The Sociophonetics and Phonology of Dutch *r*

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The Sociophonetics and Phonology of Dutch *r*

Sociofonetiek en fonologie van de Nederlandse *r*

(*met een samenvatting in het Nederlands*)

Proefschrift

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door

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geboren op 20 juli 1972
te Goirle

Promotor: Prof.dr. W. Zonneveld
Copromotor: Dr. H. Van de Velde

Dit proefschrift maakt deel uit van het onderzoeksprogramma *r-kennen, socio-dialectological, phonetic and phonological qualities of /r/ in Dutch*, gefinancierd door het Vlaams-Nederlands Comité, samenwerkingsverband van de Nederlandse Organisatie voor Wetenschappelijk Onderzoek (NWO) en het Vlaamse Fonds voor Wetenschappelijk Onderzoek (FWO).

Contents

Preface

The research project this thesis forms part of, *r-kennen, socio-dialectological, phonetic and phonological qualities of /r/ in Dutch*, investigating aspects of Dutch *r* variation, was jointly funded by *NWO* (Netherlands Organisation for Scientific Research) and *FWO* (Research Foundation Flanders). Focusing on the particularly striking example of linguistic variability that is Dutch *r*-variation, it involved researchers from Utrecht University, Radboud University Nijmegen (Netherlands) and the Vrije Universiteit Brussels (Belgium). The principal applicants and supervisors of the project were Hans Van de Velde and Wim Zonneveld. This is the second of two doctoral theses to be published from the project, the first being Evie Tops' thesis (Brussels, 2006), published as Tops (2009). It reports on *r*-variation in Belgian Dutch, with a focus on changes in progress concerning uvular *r* variants. These are on the rise throughout Flanders, and Tops uses a geolinguistic approach showing how they are spreading from a number of centres within the country. In addition, she examines the sociolinguistic situation surrounding alveolar vs. uvular variants of *r* in Flanders.

While the aim and focus of the present study are different from those of Tops (2009), there is some overlap in the data used for the respective studies, and therefore in some of the reported results. The data for Tops' study primarily come from two corpora collected specifically for the purpose of studying Dutch *r* variation: the *SAP* corpus, containing speech data from 1900 speakers in 89 speech communities across Flanders, and the *HEMA* corpus, which contains recordings from 400 speakers in 10 larger urban speech communities in the Netherlands and Flanders. The latter corpus in fact forms the primary data source for the present study. The data for it were collected by Koen Sebregts (Amsterdam, Rotterdam, Utrecht, The Hague), Charlotte Giesbers (Nijmegen) and Evie Tops (Antwerp, Bruges, Ghent, Hasselt) between 2001 and 2003 at branches of the *HEMA* department store. Tops (2009) reports some of the major results from the *HEMA* corpus and some particulars concerning the Flemish accents, but her primary source of data is the *SAP* corpus. The present study does not make use of the *SAP* corpus, but relevant findings from Tops' study are reported. An additional source of original data used in the present study is a smaller corpus of detailed articulatory data collected by Koen Sebregts and James M Scobbie at Queen Margaret University in Edinburgh in 2004.

A number of other publications have come out of the larger project. Preliminary findings were reported in Sebregts et al. (2003). The sociolinguistic aspects of uvular *r* and coda approximant *r* in Netherlandic Standard Dutch were explored by Renée van Bezooijen, the primary investigator at Radboud University, working with with Rob van den Berg and Suzan Kroezen (van Bezooijen et al. 2002; van Bezooijen 2003; van Bezooijen 2004; van Bezooijen and van den Berg 2004; van Bezooijen 2005). Scobbie and Sebregts (2010) discuss the phonological implications of the articulatory study, while Van de Velde et al. (2013) focus on the spreading of uvular *r* in Flanders. A different type of outcome of the project was the *r-atics* conference in Brussels, in December 2002, the second in what has now become a series of international conferences entirely devoted to the sociolinguistic, phonetic and phonological aspects of rhotics.

The final outcome of the project is this book.

Acknowledgements

Writing a thesis is like riding a very strangely put together Tour de France, with only a couple of flat stages, a lot of mountain stages, and an incredible number of time trials – very long stretches where you just have to go it alone. The Tour de France is not a perfect metaphor: getting a PhD is not all about finishing as quickly as possible, for one thing, although it is a good idea to try to finish before the *voiture-balai* runs out of petrol. Also, you are never truly alone in your challenge. In fact, many people have lent their support in some way over the years, and this is where I thank them.

First of all, I owe enormous thanks to my supervisors, Hans Van de Velde and Wim Zonneveld. Continuing the time trial metaphor a little, Wim took on the Manolo Saiz role in giving sustained support and keeping me focused on the road ahead. Hans was the more hands-on team manager, no less motivational, but also ready to fix brakes and change wheels (in real life, this meant sitting down with me and navigating mountains of data as my first guide to statistics). Both Wim and Hans also carefully read and commented on draft versions of my chapters, and it was good that we could argue over matters theoretical or methodological but leave time to discuss that year's favourites for the yellow jersey.

Leaving the metaphor behind now, thanks are due to the many people involved in the project, either formally or informally. Roeland van Hout gave helpful advice on data collection and analysis. Hugo Quené was always willing to answer quick questions about statistics that never warranted quick answers. I'm grateful to Charlotte Giesbers for collecting the Nijmegen data, Evie Tops for taking care of the Flemish data, and Mikhail Kissine for turning the raw data (on DAT tapes) into manageable files. In the early stages of the data analysis, Bert Schouten and Mieke Trommelen at Utrecht and Renée van Bezooijen and Roeland van Hout at Nijmegen joined in sessions listening to an array of Dutch *r*-sounds, and their comments, disagreement and general bewilderment served to make the coding process more reliable. Nonetheless, that process was a laborious one of defining and redefining categories, listening and relistening and re-relistening to thousands of tokens. It was only made manageable and even enjoyable because I got to share that experience with Evie Tops, in Utrecht, Tilburg, and summery Brussels. We're probably the only people in the world who will forever associate an alveolar trill with the number 7, and a uvular approximant with 29.

Patrycja Strycharczuk was of invaluable help. I cannot thank her enough for commenting on a number of chapters, discussing general issues in phonology with me (as much as we try to avoid it), and for her remarkable thesis chapter 2; above all, she was the one who helped me to finally tame the data in chapters 4 and 5 by being an expert coder in *R* (as much as she tries to deny it).

My research visit to QMU Edinburgh in 2004 was instrumental, as it provided extremely valuable data on Dutch approximant *r*, introduced me to the wonders of ultrasound and articulatory analysis in general, and taught me I was in a small minority of people with especially bendy arms. I owe Jim Scobbie a massive thank you for welcoming me into his lab, and both him and Alan Wrench for spending so much time and effort on my little project.

Many other people and organisations contributed in various ways: I am very grateful to *HEMA* for allowing us to use their cafeterias for our fieldwork, to the people at *UiL-OTS* and *LOT* for their administrative support, and *NWO/FWO* for their funding. Thanks also to Vincent Nicolai for sending young male Amsterdam speakers my way, Martijn Busink for magically turning my obscure IPA font into something the Mac could deal with, to Thomas Magnuson and Piet van Reenen for granting me permission to reuse their figures, and Paul Peters for the picture on the cover of this book. Thanks to Annemarie and Pepijn for being my *paranymphs*.

