

# ‘R’-sandhi in English: how to constrain theoretical approaches

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## Introduction

Varieties of English can be grouped into two large classes from the point of view of the phoneme /r/: rhotic and non-rhotic varieties. In rhotic varieties, such as General American or Standard Scottish English, /r/ is always pronounced, whatever its position within the syllable (*red* [ɹɛd], *bar* [bɑ:ɹ], *barn* [bɑ:ɹn], *Barney* [bɑ:ɹni]). In non-rhotic varieties like British Received Pronunciation (or Southern British English) however, /r/ in coda position has disappeared throughout history (*bar* [bɑ:], *barn* [bɑ:n], *Barney* [bɑ:ni]) but may still be heard when in final word-position and followed by a vowel-initial word (*a ba[ɹ] in London*): a phenomenon we call ‘r’-sandhi here. Descriptions of this phenomenon have too often been marred by prescriptive considerations relying on orthography and have rarely been based on the systematic analysis of empirical data according to explicit criteria. The goal of this paper is to present and illustrate the methodology that was adopted within the PAC program (“Phonologie de l’Anglais Contemporain: usages, variétés et structure”: Carr, Durand & Pukli 2004, Durand & Pukli 2004, Durand & Przewozny 2012) to deal with the study of ‘r’-sandhi. This methodology is similar to that of the PFC program (Durand, Laks & Lyche 2002, 2014) which has provided extensive descriptions of another sandhi phenomenon, that of French liaison (Durand & Lyche 2008).

Our plan is as follows: first we raise some essential questions relating to ‘r’-sandhi in English and review the major theoretical treatments that this phenomenon has received within diverse theoretical frameworks. Note that we use the term “sandhi” to remain as neutral

as possible on the question of the dichotomy between “linking-r” (*a ba[ɹ] in London*) and “intrusive-r” (*the Shah[ɹ] of Iran*). This distinction is important but has prescriptive origins closely linked to orthography and must be handled with caution. We will then describe the methodology of the PAC program and notably focus on the coding system that was devised to account for ‘r’-sandhi in our corpora. Most importantly, we will illustrate our analyses of ‘r’-sandhi with the results yielded by two corpora collected within the PAC program (Lancashire and New Zealand). Finally, we will offer concluding remarks.

### **Description and modeling of ‘r’-sandhi**

Throughout the 17<sup>th</sup> and 18<sup>th</sup> centuries, the English spoken in the south of England derhoticized, that is to say that /r/ ceased to be pronounced in coda position of a syllable. This is notably the case for Received Pronunciation (hereafter RP). This /r/ however left a trace in final position and can still be pronounced when it is preceded by a vowel of the [ə, ɜ:, ɛ:, ɪə, eə, ʊə, ɑ:, ɔ:] group and is followed by a vowel-initial word (*core[ɹ] of*). Sandhi-‘r’ is thus the name given to an [ɹ] which is not pronounced in an isolated word but which may be realized in such a context in connected speech. A distinction exists in the literature between two sub-phenomena, namely linking-r and intrusive-r. Linking-r involves an etymological /r/ which is reflected in the orthography and is present in inflected and derived forms of words (*store, storing, storage*), while intrusive-r involves an [ɹ] which is absent from the orthography (*draw[ɹ] a picture*) and is also attested at the lexical level (*draw[ɹ]ing*). As we will see below, this distinction based on orthography may well be inadequate for certain varieties or speakers of English, hence our choice of the neutral term “sandhi”. We will see that many theoretical treatments of ‘r’-sandhi have been built on idealized linguistic behaviors. We wish to extract three types of systems out of these classical descriptions before studying their modeling in various theoretical frameworks.

Most pedagogical descriptions of RP assume the existence of a system in which the presence or absence of a sandhi-'r' is a direct reflection of the orthography, as is pointed out by Cruttenden (2008: 305): "Prescriptivists seek to limit the allowability of linking /r/ to those cases where there is an <r> in the spelling.". Such a hyper-conservative system represents the type of varieties we will label A. In a type A system, it is the absence of an underlying /r/ at surface level that must be accounted for. In standard generative phonology, a rule of deletion such as (1) is usually postulated:

(1)  $r \rightarrow \emptyset / \_ \{ \{ +, \# \} C, \#\# \}$

Such a rule deletes an /r/ when it is followed by a consonant, by a consonant-initial morpheme or word, or by a tone unit boundary (Mohanan 1986, Durand 1990: 126–128). Multilinear phonological frameworks have reformulated deletion by calling upon the concept of syllable rime (/r/ is deleted in coda position), but the intuition is the same: in non-rhotic varieties of English, such as RP, sandhi-'r' is an underlying segment whose presence or absence recapitulates historical changes.

As early as the first descriptions of RP, the actual existence of such a system was called into question. Daniel Jones, a sharp observer of the pronunciation of English, noticed the presence of an 'r' at the end of historically r-less words, for instance *idea*[ɪ] *of it*. His attitude toward these non-etymological sandhi segments evolved over the course of his work. He first considered himself as part of a majority of speakers who do not use intrusive 'r' (Jones 1917) and treated the latter as a feature of London speech. Later, he conceded: "I... occasionally found myself using intrusive /r/" (1956a: xxv) and finally came to the conclusion that the number of speakers who never use intrusive 'r' is probably quite small (1956: §366). At any rate, the usual distinction between so called linking 'r' and intrusive 'r' points to the possible existence of a system that we will label B. In this system, there is a significant statistical imbalance between two types of behavior:

(quasi-)categorical use of linking ‘r’ in etymological contexts (for instance *far*, *better*) and occasional presence of intrusive ‘r’ in the class of words ending with a non-high vowel (for instance *Shah*, *draw*, *sofa*). In order to account for this intrusive ‘r’, a variable post-lexical rule of insertion (as in (2)) is usually postulated:

(2)  $\emptyset \rightarrow r / V[-\text{high}] \_\_\_ \#V$

The very existence of type B varieties, in which linking ‘r’ is generalized but intrusion is optional post-lexically, is rejected by certain phonologists (Harris 1994: 293, note 5) who argue that speakers who endeavor to avoid intrusive ‘r’ also tend to forget linking ‘r’ in some cases, and that therefore, a clear-cut distinction between linking and intrusion cannot be validated. Consequently, a number of specialists assume that more “innovative” varieties (which we will label C) exist in which intrusion is generalized at the post-lexical level. Thus, Hughes, Trudgill and Watts (2005: 65) describe intrusion in southern England as “so automatic that if speakers with a southeastern-type English accent fail to use intrusive [ɹ], especially after /ə/ or /ɪə/, they are probably non native speakers.” They explain, however, that many speakers of those varieties try to avoid intrusive ‘r’ at the lexical level (i.e. in examples such as *draw*[ɹ]ing). Similarly, Wells (1982: 222) offers an analysis in which a single post-lexical insertion rule is active and operates on r-less underlying forms: “Instead of these alternations being produced by an /r/-dropping rule operating on underlying forms containing /r/, a new generation of speakers came to infer underlying forms without /r/, a phonetic /r/ [...] being introduced in the appropriate intervocalic environment by a rule of r insertion.”

