

FINAL SCHWA AND R-SANDHI IN RP ENGLISH

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Abstract

An analysis of final schwa as a vocalised allophone of /r/ in RP English is presented. Phonetic similarity of [ə] and [ɹ], their distribution, and the phenomenon of R-sandhi are used as evidence to support the analysis. The continuous presence since fully rhotic times of stem-final /r/ in the context of a following vowel-initial suffix or word, and the merger of *comma* words with *letter* words beginning around the time of loss of rhoticity in the eighteenth century, are key factors in the analysis.

1. Introduction

Schwa is the most commonly occurring vowel in RP English (Cruttenden, 2001: 148; Roach, 2000: 82), being found initially, medially and finally in surface word-forms. In this paper I will focus only on schwas in surface word-form final position, as in *actor*, *bitter*, *quota*, *fear*, *layer*, *tyre*, *sour*, *employer*, *lower*, a context in which it contrasts with its absence, cf. *bit*, *quote*, *fee*¹, *lay*, *tie*, *sow*, *employ*, *low*. Non-final schwas as in *actors*, *bitters*, *quotas*, *feared*, *layers*, *tired*, *soured*, *employers*, *lowered* are excluded because the question of commutation with zero becomes relevant for assessing their functionality, e.g. in *actors*, the schwa is as predictable as it is in *abbot* (Heselwood, 1997; in preparation a²). Although there is agreement on the historical derivation from constrictive /r/ of final schwas in the *letter* and *NEAR* lexical sets³, and in the triphthongs [aɪə, aʊə, eɪə, ɔɪə, əʊə], the presence of *comma* words introduces a potential complication. *Comma* words, all of which have entered English since the fifteenth century (Wells, 1982: 167), have never had a final constrictive /r/. We thus have a phenomenon with diverse origins, a fact that has prompted the distinction between linking and intrusive Rs in e.g. *lette[r]-opener*⁴ and *salsa[r]-evening* respectively. This paper addresses the question of whether we can regard all final schwas as vocalised allophones of /r/.

First, in sections 2 and 3 I consider the evidence for claiming that *comma* words merged through analogy with *letter* words over the course of some two centuries more or less coincident with the loss of rhoticity, and that the phenomena referred to in the literature as linking R and intrusive R are in fact a single synchronic phenomenon arising from these two historical processes. Section 4 sets out the arguments for regarding surface word-form final schwa as a realisation of /r/ by offering a new interpretation of the historical process of pre-R breaking, applying the criteria of phonetic similarity, complementary distribution and distinctive function to

¹ The opposition between FLEECE and KIT qualities is suspended before schwa. I am excluding SQUARE and CURE words on the grounds that variants with final schwa are not now the most common, being replaced by [ɛ:] and [ɔ:] respectively (Cruttenden, 2001: 144-5).

² In the articles cited here I argue that because the schwa is predictable, the phonological form of *actors* is /aktz/. There isn't room in this paper to rehearse the arguments or present the full implications for such an analysis except to point out that it calls into question the assumption that the phonological form (or 'underlying' form) of a stem+affix construction properly contains the phonological form of the stem. Because an /r/ is postulated in *actor*, it does not follow automatically that there should be an /r/ postulated in *actors*. There is some further relevant discussion of this point in section 5.3 below.

³ I use the 'standard lexical sets' system of Wells (1982: 127-68).

⁴ Here and henceforth the use of the symbol [r] is for convenience and does not imply a trill. Where the particular phonetic quality of a realisation of /r/ is important, this will be made clear.

[ə] and [ɹ], and paying due attention to the fact that the so-called linking R represents an unbroken continuity of [ɹ] in historically rhotic words albeit restricted to pre-vocalic contexts. Arguments against an R-vocalisation analysis which have been advanced in the phonological literature are put under critical scrutiny in section 5 and rejected as invalid.

The second edition of the *Longman Pronunciation Dictionary* (Wells, 2000; henceforth LPD2) is used as the authority for modern RP English pronunciation.

1.1 Theoretical framework

I adopt a phonemic approach to the phonological analysis of the phenomena dealt with in this paper. A phoneme is taken to be the minimum unit of syntagmatic distribution in phonology and to comprise a set of allophones having the same distinctive function in the language variety. That is to say, there is no possibility of one allophone being substituted for another such that the result is the phonological form of a different lexical item. No psychological reality is ascribed to phonemes, neither are phonological forms set up to model speakers' mental representations. I assume that speakers' mental representations are more likely to satisfy requirements for fast and efficient usage in communication than requirements for saving storage capacity. There is therefore no call for setting up a single underlying form for lexical items from which surface forms are derived by rule, or fall out from constraint rankings.

Crucially, phonological forms cannot have grammatical boundaries built into them. For example, the phonological form /bʊks/ is merely a distribution of phonemes set up to account for the occurring phonetic forms [bʊʔks], [bʊks], etc. and which relates in a particular way to the grammatical item formed by combining *book* with the morphosyntactic category 'plural'. The form /taks/ relates similarly to *tack* and 'plural', but also to *tax* which has no internal grammatical boundary. I say crucially because it is the separation of phonological and morphological structure that allows the proposed analyses of final schwa and R-sandhi to avoid the objections discussed in section 5.3 (see also fn.2) – Giegerich's (1999: 176-7) objection to 'free ride' derivations, and the objection voiced by Uffmann (2003: 2) that post-vocalic [ɹ] is non-distinctive.

Where phonotactic analysis is undertaken to account for the distribution and realisation of /r/ in sections 4.3 and 5.3, the model used is the 'phonotactic group' (Heselwood, in preparation a), a frame in which consonants are assigned to positions around a nucleus; it is claimed that in RP English the nucleus can only be a full-vowel, never a schwa.

2. *Letter-comma merger and R-sandhi*

Despite their different origins, the final schwas in *letter* and *comma* words in RP are not distinguishable in any systematic way when they occur as isolated forms or in connected speech. The merger has brought about homophone and rhyme pairs such as *pander-panda*, *needier-media*. Whatever synchronic analysis we put forward for the final schwa in *pander* in RP English, I argue, will perforce apply to the final schwa in *panda*, and thus to *all* word-form final schwas.