I thank Jim Scobbie, Hugo Quené, René Kager, Roeland van Hout and Didier Demolin for serving as members of my reading committee and for providing feedback. Many other linguists have given me feedback, discussed my work with me, or have been important in other ways over the years, and at the risk of leaving some people out, I cannot do without mentioning Bert Botma and Dick Smakman (the perfect colleagues and co-authors); Andy Wedel, Marci Sóskuthy and true punk and scientist Petya Rácz (three people who don't consider themselves phonologists but in reality are the future of the field), Jeff Mielke, Jane Stuart-Smith, Amanda Cardoso, Iiris Rennicke, Patrick Honeybone, Leendert Plug and Ricardo Bermúdez-Otero (for comments they may not even remember making); Joaquín Romero (for the cortado in Tarragona), Paul Boersma (for tea in Amsterdam) and Dan Silverman for three separate things: 1) commenting on my first-ever poster ("I like this [pointing at the data], but not this" [at the theory]), 2) telling me to "go talk to Jim Scobbie, he'll sort you out", and 3) his 2006 game-changer of a book.

I have greatly benefitted, both academically and personally, from the people I met at my various work places over the years. Thanks go out to my phon-phon office mates at *UiL-OTS*, Annemarie Kerkhoff and Judith van Wijk, and the neighbours, Brigit van der Pas, Maya van Rossum and Esther Janse. Thanks also to the Leiden University English department, and especially to Colin Ewen who got me interested in linguistics in the first place, recommended me to Utrecht for the PhD, and gave me my first teaching opportunities at Leiden. Thanks to my friends and colleagues at the HU English department for three years of good fun and more teaching experience than I could have imagined, to Marc van Oostendorp for getting me back on my feet at the Meertens, and to my former and current friends and colleagues at Utrecht, of whom I'll single out Simon Cook, Nynke de Haas, Rias van den Doel and Syreetha Domen as the ones who have had to put up with me most.

Returning to the cycling metaphor, the following people were vital in keeping me on the road, and making sure I didn't give up when there were mountains to climb. Taking the role of supporters, Berit, Bloeme, Emily, Bev & Sandra, Simon & Anita, and Debi all found me places to stay. Thanks to my dad Hans and sis Anouk for always being there. Thanks to Margo for everything. And thanks to the people I consider my teammates: the KinkAlternatief-boys, Paul, Martijn, Joris, Gaston, Ludo, Sebastiaan, Bryan, Jan-Martijn and Sipke. My buddies Corné, Eugene, Rachel, Frederique, Marlies and, above all, Pepijn were true friends when it mattered (and I don't just mean for all their help moving).

The final thank you, for all the love and support, is for Pat and Koalito.

1 Introduction

No two speakers of any language have completely identical pronunciations, and even two realisations of the same word by a single speaker will never be absolutely identical. This inherent variability of spoken language has a number of sources. Some of the differences between speakers have to do with factors of anatomy: due to the different shapes and sizes of tongues, mouths, and throats, there will always be variability. However, this kind of variability is not usually considered *linguistically* relevant, because of a process called normalisation: speakers – or more appropriately in this case, listeners – are thought to be able to make allowances for anatomical differences, and (unconsciously) able to ignore them when listening to different speakers. Other differences between speakers, however, may be related to variation in their language *systems*, and crucially linked to different geographical or social dialects. Also, some differences between two utterances of the same linguistic item by a single speaker will be due to non-linguistic factors, for instance the environment of the speech event (as in shouting versus whispering a word). Other intra-speaker differences, however, are tied to the linguistic context: the realisation of a particular speech sound may vary depending on the sounds that surround it or on its position in a linguistic unit such as the syllable. Yet other differences have a stylistic aspect to them, and are connected with, for instance, the level of formality of the speech event. It is important to note that these various kinds of linguistic variation are not necessarily discrete, isolated notions; often, they will be intertwined, and hard to separate. Such interrelatedness of different kinds of variation will be discussed in more detail later in this chapter, and throughout this thesis.

The realisation of /r/ in Dutch is a particularly striking example of multidimensional variability. In Standard Dutch alone, the number of different phonetic variants identified as in current use has rapidly risen with each new study into the subject (Vieregge and Broeders 1993; Van de Velde 1996; Smakman 2006). The variability of Dutch *r* involves both features of place and manner of articulation. In addition to the large variation in phonetic realisations, the variation is also wide-ranging: it concerns both differences *between* speakers (inter-speaker variation) and *within* the speech of individuals (intra-speaker variation) and seems to be conditioned by stylistic, phonological and sociolinguistic factors.

The present study into Dutch *r*-variation has both an empirical and a theoretical aim. Its empirical objective is to catalogue the extent and the nature of *r*-variation, specifically in larger urban speech communities in the Dutch language area. To this end, data were collected from 10 major cities in the Netherlands and the Dutch-speaking part of Belgium, Flanders (Figure 1-1). Speech data from more than 400 informants were recorded and analysed auditorily and acoustically with respect to factors potentially influencing the variation. Explaining the patterns found in the data involves incorporating insights from sociolinguistics and instrumental phonetics into phonological analysis. In addition, evidence from historical sources and from phonological acquisition studies will be brought to bear on the questions raised by the data. While often described as “external” evidence, and sometimes seen as related to “performance” only, there is increasingly more frequent research that attempts to reconcile phonological theory with data from these other approaches. The theoretical aim of this thesis, then, is to provide an integrated account of the sociophonetic variation found with Dutch *r* and its phonological implications. Specifically, it is argued that to explain the emergence and the synchronic patterning of *r* variants, it is necessary to develop a model that establishes the diachronic relationships between them.

Figure 1-1 Locations of the cities in the corpus within the Dutch language area.

The theoretical model assumed in this thesis is broadly usage-based, and consists of three separate, but reconcilable parts. First, it assumes an Exemplar Theory view of representation, and its accompanying account of production and perception, which relies strongly on probability matching (e.g. Nosofsky 1986; Goldinger 1997; Johnson 1997; Pisoni 1997; Pierrehumbert 1999; see below for many more references). Variability is treated as inherent in speech, and the distribution of (quantitative) variants falls out of the speech forms present in the community. Secondly, the approach to explaining variation is primarily diachronic, in the sense that instead of invoking synchronic principles, it is seen as ongoing change. These changes themselves originate from processes in casual speech (see Shockey 2003). Finally, gestural representations familiar from Articulatory Phonology (Browman and Goldstein 1990a; 1992) will be assumed to provide the tools for characterising these processes as primarily in the direction of lenition. The incorporation of these three theoretical components into the model is motivated by both aspects of variation in general, and of Dutch *r*-variation in particular; these are discussed in the remaining sections of this chapter.

Section 1.1 introduces the phenomenon of *r*-variation from a cross-linguistic perspective, followed by a brief sketch of the situation concerning Dutch *r*-variation, and the potential problems facing the analyst in trying to explain its many facets. Section 1.2 contains a discussion of how different types of language variation are dealt with in the relevant linguistic subdisciplines, followed by an assessment of each of these approaches. An explication of the theoretical framework the analysis is couched in, and its advantages over potential alternatives, is discussed in sections 1.3 and 1.3.3. The chapter will close with a sketch of how the remainder of this thesis is structured.

1.1 *r*-variation

1.1.1 Cross-linguistic variation

The disparate nature of *r*-sounds, or rhotics, both across and within languages, has vexed phonologists and linguistic phoneticians for quite some time. With trills, fricatives and vocalic speech sounds, at places of articulation ranging from dental to pharyngeal, all being classified as forms of *r* in various languages, phoneticians have tried in vain to discover a unifying property for all these sounds. A common articulatory property being absent, given the large range of both place and manner of articulation (Ladefoged et al. 1977; Maddieson 1984:78-81), a unifying acoustic property of *r* became the main focus of interest (Lindau 1985). Concluding that the latter is also absent, Ladefoged and Maddieson (1996:245) throw in the towel and state that “the overall unity of the group [of rhotics] seems to rest mostly on the historical connections between these subgroups, and on the choice of the letter ‘r’ to represent them all”. From their point of view, based on the evidence from the phonetics that there is nothing – no *single* property – inherently present in the sounds themselves which directly characterises all rhotics, this conclusion is warranted. It is not necessarily problematic either, from the viewpoint of phonetics or historical linguistics: sounds which were at one point very similar may change in different directions in different dialects, creating dissimilar sounds; and sounds represented by the same orthographic symbol across various languages need not be phonetically similar, whether or not this is a result of language change.

