

Is word-frequency a factor in phonological demergers? The sociophonology of **SQUARE** and **NURSE** in Lancashire English

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The structure of this paper:

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 2. Our aims here: frequency, phonology and sociophonology
 3. The data: **SQUARE** and **NURSE** in Lancashire English
 4. Investigating the data: where do vowels demerge first?
 5. What are the implications of our observations?
 6. Conclusions
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1. Introduction: phonology and frequency – issues and assumptions

It is commonly claimed that phonology is affected by frequency

- this is intimately tied to change in phonology – it is through differential patterns in change that frequency effects can be claimed to affect the phonology of a language
 - in current phonological theory, however, there has been some considerable study of frequency effects and some fundamental conclusions have been drawn about how phonology must work, in terms of exemplar theory, from the patterns that have been thought to be found in such frequency effects
 - in this paper we argue that there are a number of problems with such work
 - in this section we set up two ‘strong positions’ which can be found in the literature
 - our point is that these strong positions cannot be right...
 - ...and certain aspects of the possible ways in which frequency and phonology interact have not previously been properly considered
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1.1 Frequency and phonology

Work such as Phillips (1984, 2006), Bybee (2001, 2006) and Pierrehumbert (2002), variously consider ways in which the phonological changes that are in progress in a language might show frequency effects in a number of ways

- we focus here on the ‘strong position’ of Bybee’s model and predictions
 - others have already disagreed with Bybee’s model for a number of reasons
 - but it is one of the clearest and best accepted attempts to account for frequency effects

Bybee (2001, 11-12) recognises two ways in which frequency can affect phonology, allowing for both frequency and anti-frequency effects; she predicts that...

- in changes which “are the result of phonetic processes that apply in real time as words are used ... words of high frequency will change at a faster rate than will words of low frequency” – we call this a **frequency effect** (= high frequency promotes change)
- and that, conversely, “[h]igh frequency ... renders items more conservative in the face of grammatical change or analogical change based on the analysis of other forms” – we call this an **anti-frequency effect** (= low frequency promotes change)

This can be summarised as in (1)

(1)

Lexical frequency	Type of change	
	Real time, phonetically based changes ('reduction', lenition)	Analogical change based on analysis of other forms
High Frequency	Faster rate of change (= a frequency effect)	Slower rate of change (= an anti-frequency effect)
Low Frequency	Slower rate of change	Faster rate of change

'The reduction effect'

'The conserving effect'

Others deny that such well behaved frequency effects exist:

- Labov (2006) explains that the large majority of changes described as being in progress across the United States in Labov, Ash, & Boberg (2006) show no frequency effect at all
- frequency may, but does not always, affect phonology?

1.2 Exemplar theory, frequency and phonology

Where frequency effects are recognised, they are typically linked to issues in **exemplar theory**, an approach which challenges standard phonological models of representation. There are several flavours of exemplar theory (some of which are more conciliatory than those which we consider here)

- we focus on a 'strong position' – an extreme of exemplar theory

The crux of exemplar theory (as in Johnson, 1997) is that the lexicon is seen as a vast repository of highly-detailed memory traces of phonetic episodes experienced by the speaker

- these are the 'exemplars'
- an extreme of this position (our '**strong position**') is that this is essentially all that speakers need and have in terms of phonological knowledge
- as Bermudez-Otero (2007) puts it, the strong position assumes that "phonological categories do not exist independently of the exemplars"
- as Pierrehumbert (2006) points out, if exemplar theory is taken in its strongest form "the phonological principle would not be in force... instead, each word would be an individual point somewhere in phonetic hyperspace"

The link between frequency and exemplar theory ('usage-based phonology') is clear in Bybee's work:

- she writes (Bybee 2006) that the explanation for frequency effects...
 - "is that the articulatory representation of words and sequences of words are made up of neuromotor routines. When sequences of neuromotor routines are repeated, their execution becomes more fluent. This increased fluency is the result of representing the repeated sequence at a higher level as a single unit"
- and she writes that the explanation for antifrequency effects is that...
 - "frequency strengthens the memory representations of words or phrases making them easier to access whole and thus less likely to be subject to analogical reformation" – infrequent words lack the 'conserving effect' of this result of exemplar entrenchment and may more easily undergo change