The twin phenomena of linking and intrusive R, referred to above, are further evidence for the merger of these lexical sets. There is no difference in the distribution of [ɹ] at word-form boundaries in relation to *letter* and *comma* words unless induced by knowledge of spelling and a greater prescriptive desire to avoid intrusive R over

linking R (Wells, 1982: 284-5; Broadbent, 1991: 282; Giegerich, 1992: 283; Giegerich, 1999: 178; McMahon, 2000: 245-6; Cruttenden, 2001: 288-9)⁵. In both sets, an [r] appears if the next word begins with a vowel but not if it begins with a consonant. Electromagnetic articulographic data from non-rhotic British English speakers examined by Mullooly (2004: 313-15) lead him to suggest a possible difference in amplitude of tongue tip gesture, intrusive R being the weaker of the two, but he admits that paucity of relevant data renders the suggestion tentative and he settles for the opinion that the difference is stylistic, not lexical-phonological, and may be prescriptively driven. Possible amplitude of articulation differences apart, speakers appear to use for linking/intrusive R whatever is their usual word-form internal intervocalic allophone of /r/ which could be a labio-dental approximant [ʋ], (post)alveolar approximant [ɹ] or a tap [ɾ]. If a speaker says [dɛ:vi] for *dairy*, he/she will say [dɛ:viŋ] for *daring* and [dɛ:v i] for *dare he*. In a corpus of read speech from 37 RP speakers, Bauer (1984: 75) found that most linking Rs were approximants but some were taps, though he did not compare usage with non-sandhi occurrences. The use of lexical /r/ allophones seems also to be true of speakers with disordered pronunciation. Ball, Lowry & McInnis (2006) present /r/-data from a Louisiana boy with articulation problems who does not produce final constrictive /r/ despite coming from a rhotic area. He does, however, produce two instances of linking R using [ɹ], one of the allophones he uses for word-form internal intervocalic /r/ (Ball, Lowry & McInnis, 2006: 122). An adult with an acquired speech disorder resulting from a brain haemorrhage described in Heselwood (in preparation b) uses the same lateral approximant for word-form internal /r/ and linking R. The situation is therefore very different from that pertaining to glide hiatus-breakers, the ‘linking’ [j] and [w] which, as Cruttenden points out (2001: 289-90), are not like the realisations of lexical /j/ and /w/ - compare, for example, *no itches* and *the axe* with *the witches* and *the yaks*. Attempts to account for R-sandhi in the same terms as linking [j] and [w] have not taken this into account (Broadbent, 1991: 297-9; Krämer, 2005: 6; Uffmann, 2003: 13-21; 2005: 20-21). While [j] and [w] can be explained as low-level articulatory transitional phenomena, my contention is that R-sandhi cannot. An interesting question in this regard is whether hiatus-breaking glides occur in languages that have no lexical glides. If glide-epenthesis requires the language in question to have the corresponding lexical glide (as implied in Uffmann, 2003: 17; 2005: 21) then the prediction would be that languages without lexical glides⁶ would not have epenthetic glides. If, however, hiatus-breaking glides *are* found in the absence of lexical glides, it would strongly suggest that they have a biomechanical origin, not a phonological origin. A closely related question is whether hiatus-breaking glides can ever be omitted when there is close juncture between a high vowel and a following vowel. Uffmann’s suggestion that glides are inserted after high vowels ‘to minimise the contrast ... and thus the perceptual salience of the epenthetic segment’ (Uffmann, 2003: 10; see also Uffmann, 2005: 17) rather begs the question as to why speakers would make sure to choose an epenthetic segment that stands the least chance of being noticed. If the option was available to leave it out then surely they would. My point here is that the occurrence of glide hiatus-breakers, and the phonetic form in which they manifest, may be entirely predictable under certain syllable boundary

⁵ This does not seem to be true of all non-rhotic accents in England – see Foulkes’ (1998) comparative sociophonetic study of [r]-sandhi in Derby and Newcastle.

⁶ About 15% of languages do not have /j/, and 24 % do not have /w/ (Ladefoged & Maddieson, 1996: 322).

conditions. This is not the case with R-sandhi: the phonetic form depends on the phonetic form of the speaker's lexical /r/, and, in the analysis presented in this paper, the occurrence of intervocalic [r] is no more predictable than the occurrence of any other intervocalic consonant because it is a realisation of /r/ in a context where it commutes with other consonants (see (9) below for examples).

Foulkes (1998: 20) argues that because intrusive R is less common than linking R it therefore contrasts with it. While it is no doubt true that for many speakers there is a difference in probability of occurrence, it is, as in cases of so-called incomplete neutralisation, a statistical matter and not a basis for a lexical-phonological distinction: linking and intrusive R are both optional across word boundaries. Word-internally at suffix boundaries, however, distribution is different: [r] is obligatory where it has historical antecedence, e.g. *lette[r]ing*, and optional where it does not, e.g. *rumba([r])ing*⁷, although it is impossible to dismiss spelling awareness as being responsible for this difference.

3. Direction of merger

Given the *letter-comma* merger, we have to ask in which direction the merger took place. Did *letter* words lose the final /ɹ/ phoneme, or have *comma* words gained it? *Comma* words in their isolated forms have not gained anything in phonetic terms. It is the *letter* words that have changed their phonetic substance by losing the constrictive articulation of /ɹ/ except in connected speech contexts where a vowel immediately follows. *Comma* words have, however, gained something in connected speech in the form of intrusive R. Figure 1 outlines the probable diachrony of the merger. The earliest evidence for intrusive R is from Thomas Sheridan writing on Cockney in 1762 (MacMahon, 1998: 476), a time when final constrictive /ɹ/ was already disappearing in much lower-class London speech (Beal, 1999: 163).

Fig. 1. *LettER-comma* merger.