For phonologists, however, the failure to find a unifying property characterising all rhotics poses a greater problem. As all of these different rhotic sounds do seem to function similarly in the phonological systems of various languages, they invite classification as belonging to a single category of some sort. In many current (generative) models of phonology, phoneme categories are distinguished by the set of features of which they are comprised. In many of these approaches, these cognitive, abstract features have a non-arbitrary or intrinsic link to phonetic content. Therefore, if the phonetic content of a single phoneme class can vary so widely, and no unifying phonetic property can be identified, the question arises which feature, or features, could successfully characterise such a class. While separate full specifications of features for each of the different members of the rhotic class might characterise them each individually, they fail to mark them as belonging to one class. Recent proposals attempting to solve this problem include severely underspecifying /r/, to the point where it is seen as featurally almost or completely empty (e.g. Ortmann 1998; Giegerich 1999; Wiese 2000), assigning a feature *without* phonetic content to the class of rhotics (Hall 1997), or deriving the unity from the similarity in the proposed feature-geometric structure, instead of the featural content (Walsh Dickey 1997). Under these approaches, the unity of the rhotic class is preserved, but the problem is shifted to the 'phonetic interpretation' component of the grammar. Answering the question of how the abstract, heavily underspecified phonological representation of /r/ relates to its physical realisations consequently becomes much more complex, as does the question of how speakers arrive at the mapping between the two. Neither question is the focus of concern in the aforementioned theoretically-oriented proposals. What these studies make clear, however, is that any unity between different rhotic phones is not to be sought at the surface level, but rather at a higher level of abstraction.

After reaching the conclusion that there was no single acoustic invariant that could be associated with all rhotics, Lindau (1985) proposes a different way of capturing their cross-linguistic unity. She calls upon the notion of "family resemblance", after Wittgenstein ([1953] 1975): each member of the rhotic class resembles one or more other members, but the resemblance is not due to the same property in each case:

> Trills and taps are alike as to closure duration, the open phase of a trill resembles an approximant in the presence of formants, and tongue-tip trills and uvular trills resemble each other in their pattern of rapid pulses. Rhotics produced with the same constriction location(s) are alike in the distribution of spectral energy. (1985:166)

The diagram in Figure 1-2 illustrates the relationships between the different sounds in the rhotic class. In the absence of an invariant phonetic feature that can be associated with all rhotics, this network of phonetic relationships seems the next best option for characterising rhotic classhood. As Lindau states:

> Clearly, searching for a single phonetic correlate underlying a whole class of sounds may not always be a profitable task. It is doubtful that any phonological class can be characterized in this simple way. Instead, the reasons for membership of sounds in phonological classes must be sought in the phonological behaviour of the sounds, and the relation between phonological and phonetic classes is considerably more complex than the one-to-one relation that is generally assumed. (1985:167)

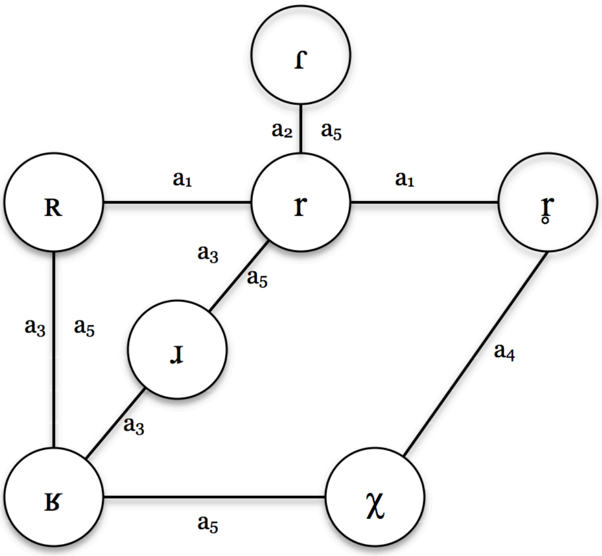

Figure 1-2: Lindau's (1985:167) diagram of relationships between rhotic sounds from a number of languages. The lines indicate the relationships that are said to hold between the various r-sounds: a1 = pulse pattern (trill); a2 = closure duration; a3 = presence of formants (sonorant); a4 = presence of noise; a5 = distribution of spectral energy (place of articulation).

From the point of view of phonology, it makes sense to characterise the *cross-linguistic* unity of a class of sounds in the way Lindau suggests: by looking at phonological behaviour, rather than direct phonetic similarity. Walsh Dickey (1997) similarly argues for rhotics being a class phonologically, and simultaneously being phonetically "a polymorphous category, defined by overlapping sets of phonetic properties" (1997:71). Lindau's diagram, however, defines rhotic classhood by these phonetic similarities (rather than phonological behaviour). She arrives at it by comparing sounds classified as /r/ in related (English, Swedish) and unrelated (Hausa, Degema) languages. From this cross-linguistic perspective, it is not immediately obvious that the /r/ of Swedish is phonologically all that similar to /r/ in Hausa, given their very different phonotactics, the processes the sounds are involved in, and so on. From the language-specific perspective, the question arises whether a classification based on phonetic similarities can be extended to the analysis of allophones, or more generally, variants, of a single /r/ phoneme in variant-rich languages such as Dutch. It will be argued below that a characterisation of the connections between the variants of a single functional unit in terms of family relationships as in Figure 1-2 can be considered a good first approach, but is in fact insufficient for this purpose, and needs to be augmented to become more insightful. Specifically, the notion of *lenition* will be put forward to provide the crucial link between the variants of *r* in Dutch (section 1.3.2.2). First, in order to motivate this approach, the nature of *r*-variation found in Dutch will be discussed in the following section.

1.1.2 Dutch *r*-variation

While Dutch, in the phonological literature, is standardly considered to have only a single /r/ phoneme, there is a wealth of phonetic realisations associated with it. That there is only one /r/ phoneme is illustrated by the fact that no lexical items are distinguished by substituting one *r* variant by another. The fact that *r* has a number of different possible realisations in Dutch is equally well-documented (see Chapter 2 below for discussion), but it is only recently that a number of sociolinguistic and phonetic studies (such as Van de Velde 1996; and Smakman 2006; an early study documenting large-scale variation within an urban accent is Elias 1977) have started to highlight the fact that the realisational variation is in fact spectacularly large, and that the distribution of variants over contexts as well as over speakers is a highly complex issue. This complexity is demonstrated yet again by the data collected within the scope of the research presented in this thesis.

The realisational variation found with *r* in Dutch largely mirrors that found cross-linguistically, as reported in the studies mentioned above. In fact, almost all sounds that have been considered rhotics in large-scale cross-linguistic survey studies such as Lindau (1985) and Ladefoged and Maddieson (1996) are also found as variants of Dutch *r*. In addition, a number of other speech sounds not generally considered to be rhotics function as *r* variants in Dutch, and it was furthermore found that finer distinctions can and should be made to subdivide some of the traditional classes of *r* variants. What follows here is a brief sketch of the extent of the variation, summing up some of the results of the data collection; these are presented in much more detail in chapter 3.

The wide range of variation is first demonstrated by the fact that 20 different variants of *r* were eventually distinguished during analysis of the data presented in this thesis, and even this fine-grained differentiation has not precluded the grouping together at times of in principle distinguishable *r*-sounds, in order to keep the transcription and coding process manageable (more on this in chapter 3). The variation encoded includes place of articulation (alveolar – post-alveolar – palatal – uvular), as well as manner features (trill – tap – fricative – approximant – vowel), and voicing (voiced – partially voiced – voiceless). Fine-grained distinctions were made to reveal potentially relevant variation between such realisations as voiced trill, partially devoiced trill, voiceless trill, voiceless fricative trill, etc.