2. Our aims here: frequency, phonology and sociophonology

We aim to show here that there is reason to question both:

- Bybee's strong position on frequency and anti-frequency effects
- the strong position that exemplars could be phonological-structure-free

In order to do this, we consider aspects of the sociophonology of Lancashire/Manchester English which have not previously been considered in detail, or, in this connection, at all

- we also aim, therefore, to provide new data for the description of these varieties
- and we aim to illustrate how an understanding of how phonological knowledge (of a phonological system and of phonological structure) and sociolinguistic knowledge (of the appropriacy and sociological effect of the usage of variants) can (i) interact and can (ii) both be necessary to understand the phonetic behaviour of speakers – this is our understanding of sociophonology
- crucially, we will need to consider the phonological knowledge of **individuals**; practitioners of both sociophonetics and autonomous phonology typically do not do this
- in sociophonetics, individual behaviour is lost in the calculation of group scores
- autonomous phonologists typically ignore variation between speakers on principle
- sociophonology can/must consider both (similar issues are discussed with relation to morphosyntax in Adger and Trousdale, 2007 and Hudson 2007b)

We consider a type of change which, in fact, Bybee does not include in her typology of types-of-change/frequency-effects:

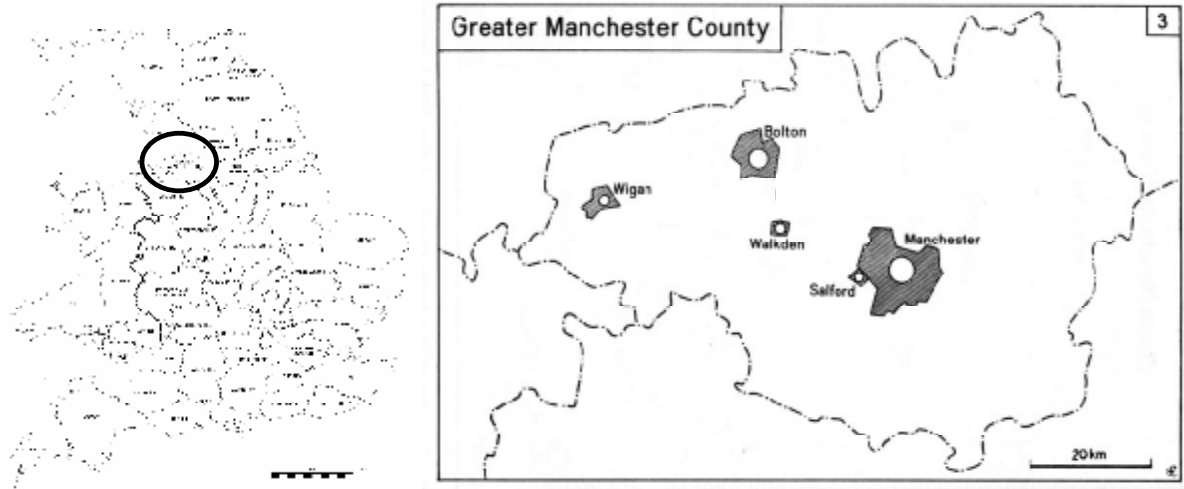
- a sociolinguistically-driven demerger
 - can frequency or anti-frequency effects be found in such changes?

We set aside a whole range of issues which could arise when we consider demergers and focus here on the fact that the change is clearly driven by sociolinguistic factors (in this our work is similar to Clark & Trousdale's from day 1 of *ICLCE2*). We expect other types of sociolinguistically-driven changes will show the same type of effect (and a demerger is arguably the best kind of change to consider in this light: could there ever be a *non*-sociolinguistically-driven demerger?)