The analyses formulated within the SPE tradition have often focused on the opposition between deletion and insertion, and on the nature of underlying forms on which they operate. For type C varieties for example, several specialists have analyzed sandhi-‘r’ as a case of rule inversion by which a rule that deletes /r/ in a given context is reinterpreted as a rule that inserts an [ɹ] in the opposite context

(Venneman 1972, Donegan 1993, McMahan 2000). It has also been suggested that /r/ is always underlying (e.g. *draw* /drɔ:r/) and submitted to a single rule of deletion. However, this hypothesis has often been discarded for two reasons: first, intrusion is productive and applies to sequences borrowed from foreign languages, as in *viva*[ɹ] *España* (Wells 1982); second, intrusive 'r' is attested after schwas that are reduced variants of full vowels which do not license sandhi-'r', as in *tomato and* pronounced as [təmə:tərənd], the lexical form of *tomato* being /təmə:təʊ/.

Ever since the development of generative phonology, various theoretical frameworks have been exploited for the modeling of sandhi-'r'. Harris' influential 1994 analysis is couched within Government Phonology (Kaye, Lowenstamm and Vergnaud 1985), which rejects derivational processes and favors the enriching of phonological representations. Harris' treatment relies on the idea that an extrametrical segment, or "floating r", is present in final position of the domain under consideration, in the lexical representations of morphemes or words producing 'r'-sandhi. This solution is identical with what has frequently been proposed for the modeling of French liaison (Durand and Lyche 2008). There is a condition of NON-RHOTICITY which only licenses /r/ in onset position of a syllable. When a floating 'r' precedes a vowel-initial morpheme (whose initial syllable has an empty onset), it docks onto the empty onset creating an X on the skeletal tier which allows for its phonetic expression. If the onset which follows the floating 'r' is already occupied by consonantal material, the 'r' cannot be realized and is automatically deleted (or "not heard" in the terminology of Government Phonology). Linking 'r' and intrusive 'r' are treated in the same way by Harris. Forms which historically had a final vowel of the relevant class (non-high) automatically acquire a floating 'r' in their lexical representation. Harris describes the difference between type A and type C varieties as "purely a matter of lexical incidence" (1994: 250). The latter aspect of

Harris' treatment is problematic insofar as it implies that the centralizing diphthongs of English always come with a floating 'r'. Yet, those centralizing diphthongs are needed at the underlying level in words like *beard* /bɪəd/ or *gourd* /gɔəd/ which never show a Ø/r alternation. Furthermore, this solution is equivalent to the postulation of an underlying /r/ for all sandhi cases, a solution that we criticized earlier.

Within Government Phonology, specialists have also argued that the use of unary features (called "elements") allowed for a better description of sandhi-'r'. Thus, Broadbent's (1991) analysis of West Yorkshire English sees sandhi-'r' as a case of glide formation. She draws a parallel between sandhi-'r' and the [j] and [w] glides that can be heard in *see*[j] *a* or *do*[w] *it*. In the latter cases, the |I| and |U| elements, present in the vowels of *see* and *do* respectively, are said to spread to a following empty onset, consequently creating a glide. What 'r'-sandhi triggering vowels have in common is the |A| element in head position of their representation (1991: 300). Broadbent concludes that |A| is responsible for the formation of 'r'-sandhi. This description however disagrees with that of Harris (1994) who argues that the coronal element |R| is necessary for the formation of the [ɹ] segment. If a coronal element |R| is indeed indispensable, Broadbent's analysis requires an extra rule of insertion to allow for |A| to be accompanied by |R|, but such a transformational mechanism is rejected by Government Phonology. Finally, if [ɹ] really is the default segment after non-high vowels (in the same way as [j] and [w] after high front and high back vowels respectively), why is 'r'-sandhi not more widespread in the languages of the world?

The birth of Optimality Theory (Prince and Smolensky 1993) has also inspired various analyses of 'r'-sandhi. One of the first illustrations of Optimality Theory (hereafter OT) was in fact McCarthy's analysis of 'r'-sandhi in the non-rhotic Boston variety. His treatment is based on the existence of incompatible constraints which govern the coda of linking words. One of them (CODA-COND) bans [ɹ] from

post-nuclear position, and the other (Final-C) requires a consonant or a glide in final position. A ranking of these two constraints allows McCarthy to model 'r'-sandhi in type C varieties. Still, this treatment also requires an [ɹ] insertion rule in cases of intrusion, which undermines McCarthy's overall strategy. In the wake of this analysis, Uffmann (2007) focuses essentially on intrusive 'r' and notably on the motivation of the choice of [ɹ] to break hiatus after [-high] vowels, a problematic aspect of previous treatments.

Within OT, the selection of an optimal output form does not mean that it violates no constraint. The optimal output of a given input is the one which violates only the constraint(s) situated lower in a given hierarchy than the most penalizing constraints. Breaking a hiatus by adding a segment within a sequence violates the DEP constraint (i.e. do not add any material to the input). In the following *tableau*, featuring *law is* /lɔ: ɪz/ as an input, we can see why all potential outputs except the first one violate this constraint:

**Figure 1:** Constraint tableau (Uffmann 2007: 464–465)

| /lɔ: ɪz/              | ONSET | *G <sub>[-hi]</sub> | DEP(hi) | DEP | *V_V/lar | *V_V/r | *V_V/V |
|-----------------------|-------|---------------------|---------|-----|----------|--------|--------|
| [lɔ:ɪz]               | *!    |                     |         |     |          |        |        |
| [lɔwɪz]               |       |                     | *!      | *   |          |        | *      |
| [lɔʏɪz]               |       | *!                  |         | *   |          |        | *      |
| <sup>EP</sup> [lɔɹɪz] |       |                     |         | *   |          | *      |        |
| [lɔ:ʔɪz]              |       |                     |         | *   | *!       |        |        |

The selection of [lɔɹɪz] is justified by the fact that the preceding vowel is non-high and does not allow the hiatus-breaking epenthesis of a high glide such as [j] or [w]. Indeed, the presence of [j] or [w] in a potential hiatus context is usually the result of the spreading of the [+high] feature from the preceding vowel. In the case of sandhi-'r', it is usually assumed that only non-high vowels trigger the liaison. However, it is still necessary to motivate the presence of [ɹ] rather than a transition such as [ʏ] for example (see [lɔʏɪz] in figure 1). We

will not go into further details concerning Uffmann's constraint ranking but will simply point out that his basic intuition is that a hiatus-breaking consonant should be salient enough phonetically, which in his opinion motivates the preference for [ɪ] in English.