The geographical distribution of the variants further shows the breadth of the variation. The number of variants within a single urban accent ranges from fourteen (for two of the accents) at the lowest to the full 20 (for one). Although a small number of variants are associated with particular dialects to the exclusion of others, most of the variation is quantitative (ranging across dialects in different numbers) rather than qualitative (distinguishing dialects by their categorical absence or presence).

Differences between speakers within the same urban dialect were furthermore found to be related to social parameters (age, sex), while other differences appear to be more idiosyncratic. Small and large-scale differences were found not only between dialects and within dialects between speakers, but also within speakers' productions in different linguistic contexts, and even within the same context for individual speakers. In fact, it was found not uncommon for speakers to produce considerably different variants of *r* within two repetitions of the same lexical item.

Finally, a number of different patterns of allophony, although hardly ever categorical, revealed themselves for individual speakers and speaker groups; these also turned out to be inextricably linked to geographical and social factors.

The data on Dutch *r* thus reveal a large amount variation along many different dimensions and offer challenges to most approaches to language variation that are common in current linguistic models. The following two sections sketch a number of these challenges.

1.2 Dimensions of language variation

As noted above, language variation operates within several dimensions, which may or may not interact with one another. A first approximation of separating out these dimensions concerns breaking variation up into two categories: *inter-speaker variation* and *intra-speaker variation*. Inter-speaker variation involves variation between speakers of different dialects (also called inter-dialectal variation) as well as between different speakers of the same dialect. Intra-speaker variation concerns the variability within the speech of an individual, which can be subdivided into variation between linguistic contexts (allophony) and that within a linguistic context (which is either stylistic or 'free'). The diagram in Figure 1-3 schematically represents these dimensions of variation.

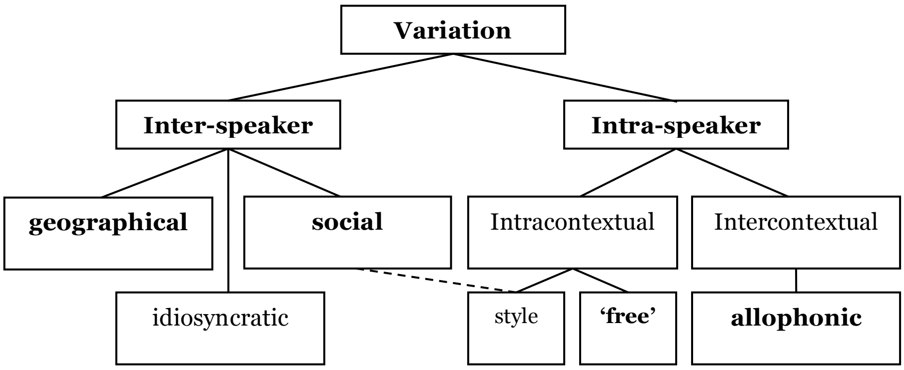

Figure 1-3: Dimensions of variation.

Note again that these categories are not mutually exclusive, but may overlap or intersect: for instance, there may be social variation within a particular geographical dialect that is absent in another. Likewise, a particular allophonic pattern may exist in one social or geographical dialect to the exclusion of another. Thirdly, and perhaps most crucially, the inter-speaker variation associated with social factors such as age or social class is often characterised by the use of so-called vernacular forms vis-à-vis standard forms, and this is precisely what is also found in (intra-speaker) stylistic variation. That is, individual speakers may vary stylistically along a scale of standardness, and the way in which they do so correlates with social factors. Johnstone (2006), following Labov (1972a), in fact subsumes this kind of stylistic variation under the heading of sociolinguistic variation, differentiating between sociolinguistic inter- and intraspeaker variation instead. This is the reason for the dotted line between 'social' and 'style' in the diagram above.

The dimensions of variation set in bold in Figure 1-3 constitute the central topic of this thesis. This means that purely idiosyncratic inter-speaker variation will be ignored where possible, and that the focus instead will be on examining how much of the inter-speaker variation is attributable to geographical and/or social factors. A brief note on terminology: the term 'accent' is used here as a short form of geographically-determined pronunciation variety, and the varieties of Dutch that form the main source of data for this thesis are referred to as 'urban accents'. More on these terminological choices can be found in chapter 3, where the status of these urban accents on the standard–vernacular scale will also be addressed. Variation along the social parameters of sex and age will be referred to explicitly as sociolinguistic variation, avoiding the use of the term 'dialect'. Note that the parameter of social class is not a factor taken into account in the data presented here, for reasons also to be discussed in Chapter 3.

Another dimension of variation not set in bold in Figure 1-3 is that of stylistic/register variation, limiting the analysis of intra-speaker variation to contextual or allophonic, and 'free' variation. Although two different elicitation tasks were used during data collection, style and register are considered to be constant in the data set; the very existence of 'free' variation will be called into question in this thesis.

Moving from right to left in the diagram above, the discussion will now turn to the ways in which these dimensions of variation are commonly dealt with in phonological and sociolinguistic approaches. Some preliminary results of the large-scale study of Dutch *r*-variation are then introduced to show the potential challenges to these approaches.

1.2.1 Phonological variation: allophony and the phonetics-phonology distinction

The question of how allophony – the variation found when the exponents of what is considered to be a single phoneme appear in differing prosodic or segmental contexts – is dealt with in phonological analyses is strongly connected to how the relationship between phonetics and phonology is conceived of by the theories underlying these analyses. Section 1.3 will discuss the usage-based, "exemplar" model that is assumed throughout the thesis, but it is important to discuss the definitions of phonetic and phonological knowledge here, given its relevance to describing allophonic variation.

In early generative studies, only phonology was assumed to be a type of *knowledge* possessed by speakers, describing discrete categories (phonemes and the features they are made up of), and the operations they undergo. Phonetic detail was only thought to be present at the non-linguistic level of *phonetic implementation*, which was generally thought to be universal and automatic (Chomsky and Halle 1968; Chomsky 1993). Since then, numerous studies have shown that phonetics cannot be universal, as there are fine-grained differences between languages in how phonological categories that are described by the same feature bundles are implemented. Pierrehumbert (1999) gives several examples of such differences found between different languages and varieties of the same language: the peripheral vowels /i/ and /u/ in English vs. Spanish, VOT for stops in English vs. European French vs. Canadian French, vowel lengthening before lenis obstruents in English vs. French, and the scaling of boundary tones in English vs. Tokyo Japanese vs. Osaka Japanese. In all of these cases, the different languages or dialects have comparable categories or processes, but the exact target formant frequencies, durations and distributions of values differ. These exact phonetic targets, as well as the patterns of variation surrounding these targets, she argues, must be learnt in acquisition. They therefore form part of speakers' implicit knowledge of their language, i.e. their competence (1999:114). Sociophonetic studies show that not only is this knowledge fine-grained, it can be exploited by speakers in indexing social categories, as gradient variation at the level of phonetic detail exists between speaker groups (Foulkes et al. 2010, and section 1.2.3 below).

While acknowledging that phonetic knowledge is part of speakers' competence, most current theories of linguistic knowledge assume a strict distinction between phonology and phonetics as separate modules. Phonological knowledge deals with categorical, discrete phenomena in a symbolic representation, and phonetics with the gradient, continuous interpretations (in articulation and perception) of these symbols (Keating 1990; Pierrehumbert 1990; Cohn 1993; for an overview see Ernestus 2011; cf. Strycharczuk 2012 for further discussion).