3. The data: SQUARE and NURSE in Lancashire English

Lancashire lies in the North-West of England; it previously (before 1974) included what is now the politically independent Greater Manchester

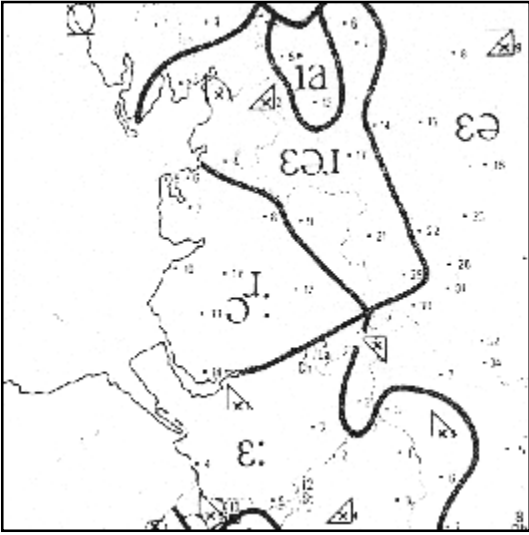
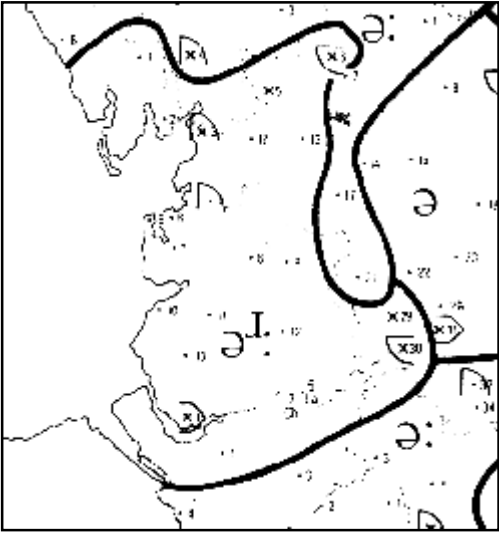
- we focus here on data from 'Lancashire' in the pre-1974 sense
- most particularly on the interaction of accents within Greater Manchester, some of which show 'classical' Lancashire patterning in terms of the phonological feature that we consider, and some of which do not
- the key area for us is shown in the maps below: Bolton, Walkden, Salford, Manchester



The traditional dialects of South Lancashire, including northern Greater Manchester underwent a merger of the vowels in Wells’ (1982) NURSE and SQUARE lexical sets

- historical dialect data clearly suggest a merger in southern Lancashire to /ɜ:/, as in the maps in (2), from the *Linguistic Atlas of England*, showing the extent of the merger in data from the *Survey of English Dialects*.
- words of both sets are consistently transcribed with [ɜ:] (or, rather as [ə:], using the older symbol for the stressed central vowel) in the nearest localities to Bolton that were investigated in the *Survey of English Dialects*
- Wells states that in areas of Lancashire such as “Wigan, the quality... is characteristically central, [nɜ:s], [skwɜ:], etc.” (1982: 372).

(2)



LAE Map for THIRD
South Lancashire has a central vowel in *hare* and *third* (and now-waning rhoticity is also shown)

LAE Map for HARE (Orton *et al.*, 1978).

3.1 The demerger of SQUARE and NURSE in southern Lancashire

The Greater Manchester area is bisected by the merger/contrast isogloss on the *hare* map in (2)

- some inhabitants of Greater Manchester in, eg, Bolton, have a merged SQUARE/NURSE set

- inhabitants in areas of central Manchester such as Salford have a SQUARE/NURSE contrast, as NURSE has [ɜ:] but SQUARE has [ɛ:].

Research for Barras (2006) considered the possibility of a contact-induced, sociolinguistically driven **demerger** in the speech of some Greater Manchester speakers, given the presence of a nearby large city where speakers have a contrast between the vowels in the two sets

- the change affects the vowels of words in the **SQUARE** set in the speech of those in Bolton and (previously?) Bolton-oriented areas (as only these have [ɛ:] in those other parts of Greater Manchester that the demerging speakers are aiming to sound like)
- this is our empirical focus here: the sociolinguistically-driven demerger of the SQUARE and NURSE sets of words = the split of one phonological category into two = the (re)establishment of a contrast
- the full data collection and analysis considered a range of factors which we do not discuss here – we focus here only on those aspects of the analysis which consider the frequency of the words involved

4. Investigating the data: where do vowels demerge first?

If we consider this change in the light of the issues from in section 1, the obvious questions are:

- are **all** occurrences of /ɜ:/ in SQUARE words as likely as each other to become [ɛ:]?
- or are there patterns in terms of which occurrences of /ɜ:/ are more likely to change?
 - and if so, are these frequency-related patterns
 - or are the patterns phonologically conditioned?