Nevertheless, this analysis raises many questions. As we have mentioned before, the insertion of an anti-hiatus [ɪ] is not a very common strategy in the languages of the world. In contrast, the insertion of a glottal stop is usually motivated for low vowels (see Durand 1987 on Malay). Within Government Phonology analyses, /r/ and the |A| element have been argued to be linked, but a relation between /r/ and |@| could be defended as well, given that the reduction of /r/ in English yields schwa. Yet, the |@| element is usually the lowest element in the sonority hierarchies that have been proposed. Furthermore, Uffmann's analysis, like so many other theoretical studies, suffers from a major drawback: the data presented do not rest on any specific observational basis. Varieties under study are presented as evident, while their very definition is problematic. Thus, Uffmann only deals with what we have called a type C variety but rules out a sequence such as [ɔ:ɪZ] which is the most penalized candidate in figure 1. This type of sequences is however present in the Lancashire and New Zealand corpora that we present below. Similarly, sequences such as [ɔ:ʔɪZ] (also rejected in figure 1) are indeed present in our data, even though they are not as common as examples involving 'r'-sandhi.

Without any data that have been collected according to a precise protocol, annotated and analyzed systematically, it is impossible to support or reject the treatments that have been offered within different theoretical frameworks. For these reasons, we have decided to adopt a precise methodology which consists in constructing and exploiting corpora in a well-defined framework, that of the PAC program. This is the issue to which we now turn.



## **The PAC program**

### **Protocol**

The PAC program (“La Phonologie de l’Anglais Contemporain: usages, variétés et structure” or “PCE, Phonology of Contemporary English: usage, varieties and structure”) is a sociolinguistic program coordinated by Philip Carr, Jacques Durand and Anne Przewozny. Its main goal is to build a large database of spoken English in its geographical, stylistic and social diversity. This database has strong phonological and phonetic foundations allowing for the testing of various contemporary theoretical models, but its ambitions go beyond phonology. Indeed, recordings and transcriptions can be exploited for the study of many aspects of English, from lexicon to discourse. In this article however, we will only focus on phonological questions.

The methodology adopted within the PAC program is inspired by the classical work of Labov (e.g. 1966, 1972, 1994, 2001) and relies on the construction of corpora of recordings of spoken English throughout the world. This methodology is similar to that of the PFC program (see Durand, Laks and Lyche 2003, 2009) and revolves around four registers: the reading aloud of two wordlists focusing on segmental phonology; the reading aloud of a text which gives us another access to segmental aspects as well as aspects of post-lexical phonology (notably ‘r’-sandhi as far as we are concerned here); a formal conversation between the fieldworker and the informant; and an informal conversation involving two or three speakers belonging to the same close network (friends or family members). This latter conversation ideally takes place outside the presence of the fieldworker and is crucial for it offers access to the type of linguistic interaction which involves the least self-monitoring and hyper-correction. It brings our data closer to what can be drawn from surreptitious recordings, an unacceptable method on ethical grounds.

The two wordlists combined with the text and conversations nota-

bly help us determine whether the system under study is rhotic or non-rhotic and explore the consequences of the presence or absence of /r/ on the vowel system. The text resembles a newspaper article and includes many of the segmental oppositions attested in the varieties of English. It can be used to test various hypotheses on the post-lexical phonology and prosody of English. As far as we are concerned, it contains several potential sites of ‘r’-sandhi (both linking and intrusive ‘r’). The protocol we describe here is systematically applied to each survey point although investigators are free to add other elements if they wish (e.g. additional word-lists, short sentences, a map task or a video recording of a meal).

The digitally recorded data are transferred onto a computer and transcribed using Praat (Boersma and Weenink 2009, Boersma 2014). This software is widely used within the linguistic community. It lets its users align a sound sequence with the corresponding orthographic transcription. It offers the possibility of creating and aligning several tiers containing various types of information. Besides the wordlists and the text, five to ten minutes of both conversations are transcribed (including hesitations, repetitions, truncations, pauses, etc.) using standard orthography without any modification. This methodological choice is the result of a thorough reflection on the comparability and alignment of transcriptions. Praat’s ability to create several tiers allows us to do away with the necessity of setting up a unique transcription level with complex annotations taking into account many segmental, prosodic or pragmatic features of the data under examination. Simple orthographic transcription combined with a small number of additional conventions ensures the portability of the data and facilitates the devising of search and indexation tools that are efficient and robust. We argue below that some phenomena (such as ‘r’-sandhi) can profitably be studied by simply annotating (coding) our baseline orthographic transcription on a specific tier under Praat.

### **Transcription, coding and tools**

Our coding system for 'r'-sandhi is inspired by the coding system for French liaison in the PFC program. It aims to provide an accurate transcription of the cases of sandhi observed in the auditory analysis (backed with acoustic analysis whenever necessary) and allows for quantitative as well as qualitative analyses by automatic extraction of the codings. The tool we are currently using for the extraction and quantitative analysis is called DOLMEN and was devised by Julien Eychenne ([www.julieneychenne.info/dolmen](http://www.julieneychenne.info/dolmen)). We will now briefly describe our coding system.

The creation of a tier of orthographic transcription aligned with the signal sets us apart from many corpus-based sociolinguistic projects in which only sequences that are deemed relevant to the study of specific variables are transcribed and annotated. While we do not reject this technique, we believe that creating a zero layer of continuous transcription combined with annotation and coding tiers offers significant advances in the treatment of a number of phenomena in context.

Our 'r'-sandhi coding is carried out using the orthographic transcription which we duplicate onto an independent tier. This coding is implemented for every (non-rhotic) speaker in the text reading task, five minutes of formal conversation and five minutes of informal conversation. Two major criteria have led to the elaboration of our coding system: it must be readable and understandable by non-specialists of the subfield in question and must offer a global approach of the data. Thus, we do not code too many details such as the degree of stress of the left and right syllables involved because of the lack of agreement among specialists on the relative stress properties of words within the speech chain. It is however possible to integrate this parameter by constructing a further tier under Praat specifically devoted to this dimension (as is done by Navarro 2013). We briefly return to this issue further down.

As we have just underlined, our coding system has been devised to offer a first scanning of the data and minimize theoretical preconceptions. All sites traditionally considered as potential sites of linking or intrusive ‘r’ are coded. However, we do not sort out these two phenomena in the initial stage of the process since, as we have pointed out earlier, this distinction needs to be validated and is universally founded on spelling, thus directly retrievable from our orthographic transcription.