Allophony is typically modelled in standard modular phonological analyses in the following ways. In rule-based phonology, an underlying representation (a set or constellation of features) is mapped onto a number of context-specific surface representations via rules, for instance by deletion of features, changing feature values, or the filling in of default values. In constraint-based phonology, the features are not changed or deleted in a procedural manner; instead, there may be a ban on the appearance of certain features in a particular context. The typical situation in both types of phonological analyses is then for allophones in so-called strong positions (onsets, stressed syllables) to rather closely resemble the underlying representation (with few features changed, deleted or banned), whereas the variants that appear in what are considered to be weak positions (codas, unstressed syllables) may be further removed from this invariant underlying representation. An example in rule-based phonology is Wiese's (2000) treatment of /ʀ/ in Standard German, which is said to be realised as a uvular approximant [ʁ̞] in syllable onsets, and as a low central vowel [ɐ] in rhymal positions. Wiese assumes an underlyingly underspecified representation of /ʀ/ as [+low, +continuant], and derives the rhymal variant by a rule of ‘*r*-vocalisation’:

(1.1) *r*-vocalisation in Wiese (2000:256)

$$\begin{bmatrix}+\text{continuant}\\+\text{sonorant}\end{bmatrix}\rightarrow\left[-\text{cons}\right]\ /\ \begin{array}{c}\text{rhyme}\\ |\\ \underline{\hspace{2em}}\end{array}$$

This approach thus draws an explicit synchronic link between the onset and rhyme variants in the dialect: both onset [ʁ̞] and coda [ɐ] have virtually the same underlying and surface representations, with only the value of [±consonantal] marking the difference between the two. It is crucial in such an analysis that the featural make-up of the allophones is near-identical, to avoid excessive arbitrariness in the rewrite rules that derive the two allophones from the underlying representation. In Wiese’s account, /ʀ/ is severely underspecified (with only [+low, +continuant] present at the underlying level), other features, such as [+sonorant], are assigned by default rules, and the vocalisation rule derives the rhymal allophone. The phonetic facts correlate strongly with the proposed feature trees, as dorsal approximants and low central or back vowels share place and manner of articulation: they differ mainly in *degree* of approximation between the articulators. This works well when there is a small number of closely related allophones to be generated by the phonology.

There are two main reasons why the Dutch *r* data present problems for such approaches to allophony, the first being precisely the challenge of avoiding excessive arbitrariness in relating the onset and coda variants of *r*. As will be illustrated in more detail in Chapter 5, many Netherlandic Dutch speakers display an allophonic pattern in which the onset and coda realisations of /r/ are not phonetically closely related at all, but differ widely: they realise /r/ as a uvular trill or approximant in onsets, and as a retroflex or bunched palatal approximant in coda. These articulatory configurations as well as their acoustic effects have virtually nothing in common, and it is not easy to see how they could be derived by rule from a common phonological object that both allophones share features with. It would seem, therefore, that the relationship between these allophones is of an even more abstract nature, and not necessarily characterisable in terms of operations on categorical phonological features.

A second difficulty for accommodating allophony is in the interplay of categorical and gradient effects in the large-scale quantitative variation found with Dutch *r*. The distribution of variants is influenced by many contextual factors, prosodic (onset vs. coda) and segmental (the voicing value and place of articulation of preceding or following consonants, height of a preceding or following vowel, etcetera), and very few of these are deterministic. For instance, following voiceless obstruents, uvular *r* is *often* fricative for many speakers, but not categorically so. Both analysing uvular fricative *r* as a phonological allophone here and analysing it as occurring due to a purely phonetic effect would miss the point that it variably and gradiently alternates with approximant and trill realisations in this context. The probabilistically determined occurrence of gradiently as well as categorically different allophones makes assigning them to either phonology or phonetics a dangerously arbitrary exercise.

There are alternatives to the mainstream approach to allophony. An extreme position on the place of allophonic variation within a modular theory is that of the Contrastivist position, or the Toronto School (Hall 2006a; Dresher 2009), in which only lexically contrastive elements are part of phonology, and all allophony is part of phonetic implementation. While this alleviates the task of the phonologist, it loses the important insight that not all allophony is created equal. The strongly categorical variation between uvular trills and retroflex approximants is of a different nature than that between, say, uvular trills and uvular trilled fricatives.

Another possibility, leading to another extreme, comes from approaches that reject the phonetics-phonology distinction altogether, such as Articulatory Phonology (Browman and Goldstein 1990a; 1992), in which articulatory gestures are the primitives of an integrated phonetics-phonology, and Functional Phonology (Flemming 2001; Kirchner 2001), in which the demands of articulation and perception are directly encoded in the grammar (e.g. in the violable constraints of Optimality Theory [OT]). These approaches, too, are not without their problems. In general, Articulatory Phonology is very well-suited to describing gradient patterns such as coarticulation, as overlap between independently specified gestures. Gradient patterns of allophony, too, are often modelled as overlap (with neighbouring phones), or as the temporal or articulatory reduction of particular gestures in certain contexts, for instance the syllable coda. However, Articulatory Phonology is less successful in modelling categorical phenomena, other than as complete overlap or total reduction of gestures without a principled way of stipulating when this occurs. It also runs into trouble (as exemplified in the discussion of schwa-insertion in Dutch in Chapter 6) with its theoretical assumption that gestures (unlike features in other models) cannot be inserted, and it would fail to be able to account for the uvular onset ~ retroflex coda allophony mentioned earlier. Functional OT is a very powerful paradigm that is able to account for gradient and categorical phenomena in a unified framework through its constraint set. Thus, it imputes a real (though unconscious) knowledge of phonetics (not to be confused with "phonetic knowledge", i.e. knowledge of phonetic implementation) to the speaker, such as being able to calculate articulatory effort in attempts to minimise it, or to estimate acoustic distinctions in attempts to maximise them. As Strycharczuk (2012:39) points out, this leaves such approaches with exactly the problem they set out to avoid. There is a degree of "duplication", or redundancy, in modular approaches, where a single effect is often accounted for twice – once in the phonology, and once in the phonetics (e.g. assimilation and coarticulation, respectively). Functional OT tries to overcome this problem by integrating phonetics and phonology, but ends up encoding physical constraints of articulation, aerodynamics and perception as cognitive ones in speakers' grammars, which again leads to a form of duplication.

Surveying the debate around the relationship between phonetics and phonology, some researchers, such as Cohn (2006) and Scobbie (2005; 2007) argue for a "Third Way" between strict modularity and rejecting the idea of a phonetics-phonology distinction. Cohn argues that there are "grey areas", patterns that are both gradient and phonological, and that these show "that the distinction may be more porous than assumed following strict modularity" (2006:30). Scobbie discusses the notion of the "interface" between phonology and phonetics (which modular models need to also have a theory of), and concludes that existing models often fail to account for data when the latter are considered in their full complexity. Similarly to Cohn, he proposes that the notions “categorical” and “gradient” are themselves not necessarily discretely distinct, and that while there are clearly phonological (categorical) categories, there are also “not-so-clear categories” (2005:26). He argues for a “quasi-modular framework” where the interface between phonetics and phonology takes the form of partial *overlap*. This retains the notion that phonetics and phonology are distinct domains, but allows for the possibility that some phenomena (he mentions fuzzy contrasts and marginal phonemes) show characteristics of both, for both the analyst and the speaker, and reside in the overlap area. He suggests that Exemplar Theory may be an example of such a quasi-modular model, able to handle phenomena that exhibit both categorical and gradient characteristics at the same time. Given the nature of Dutch *r*-variation described in this thesis, this ability is a necessity. Section 1.3 discusses Exemplar Theory in more detail.