4.1 Methodology

Tests of production and perception were carried out for teenagers and old age pensioners in Bolton, Salford and in Walkden, which lies between the first two areas.

- Each speaker was recorded in casual conversation; carrying out a picture task and a map task; reading a passage and reading a word list containing (potential) minimal pairs such as *fair/fur*, which were then used in a perception test.
 - here we consider material from the reading passage
- The reading passage and word list were constructed in order to enable the conduction of **minimal pair perception tests** using the data, but also to include relevant SQUARE and NURSE tokens with a range of spoken **frequencies**, as given in the COBUILD spoken English word frequency counts in the WebCelex corpus.

The words in question here, and their associated frequency counts per million words, are given in (3). They are divided into two categories, for reasons to be explained later...

- (i) words where the vowel in question is followed by an onset-*r*
- (ii) elsewhere

NB: The term 'elsewhere' is meant to contrast with (i). Essentially it indicates that there is **no surface rhotic** following the vowel, unlike in (i), where the presence of /r/ in an onset ensures [ɹ] on the surface. We set aside here the potentially complicating issue of residual rhoticity which exists further north in Lancashire – the Greater Manchester speakers considered here do not show non-pre-vocalic-surface-*r*.

(3)

NURSE elsewhere	COBUILD Spoken Frequency per million
world	713
personal	129
girl	123
further	86
earth	62
circle (N)	40
nerve	6
curl (V)	1
merger	0
perch	0

NURSE with following onset- <i>r</i>	COBUILD Spoken Frequency per million
occurring	6
stirring	5
blurring	4
whirring	2
deterring	2
stirrer	1
furry	0
slurring	0
purring	0
transferable	0

SQUARE elsewhere	COBUILD Spoken Frequency per million
there	4509
where	766
air (N)	79
fair (N)	16
compare	10
dare (V)	4
bear (N)	3
hare (N)	2
swear	2
pear	1

SQUARE with following onset- <i>r</i>	COBUILD Spoken Frequency per million
area	305
various	186
parents	174
whereas	133
Mary	37
wearing (V)	26
dairy	5
hairy	0
blaring	0
bearings	0

The tokens from the reading passage were transcribed auditorily according to a four-point scale of degrees of fronting of the vowel, as shown in (4):

(4)

	Clearly Front Variants	Fudged Front Variants	Fudged Central Variants	Clearly Central Variants
Value on scale	0	1	2	3
Phonetic representation	ɛ:	ɛ:	ɜ:	ɜ:

- Each category included a range of phonetic variation in terms of vowel length, *r*-colouring, lip rounding, presence of a schwa offglide. The most important feature for establishing a SQUARE/NURSE contrast is **degree of fronting** though, so that was used for the index scale.
- The numbers on the y-axis of each chart in (5) below correspond to the values on this scale.

4.2 Summary of results for the geographical aspect of the study

Speakers in Bolton and Walkden showed varying degrees of demerger of the vowels in the SQUARE and NURSE sets in the direction of the forms found in accents in Salford and central Manchester, where SQUARE has [ɛ:] and NURSE has [ɜ:]. Full results are given in Barras (2006), but not here, as they are not of central interest here.

- This demerger is sociolinguistically conditioned in that the younger speakers were more likely to have the demerger than the older speakers in the same location.
- However, some of the younger speakers in Bolton were more consistently merged in their production of SQUARE/NURSE than were the older speakers in the

same location. This unexpected result leads us to a discussion of the concept of **spatiality** (Britain, 2002) which considers geographical variation not just in terms of points on a map representing physical distance, but also in terms of perceptual geography: people's perception and self-construction of their location. We return to this briefly in section 5 below.

4.3 Summary of results for the frequency-related data

In my consideration of potential frequency effects, values for **individual tokens for individual speakers** were analysed.

- Given the direction of the demerger outlined above, it is unsurprising that the realisation of NURSE words is fairly uniform for all speakers in the sample.
- While some speakers tend to use a 'fudged central' vowel, leading to a value of 2, most speakers have most NURSE words with values of 3 on my index scale.

