuccessful attempt to unmerge the two vowels by centralising some members of the *call/cool/cooling/caught* set, however unsystematically. She also reports one of her subjects commenting that she "probably shouldn't pronounce the vowels identically" (Slight 2010: 23), thus showing awareness of the merger but also a prescriptive bias against it. I would like to add that several speakers have a single outlier in the *cooling* set in the word list task, that is, isolated successful attempts to unmerge and realise the derived forms with a centralised vowel. In how far this manifests random variation or possible lexical differences (such that some *cool* words still retain underlying /uː/ while others have merged) cannot be established on the basis of the present data, however.

Several Home Counties speakers show a similar pattern that could be described as an unsuccessful or only partially successful unmerge operation in the word list task. Others, however, show a different and perhaps surprising pattern. We established above that the Home Counties speakers' merged *call/cool* vowel occupies a larger phonetic space. In the word list experiment, for several speakers this space shrinks and becomes similar to that of the London merger, that is, a fairly consistent realisation of *cool/call* as back and high. We can interpret this as the conscious adoption of the London norm by these speakers in a more controlled environment, where they can monitor their speech. It would seem inappropriate, though, to assume that speakers suddenly devise a separate phonological system in an experimental task, in which they have a [high, back] phonemic category at their disposal. Instead, I interpret this as evidence for a controlled, autonomous phonetics and as evidence for underspecification. The vowel is just [back]; it can show considerable variation in height, as it does in the reading task, but speakers can also selectively target only part of the available phonetic space and thus realise the vowel as phonetically high in an experimental setting. This, however, is a matter of phonetic realisation, not a matter of phonology. A final comment: How traditional

fully specified representations or phonetically enriched representations could account for this difference in the reading task and the word list task is unclear.

8.3. Future directions and conclusions

We have seen that the discussion of the word list data and of the Home Counties speakers is still only tentative. In the discussion of the London speakers, we have been able to extract four patterns and make conjectures about the diachronic development of the merger, but for a proper variationist study we simply lack sufficient data, both in terms of speakers (the current study comprises 2x10 speakers, who in addition are all female) and in terms of tokens per speaker. A more detailed study is thus a desideratum. It should help us to make clearer statements about the diachronic development of the *cool-call* merger and also allow us to say something about the prevalence of the two types of merger (the full merger vs. the merger-cum-split). So far, all we can say is that both types exist. We also can but speculate about how the neutralisation pattern becomes a full merger, and to what extent it has done so: Are speakers still neutralising and use paradigm uniformity in morphologically related forms, or have *call* and *cool* merged lexically? And: Have they merged as a group, or is this merger lexically diffusing, so that some speakers may, for example, have underlying /ɔː/ in *cool* but still retain underlying /uː/ in *fool*? These are questions that future research should address. Moreover, the discussion of the *ruler* split has shown that the choice of vowel in morphologically derived environments is still very much an open question, with data so far being unsystematic and anecdotal. A detailed exploration of this split (which morphologically complex forms have the back variant, which have the fronted variant, which vary?) should be a promising endeavour. More generally, this article has nothing to say about vowel specifications in London English beyond the set of three vowels discussed here. How this proposal fits in within the larger context of the London English vowel system, and what this means for the featural representation of other vowels also remains a question for future research.

That said, the focus of this article was on the formal properties of the current vowel changes in London English (and beyond), and the data collected so far can establish the main patterns of variation and change and make an empirical contribution nonetheless. The main theoretical idea presented in this article is that underspecified representations can shed light on phonetic

variation and change, avoiding the pitfalls of both phonetically enriched representations (which lose sight of contrast as an important property of phonological systems) and traditional binary features (which do not accommodate phonetic variation well). It is my hope that this article has shown that there is no inherent conflict between phonetic detail and categorical, abstract phonological representations, but that the combination of contrastive underspecification with privative features can offer a way forward to understand how the two interact. The application of this model to other instances of variation and change should be an intriguing future enterprise.

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