1.2.2 Stylistic and ‘free’ variation

Intra-speaker *r*-variation may also involve non-contextual variation. The speech of a single speaker may alternate between high-prestige and low-prestige forms, for instance, in different communicative settings (stylistic variation). A speaker may even vary between two (or more) variants that are equally acceptable in a given setting (‘free’ variation). In both cases, phonological accounts that try to model this kind of variation differ in whether they view these types of variation as the result of two competing forms within one linguistic system, or of the competition between two systems (see Hinskens et al. 1997 for various possible answers to this issue). Honeybone (2011) argues that, while speakers may possess more than one grammar (most clearly in the case of multilingualism), most cases of intra-speaker variation within a language should be modelled as intra-grammar variation. His principal example is the case of stop consonant lenition in Liverpool English, where both the realisations of the stops and the constraints governing their appearance are too closely related to be plausibly described as inter-grammar competition. Much of the variation found with Dutch *r* seems to pattern similarly to the Liverpool case (though with less clearly defined environments), and the concept of lenition will play an important role throughout this thesis as an explanatory device. Even when lenition does not seem to be involved, Dutch *r* provides arguments for an intra-grammar view of phonological variation within a language. For instance, some Flemish (Belgian Dutch) speakers alternate between alveolar and uvular *r* within the same linguistic context (Tops 2009 and this dissertation). If, as seems to be the case, alveolar *r* is the prestige variant in Belgian Dutch, would such a speaker be considered to be switching between different grammars? If so, then the common occurrence of varying between alveolar and uvular *r* during the same (five minute) elicitation task, as witnessed in the data presented in this thesis, is highly surprising. It would be a rather extreme from of code-mixing. If, on the other hand, a speaker is not deemed to be switching between grammars during this single task, both variants would have to be accommodated within a single linguistic system. Variation would, in other words, be part of speakers' linguistic competence.

1.2.3 Sociolinguistic variation

Inter-speaker variation within a (geographical) speech community includes social and individual variation. Inter-speaker variation is usually not dealt with by phonological analyses at all, as it is often considered irrelevant for the phonological *systems* as such. In classical generative linguistics, where the knowledge of the "ideal speaker-hearer in a completely homogeneous speech community" (Chomsky 1965:3) is the object of study, intra-speaker variation is abstracted away from on account of the first part of that famous phrase, and inter-speaker variation because of the second. Therefore, social variation has become the exclusive task of sociolinguistics, while purely individual or idiolectal variation – outside of language acquisition or child phonology – is studied only in detailed instrumental phonetic studies. Within sociolinguistics, there is a strand of research which aims to reconcile the social dimension of language variation with generative linguistic theory: the work of Labov (see e.g. Labov 1972a; 1981; 1994) and that inspired by him. These so-called variationist approaches overlaid the generative rule formalism with *probabilities*, creating *variable rules* (Labov 1969; Cedergren and Sankoff 1974; Sankoff 1987), in contrast to the categorical nature of rules in standard generative analyses. Trends in theoretical linguistics with respect to the formalism used have been followed by some sociolinguists, and there exists variationist work couched in non-linear phonology (Enbe and Tobin 2007), Optimality Theory (Borowsky and Horvath 1997; Auger 2002; Johnson and Britain 2003) and Exemplar Theory (Mendoza-Denton et al. 2003; Boomershine 2005). These different approaches have very different conceptions of the role of probabilities and the origin of variability, as well as how variation is ultimately modelled. These differences are discussed under 1.3 below, in the context of an outline of the exemplar-based model used in this thesis.

Variationist approaches emphasise the close relationship between linguistic variation and linguistic *change*, viewing them as two aspects of essentially the same phenomenon: "[A]ll human speech communities exhibit synchronic variation on a large scale and language change across time is one outcome of this variation; conversely, linguistic variation is the inevitable synchronic face of long-term change. It is taken as virtually axiomatic that there is no change without variation" (Guy 2003). In such an approach, variation is seen as normal, the inherent state of affairs in language at any one point in time. Change is not a move from one invariant state into another, but a shift from one variable state to another. The processes and mechanisms of diachrony are therefore reflected in synchronic variation (Guy 2003:372). The conventional view of sound change, traditionally expressed by rewrite rules such as $x \rightarrow y$, is better viewed as representing the endpoints of long-term, gradual change. Everything in-between these two states can only be characterised as "more x than y" or "more y than x", where these quantitative statements reflect numbers of individual speakers within a speech community that produce either x or y, or indeed individual speech acts from all members of the speech community, producing both *x* and *y* in different relative numbers. It is then the identification of the social factors underlying these differing quantities that is the job of sociolinguists; however, phonologists should not subsequently gloss over the variation found and explained by sociolinguists, equating idiolects with invariant states, but recognise that incorporating social variation into their theories might very well be a worthwhile and interesting enterprise. After all, as is argued in some detail below, social variation, too, is at the command of the speaker, and should therefore be considered to form part of the native speaker's *competence*. As Weinreich et al. (1968) put it in this frequently quoted passage from their seminal paper on variationist linguistics:

> The association between structure and homogeneity is an illusion. Linguistic structure includes the orderly differentiation of speakers and styles through rules which govern variation in the speech community; native command of the language includes the control of such heterogeneous structures. (1968:187-188)

Examples abound in the Dutch *r* data presented in this thesis of this orderly differentiation. For example, for a number of the variants of *r* found in Dutch, there is a clear sociolinguistic dimension to their occurrence, as well as an indication of them representing sound change in progress. The use of a retroflex/bunched approximant *r* in coda positions seems to be on the rise in Netherlandic Dutch, for instance, with young female speakers leading this change. In Bruges Dutch, devoiced (fricative) coronal *r* in coda is on the rise, with young speakers producing these variants in larger numbers than older speakers. In a number of the urban dialects under review, the use of uvular *r* variants is associated with younger speakers, whereas in others it is older speakers that produce more uvular *r* (and these ratios also differ according to sex). Most importantly, however, in none of these cases is the use of any of these variants categorical: all speakers produce a range of *r* variants, and the differences between the sexes and between the age groups are found in the relative numbers with which they use particular variants as opposed to others. The variation, in other words, is both quantitative and qualitative, and in fact the former more so than the latter. It is therefore in line with the past half century of results from sociolinguistic studies, which have shown this to be the case for many linguistic variables. In fact, in some cases of Dutch *r*-variation, such as that of devoicing of *r* in Bruges Dutch, the matter is not so much one of devoiced variants vs. voiced variants, as the *degree* of devoicing that is crucially linked to age. This means that apart from quantitative rather then qualitative, the variation is gradient rather than discrete. In other words, Dutch *r*-variation is typically of the *sociophonetic* kind: variation in fine phonetic detail is shown to be related to social factors, and under control of speakers. This demonstrates once more the necessity of incorporating variation in the analysis of Dutch *r*.

1.2.4 Geographical dialect variation

The final type of variation in Figure 1-3 and discussed in this thesis, concerns that *between* dialects. This has been given some attention in phonology, although it has not usually been considered a 'problem' as such. In early generative phonology, differences between dialects were argued to be the result of differences in the rule systems of these varieties, while the underlying representations are said to be identical across dialects (the 'identity hypothesis', cf. Chomsky and Halle 1968:49; Newton 1972). In a number of more recent approaches, both underlying representations and rule/constraint systems have been argued to differ from dialect to dialect – perhaps even from idiolect to idiolect (Harris 1985; McMahon 2000).[1] Both approaches are not without their problems in the face of the Dutch facts, however.

A comparison between dialects reveals both large-scale and fine-grained differences with regard to the number of different variants used, the relative frequencies of the different variants, and the way they pattern in speakers' productions. For instance, glossing over some of the internal variation, the difference between *r* in onsets in Bruges and Ghent (both in Flanders) can be said to be primarily one of place of articulation (alveolar vs. uvular, respectively). While Ghent (Flanders) and Leiden (Netherlands) have very similar onset *r* variants (mainly uvular trills and fricatives), they differ greatly in both place and manner of articulation in their coda variants (uvular fricatives vs. retroflex/bunched approximants, respectively). Such facts, with large-scale variation along several phonetic parameters as their most striking property, indicate that both the identity hypothesis and its alternative of specifying distinct underlying representations may be hard to sustain. The identity hypothesis needs to assume an implausibly elaborate (feature-changing) phonetic interpretation module for at least some of the dialects. That is, unless even *more* abstract underlying representations are assumed (e.g. features without intrinsic phonetic content, or the aforementioned empty or almost empty specifications of /r/ – Chapter 6 discusses a number of these proposed solutions).