<i>letter</i>			<i>comma</i>	
__#	__V		__#	__V
ɪ	ɪ	(>late 17 th C)	ə	ə
		↓		
ə	ɪ	(mid 20 th C<)	ə	ɪ

The appearances of linking R and intrusive R thus seem to be more or less coincident. As Wells (1982: 223) notes, '[I]ntrusive /r/ arises essentially from the natural tendency to give identical treatment to words with identical endings.' That is to say, it arises by analogy. The historical record supports an account in which *comma* words begin to systematically merge with *letter* words in the eighteenth century, the merger working its way up the social scale to reach completion in RP (prescriptive avoidance

⁷ LPD2 recommends learners not to use intrusive R in *rumba+ing* (Wells, 2000: 663)

apart) by the middle of the twentieth century (MacMahon, 1998: 477; see also Bauer, 1984: 76). Were it not for R-sandhi, the argument would be much stronger for the merger having taken place in the other direction, i.e. *lettER* words merging with *commA* as final /r/ weakened to a schwa. As it turned out, *commA* words were interpreted as having the same stem-final phonology as *lettER* words rather than vice versa (Donegan, 1993: 118).

4. Vocalised allophone of /r/

The argument I am putting forward in this paper is that final schwa in RP English, and other non-rhotic varieties with R-sandhi that do not unconsciously or systematically distinguish between intrusive and linking R, should be regarded as a vocalised allophone of /r/. This is a view that has been put before (Donegan, 1993: 117-19; Harris, 1994: 230-54; Gick, 1999: 49-50; Krämer, 2005) but either not argued for at length or argued under a different approach to phonology than the one taken here. In the following subsections I maintain that pre-R breaking affected only the *realisation* of final /r/, not its phonological identity; that the traditional criteria of phonetic similarity and complementary distribution, together with the notion of distinctive function, lead to an R-vocalisation conclusion; and that RP is not, and never has been, ‘properly’ non-rhotic in the sense of lexical sets completely losing constrictive realisations of /r/ in all stem-final contexts.

4.1 The phonological status of schwa in pre-R breaking

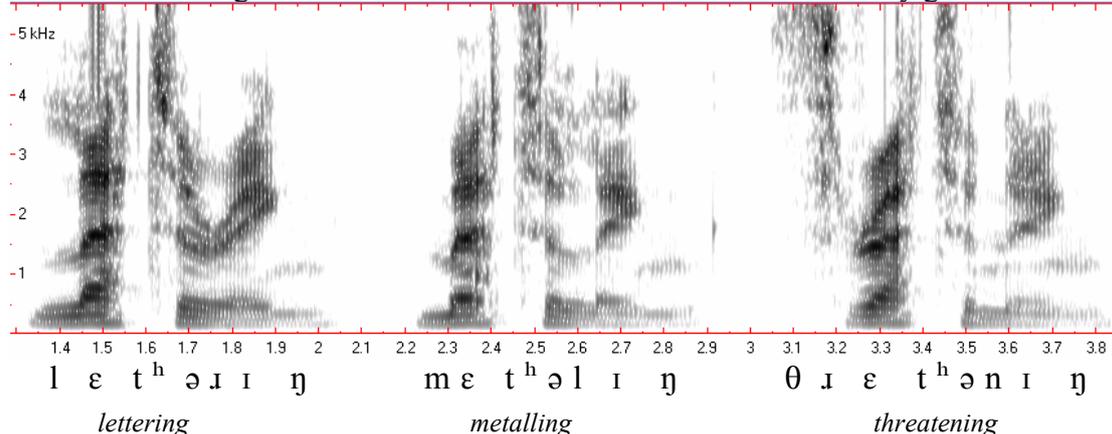
The crux of any phonological analysis of R-sandhi is how one phonemicises the schwa that arose in the historical process known as pre-R breaking (Wells, 1982: 213) which is part of a wider process that could be called ‘pre-liquid breaking’ in English (see e.g. Lutz, 1994; Krämer, 2005). In the stage during which a constrictive realisation of /r/ still remained in absolute final position, probably during the late sixteenth and through the seventeenth century (see Dobson, 1968: 914-5 for the suggestion that the vocalisation of final /r/ started in unaccented syllables), this schwa glide ‘is non-syllabic, and can generally be regarded as a non-distinctive transition phenomenon’ (Wells, 1982: 214). Once the constrictive realisation of /r/ weakened to the point of disappearance by the close of the eighteenth century, the schwa is no longer transitional and, according to Wells (1982: 214-16), becomes therefore a phoneme in its own right in *lettER* words and triphthongs and gives rise to minimal pairs such as *bet-better*, *lad-ladder*, *lay-layer*, *sow-sour*, etc. In *NEAR* words the schwa, rather than being seen as a phoneme in its own right, is regarded as the off-glide of a diphthong phoneme /ɪə/ (Wells, 1982:153; Lutz, 1994: 170-1). MacMahon (1996: 74; 2000: 269) gives the schwa immediate phoneme status in her version of the rule expressing pre-R breaking.

An alternative account of the process is to regard the schwa glide as part of the realisation of the /r/, i.e. [əɪ] as a contextually determined allophone of /r/⁸, rather than as a phonemically unassigned epenthesis. Pre-R breaking is then not described by a rule inserting a schwa, whether as an epenthetic glide or a phoneme, between a vowel and /r/, but as a change in the realisation of the /r/ in that context. The inherent arbitrariness of insertion rules (Giegerich, 1999: 183) is then avoided. It is harder in [əɪ] than in other schwa+consonant sequences to identify a point in the signal when the more vocoidal part changes to a more contoidal part. Rather, there is a continuous

⁸ Similarly, the sequence [əɪ] in *feel*, *fail*, *foul* can be regarded as a contextually determined allophone of /l/.

shift in formant frequencies without the sudden change of acoustic class found in schwa+obstruent sequences and without the spectral discontinuities found in schwa+/l/ and schwa+nasal (see figure 2). From a phonetic point of view, regarding the [əɹ] sequence as the realisation of a single phoneme is at least as coherent as regarding e.g. the sequence [t^h] as the realisation of a single phoneme /t/, given the phonetic similarity (and complementary distribution) of [t^h] and [h].

Fig. 2. Lack of spectral discontinuities in schwa+[r] compared to schwa+[l, n], the latter two showing much clearer boundaries to the coronal articulatory gesture.