The alphanumeric coding focuses on the following parameters: (i) presence or absence of a sandhi-‘r’, (ii) syllabic makeup of the left word or W1, (iii) syllabic makeup of the right word or W2, (iv) presence of a zone of turbulence or non-linking. To take a concrete example, a sequence such as *more often* pronounced [mɔːɹɒfən] would be coded as <more112 often>. In this example, the first figure “1” indicates that a sandhi-‘r’ is realized. The second figure “1” indicates that W1 (*more*) is monosyllabic and the third figure “2” indicates that W2 (*often*) is polysyllabic. Similarly, the sequence *China in February* pronounced with a so-called intrusive ‘r’ between *China* and *in* will be coded as <China121 in February>, since ‘r’ was indeed pronounced (“1”) between a polysyllabic W1 (“2”) and a monosyllabic W2 (“1”).

Let us now look at the coding system more closely. The alphanumeric notation includes four fields, the first three of which are compulsory and the fourth one optional.

**Field 1:**

- 0: ‘r’ is not realized
- 1: ‘r’ is realized
- 2: uncertain realization
- 3: presence of a non-orthographic word internal (epenthetic) ‘r’ (e.g. *draw[ɹ]ing*)

**Field 2:**

- 1: W1 is monosyllabic
- 2: W1 is polysyllabic

**Field 3:**

1: W2 is monosyllabic

2: W2 is polysyllabic

**Field 4** (optional) involves the adding of <h> or <rh> after the three figures linked to Fields 1 to 3 with the following interpretation:

<h> indicates a zone of “turbulence”, i.e., a glottal stop or a pause or a hesitation. In our broad phonetic transcriptions, we will use the PH (for “pause/hesitation”) notation for such a rough transition.

<rh> indicates the presence of an [ɹ] before a pause, a hesitation or a glottal stop, as in French “liaison non-enchaînée” (unlinked forward liaison).

To illustrate the above remarks, let us consider one more concrete example: *brother and sister* hypothetically pronounced as [brʌðə PH ənsɪstə]. This sequence would be coded <*brother121rh and sister*>, where the first “1” indicates the presence of a sandhi-‘r’, “2” indicates that W1 is polysyllabic, the second “1” indicates that W2 is monosyllabic and <rh> indicates that the sandhi-‘r’ is not directly linked but separated from W2 by a zone of turbulence (for example a period of glottal constriction).

As we have mentioned before, this coding process is only a starting point. Many other factors that are essential to our analyses (particularly the nature of the preceding vowel, the degree of stress, the phonetic quality of the ‘r’ or the syntactic or prosodic domain) are not initially taken into account. Our coding system only offers a first tool to sort out the data which are then submitted to a deeper analysis. Nonetheless, it is formulated explicitly and applied systematically. It can be examined by other researchers and enriched with extra annotations on lower tiers. Consequently, it is an indispensable step in the elaboration of a properly constructed phonological corpus.

The results we would like to present now are based on two spoken corpora that have been recorded following the PAC methodology which we have described above. The first one was recorded in 2002

in Lancashire, in north-west England, and the second one was recorded in 2010 in New Zealand, more specifically in the capital of the Otago region, Dunedin.

### **The PAC Lancashire survey**

The PAC Lancashire survey was carried out in southeastern geographical and historical Lancashire, more precisely in the region of Burnley, 30 kilometers north of Manchester. 10 speakers were recorded during this survey. This first corpus is unbalanced as regards gender since it includes 9 women. However, the speakers represent various age groups and socio-economic backgrounds.

Descriptions of Lancashire pronunciation have often mentioned rhoticity as one of the remarkable characteristics of this part of England. Upton and Widdowson (1995: 30–31), in *An Atlas of English Dialects* which synthesizes the findings of the famous SED (*Survey of English Dialects* coordinated by Harold Orton in Leeds between 1950 and 1961), describe this region as rhotic. Similarly, Wales (2006: 170), in her detailed study of “Northern English”, quotes work such as Trudgill’s (1999: 53) attesting the presence of rhoticity in Lancashire, particularly in the region of Burnley. We do not question the existence of rhotic speakers in Lancashire north of Manchester, but specialists also agree that, in northern England, rhoticity is recessive under the influence of what is often called “Estuary English” (Beal 2008: 139–140). Incidentally, the city of Manchester, which has a great linguistic influence over neighboring varieties, is completely non-rhotic. In fact, all of our speakers from the region of Burnley are non-rhotic, which corroborates Ferragne and Pellegrino’s (2010) results who found no trace of rhoticity in their Burnley corpus recorded in 2003. Although on a modest scale, our study helps to demonstrate the apparently relentless progression of non-rhoticity in England.

It should be obvious that if our speakers were rhotic, the study of

'r'-sandhi would be impossible. By definition, a rhotic speaker pronounces every etymological /r/, whether or not this phoneme is followed by a vowel-initial word. If a speaker of a rhotic variety exhibited intrusive 'r' (for instance after words like *panda*, *quota*, *raw*, *saw*, etc.), it would imply that all phonotactic difference between /r/-final and vowel-final words would be eliminated. Pairs such as *panda*/*pander* or *saw*/*soar* would become homophonous. To our knowledge, varieties which are consistently rhotic do not have 'r' intrusion. It is therefore essential to make sure that speakers are indeed non-rhotic before applying the codings described above.

As we have mentioned, our coding system does not provide any annotation concerning the quality of linking vowels. It is a key question for the theoretical interpretation of the data, but it requires the preliminary analysis of the whole vowel system of the speakers under study. Our observations, as well as those of Ferragne and Pellegrino (2010) in Burnley, show that the system is not isomorphic to that of RP mentioned above. Nevertheless, as is the case in all varieties usually described by specialists, only non-high vowels can trigger 'r'-sandhi. Note that, in this context, the phonetic analyses carried out through our corpus show that prevocalic /r/ is mainly realized as a post-alveolar [ɹ] and in a few cases as an alveolar tap. Yet, the tap never appears in sandhi context where only approximant [ɹ] is attested in our observations. The quality of the linking vowel and that of the sandhi-'r' are therefore compatible with an interpretation in terms of unary features such as |A| (aperture) or |@| (centrality), as argued in Government Phonology.