On the other hand, if large-scale variation prompts us to propose different underlying representations for different dialects, the question arises what makes a dialect a dialect, or indeed, if the concept has any value at all. While all the varieties in the data have specific /r/ realisation patterns, no *r* variants are exclusive to any of them. For instance, the vast majority of Nijmegen Dutch (Netherlands) speakers realise /r/ as a uvular approximant or light fricative in onsets, while most speakers of Antwerp Dutch (Flanders) have an alveolar tap in these positions. This may lead to the proposal that Antwerp Dutch has an alveolar /r/ underlyingly, while Nijmegen Dutch has uvular /ʀ/. But what does this mean for the four Antwerp speakers (9.8%) in our survey who realise /r/ predominantly as a uvular approximant? Do they have different underlying representations from their fellow Antwerp speakers and

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[1] See Honeybone (2011) for a discussion on pan- and polylectal vs. dialectal and idiolectal approaches to variation. Under the former, a grammar describes more than one 'lect', deriving the differences between them via different rules, rule orderings, or – in Optimality Theory – different constraint rankings. The latter approaches aim to ignore other varieties than the one under analysis, on the notion that a speaker's grammar cannot be informed by these other varieties. Under a strong mentalist assumption (a grammar describes only a single speaker's internal knowledge), a panlectal approach is not a viable option, although most speakers are assumed to have at least *some* knowledge of other dialects than their own.

therefore speak a different dialect? Or do they have the same underlying representations plus a more complex phonology to derive their surface variants? Furthermore, two Antwerp speakers (4.9%) largely conform to the general pattern of the dialect, but realise a small number of the test items as uvular approximants or fricatives. What is the origin or status of these uvular variants, if these speakers have a single invariant underlying representation of (alveolar) /r/?

None of these questions are easily resolved, but perhaps they are the wrong questions to ask. It appears that neither trying to fit dialectal variation into an analysis of invariant underlying representations nor specifying different underlying representations for each of the dialects (and subdialects within dialects) provides any insight into what drives variation in the first place, and how speakers deal with the large-scale variation that surrounds them. Section 1.3 introduces a theoretical framework that places variation – on all dimensions discussed in this section – rather than invariance at the heart of its analyses, attempting to avoid the problems other theories encounter when trying to explain, or abstract away from, variation.

1.3 The theoretical model

The model of phonology and its relation to phonetics adopted in this thesis is based largely on two schools of thought in current phonological theory. First, it is influenced by recent approaches that view language *use* as central to the structure of phonological systems, the variation they display, and the changes they undergo. The communicative function of language is argued to be the driving force behind the cognitive organisation of phonology, specifically, behind that of lexical representations. These representations are viewed as rich, detailed, and ever-changing, rather than underspecified, abstract, and static. A second important influence comes from approaches that view *diachronic* developments in phonology (sound change) as the prime source of explanation for synchronic sound patterns. These historical developments find their motivation in phonetically natural processes operating in the transmission of language (from speaker to listener-learner). The result of these sound changes, the synchronic state of affairs, is obviously the input to the construction of speakers' phonological systems, but it is not consequently required to contain the motivation, i.e. not required to contain the *explanation* or even be that, for the patterns that can be discerned in the synchronic data.

Models in which language structure emerges from language use are subsumed under the header of *usage-based phonology*, and an important instantiation of such a model is that of Exemplar Theory, which was briefly mentioned before in section 1.2.1. An outline of this theory is given in section 1.3.1. Section 1.3.2 elaborates on so-called *evolutionary* models of language variation and change, which place diachrony at the heart of explanation. This will include a discussion of the concept of lenition, a major operating force in sound change in general, and the main starting point for explaining sound change affecting Dutch *r*. These various strands (Exemplar Theory, evolutionary approaches, and the particular definition of lenition argued for here) are then drawn together in section 1.3.3 in a comprehensive model of *family* *relationships* which is used in chapters 4 and 5 to provide an account of the emergence and current distribution of *r*-variants in Dutch.

1.3.1 Usage-based phonology and Exemplar Theory

Recent years have seen an increase in studies that have argued for the role of language use in phonology. Bybee (2001) represents the most comprehensive overview of the arguments in favour of this move. Many of these studies were inspired by Exemplar Theory, a line of research that has its roots in psychological models of classification and similarity in perception (see e.g. Hintzman 1986; Nosofsky 1986; Kruschke 1992), and has been extended to linguistics, in the first instance to speech perception (Goldinger 1996; 1997; Johnson 1997; Pisoni 1997), then to models of phonological knowledge (Pierrehumbert 1999; 2001; 2003b; Hawkins 2003; Hume 2004; Silverman 2006; Van Dam 2007), sociolinguistics (Mendoza-Denton et al. 2003; Boomershine 2005), and sociophonetics and -phonology (Docherty and Foulkes 2000; Foulkes and Docherty 2006; Watson 2007). What these approaches share is that they assume an “episodic”, “trace” or “exemplar” model of the lexicon, in which phonetic detail is part of lexical representations. They view phonology as emergent from language experience and use, and instead of relegating fine phonetic detail to a separate module linked only indirectly to the phonological level, they place it in the centre of phonological description, if not the full explanation for sound patterns and regularities. Exemplar Theory deals with the challenge posed by evidence that speakers have fine-grained phonetic knowledge that is “not readily modelled using the categories and categorical rules” of traditional phonological theory (Pierrehumbert 2001:137), and simultaneously of larger, categorical patterns, too. Exemplar approaches assume that fine phonetic detail is stored along with tokens, and that category formation proceeds bottom-up. Speakers are able to make generalisations over clusters of tokens. Such categories may then be of traditional phoneme size, but also consitute subphonemic, “categorical allophones”, and have fuzzy boundaries between them.

1.3.1.1 Variation in Exemplar Theory

In Exemplar Theory, not only is fine phonetic detail part of the representations of lexical categories, but so is the variation associated with this phonetic detail. Under the view that phonetic detail only arises in a language-independent implementation module, variation cannot really be captured as anything other than production noise: a factor of the imperfect execution of phonetic targets by the speaker, and, on the other side of the speech chain, a perceptual problem for the listener. The phonetic variation found in natural speech, however, cannot simply be rooted in imperfections of the articulatory systems of speakers. As discussed in section 1.2.1 above, phonetic variation is no more universal than is phonetic detail itself: it is language-specific in the extent of variation that is allowed for a given category, as well as in the direction in which this variation occurs (Sapir 1925; Pierrehumbert et al. 2000). For example, while both American English [u] and Korean [u] vary with the place of articulation of a preceding consonant, the range of

F2 values displayed by American English [u] is much greater than that found in Korean (Johnson 2001). Secondly, speakers are able to exploit variation in phonetic detail socially: even fine-grained subsegmental differences including magnitude and timing of gestures have been found to act as sociolinguistically relevant in distinguishing social or regional dialects (Foulkes and Docherty 2006; Stuart-Smith 2007). A great deal of phonetic variation is, in other words, not only language-specific, but variety- and even speaker-specific. This sociophonetic variation, therefore, must also be represented as knowledge that speakers have of their language.

Phonetic variation has been shown not only to be a property of particular language varieties vis-à-vis others, but also to be associated with individual words. Evidence for this has come from the many studies into word frequency effects in recent years (see, for instance, Bybee 2000). The fact that processes may apply to individual words to the exclusion of others, and that the optional application of processes correlates with the frequency of words, is what led some to develop or endorse an exemplar view of phonology. Pierrehumbert (1999) abandons the clear distinction between the lexicon and the phonological system. However, she does not advocate replacing the standard model with one in which "holistic gestural or acoustic templates" (2001:139) of each utterance form the only representations. Insights from standard generative phonology about the internal structure that can be identified in speech, such as evidence of segmentation into phonemes and syllables (from the production of neologisms with native allophonic patterns, the assimilation of loan words, etcetera) should be *combined* with a view of lexical representations as detailed phonetic memories, containing word-specific phonetic probability distributions, which leads to a view of the grammar as essentially a higher level of generalisation over those same phonetic memories.