Two of the older Bolton speakers, Effie and Moira, produced some NURSE tokens with a fronted vowel, however, especially where [ɪ] was realised on the surface, as shown in (5). This is unexpected given that it is sometimes claimed that [ɪ] has a centralising effect on neighbouring vowels, or indeed that [ɪ] and central vowels such as [ə:] or [ɜ:] are essentially realisations of the same underlier (Broadbent 1999, Giegerich 1999). Given the otherwise consistently central pronunciation of NURSE words though, these may be regarded as occasional variants, or perhaps even production errors: these tokens were recorded in a reading style of speech, as my informants read an unfamiliar passage of text.

- important here is the fact that speakers like Effie **failed the perception test** for SQUARE/NURSE words
- this means that they still only have **one phonological category** (they have the SQUARE/NURSE merger), it's just that the realisation of that category can range over a wider phonetic space

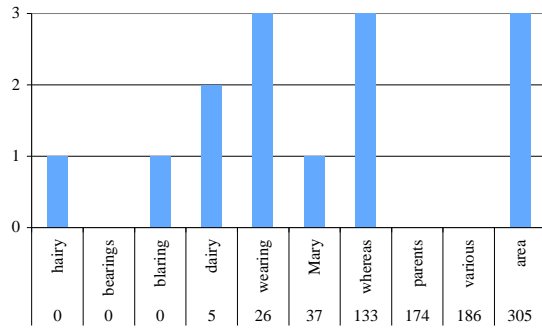
Variation in the realisation of SQUARE words is more interesting in terms of tracking the SQUARE/NURSE demerger. If a speaker has demerged the sets, then SQUARE words should tend to be realised with more front vowels, represented by lower values on the scale.

Some of the Bolton speakers showed little evidence of any demerging (this is especially true of some of the younger speakers mentioned above).

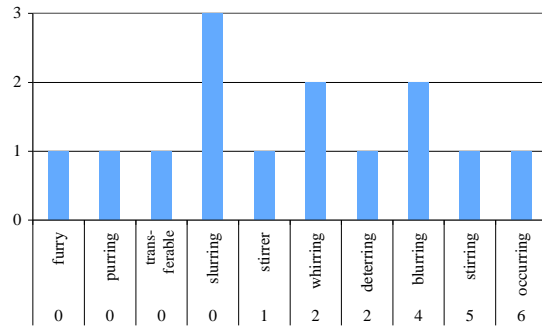
- For some of the speakers with variable demerging, **no frequency related pattern exists**
 - for example, Effie, a Bolton pensioner – see the data in (5) –, and Anne, a Bolton teenager both show no frequency related patterning of SQUARE words at all
- For other speakers with variable demerging such as Madge, an older Bolton speaker – see the data in (6) –, **an 'anti-frequency' effect is found**, but only when the vowel directly precedes an onset-*r*

(5)

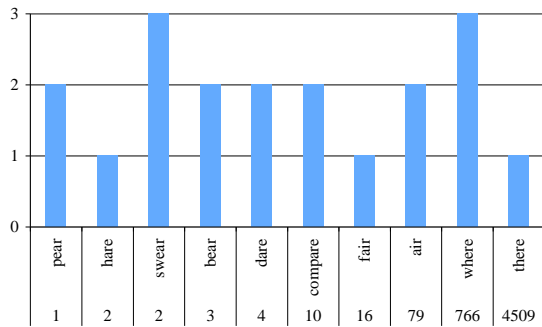
Effie - SQUARE (with following onset-*r*)



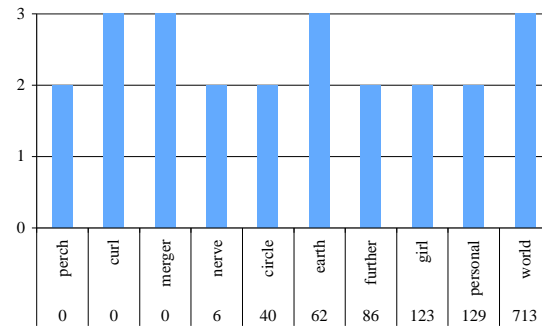
Effie - NURSE (with following onset-*r*)



Effie - SQUARE (elsewhere)