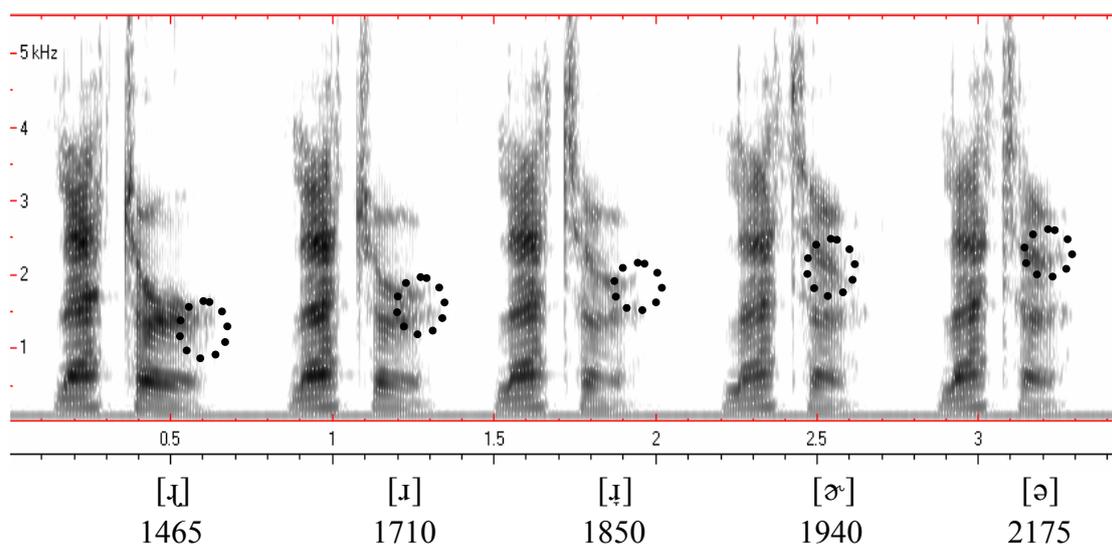
Pre-R breaking can be seen as resulting from an increasing asynchrony of the component gestures in the production of constrictive [r]. Referring to X-ray data in Delattre & Freeman (1968) showing that American /r/ has both a palatal and a pharyngeal gesture, McMahon, Foulkes & Tollfree (1994: 303-4) speculate in relation to British English that ‘if the palatal gesture was reducing in magnitude, then one would expect the pharyngeal gesture for the /r/ to be heard as a schwa’. Gick (2002: 43-5) reports from an examination of archive X-ray footage that final schwas, regardless of their etymology, in American English do indeed exhibit a mid-pharyngeal constriction. Using magnetic resonance imaging (MRI), Gick, Kang & Whalen (2002) found similar pharyngeal constriction for /r/ and the vowel /ʌ/ from which they infer a similarity between /r/ and schwa. Schwa itself did not feature in the study because of the difficulty of sustaining an unstressed vowel over the time needed for MRI data collection (Gick, Kang & Whalen, 2002: 363). Linking articulatory, acoustic and auditory phonetics, McMahon (2000: 273) points out regarding the approximant allophone [ɹ] that ‘any relaxation of articulatory effort will allow F3 to raise, increasing its perceptual similarity to schwa.’ Figure 3 shows a spectrogram of this effect in the word *letter* produced by the present author with decreasing rhoticity.

Sixteenth century speakers may have begun to delay the lingual-palatal gesture until after the inception of the pharyngeal gesture. If this temporal separation of the gestures became greater in subsequent generations of speakers, it may have led to the lingual-palatal gesture being increasingly reduced in articulatory amplitude, in non-pre-vocalic contexts, to the point of disappearance in the latter half of the eighteenth century. If this speculation is essentially correct, then the realisation of final /r/ in non-prevocalic contexts gradually changed from bi-gestural to uni-gestural over the course of some two centuries, i.e. from a more synchronous bi-gestural [ɹ] via asynchronous bi-gestural [əɹ] to uni-gestural [ə]. Both bi-gestural realisations are still present in modern RP as free variants (see examples in (2) and (3) below) but only in the context

of a following vowel. Because of the *letter-comma* merger, they are also present in *comma* words in the same context. The ongoing vocalisation of /l/ in some British English varieties is following a similar pattern (Lutz, 1994: 173-5; Krämer, 2005: 6) and the asynchrony of its two articulatory gestures in non-onset positions is described in Sproat & Fujimura (1993: 302-9). They present X-ray data to show that of the two gestures of /l/, the consonantal apical gesture is delayed relative to the vocalic dorsal gesture in syllable rhymes because of the latter's 'stronger affinity' with the syllable nucleus. It is highly likely the same has been true of the two gestures in /r/. According to Gick, Campbell, Oh & Tamburri-Watt (2006: 69) there is a cross-linguistic tendency for the two gestures of a liquid to be separated in post-vocalic contexts, with the more posterior gesture occurring first. However, Mullooly (2004: 290-91) found variable results from his three non-rhotic subjects and suggests that preceding vowel quality and stress location may also influence relative gesture timing.

In interpreting the gradual historical weakening of the lingual-palatal gesture for [ɹ], we should regard each stage of change as a change in realisation rather than in phoneme identity unless and until it becomes impossible to do so without violating general principles of phonological analysis. The change has not yet progressed to a stage where this problem arises. Under this view, the appearance of linking/intrusive R is not, strictly speaking, a sandhi phenomenon at all but a matter of contextually-conditioned allophony. I shall nonetheless continue to refer to it as R-sandhi for convenience.

Figure 3. Spectrogram of five pronunciations of *letter* with F3 rising as rhoticity decreases. (F3 offset circled and given to nearest 5 Hz).



4.2 Phonetic similarity and complementary distribution

The close phonetic similarity of final schwa and [ɹ], together with their complementary distribution (Mulder, 1989: 241; Giegerich, 1999: 189-90), supports an R-vocalisation analysis.

