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1. Introduction

Although [r]-sandhi is widely referred to in the phonological and phonetic literature on English, descriptions of it have rarely been based on analysis of any large corpus. Trudgill (1974) included intrusive [r] as a variable in his Norwich study, but found it to be used categorically and therefore paid little attention to it. The only other similar study is that by Bauer (1984), who analysed 37 RP speakers reading a short passage which contained 10 possible linking [r] and 2 possible intrusive [r] sites. This data-base is quite limited, but it is interesting that Bauer concludes "although there is variability in the use of linking /r/ in RP there is little evidence of the variation being linked to any of the kinds of factors that would be expected from Labovian research" (1984:77).

In this paper I report the findings of an investigation of [r]-sandhi using a large corpus collected in the city of Newcastle upon Tyne (the largest urban centre in the north east of England). The corpus comprises samples both of naturalistic speech and word-list readings, sampled to reflect a broad cross-section of the population in terms of age, sex and broadly-defined socio-economic class. The patterns which emerge reveal [r]-sandhi to be a more complex process than is generally acknowledged, correlating with social and even stylistic factors. The evidence from Newcastle is then used to assess the most prominent accounts in the phonological literature, supporting an analysis in terms of rule inversion (Vennemann, 1972). More generally the study

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demonstrates that corpus-based approaches can make a significant contribution to theoretical research—phonological patterns are identified which lie beyond the scope of methods based on unsystematic and unaccountable observation, in turn facilitating evaluation of competing theoretical analyses.

The paper begins with a description of [r]-sandhi and a brief synopsis of previous accounts (section 2). The sociolinguistic study and its results are described in section 3, and the phonological implications of the results are outlined in section 4.

2. [r]-Sandhi

In 'non-rhotic' varieties of English [r] can only be realised before a vowel. As a result, there are phonologically conditioned alternations between \emptyset and [r] in some words. For historical reasons the alternation only occurs after the set of vowels /ɔ: ɑ: ə/ (or their dialectal equivalents). Where the [r] is etymologically appropriate it is termed 'linking [r]', examples of which are given in (1):

- | | | |
|-----|------------------|-------------------|
| (1) | pre-pausal | dollar [Ø] |
| | pre-consonantal | dollar [Ø] bill |
| | pre-vocalic | a dolla[r] or two |
| | in derived forms | dolla[r]isation |

For speakers of some dialects the [r]- \emptyset alternation has been extended to certain words which did not historically contain /r/, but which now end in one of the vowels /ɔ: ɑ: ə/. In these cases the [r] is labelled 'intrusive'. Examples are given in (2):

- | | | |
|-----|-----------------|------------------|
| (2) | pre-pausal | Tessa [Ø] |
| | pre-consonantal | Tessa [Ø] Smith |
| | pre-vocalic | Tessa[r] O'Brien |

It should also be noted that intrusive [r] is highly stigmatised in prescriptive works, and is often cited in letters of complaint to the BBC and the quality press.

[r]-sandhi is one of the most widely discussed consonantal topics in studies of British English. I proceed now to a brief review of previous descriptive and theoretical accounts.

Until recently phonologists have almost without exception analysed [r]-sandhi within a rule-based framework. The main source of argument has centred on whether the sandhi process is best described as a rule of insertion or of deletion (or a combination of the two), and it is this issue which I shall address with reference to the Newcastle data.¹

Deletion accounts (e.g. Donegan, 1993) assume that the historical /r/ is still encoded in the speaker's lexical representation. The /r/ segment is deleted before a consonant or pause, but is allowed to surface before a vowel. By contrast, in insertion accounts (e.g. McMahon, Foulkes & Tollfree, 1994) there is said to be no lexically-encoded /r/. Instead, it is proposed that /r/ is inserted by rule after the set of vowels /ɔ: α: ə/, if another vowel follows. The deletion and insertion analyses are illustrated in (3):

	/r/-DELETION	/r/-INSERTION
underlying	/dɔləɾ/	/dɔlə/
<i>dollar</i>		
before C	DELETE /r/	—
<i>dollar bill</i>	[dɔlə b—]	[dɔlə b—]
before V	—	INSERT /r/
<i>dollar or two</i>	[dɔləɾ ɔ:—]	[dɔləɾ ɔ:—]

I return to address the deletion-insertion debate in section 4, with reference to the findings of the investigation into Newcastle English. The next section summarises the fieldwork and results of this study.

¹ There are more recent accounts within Government Phonology (Harris, 1994) and Optimality Theory (McCarthy, 1993). For discussion of these models see Durand (1997) and Foulkes (1997).

3. The Sociolinguistic Study

The empirical basis for the [r]-sandhi findings is provided by a sociolinguistic study carried out in Newcastle upon Tyne.² Fieldwork has yielded recordings of 32 adult speakers, divided according to the criteria listed in (4).