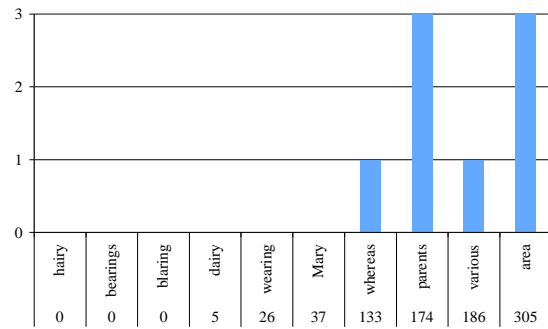
Effie - NURSE (elsewhere)



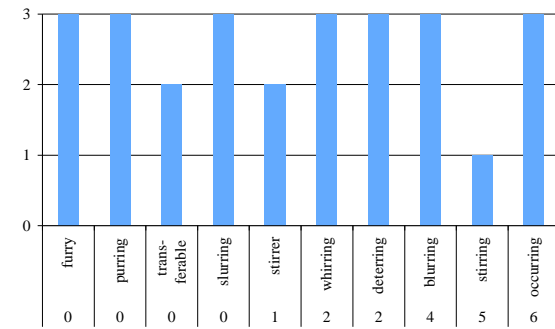
Effie: no frequency patterns

(6)

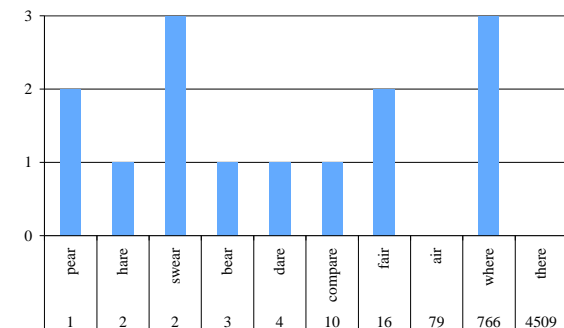
Madge - SQUARE (with following onset-*r*)



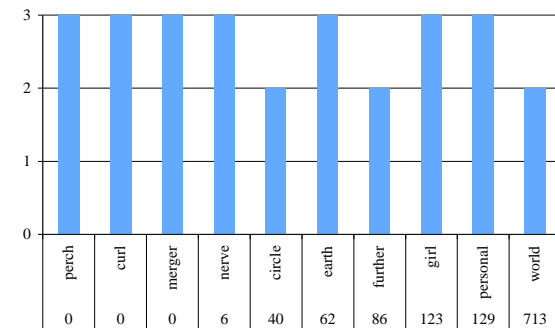
Madge - NURSE (with following onset-*r*)



Madge - SQUARE (elsewhere)



Madge - NURSE (elsewhere)

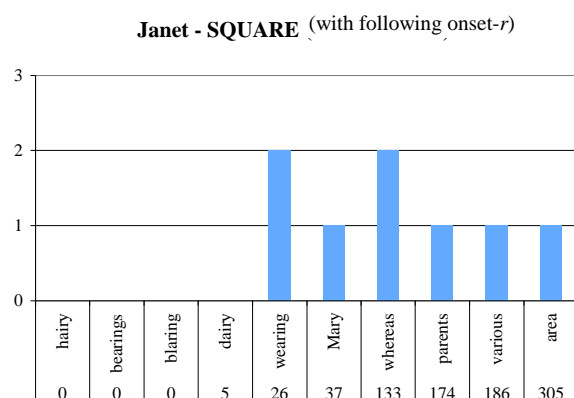


Madge: an apparent anti-frequency effect for SQUARE when the vowel precedes a surface realised rhotic.

This anti-frequency effect shown here is perhaps only tentative, and we do not have robust figures from a wide range of speakers, but we believe that it is suggestive, and that it represents a possible authentic sociophonological effect in the linguistic behaviour of speakers

- it is the only frequency-related effect shown in any of the data
- essentially the same effect as that found in the speech of Madge in (6), is also shown in the speech of Janet – a Walkden Pensioner – as shown in (7)

(7)



The spoken frequency per million words is shown for each word, and the values on the y-axis correspond to the index scale discussed above.

- In contrast to the effects of Effie's phonology, Madge's (and Janet's) production of SQUARE tokens is interesting because, while there seems to be no frequency-based pattern for the vowel realisation in SQUARE tokens with no following onset-*r*, **there is a pattern in tokens where the vowel precedes [ɹ]. In this set of tokens, the demerger is inhibited in the most frequently occurring words**, but in less frequently occurring words the vowel has consistently fronted to [ɛ:].