Another interesting question for this variety is the relation between the presence of a sandhi-'r' and the behavior of an initial /h/. The phenomenon described by sociolinguists as "h-dropping" is one of the most prominent features of the pronunciation of English in northern England but also in the popular speech of London (Wells 1982, Wales 2006: 177–178, Beal 2008: 137–138). In all varieties of English, an

initial /h/ in a grammatical word is usually not realized in unstressed position, but “h-dropping” actually refers to the non-realization of /h/ in a lexical word. This type of pronunciation is strongly stigmatized in Great Britain. This phenomenon is widely attested in our Burnley survey, even in the reading task, and we have found many occurrences of ‘r’-sandhi realized before an (orthographic) <h>-initial word, whether lexical (eg. JM1: *they*[ɪ]e (h)orrible or *fou*[ɪ] (h)undred) or grammatical (eg. JM1: *fo*[ɪ] (h)imself). These pronunciations raise an interesting question for phonological theory. If the initial /h/ is indeed underlying, it must be deleted before the ‘r’-sandhi process, which implies an extrinsic rule ordering (a device found too powerful by most modern generative models). It is however possible that two forms (with and without /h/) are lexically available to the speakers, without involving an actual deletion process. We will leave this question open for now, but it needs to be solved if one wants to offer an adequate treatment of ‘r’-sandhi.

Let us now examine some of the results yielded by the extraction of our codings. A first observation concerns the rate of realization of sandhi-‘r’ in two different tasks of the protocol: the formal and informal conversations on the one hand, and the reading aloud of the text on the other. The comparison of the rates of realization of ‘r’-sandhi for our Lancashire informants in these two contexts appears in figure 2 below.

The first observation we can make is that ‘r’-sandhi is not categorical for any of the speakers in this corpus. As we have mentioned, some theoretical treatments consider that the presence of [ɪ] in sandhi contexts is automatic (see our discussion of Uffmann 2007 above).

This is not the case in our corpus since we note such examples as:

(3) Non-realization of ‘r’-sandhi with no pause between W1 and W2

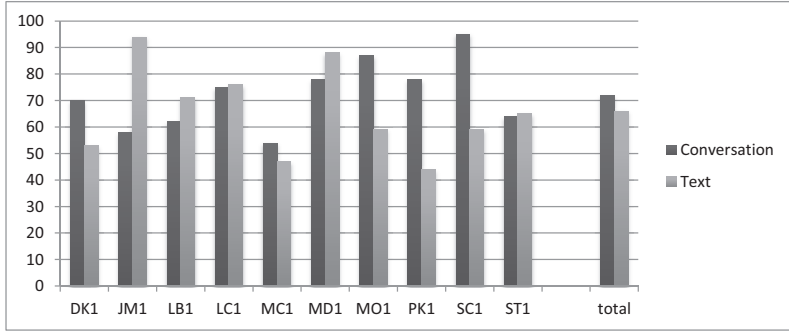
MC1: *And when I hear*012 *Italian, you know*

DK1: *it's in your*012 *exhaust*

Moreover, we pointed out that many specialists who favor the hy-



**Figure 2:** Individual rates (%) of 'r'-sandhi in the conversations and text reading task

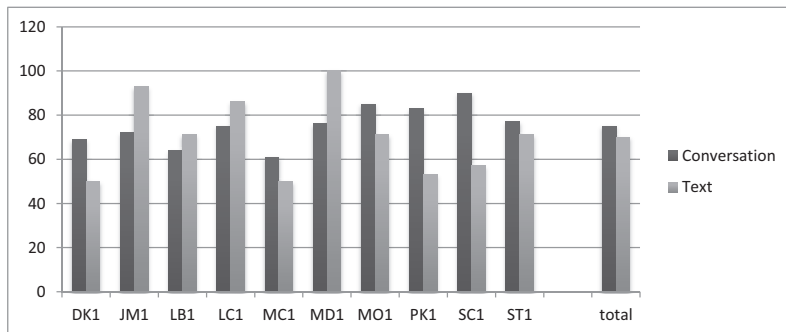


pothesis of generalized 'r'-sandhi go as far as denying the existence of type B systems (our label) in which linking and intrusion can be distinguished. Our results indicate that the overall rates of realization (all tasks together) are 76% for linking 'r' and 38% for intrusive 'r'<sup>1</sup>). In comparison, Foulkes (1997), in the corpus he built in Derby, finds 90% for linking 'r' and 57.3% for intrusive 'r'. However, it should be noted that Foulkes withdrew a number of occurrences of non-realization from his statistics in cases where a clearly perceptible pause was inserted. As we have not excluded such occurrences, we obtain a slightly higher proportion of non-realization and, consequently, slightly lower rates.

As regards registers, our Lancashire survey shows that the rate of linking 'r' is slightly lower (70%) in the reading task than in the conversations (78%). Figure 3 below proves that performances are not uniform and that 7 out of our 10 speakers have a greater rate of linking 'r' in the conversations than in the reading task.

This situation is not comparable to what we observe in French: if we examine the PFC database, we find that the rate of realized liaison is clearly higher in the reading task (59.4%) than in the conversations (43.4%), and this discrepancy is generalized to all speakers (see Du-

**Figure 3:** Individual rates (%) of linking ‘r’ in the conversations and text reading task



rand, Laks, Calderone and Tchobanov 2011). Besides, in our Lancashire survey, the absence of an orthographic <r> does not block intrusive ‘r’. We think that two explanations are possible. First, in spite of purists’ attacks against intrusive ‘r’, the opposition between linking ‘r’ and intrusive ‘r’ does not receive the same attention in English-speaking schools as French liaison does. The latter, as we know, involves explicit learning and plays a more important social and political role than the presence or absence of ‘r’-sandhi in English (Encrevé 1988). Second, our data prove that the prosodic linking of words is necessary to the presence of a sandhi-‘r’. The presence of a PH systematically blocks the sandhi process as in the following example after *wear*:

(4) Non-realization of ‘r’-sandhi after a pause/hesitation between W1 and W2

MD1: *you had to wear012h indoor shoes when you were112indoor, like plimsolls or*

Our informants’ reading performances with slower delivery and occasional lack of fluidity seem to inhibit ‘r’-sandhi in a great number of contexts. In PFC, “liaison non-enchaînée” (unlinked forward liaison) is extremely rare in conversations but well attested in reading

tasks. We have no example of this type in our corpora and, to our knowledge, it is not discussed in the English literature devoted to 'r'-sandhi. However, a deeper acoustic analysis of our data revealed a tendency for younger speakers to use “creaky voice” (laryngealization) as a possible hiatus breaking strategy (Mompean and Gomez 2010).

As regards the distinction between informal and formal conversations, we have not noticed any significant discrepancy. The overall rates of realization are 73% in the informal conversation and 79% in the formal conversation. There are, nevertheless, individual differences as some speakers have a higher rate of realization in the informal conversation than in the formal. The number of tokens at our disposal however forces us to use caution in the interpretation of these disparities.