- | | | |
|-----|---------------------|----------------------|
| (4) | 2 age groups | - 16-25; 45-65 years |
| | 2 genders | - male; female |
| | 2 classes | - WC; MC |
| | 4 speakers per cell | |

Informants were recorded first in a single sex dyadic conversational exchange for around 50 minutes. They were then asked to read a word-list constructed to elicit citation forms containing numerous variables under investigation. A sentence was included to elicit intrusive [r].

The whole corpus was analysed auditorily. Potential [r]-sandhi sites in the conversational material were identified, and numerical scores for two variants, [r] and Ø, were compiled for each speaker before log-linear statistical analysis was carried out.³

3.1. Results: Linking [r]

Linking [r] is clearly favoured by older speakers and by the middle class in Newcastle. Older speakers in all groups score over 20%

² This study, along with a similar one carried out in the city of Derby, forms part of an ongoing research project entitled "Phonological variation and change in contemporary spoken British English", supported by the UK Economic and Social Research Council (grant no. R000 234892). My co-researchers are Gerry Docherty, Jim Milroy, Lesley Milroy, David Walshaw and Penny Oxley.

³ The Ø variant is more precisely defined as 'not [r]' rather than zero, since in some cases where [r]-sandhi is absent, speakers insert a glottal stop between two adjacent vowels. Scores for [r] conflate various types of rhotic. These are, in the main, alveolar approximants, but some taps were used, and there is a rapid spread of a labial or labio-dental [ʋ] in much of England. See Foulkes (1997) for further discussion of this variant.

higher than the corresponding younger group. Similarly, all middle class groups score higher than the corresponding working class cohort. Statistical analysis shows that both age and class (but not gender) are overwhelmingly significant ($p < 0.001$). There is, therefore, a marked sociolinguistic patterning of linking [r] usage in Newcastle, which contrasts with the absence of sociolinguistic correlation found in the studies by Bauer (1984) and Trudgill (1974). Note also that the age group finding indicates that production of linking [r] is decreasing over apparent time, and may thus be heading towards elimination from the dialect. The direction of this change may surprise many observers, since it is almost always assumed that linking [r] remains stable whilst intrusive [r] may be spreading.

This point is illustrated more clearly by the data in Table 1, which presents scores for the two groups at the poles of the continuum of variation, namely the older MC and younger WC speakers. (The data in Table 1 are therefore a subset of those in Figure 1, but with male and female scores combined, since gender was not found to be relevant in the statistical analysis.)

Linking [r] is not far from categorical for the older MC, at around 80%. The counter-examples for the most part involve a

Figure 1: % linking [r] in Newcastle, by speaker group (number above each bar = N tokens analysed)

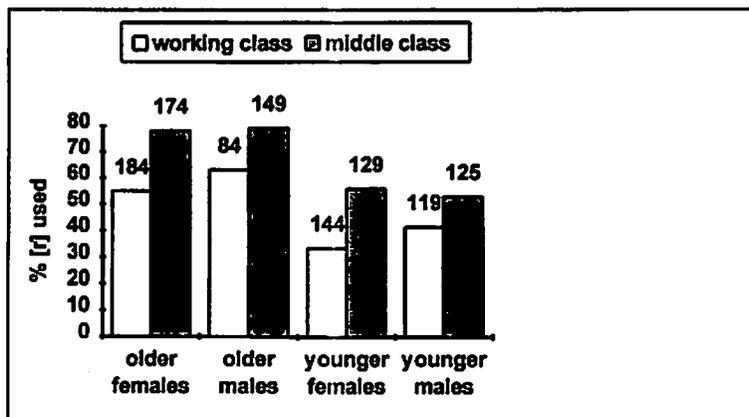


Table 1: Linking [r], selected Newcastle groups

	N tokens	[r] used	% [r]
older MC	323	254	78.6
young WC	263	97	36.9

glottal stop being produced between the two relevant vowels. By contrast the young WC speakers are clearly abandoning the use of linking [r]—overall they produce it in just 37% of cases.

However, looking more closely we find that there is a marked degree of lexical restriction underlying this distribution: the word *for* accounts for 44 of the 97 examples where [r] is used by this group. Where *for* occurs in the young WC corpus, linking [r] is produced in 76% of cases; but for all other lexical items we find linking [r] applies in just 27% of cases. Thus, with the exception of that single item *for*, linking [r] is otherwise in the process of being erased from the accent by these younger speakers. These findings are very interesting from a phonological point of view, as we shall see later.