5. What are the implications of our observations?

Although any implications can only be tentative, we believe that the data discussed in section 4 have a number of important implications in terms of the material discussed in section 1. The survey on which our claims are based is clearly limited in scale, but it seems to connect with a number of issues, due to the unexpected patterning of the anti-frequency effect.

5.1 Implications for predictions of frequency effects in phonological change

The data discussed in section 4 are interesting here because they suggest that the type of frequency effects predicted by Bybee (2001) are not universal.

- Bybee's **strong position** on frequency and anti-frequency effects cannot be the full story

According to Bybee's predictions, repeated from (1) as (8), below

(8)

Lexical frequency	Type of change	
	Real time, phonetically based changes ('reduction', lenition)	Analogical change based on analysis of other forms
High Frequency	Faster rate of change (= a frequency effect)	Slower rate of change (= an anti-frequency effect)
Low Frequency	Slower rate of change	Faster rate of change

This would seem to suggest that if an anti-frequency effect is observed, the phonological change must be driven by analogy

- this is not the case for our demerger here

Predictions such as those summarised in (8), made by proponents of usage based theories such as Bybee, do clearly hold for some data, but as we show here, they are not universal patterns. The demerger of SQUARE and NURSE in Lancashire is a sociophonologically conditioned process, and a consideration of sociophonology is essential in trying to account for some of the variation that occurs during sound change.

To summarise the findings: the data we've presented suggest that, while frequency may have a role to play in the demerger of NURSE and SQUARE vowels in Lancashire English, we cannot explain the entire change by appealing to frequency effects alone:

- the demerger is neither a case of reduction, nor driven by analogy
- in a specific phonological context, for specific speakers, there is an anti-frequency effect, with the demerger before the onset-*r* inhibited in high-frequency words.
- there is thus both speaker-specific variation in behaviour and a phonological anti-frequency effect

We therefore concur with Labov (2006), who suggests that frequency effects are not universal: while phonological changes may display lexical and social effects, often the main constraint to change is phonetic environment. Furthermore, if there is an observable frequency effect, in a sociophonologically conditioned change, the patterning with word frequency may not correspond to the frequency patterns noted by Bybee (2001).

5.1.1 Explaining the anti-frequency effect

- On one hand, high frequency of use serves to reinforce the traditional merged vowel realisation: these words are produced more often.
- On the other, given the dialect levelling in the Greater Manchester area (Barras 2006), it may be that de-merged realisations of these words will be encountered often given the day-to-day contact that the informants have with speakers with a contrast between SQUARE and NURSE.
- In terms of the phonology, the data seem to indicate that there is an effect whereby the adjacency of (i) the vowel in SQUARE words and (ii) a following onset-*r* promotes the retention of a merger. This is a further instance of the 'sharing = strength' effect that has been observed in a range of other historical changes (Honeybone 2005), based on the assumption that central vowels and *r* are phonologically the same thing and thus can share subsegmental material. In other words, the phonological sharing serves to inhibit the demerger process and maintain [ɜ:] instead of allowing a move to [ɛ:].

5.2 Implications for the status of exemplars in sociophonological theory

The data discussed in section 4 are interesting here because, given the fact that the interplay between demerger and frequency is constrained by phonological context, they support those who argue against the strong position of extreme exemplar theory

- we are unable to accept the **strong position** that exemplars could be phonological-structure-free

The critical question is one of visibility: is the internal structure of the lexical representation ‘visible’ in a usage-based exemplar theory? Clearly any model which attempts to account for the data presented here will need to have recourse to the internal phonological structure of the morpheme.

- several aspects of purely phonological structure (such as phonological segments, vowel-consonant interaction, syllabic environment) must be referred to in order to explain the anti-frequency effect

Unless this is embedded in the theory, an exemplar model will not be able to account for the phonological conditioning, and its intersection with frequency effects, which we have observed in the Bolton data

- the phonological conditioning seems to go hand-in-hand with the rate of demerger.