Phonetic similarity, although 'not a well-defined notion' (Wells, 1982: 44), can be demonstrated acoustically with respect to [ɹ] and [ə] as fig.3 shows, and is well described in articulatory terms by McMahon, Foulkes & Tollfree (1994: 303-4) and McMahon (2000: 273). Complementary distribution, as McMahon (2000: 248) points out, is not total and there is some apparently free-variation overlap, e.g. in the

examples in (2) and (3) below where [əɪ] and [ɪ] can occur in the same context in e.g. *watering, better off, hiring, vodka and lime*. However, the point is that where there is parallel distribution there is no lexical-phonological opposition, just as there isn't in cases of potentially syllabic /m, n, l/. In fact /r/ can occur syllabically in the forms in (2). The overlap is no more of a problem for an R-vocalisation analysis than is the overlap of e.g. [t] and [ʔ] (or [ʔt]) in many accents of English. The distributions of realisations of /r/ are given in (1):

(1)	/r/ → [ɪ] /	$\left\{ \begin{array}{l} \emptyset \\ C \\ V \text{ [short]} \\ \text{[long, non-high]} \end{array} \right\}$	— V	<i>red, rope</i> <i>bread, comprise</i> <i>tyrrany, very, narrow,</i> <i>burrow, borrow, Fourier</i> <i>fairy, barring, blurring,</i> <i>boring, hair oil, car allowance,</i> <i>Sir Alec, more effort</i>
	→ [əɪ] /	V[long, high]	— V	<i>eyrie, bleary, brewery,</i> <i>flowery, here is</i>
		C	— # V	<i>watering, picturesque,</i> <i>over all, vanilla essence</i>
	→ [ə]	/ —	$\left\{ \begin{array}{l} \emptyset \\ C \end{array} \right\}$	<i>near, layer, letter, sofa,</i> <i>fire, flower, soya,</i> <i>nearby, letter-box, sofa cushions,</i> <i>fire wall, flower pot, soya bean</i>

= word or suffix boundary

4.3 Continuous rhoticity of RP

Although final schwa in non-*comma* words results from weakening of final /r/ through pre-R breaking and subsequent loss of the lingual-palatal gesture, the lingual-palatal gesture never completely disappeared. It has been maintained in pre-vocalic contexts up to the present day (see column 2 in fig.1). Why it should have survived in this context it is not the purpose of this paper to ask, but it is likely to have been motivated by a desire to keep otherwise adjacent vowels apart, similar to the retention of /n/ in the indefinite article after it reduced to *a* before consonants in Middle English. Examples given in (3) below show that even pre-R breaking may not have affected all styles of speech. To call this situation non-rhotic is a little misleading in the sense that there are plenty of stem-final and post-vocalic /r/s around, admittedly in fewer contexts than was the case before the eighteenth century, but in more lexical items because of the *letter-comma* merger and the subsequent increasing incidence of 'intrusive' R alongside 'linking' R (Harris, 1994: 236).

The mapping of /r/ onto syllable positions in R-sandhi is a complex issue that cannot be pursued fully in this paper, but some observations and comments will be useful. When /r/ is realised as [ər] the [ə] component maps onto a syllable nucleus and the [r] component onto a syllable margin (Giegerich, 1999: 192). The syllable margin is intervocalic, presenting three possibilities, each of which has its adherents. Firstly, [r] could be the coda of the first of the two syllables in question. Cruttenden (2001:

289) claims it is shorter than an onset allophone and that therefore it closes the first syllable. This is consistent with Foulkes & Docherty's (2000: 50) finding that F3 is not as low intervocalically as in initial allophones, suggesting that the tongue gesture is of lesser amplitude. Secondly, it could be the onset of the second syllable. This is the position taken by Harris (1994: 251) in his 'floating r' approach to R-sandhi and by Giegerich (1999: 184-97). Thirdly, it could be ambisyllabic in the sense of possessing phonetic characteristics unique to intervocalic contexts. Ambisyllabicity is favoured by Gick (1999: 47-9) who found that, in rhotic speech, the palatal gesture is not as strong as in onset allophones and not as weak as final allophones. However, Mullooly (2004: 311) was unable to find clear evidence in support of ambisyllabicity in these terms.

It also possible for /r/ in sandhi contexts to be realised as a syllabic contoid and thus to map onto the syllable nucleus, e.g. *watering* → [wɔ:tɹɪŋ], *vodka and lime* → [vɒdkɹənlaɪm]. A further possibility is for the /r/ to be realised as part of an onset consonant cluster, e.g. [wɔ:tɹɪŋ], [vɒd.kɹən.laɪm]. More examples are given in (2) below.

The main point to make is that the realisational behaviour of /r/ in sandhi contexts vis-à-vis syllable positions is the same as in word-internal lexical /r/ in e.g. *mystery* which can be any of [mɪstəri, mɪstɹi, mɪstɹi], and much like that of the other potentially syllabic sonorants /m, n, l/. As Bybee (2001: 42) states, 'all instances of [ər] can be taken to be syllabic [r]'.

Because realisations vary from purely vocoidal [ə], through vocoidal-plus-contoidal [ər] to contoidal [r] (whether tap or approximant), it is problematic to map a final /r/ phoneme onto the syllable in a straightforward manner. There is no such difficulty if, instead of the syllable, a structure such as the phonotactic group (Heselwood, in preparation a) is used in order to account for its phonotactic distribution. The phonotactic group only recognises full vowels as possible nuclei in RP English⁹; predictable schwas are ignored as irrelevant to phonotactic structure just as predictable aspiration is, although of course in surface realisation they are syllable nuclei. Final schwas, this paper contends, are allophones of /r/ and therefore do need to be accommodated in a phonotactic structure. Table 1 presents the suggested phonotactic structure of selected /r/-final forms.

Table 1. Phonotactic analysis of final schwa.

	ONSET	NUCLEUS	CODA 1	CODA 2
<i>letter</i>	l	ɛ	t	r
<i>comma</i>	k	ɒ	m	r
<i>near</i>	n	i	r	
<i>layer</i>	l	eɪ ¹⁰	r	
<i>tyre</i>	t	aɪ	r	
<i>sour</i>	s	aʊ	r	
<i>horror</i>	h	ɒ	r	r

⁹ This is not necessarily the case in all varieties of English, and is certainly not the case in languages such as Berber where there may be no phonological vowels in many word-forms.