The syllabic weight of W1 and W2 in sandhi context happens to be a relevant factor for which we have more solid results. According to research carried out by Hannisdal (2006) using recordings of BBC World, Sky News and ITV anchors, monosyllabic W1 and W2 words favor 'r'-sandhi more than polysyllabic W1 and W2 words. Similarly, according to her study, grammatical words trigger more realized 'r'-sandhi than lexical words. As far as we are concerned, the syllabic makeup of W1 and W2 is clearly a determining factor but only for W1, as can be seen in the chart below (figure 4):

**Figure 4:** Rates (%) of 'r'-sandhi realization depending on the syllabic makeup of W1 and W2

|                 | Monosyllabic W2 | Polysyllabic W2 | Total |
|-----------------|-----------------|-----------------|-------|
| Monosyllabic W1 | 78%             | 75%             | 77%   |
| Polysyllabic W1 | 56%             | 60%             | 59%   |

If our observations are correct, they correspond to the French state of affairs where the syllabic weight of W1 is the most crucial factor. The most frequent W1 words are monosyllabic grammatical words which

are more likely to form fixed or semi-fixed phrases with the W2 they specify. This question remains open and, as we enrich our data, our conclusions may agree with Hannisdal's.

Finally, we wish to briefly examine the syntactic or prosodic domain which conditions 'r'-sandhi in English. As the examples in (5) below show, phrase or even sentence syntactic boundaries do not block the realization of 'r'-sandhi.

(5)

MO1: *I'm not sure<sup>111</sup>, it looks a bit peculiar.*

LC1: *Oh, I'm sure<sup>111</sup>, I'm sure.*

MO1: *I mean when he, when he was younger<sup>121</sup>, I mean he was in dramatics*

ST1: *I did have a good career<sup>121</sup>, I worked hard to, to get on the air-line, it wasn't easy at all.*

LB1: *Oh yeah, I do have a brother<sup>121</sup>, I, I haven't mentioned him on there.*

An auditory and acoustic analysis of such examples also indicates that tone group boundaries do not hold back 'r'-sandhi either. Of course, syntactic structure is relevant but only in so far as it has a prosodic interpretation. As already proposed in the classical work of Nespor and Vogel (1986: 229) on the prosodic hierarchy, we believe that U (for Utterance) is the required domain for 'r'-sandhi to apply. The only requirement is complete phonetic fluidity excluding pauses.

### **The PAC New Zealand survey**

The PAC New Zealand survey, built in late 2010 as we have mentioned above, is the most recent of the PAC corpora to have been used to study rhoticity and 'r'-sandhi. In as much, it offers the possibility of supporting or, on the contrary, questioning some of the results provided by previous corpora, such as the PAC Lancashire corpus. Indeed, New Zealand English (NZE) and Lancashire English being two different varieties with distinct origins, histories and evolu-

tions, studying 'r'-sandhi in both varieties provides a relevant perspective on the phonological and phonetic characteristics of this phenomenon. What is more, the PAC-NZ corpus has benefited from the work based on the PAC Lancashire data (Navarro 2013), which has greatly contributed to making it a solid resource that can be analysed in a multi-dimensional way (see Viollain 2014).

For the PAC-NZ oral corpus, 21 informants were initially recorded in Dunedin. This location was chosen because it is the capital of the Otago region which constitutes, with the Southland region, the southernmost part of the New Zealand south island. The two regions have always been described as a resistant pocket of rhoticity in a non-rhotic territory (Wells 1982, Bartlett 1992, 2003). In fact, they have a settlement history that is quite different from that of the rest of New Zealand. When New Zealand was colonised from the British Isles in the second half of the 19<sup>th</sup> century, i.e. after the Treaty of Waitangi (1840), Otago and Southland saw a massive influx of Scottish settlers, especially after the discovery of gold in the region in 1861. In the rest of New Zealand, the great majority of the settlers came from England, and more specifically from the southern and eastern counties. The census figures of 1871 (McKinnon 1997 in Gordon *et al.* 2004: 444–445) recorded 51% of settlers coming from England, 27.3% from Scotland and 22% from Ireland. As Scottish variants were the majority in Otago and Southland, some Scottish features won out when a local New Zealand dialect emerged (Trudgill 2004), and notably rhoticity. On the contrary, in the rest of New Zealand, southeastern English features were the majority, which contributes to explaining why General NZE, the standard accent in New Zealand today, is non-rhotic. Consequently, the history of Otago and Southland is similar, to some extent, to that of Lancashire inasmuch as these regions are surrounded by non-rhotic varieties and subjected to the pressure exerted by standard non-rhoticity.

Dunedin was also chosen as our survey location because it is one of

the four main urban centers in New Zealand, which ensured a diversity of potential informants as far as age, sex, socio-economic background and geographical origins were concerned. All the informants in the corpus are Pakeha, which means that they have Anglo-Saxon or European origins, and there are, therefore, no Maori informants in our corpus. Out of the 21 original recordings made in Dunedin, 13 informants were selected. Among the 13 informants that constitute the final corpus, there are 5 men and 8 women, which makes it a rather balanced corpus: 3 informants are between the age of 18 and 20 (2 women and 1 man), 5 informants between 43 and 51 (3 women and 2 men) and 5 informants are between the age of 65 and 76 (3 women and 2 men).

It should be mentioned that an additional reading task, which consists of 14 short sentences (see Viollain 2014), was added to the PAC protocol for the New Zealand survey so as to provide more contexts of 'r'-sandhi and guarantee more robust statistical results. Our recordings were transcribed and coded according to the conventions defined for the PAC program (see above), and the personal information about our 13 informants were compiled into individual profiles which we used to formulate sociolinguistic analyses (see Viollain 2014).

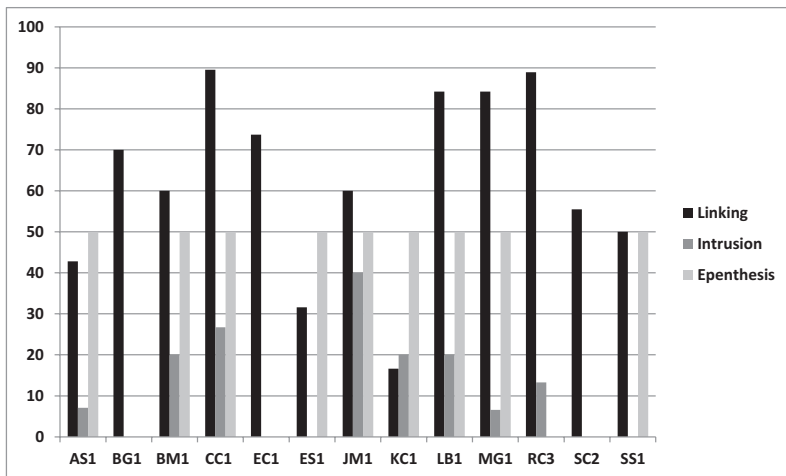
It should also be noted that Otago having long been described as rhotic, we first implemented a coding system to determine whether our speakers are consistently rhotic, non-rhotic or variably rhotic. These codings revealed that out of our 13 informants, 2 are variably rhotic, and the rest are consistently non-rhotic. For our 2 variably rhotic informants (BM1 and LB1), our data showed that they are undergoing a process of derhoticisation, which means that they are gradually becoming non-rhotic. Consequently, we decided to apply the codings for 'r'-sandhi described earlier to the recordings made with all our informants as we deemed that they would provide valuable information as to the stage of derhoticisation reached by our two variably rhotic informants. Therefore, we treated these two informants

separately from the rest of our consistently non-rhotic informants. For the reading tasks (text and short sentences) and the conversations (formal and informal), we got the following rates of realization of linking 'r', intrusive 'r' and epenthetic internal intrusion, as shown in figures 5 and 6 below.