3.2. Results: Intrusive [r]

Table 2 gives the intrusive [r] results by social group. What is most striking is how rare intrusive [r] is in Newcastle: only 7 tokens emerged from a potential 82 cases, in a corpus containing around 13 hours of material. This gives an overall appearance rate of just 8.5%. In the speech of 15 of the 16 MC speakers, and 11 of the 16 WC speakers, intrusive [r] does not occur at all.

Table 2: Intrusive [r] usage in Newcastle, by speaker group

	WC		MC	
	N	[r]	N	[r]
older females	11	3	13	0
older males	5	1	10	0
young females	7	1	20	1
young males	4	1	12	0

It is also apparent from Table 2 that intrusive [r] usage is mainly a characteristic of the lower socio-economic group: six of the seven [r] tokens are produced by WC speakers. For the WC as a whole intrusive [r] is employed in 22.2% of potential cases. These figures contrast with those of the MC, where only one token from 55 has [r], amounting to just 1.8%. The class effect is in fact highly significant ($p=0.015$). Statistical analysis therefore shows both intrusive and linking [r] to be sociolinguistically correlated in Newcastle.

The 7 tokens of intrusive [r] and the social characteristics of the speaker responsible are listed in (5):

- | | | |
|-----|--|---|
| (5) | Amanda[r] Orton
...in the wilds of Siberia[r] and...
a place for Sylvia[r] on it
we saw[r] it all
little do I know [...dəɪ...]
just to follow on [...fɒləɪ ...]
when I saw[r] it | young MC female
older WC female
older WC female
older WC female
older WC male
young WC female
young WC male |
|-----|--|---|

The figures presented in Table 2 are derived from analysis of data recorded by speakers in dyadic conversational exchange. However, recall that intrusive [r] was also tested for in the word-list, in the trigger sentence *put a comma in it*. Word-lists are designed to elicit citation forms, forcing speakers to be comparatively self-conscious of their speech as they read out single lexical items into a microphone. Previous studies of [r]-sandhi have universally agreed that the use of intrusive [r] is socially stigmatised. Therefore it is predicted that speakers should try to avoid using intrusive [r] when speaking in more self-conscious styles (e.g. Gimson, 1980:208; Brown, 1988:145; McMahan et al, 1994:306; Spencer, 1996:236).

In light of this, a remarkable finding emerges on analysis of the Newcastle word-list data. As the results in Table 3 indicate, no fewer than 14 speakers actually produced [r] when reading the

Table 3: Intrusive [r] usage in word-list style, Newcastle speakers

	N	[r]	% [r]
middle class	13	10	76.9
working class	15	4	26.7
TOTAL	28	14	50.0

trigger sentence. Ten of these were middle class speakers.⁴

The 14 tokens of intrusive [r] collected from just 28 read sentences contrast markedly with the findings from the conversational data, where only 7 tokens emerged from 13 hours of material! For WC speakers there is little difference between the proportional usage of [r] in the word-list data (26.7%) and conversational data (22.2%). But while MC speakers avoid [r] almost totally in their everyday speech, three quarters of them use [r] in the reading task.

This would seem to indicate that intrusive [r] is not perceived as stigmatised by these speakers. Rather, they treat intrusive [r] as what would traditionally be called a prestige feature, which conflicts starkly with the received wisdom that intrusive [r] is highly stigmatised.

It is not my intention to speculate at length on this unexpected style-shifting. However, the reason behind it is probably connected to the fact that, whilst intrusive [r] is not a feature of the local dialect, informants are nevertheless used to hearing it in almost all other non-rhotic varieties. This includes the standard spoken form RP as well as read speech, for example by newscasters and announcers on television and radio. Newcastle inhabitants therefore recognise intrusive [r] as a feature of relatively formal styles, and so use it themselves when reading aloud. Middle class speakers have been shown in many previous studies to be more sensitive to perceived higher prestige forms of speech, such as those typically used in the media. As a result, it is the middle class who make the greater conscious effort to incorporate features of non-local forms into their own speech.

⁴ Note that four speakers inserted a clearly perceptible pause after reading the word *comma*, such that sandhi could not apply. Their scores are therefore omitted from Table 3.

3.3. Summary of Results

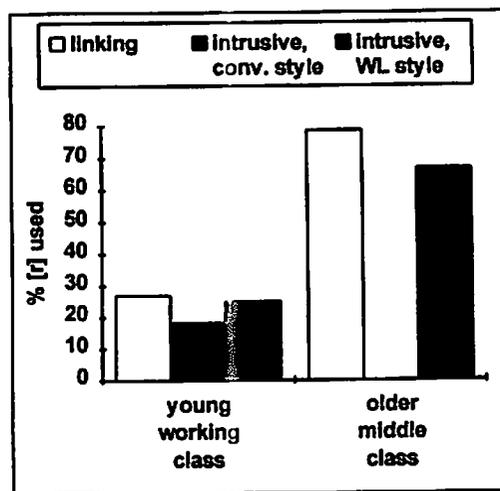
In sum, the study reveals an unexpected complexity in [r]-sandhi usage in Newcastle. Linking and intrusive [r] are both sociolinguistically correlated, and intrusive [r] also shows stylistic patterning. The results in themselves conflict with previous descriptions of [r]-sandhi, but they furthermore pose interesting problems for phonological modelling. These will be discussed in the remainder of the paper.