¹⁰ Whether diphthongs should be analysed as monophonemic or biphonemic is not an issue to be pursued in this paper; they are represented here as monophonemic for convenience.

5. Objections to an R-vocalisation analysis, and counter-arguments

As mentioned above, analysis of final schwa is complicated by the presence of *comma* words which exhibit the same pattern of R-sandhi as words that once had a final constrictive [r]. Foulkes (1998: 19) notes that R-sandhi is ‘one of the most widely discussed consonantal topics in studies of English’; it has certainly posed a challenge to phonologists. Whatever solution is put forward is likely to meet with objections, and an R-vocalisation analysis is no exception. In the following subsections some objections that have been voiced in the literature are addressed, namely the ‘double /r/’ objection, the (im)plausibility of underlying /r/ in *comma* words, the necessity of postulating /r/ in e.g. *weird* if postulated in *weir* (the ‘free-ride derivation’ problem), the apparent non-distinctiveness of [r] in codas, and the lower incidence of R-sandhi in slow speech. Answers are offered to each in turn.

5.1 The ‘double R’ objection

Wells (1982: 45, 220) would be prepared to accept a vocalisation analysis if the phonetic sequence [ər] never occurred, but because it does he rejects it on the grounds that if schwa is a realisation of /r/ then [ər] would have to be analysed as /rr/, e.g. *watering* as /wɔ:tɹɪŋ/. The objection can be discounted, however, if context is taken sufficiently into account. Final /r/ is realised as [ər] in those contexts where a historically weakened final /r/ finds itself occurring before a vowel. It is this which is responsible for the difference between e.g. *nearing* and *tyranny*. The /r/ in the latter has never been subject to pre-R breaking because the preceding vowel is short (Wells, 1982: 214), nor has it ever been final, and has therefore never weakened to a schwa. Consequently, it is realised without a schwa component. It is also interesting in relation to Wells’ point that the schwa component in [ər] realisations is optional, its absence probably more likely after a consonant (examples given in (2)) but also possible after a vowel (examples given in (3)).

- 2) *for ever and ever* → [fɪɛv.ɪəndɛvə]
cash for honours → [kəʃfɹɔnəz]
feverish → [fi:v.ɪʃ]
watering → [wɔ:tɪŋ]
better off → [bet.ɪf]
vodka and lime [vɒdkɪənlaɪm]

- (3) *near it* → [nɪ:ɪt]
hiring → [haɪɪŋ]
flowering → [flaʊɪŋ]

In (2) the /r/, as discussed above, can either be realised as part of an onset cluster with the preceding consonant, or as syllabic [ɹ], cf. /l/ in *cancelling* → [kʰənsɪŋ]. After the voiceless stops in (2) it is often realised with the same kind of voiceless friction found when preceded by a voiceless stop in an underlying cluster, such as *trough*, *cremation* (see discussion of experimental results with read speech in Docherty, 1992: 182-90). Absence of the schwa component in examples such as these presents a problem for the usual interpretation and use of the term ‘linking’ R because [r] is present but is not linking two vowels. It strongly suggests that /r/ is part of the

phonological form of the stem. Rule-based accounts that allow rule ordering can handle this by stating that a rule of schwa-deletion applies after a rule of R-insertion, but, as argued in section 4.3 above, these pronunciations in *letter* words have been in continuous existence since before the transition to non-rhoticity. It is not only implausible but needless to claim that speakers had to develop a rule of R-insertion to keep doing what they had always been doing anyway.

5.2 *Comma* words can't have final /r/

A different kind of objection concerns the treatment of schwa in *comma* words and centres on the assumed improbability of their acquiring a final /r/ in speakers' underlying representations. Phonologists who have made this objection include Wells (1982: 222-7), Foulkes (1998: 20), Carr (1999: 125-7), McMahon (2000: 241-6) and Uffmann (2003: 5-6). To avoid the necessity of an R-vocalisation analysis, Wells argues for the rule of R-insertion in (4) to account for linking and intrusive R:

(4) $\emptyset \rightarrow r / [-\text{high V}] _ \# \textcircled{\small o} \text{V}$ (# $\textcircled{\small o}$ = optional morpheme or word boundary)

In support of his argument he cites examples of intrusive R in a number of contexts where it is problematic to set up an /r/ phoneme as part of the phonological form. Some examples from Wells (1982: 226) and McMahon (2000: 243-4), plus some further examples, are given in (5).

- (5) foreign names: *Sujunya*[r] *arrived*; *Malaga*[r] *Airport*
 foreign expressions: *viva*[r] *España*; *gloria*[r] *in excelsis*;
 acronyms: *JIPA*[r] *editor*; *FIFA*[r] *official*
 pause-filler: *just...[ə:r]* *a bit more*
 weak-form of *you*: *get ye*[r] *own*
 final unstressed /əʊ/-reduction¹¹: *eye-shad*[ər] *and make-up*; *the shall*[ər] *end*
 weak-form of *of/have* with elided /v/: *a splash* [ər] *ink*; *must* [ər] *eaten it*

The essence of the argument is that speakers will produce an intrusive R in the forms in (5) but cannot plausibly have /r/ in their phonological representation of the item because, unlike in cases of linking R, there has never been a final /r/ in the isolated form. Instead, they have a rule of R-insertion which applies post-lexically (McMahon, 2000: 280) to all forms with final schwa, whether deriving from historical final /r/ or not, and despite the fact that forms with stem-final /r/ have been in continuous existence in pre-vocalic contexts since before the loss of final constrictive [r] and have therefore never needed a rule of insertion.