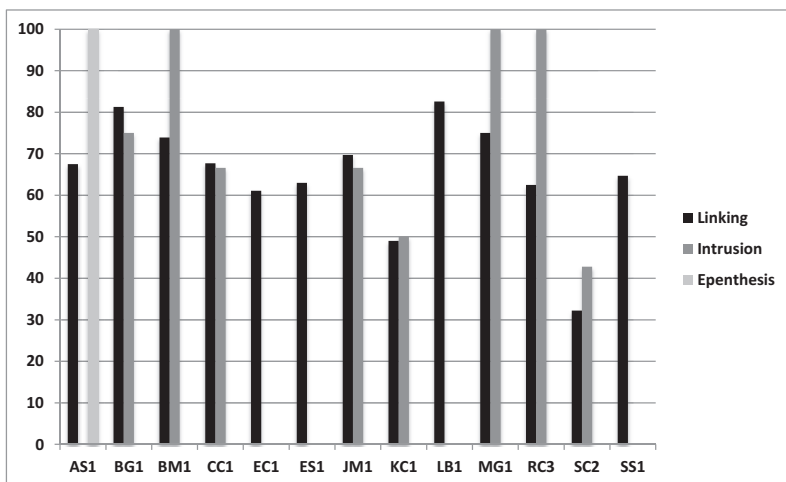
In total, we extracted 1179 codings of 'r'-sandhi, 923 of which correspond to a linking 'r', since an orthographic <r> is present in the transcription, 226 to an intrusive 'r' since no orthographic <r> is present in the transcription, and 30 to an internal epenthetic 'r' since an [ɹ] is realized word-internally between a vowel-final morpheme and a vowel-initial morpheme, as in *drawing*. We can establish from our results that, as in the PAC Lancashire corpus, 'r'-sandhi is not categorical for any of our speakers in any of the tasks, and that the three phenomena under study behave differently in the reading tasks and in the conversations. In as much, the variety of English spoken by our New Zealand informants does not correspond to any of the labels we have described before in our summary of the theoretical accounts of 'r'-sandhi presented in the literature.

We notice that linking has higher rates of realisation among our consistently non-rhotic informants (i.e. excluding BM1 and LB1) than intrusion, with 52,1% of realized linking in the reading tasks and 62,2% in the conversations for 10,3% realised intrusion in the reading tasks and 46,7% in the conversations. Thus, there is a statistical imbalance between the rates of realisation of linking 'r' compared to intrusive 'r', as was the case in the Lancashire corpus. We also observe great inter-individual variation between our informants as some of them have high rates of realisation of linking 'r' (RC3 in the reading tasks for example) and others low rates (KC1 in the reading tasks), and as some of them realise 100% of the potential intrusions in the conversations (CC1, MG1, RC3) while others do not realise any intrusion at all, either in the reading tasks or the conversations (EC1, ES1 and SS1).

**Figure 5:** rates (%) of realisation of linking, intrusion and epenthesis in the reading tasks by the PAC-NZ informants



**Figure 6:** rates (%) of realisation of linking, intrusion and epenthesis in the conversations by the PAC-NZ informants





Our observations support Navarro's (2013) results based on the PAC Lancashire data as phonetic fluidity seems to play a major role in the realisation of a sandhi-'r', in the reading tasks as well as in the conversations. The insertion of a pause or a hesitation blocks the realisation of a sandhi-'r' in our corpus. In the same way, fluidity plays a great role in the realisation of intrusion, but what we could label "collocational frequency" also seems to be of major importance as, based on the reading task (short sentences) we have added, we observed that intrusion was more frequently realised in segments which can be labelled 'common' and are widely found in internet searches, whereas it was (almost) never realised in segments which can be labelled 'unusual' and 'unexpected'. We provide examples of both types of segments below:

'common' segments:

- *Law and Order*
- *India and Pakistan*

'unusual' segments:

- *Mia and Joe*
- *she got her first bra and*

The phonetic quality of the preceding vowel also plays a crucial part in the realisation of all sandhi phenomena but we will not discuss this issue here (see Viollain 2014). Moreover, we note that intrusion is far more realised in the conversations than in the reading tasks, as was also the case in the Lancashire corpus, which points to the fact that even though the presence of orthographic information does not block intrusion in the reading tasks, there might be a sociolinguistic limitation to the realisation of this phenomenon in more controlled contexts. And, as in the Lancashire data, we note that there is no statistically relevant discrepancy between the rate of realisation of 'r'-sandhi in the formal and in the informal conversations, which suggests that the PAC protocol, as devised and implemented in Lancashire and New Zealand, allows the researchers to access authentic speech.

We have focused on quantitative analyses regarding 'r'-sandhi in our New Zealand corpus: we would now like to say a few words about the quality of the realisation of this phenomenon as our coding system

allows us to extract such information (see above). Indeed, we notice that 48,9% of non-realised sandhi-‘r’ involve an “h”, i.e. a zone of turbulence. This zone of turbulence often corresponds to a pause or a hesitation, as we have already commented on earlier. However, this zone of turbulence can also be interpreted in some cases as a hiatus-breaking strategy: in other words, as an alternative to ‘r’-sandhi. This zone of turbulence can involve a glottal stop or some glottal constriction. It can also correspond to what we have previously called “creaky voice”, which is mostly used by our younger speakers, as was the case in Lancashire also.

As far as the “rh” coding is concerned, it is quite rare in our corpus: only 10 occurrences of “liaison non-enchaînée” were found, as in the following segment taken from the formal conversation with CC1, *my Mum first left the country on her111rh own, no less, at seventeen*, where an [ɹ] is realized before a pause. None were found in the Lancashire corpus however, which begs for an explanation. We gathered from our results that 40% of these sandhi-‘r’ come from the recordings made with one of our variably rhotic speakers, LB1, and can therefore be considered as the manifestation of rhoticity. Other cases can be interpreted as pragmatically conditioned, that is the realisation of an [ɹ] before a pause emphasises the idea put forward by the speaker, as in the example above. In any case, we did not find, in our New Zealand or Lancashire corpora, any occurrence of an [ɹ] realized after a pause, or linking with a hesitation, as in French in *les (pause) [z]enfants*. This conclusion can support McCarthy’s (1993) hypothesis of the phonetic ambisyllabicity of [ɹ] which would not entirely be in onset position in ‘r’-sandhi contexts.