4. Phonological Implications

What is obvious from the findings presented above is that simple accounts in terms of insertion or deletion are not going to be adequate to model all the complexities we find in Newcastle English. Instead, the variation in the data forces us to propose different analyses for different speaker groups.

Figure 2 summarises the results already presented, but again focuses only on the two polar ends of the dialect continuum, the older MC and younger WC. From left to right Figure 2 displays scores for linking [r] (omitting the item *for*); intrusive [r]

Figure 2: summary of [r]-sandhi, selected speaker groups



in conversational data (recall that no tokens at all were produced by older MC speakers); and intrusive [r] in word-list style.

Older MC speakers have 80% linking [r] (which means we can consider it to be close to categorical) but no intrusive [r] at all in conversational style. These speakers therefore maintain a division of the lexicon which is entirely appropriate from a diachronic perspective: words which contain an etymological /r/ are treated wholly separately from those which do not. There is no confusion regarding which division of the lexicon a particular item belongs to, and therefore intrusive [r] cannot apply. For these speakers, therefore, a deletion analysis would be adequate: they have /r/ encoded in those items which contain a historical /r/, allowing it to surface only before vowels. If there is no etymological /r/, of course, it cannot surface, which accounts for the absence of intrusive [r].

A complication arises when we examine the word-list data. Although intrusive [r] is forbidden in casual speech, speakers can and do produce it when conscious of their speech. These instances have to be explained by a hyper-adaptive rule of insertion which is connected to stylistic criteria. In effect, therefore, this means that *both* deletion *and* insertion are active for older MC speakers.

The same analysis, however, will not adequately account for the observed behaviour of the young WC speakers. For this group, as Figure 2 illustrates, linking [r] is on the wane (and largely restricted to the word *for*). At the same time, intrusive [r] is found in their speech, and to about the same degree of frequency in both conversational and word-list styles. We can consider, then, that these younger speakers have largely erased that historical division in the lexicon which their older MC counterparts still maintain: items with etymological /r/ are increasingly being treated in the same way as items which lack etymological /r/.

Moreover, the great majority of lexical items never occur with a final [r], even before vowels. It therefore seems appropriate to suggest that their representations no longer contain /r/. A minority of items, notably *for*, generally do occur with [r]. So, it is possible to argue that these items still contain encoded /r/, and the last vestiges of the deletion rule apply to them. But this would not account for the development of intrusive /r/. Instead, a more

satisfactory analysis is provided by a traditional rule of insertion. That is, no /r/ is encoded in any item, irrespective of the item's history. A few items like *for* are marked to undergo [r] insertion before vowels. But since there is now no encoded difference between forms with etymological /r/ and those without, speakers may make 'errors' in where they apply the rule of insertion—errors in the sense that insertion can occur where it is not historically appropriate. These 'errors' yield tokens of intrusive /r/.

In sum, this means that in Newcastle English a process of rule inversion (in the sense of Vennemann, 1972) has taken place, which is illustrated in (6).

(6)	older MC		young WC
underlying	/fɔ:r/	/tesə/	/fɔ:/
<i>for, Tessa</i>			/tesə/
before C	DELETE	—	—
	[fɔ: ðem]		
before V	—	—	INSERT
			[fɔ:r ɪt]
			[tesər o—]

Young WC speakers have restructured the lexicon and composed a phonological rule which operates in a mirror-image fashion to the deletion rule which is still operative for older MC speakers. It is 'mirror-image' in that the rule causes the opposite effect (insertion rather than deletion) in complementary phonological contexts (in this case before vowels, rather than before consonants and pause).

5. Conclusion

This paper has reported findings from an investigation of [r]-sandhi based on sociolinguistic fieldwork material collected in Newcastle, which (in tandem with a similar study in the city of Derby) constitutes the most extensive study to date of this much discussed topic. The study reveals [r]-sandhi to be more complex than has previously been acknowledged, with both linking and

intrusive [r] correlating with social and even stylistic variables. There is also evidence for change in progress, and in a surprising direction. The findings pose some interesting challenges for traditional phonological accounts, supporting in some cases analysis in terms of a deletion rule, and in others of an insertion rule. When viewed as a whole the dialect appears to manifest an archetypal case of rule inversion.

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