But how implausible is it to hypothesise that *comma* words have a final /r/ in their phonological form? Unlike *letter* words, there has never been an /r/ in citation forms and there most probably was never an /r/ in prevocalic contexts before the eighteenth century. The *letter-comma* merger consisted, as shown in fig.1, of aligning the non-pre-vocalic forms of the *letter* words with those of the *comma* words in a common final [ə], and the prevocalic forms of the *comma* words with those of the *letter* words in a common final [(ə)r]. It is possible to describe these developments in terms of a diachronic rule of R-deletion affecting *letter* words (and other /r/-final

¹¹ This and the following are not RP phenomena, but are found in some non-rhotic accents with linking and intrusive R. A lexical exception is *fellow* → *feller* in RP.

words) in non-pre-vocalic contexts and a rule of R-insertion affecting *comma* words in pre-vocalic contexts, but there is no need to postulate either rule as operating synchronically unless it is assumed that speakers have only one phonological representation for lexical items that exhibit surface variation, an assumption that may not be warranted and which has often been questioned (e.g. Linell, 1979; Johnson & Mullenix, 1997; Bybee, 2001). Speakers may well have multiple representations for what is considered a single lexical item, more akin to a set of context-sensitive allophonic transcriptions than a single abstract phonemic one. Successive generations reproduce them all from the ambient input. While such an arrangement would use more storage space, access for immediate use would be quicker because rules deriving the desired context-specific output would not have to apply on-line. Speed and efficiency of language use is likely to be more highly valued than storage space when the latter is not in short supply, as it does not seem to be in the human brain. ‘The storage capacity of the human brain appears to be so vast that it is not clear that shortage of space is the origin of any limitation on human learning’ (Markovitch & Scott, 1988: 462). If this is the case, then it is likely that a word such as *visa* has the representation [vi:zə] for contexts not containing a following vowel (and optionally for contexts that do), and the representation [vi:zəɹ] only for contexts where there is a following vowel, e.g. *visa*[r] *application*. The pattern generalises so that any novel form with final schwa that the speaker may come across, e.g. a new acronym such as *DOCA*, or a new foreign name such as *Alafya*, gets the same treatment – it joins the *letter-comma* set. This state of affairs can of course be described by a rule of R-insertion, but also by contextually-sensitive realisation statements for /r/ as in (1) above. Linking R in words such as *spar*, *lore*, and intrusive R in e.g. *spa*, *law* can be accounted for in the same way. Pronunciations with [r] have always existed in the former type in prevocalic contexts since before the loss of rhoticity. Words of the latter type began to merge with them, in the same way that *comma* words merged with *letter* words, after the loss of pre-pausal constrictive [r].

Context can be stylistic as well as phonological. Speakers may store [fɛlə] in addition to [fɛləʊ], selecting the one rather than the other to suit the extra-linguistic nature of the occasion, the schwa-final form being a member of the *letter* set but the other form not.

The appearance of [r] after a pause-filling mid-central vowel may seem more difficult to account for without an R-insertion rule, but pause-fillers are accent- and language-specific (Cruttenden, 1997: 30) and therefore conventionalised like lexical items. There is no reason why they should not belong to lexical sets and therefore behave like other members of the set in question.

If economy of storage is not important for speakers, then economy of description becomes entirely a theory-internal requirement. If a phonologist applies a theory that values economy of description very highly then it should be no surprise if the description of the observed phenomena is not a description of speakers’ mental representations. While [ə] and [r] might be chalk and cheese from a given speaker’s point of view, the phonologist should assign them to the same category unless doing so leads to an analysis contradicted by the data. A theory that, in addition to valuing economy of description, also recognises distribution, phonetic similarity and distinctive function as valid criteria in phonological analysis, is unlikely to yield descriptions that mirror speakers’ mental representations – likely, in fact, to describe final schwa as an allophone of /r/. Whether speakers have some kind of /r/-like object in their representations of schwa-final items is something that can be investigated

experimentally using paradigms from psycholinguistics of the kind used, for example, to explore neighbourhood densities.

5.3 ‘Free-ride’ derivations and the non-distinctiveness of coda [r]

Giegerich (1999: 176-7) argues that if the schwa in e.g. *weir* is taken as a realisation of /r/ then it must also be a realisation of /r/ pre-consonantly in *weird* despite the absence in non-rhotic speech of any form with a constrictive [r] and the consequent ‘learnability problem’. The same phonetic material does not force the same phonological analysis, however, if the context is different. The schwa in *weird* can be handled by postulating a certain phonotactic relation between the /d/ and the full-vowel nucleus, such that this relation is the only difference between the phonological forms of e.g. *beard* and *bid*. The /d/ is analysed as occupying a position in the phonotactic group further to the right of the nucleus in the former than in the latter, with the preceding position left phonologically empty; empty positions are realised phonetically as schwa (Heselwood, in preparation a). The same analysis applies to the schwas in triphthongs. Table 2 presents examples (adapted from Heselwood, in preparation a).

Table 2. Final and non-final schwas in diphthongs and triphthongs.

	ONSET	NUCLEUS	CODA 1	CODA 2
<i>liar</i>	l	aɪ	r	
<i>line</i>	l	aɪ	n	
<i>lion</i>	l	aɪ	∅	n
<i>beer</i>	b	ɪ	r	
<i>bid</i>	b	ɪ	d	
<i>beard</i>	b	ɪ	∅	d
<i>sour</i>	s	aʊ	r	
<i>loud</i>	l	aʊ	d	
<i>coward</i>	k	aʊ	∅	d
<i>layer</i>	l	eɪ	r	
<i>laid</i>	l	eɪ	d	
<i>layered</i>	l	eɪ	∅	d
<i>lower</i>	l	əʊ	r	
<i>load</i>	l	əʊ	d	
<i>lowered</i>	l	əʊ	∅	d

It is the assumption of having to account for non-final schwa in *weird*, *beard* in the same terms as final schwa in *weir*, *beer* that makes Giegerich reject an analysis

with final /r/. Instead he presents a solution which in some respects is very similar. Giegerich (1999: 184-97) proposes that [r] and [ə] are complementary realisations of a phonological zero (represented as /∅/) - [ə] appearing in rhymes, [r] in onsets (or, in Giegerich's formulation, 'elsewhere'). The 'double /r/' problem is avoided by associating a single /∅/ with two skeletal x-slots, one accommodating the [ə] component, the other the [r] component. However, the charge of arbitrariness is rather easily levelled at Giegerich's proposal insofar as he fails to give a convincing explanation for why /∅/, specified only as [+sonorant] (Giegerich, 1999: 191), should manifest as [r] in onsets rather than as something else - fails, that is, to answer the 'Why [r]?' question (McCarthy, 1993: 190; Giegerich, 1999: 183). While it is uncontroversial to regard schwa as a default vocalic sonorant, it can hardly be uncontroversial to regard [r] as 'the consonantal default sonorant' (Giegerich, 1999: 191). No independent evidence is put forward to support this contention¹². The most common variant in non-rhotic varieties is [ɹ] which is one of the last consonants that children acquiring such varieties learn to master (Grunwell, 1987: 224-5), whereas according to Bernhardt & Gilbert (1992: 130-31) it is expected that default sounds are acquired early. They suggest that [j] is the default sonorant for English.