As far as epenthesis is concerned, our analyses are based on 30 occurrences only, which forces us to be cautious. Nonetheless, we can conclude that even though this phenomenon appears to be marginal in our corpus, our informants from the two youngest generations all realise an epenthetic [ɹ] in *drawing*, whereas our older informants do

**Figure 7:** influence of syllabic weight on the rate (%) of realisation of 'r'-sandhi in the PAC-NZ corpus

|                 | Monosyllabic W2 | Polysyllabic W2 | Global |
|-----------------|-----------------|-----------------|--------|
| Monosyllabic W1 | 53 %            | 68,3 %          | 56,6 % |
| Polysyllabic W1 | 47,8 %          | 43,3 %          | 46,8 % |

**Figure 8:** rate of realisation of 'r'-sandhi for lexical and grammatical words in the PAC-NZ corpus

| <i>for</i> | <i>here/there/where</i> | <i>BE</i><br>( <i>were/are/’re</i> ) | <i>your</i> | <i>or</i> | <i>her</i> | <i>our</i> | <i>their</i> | lexical words |
|------------|-------------------------|--------------------------------------|-------------|-----------|------------|------------|--------------|---------------|
| 17,25 %    | 12,75 %                 | 21 %                                 | 4,25 %      | 4,25 %    | 1,75 %     | 1,5 %      | 1,25 %       | 36 %          |

not, which could indicate that this phenomenon is spreading in contemporary NZE, as suggested by Hay and Sudbury (2005).

We would now like to briefly comment on the influence of syllabic weight on the realisation of 'r'-sandhi in our New Zealand corpus: once again, our results support our analyses based on the PAC Lancashire corpus. Indeed, the weight of the linking word (W1) appears to be the most relevant factor, and 56,6% of sandhi-'r' are realised after a monosyllabic W1, as shown below (figure 7). What is more, based on our New Zealand data, we studied the rate of realisation of 'r'-sandhi after monosyllabic lexical and grammatical words (figure 8). This study revealed that there is no restriction in NZE, and more generally in English, on the syntactic categorisation of W1 and W2, but 'r'-sandhi is significantly more realised after monosyllabic grammatical words (64%) than after lexical words (36%), as argued by Hannisdal (2006).

Besides, some grammatical words trigger more 'r'-sandhi than others: for example, *BE* and its most frequent forms, as well as the

preposition *for*, are among the grammatical words that trigger most realised ‘r’-sandhi (17,25%) in our New Zealand corpus. We can draw the following conclusion from this study: monosyllabic W1 being predominantly grammatical whereas polysyllabic W1 are mainly lexical, it appears that the syntactic category of the words involved in ‘r’-sandhi plays a significant role and that it could explain why ‘r’-sandhi is more frequently realised after a monosyllabic W1 than after a polysyllabic W1. In the same way, taking syntactic category into account could explain why linking is more realised than intrusion as the latter phenomenon only involves lexical words (*draw, panda, idea, Grandma, India*).

We have seen that our New Zealand data supports most of the conclusions drawn from the study of the PAC Lancashire corpus and offers the possibility of refining some results with more occurrences of ‘r’-sandhi, an added reading task (short sentences) and different research objectives (variable rhoticity).

In conclusion, we hope to have demonstrated, on the basis of the PAC New Zealand data, that ‘r’-sandhi is a complex phenomenon that is subject to great intra as well as inter-individual variation which, in turn, is symptomatic of the current evolution of this phenomenon, and of its three manifestations (linking, intrusion and epenthesis), in contemporary NZE. The PAC corpora allow us to draw phonological, phonetic and sociolinguistic (see Viollain 2014) conclusions on the realisation of ‘r’-sandhi in the different varieties of English worldwide.

## Conclusions

In this paper we have presented a number of observations on ‘r’-sandhi in English based on two surveys carried out in Lancashire and New Zealand. We have illustrated the methodological approach adopted within the PAC program which has drawn much inspiration from the PFC research on French (Durand, Laks, Lyche 2002, 2009). We must however underline an important difference between the data

collected within these two research programs. French liaison is a much more frequent phenomenon than English 'r'-sandhi. Durand, Laks, Calderone and Tchobanov (2011) exploited 35 surveys featuring 372 speakers amounting to 49 728 potential liaison sites (23 953 of which were realized). Approximately 133 liaison contexts were available to these authors for each speaker. For the 23 speakers of our two surveys, we only had a total of 2019 potential sites of 'r'-sandhi, namely an average 87 contexts per speaker. The statistical incidence of 'r'-sandhi is therefore much lower than that of French liaison. In this respect, we would like to point out that in one of the most solid empirical studies on this question, Foulkes (1997) had an average of 37 sites for each of his 32 speakers (i.e. a total of 1190 contexts). We are well aware that the number of potential sandhi sites can be greatly extended by using orthographically transcribed data such as television or radio news. We know however that these types of broadcast mainly consist of reading material, and although we do include this dimension in our work, we prefer to focus on a more spontaneous and interactive type of speech.

To conclude, we would like to note that the comparative study of 'r'-sandhi and French liaison is very informative. These two phenomena have in fact received similar theoretical treatments, from standard generative phonology to optimality theory. Yet, we believe that in spite of undeniable similarities, a number of parameters distinguish them. French liaison is much less sensitive to rhythmic fluidity than 'r'-sandhi. French liaison relies heavily on morphological information while 'r'-sandhi operates at a much shallower phonological level (although, as we have shown, 'r'-sandhi is influenced by syllabic weight and the statistical distinction between grammatical and lexical words). In both cases, quantitative factors (such as the cohesion between W1 and W2) seem essential to an adequate treatment. Our investigations aim at consolidating the observational base before launching into theoretical treatments as phenomena such as 'r'-sandhi cannot be

properly dealt with by collecting a few relevant examples on the fly. A more thorough strategy of data collection and systematic analysis of shared data is an urgent task. This is what we are committed to as members of the PAC research program.

### Note

- 1) We are considering linking and intrusion separately. Given the contexts where e.g. linking 'r' is theoretically possible, a figure such as 76% indicates the frequency of attested realizations in such contexts. We do not lump together linking and intrusion as a global figure as the number of contexts for intrusion is much lower than that for linking. Navarro (2013) provides more complete statistics than presented here.

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