Some of the more moderate versions of exemplar theory may be of more relevance of the sociophonological material discussed here:

- Linguistic categories are “represented in memory by a large cloud of remembered tokens” (Pierrehumbert 2001: 140); however, “the correct model must describe the interaction of word-specific phonetic detail with more general principles of phonological structure” (Pierrehumbert 2001: 139).
- Frequency effects are part of the mechanism by which exemplar clouds (and categories) are formed, and by which new instances of a category are sanctioned. These frequency effects may be part of the speaker’s knowledge of a set of lexical items and their phonological composition (Pierrehumbert 2002).
- The model is consistent with a multiple inheritance model of categorization (cf. work in construction grammars of various kinds, Goldberg 2006, Hudson 2007a); such a model is applicable to social categorization too (Hudson 1996).

Such factors, among others, have meant that exemplar theory has appealed to some researchers working on sociophonetic variation. Foulkes (2006) suggests that exemplar models can bring together many of the strands that emerge in the study of variation. He notes, for instance, that socio-phonological knowledge is not merely knowledge of a set of lexical contrasts, but can incorporate sociolinguistic knowledge. This is presumably extendable to spatiality (Britain 2002): one of the things that speakers ‘know’ about the SQUARE/NURSE merger is that it is ‘Bolton’ not ‘Manchester’.

We therefore find something in common with those who seek to find some way to render the exemplar model compatible with traditional phonological structure, such as Pierrehumbert (2002), who argues that lexical items are associated with both a phonetic exemplar cloud and categorical phonological information, and with Bermúdez-Otero (2007), who suggests that an integrative approach, feeding phonological representations forward into ‘phonetic’ exemplar model.

5.2.1 The sociophonology of SQUARE and NURSE in Lancashire English

To bring this all together, we need to consider the place of ‘individual’ and ‘community’ in the phonological and frequency patterns we have observed, and the way in which such patterns establish a link between exemplars and traditional phonological structure.

We observe that:

- Individuals behave differently in terms of the anti-frequency effect;
- This idiolectal variation is problematic for the notion that there could be a unified phonology for any given community;
- The effect of the following onset-*r* is problematic for the notion that speakers do not have a phonology and rely only on phonetic exemplars;
- The fact that there is a frequency effect is problematic for the notion of an autonomous phonology;

Bringing these together, we suggest that only an integrative sociophonological account can make sense of all of this. We therefore propose that:

- (i) the difference between individuals can be accounted for by assuming that the phonology supplies different representations to the phonetics;
- (ii) the phonetics is exemplar-based and accounts for (anti-)frequency effects;
- (iii) phonologies are not consistent within communities: each individual may have different phonological knowledge;
- (iv) for speakers where there is no frequency effect, there is no phonological sharing between vowels and a following onset-*r* – there is therefore no inhibitory effect; for speakers where there is such an effect, there is a phonological sharing between vowels and a following onset-*r*. This is a purely representational account of the difference: it is a matter of phonology (not sociophonology or phonetics);
- (v) the anti-frequency effect, by contrast, is a phonetic phenomenon;
- (vi) the demerger is a combination of (iv) and (v), driven by sociolinguistic phenomena (relating to the construction of identity and spatiality).

The patterns we observe in the data can only be fully accounted for by taking all of the above into account.

6. Conclusions

While our dataset is small and our conclusions tentative, we believe that the take home messages are:

- there are more types of change than are typically considered in connection with frequency and anti-frequency
 - sociolinguistically-driven processes, such as demergers also affect speakers’ phonologies
- there is a currently ongoing demerger occurring in South Lancashire English (in ‘Lancashire’ in the pre-1974 sense, involving Bolton in Greater Manchester)
 - where there once was one phonological category – /ɜ:/ – in a merged SQUARE/NURSE set, some speakers are now separating SQUARE words out to create the new category /ɛ:/
- the predictions of Bybee’s model of frequency model are problematic
- the strong position that exemplars could be phonological-structure-free is false

In relation to the observations on sociophonology made in section 5.2.1, we reiterate the fact that research in sociophonetics and autonomous phonology typically ignores individual differences; in order to understand the data that we have discussed, we need to bear in mind individual behaviour, as well as phonological structure and the social context in which that structure is operationalised. It is only by taking all of these factors into account that we can provide a fully satisfactory analysis of the data: phonological patterns may be missed unless we consider both individuals and groups.

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