If, as I argue, final schwa is a realisation of /r/ then the appearance of [r] in alternating contexts does not need to be accounted for by assuming its status as a default sonorant consonant - /r/ is lexically specified as part of the phonological form of the stem.

A further problem is solved by the same phonotactic analysis, namely the problem of the apparent non-distinctiveness of coda [r] in forms with the tense vowels [ɑ:, ɔ:] (Uffmann, 2003: 2) and [ɜ:]. If the occurrence of R-sandhi in the examples in (6) is explained as the realisation of an underlying /r/ phoneme which is present in the items in (7), then it might be assumed that there must also be an underlying /r/ phoneme in the items in (8).

(6) *ca[r] allowance*
spa[r] attendant
soa[r] up
saw[r] up
blur[r] it

(7) *car, spa*
soar, saw
blurr

(8) *cars, card*
spas, calm
soared, sword
sawn, yawn
blurred, blurt

¹² Uffmann (2003: 20-21) identifies the formant structure of [r] with non-high vowels though it is not explained how differences in formant values between front and back non-high vowels could be accommodated.

If that assumption is accepted, then the presence of [r] is predictable because wherever these vowels occur they are followed by [r], and [r] is therefore not distinctive. However, there is no need to assume an /r/ in the items in (8) if we are prepared to abandon the view that the phonological form of e.g. *cars* must properly contain the phonological form of *car*. Once that view is no longer held, we can describe the phonological forms of the items in (7) as having final /r/ which is realised word-form finally as vowel length (cf. Mulder, 1989: 252) and pre-vocalically as a constrictive (typically [ɹ]). Realisation as vowel length represents a later stage of historical change in which the tongue gesture has further weakened to the point where there is no offglide and the schwa is absorbed by the preceding vowel; McMahon (2000: 274) reports that an offglide can still be heard in the speech of some older RP speakers.

Commutation of [r] with other consonants, as in (9), is proof of its distinctiveness. Not needing to have /r/ in the phonological forms of the items in (8) fits well with the fact that there has been no continuity of rhoticity, no synchronic alternations with [r], where the site of historical /r/ is followed by a consonant within the same word-form.

- (9) *car allowance* – *cars about*
 /kar/ /kaz/
- spa attendant* – *park attendant*
 /spar/ /pak/
- soar up* – *soared up*
 /sɔr/ /sɔd/
- sawing* – *yawning*
 /sɔrɪŋ/ /jɔnɪŋ/
- blurr it* – *blurt it*
 /blɜr/ /blɜt/

A consequence of these analyses of R-sandhi is that we are led to conclude that no word-forms in RP English end with a non-high vowel. The high vowels /i/ and /u/ being the most consonant-like, it seems there is a strong constraint in favour of post-vocalic consonants in this variety of English, although realisational forms with non-high final vowels are common due to the weakening and vocalisation of /r/ and, in the context of a preceding /ɑ, ɔ, ɜ/, its absorption by that vowel.

5.4 Slow speech is less R-ful

McMahon (2000: 249-50) makes the point that ‘slower speech seems to produce fewer [r]s’ and that this supports an R-insertion account because insertion rules generally are less likely to operate in slow speech. The argument is that if the presence of [r] is a connected speech phenomenon, then the less strong the connectedness of the speech, the less likely the phenomenon is to occur. However, this fails to acknowledge the influence of final position, and boundary conditions in general, on items in phonological structures. The slower the speech, the stronger such an influence will be. Devoicing in final obstruents in English provides an illustrative

case. In word-final pre-pausal position, /z/ is typically devoiced and realised as [z̥] but in connected speech where the next word begins with a vowel such that the word-final /z/ is intervocalic, it is much more likely to be voiced (Docherty, 1992: 125-6). The more rapid the speech, the less devoicing influence the boundary will have. Loss of voicing whilst remaining lenis results in a phonetically weaker consonant. Similarly, /r/ is realised as weaker [ə] when the influence of final position is more dominant, and as [r] or [ər] when that influence is less dominant, i.e. in rapid speech between vowels. The variant without the schwa component, as in (2) and (3) above, – one might say the maximally rhotic variant, – is most likely the more rapid the speech.

6. Conclusion

A case has been made for regarding final schwa in RP English as a contextually-determined vocalised allophone of /r/. The planks in the argument are that rhoticity in words with historical final /r/ has been continuous in English in pre-vocalic contexts; that pre-R breaking was a phonetic change in the realisation of final /r/, not a phonological change of final /r/-loss; that the criteria of phonetic similarity, phonotactic distribution and distinctive function are consistent with an R-vocalisation analysis; that *comma* words have merged with *letter* words as evidenced by the phenomenon of intrusive R and therefore behave as if they once had had historical final /r/; that speakers store contextually different forms of the same lexical item rather than deriving them by rule from a single underlying form; that the realisations of final /r/ are sensitive to boundary conditions which accounts for the greater incidence of constrictive realisations in rapid speech compared to slower speech. I have suggested that the same arguments and analysis are applicable to words ending in [ɑ:], [ɔ:] and [ɜ:] as well providing we do not assume that the phonological form of a grammatically complex item is the sum of the phonological forms of its simple constituents.

I have suggested that the phonotactic group rather than the syllable is a better structure for describing the distribution of /r/, because it readily deals with realisations that cut across the contoid-vocoid distinction.

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