The representation of fine phonetic detail, its associated ranges of variability, and the fact that both are under speaker control (and amenable for use as social markers) are hallmarks of the exemplar model. This means that lack of invariance itself is not a "problem", as it is for modular approaches that assume invariant phonological representations. While being able to model any variation found in an individual's language use as arising out of the variation found in the speech community, it does not in itself, however, *explain* the variation found with any phonological category, such as *r* in Dutch, for any individual speaker nor within the larger language community. Explanations will have to be sought in the domain of phonetics (articulation, aerodynamics, and acoustics), and placed within a model of sound change. An outline of such a model will be given in 1.3.3; first, however, a more detailed description of an exemplar model of phonology is presented, along with examples of phonological phenomena other than sociophonetic variation where Exemplar Theory has been shown to be particularly successful.

1.3.1.2 An Exemplar model of phonology

The Exemplar model of linguistic knowledge entails that phonological structure emerges as generalisations over representations in the lexicon, and is incrementally developed through experience with language forms. In early generative models and in later models endorsing underspecification, it is assumed that only non-predictable, or non-redundant, information of words is stored in the lexicon, that is the string of phonemes (or feature complexes) they are made up of. Exemplar approaches assume instead that detailed memories of words as they are encountered are stored wholesale, including all predictable, non-predictable and extrinsic information that is inherent in these tokens, be it phonological (lexically distinctive), phonetic, or extralinguistic. A linguistic category (a word, a phrase, a sound) is represented as a cloud of remembered tokens of that category. The remembered tokens are labelled so as to categorise them.

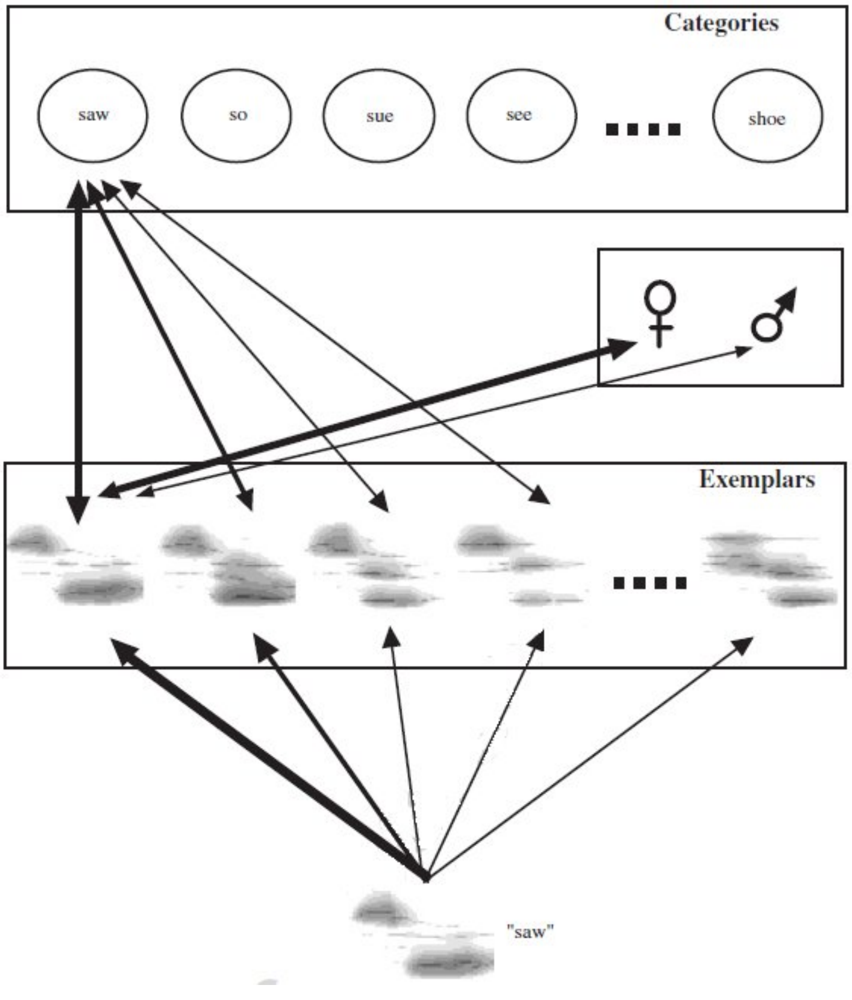

Figure 1-4 Figure 1-5: A set of exemplars relating auditory properties of an input "saw" [sɔː] to category labels via activation of exemplars.[i]

[i] Reprinted from *Journal of Phonetics*, 34(4), Johnson, K., Resonance in an exemplar-based lexicon: The emergence of social identity and phonology, 485-499, Copyright (2006), with permission from Elsevier.

Figure 1-5, taken from Johnson (2006), shows exemplars depicted as links between a set of auditory properties and a set of category labels. This labelling is multi-dimensional: a token of any word will be labelled as belonging to the relevant lexical category, but also with characteristics of the speaker – social (such as gender, indicated here), geographical, or individual. The tokens are organised, reflecting higher (tokens are close together) or lower (tokens are far apart) degrees of similarity. Similarity is here defined in a multi-dimensional phonetic parameter space. Upon encountering a new token, stored tokens are activated with respect to the degree of perceived similarity and themselves labelled probabilistically. This is similar to other connectionist network-based models of memory, including those that do not assume storage of detailed tokens (McClelland and Elman 1986). It is activation of connected tokens and clouds of tokens that ultimately drives generalisation and abstraction (Goldinger 1997). At the highest level in the picture are the categories that are set up (in this case, words rather than sounds).

The range of variation associated with each category is inherent in its representation as a cloud of exemplars. For instance, the set of tokens of a particular vowel will display all encountered differences in formant values and duration associated with various speakers' realisations of this vowel. Frequency effects are likewise inherent in the representation: frequent categories will be represented by many tokens, infrequent ones by few; moreover, frequent realisations of a category will be represented by many tokens, and infrequent realisations by few.

Note that although the human capacity for storage has been shown to be very large indeed, Exemplar Theory does not necessarily hold that all instances of all encountered words are remembered forever. Rather, it is assumed that memories decay over time (as is true for other memories of experiences), so recent tokens are stronger than those encountered long ago, which accounts for effects such as "losing one's accent". Furthermore, tokens may be so similar that they are stored as identical: there are limits to what the human ear can distinguish, known as 'just noticeable differences' (JND) in phonetics. One *exemplar*, in this view, corresponds to a class of perceptual experiences, rather than to individual tokens. Frequency is consequently encoded as higher or lower activation levels, which correspond to the strength of the exemplar. An exemplar is strengthened when more and/or more recent tokens are categorised as belonging to it.

An exemplar approach does not necessarily imply that there is no room for the notion of the *phoneme* (Välimaa-Blum 2009; Dresher 2011:251). As mentioned above, the categories that speakers form on the basis of generalisations over tokens may be of phoneme or allophone (or sub-allophone) size. It is likely that speakers form categories corresponding to traditional phonemes (Pierrehumbert 2001:148), as lexical contrast is so salient, although it is improbable that this level of organisation is crucial to lexical access (Nooteboom 2004). As a level of generalisation in Exemplar Theory, however, the concept of a phoneme will be closer to its original conception in Kruszewski's ([1881] 1995) work than its subsequent development by the Prague School and its later use in Generative Phonology. A phoneme can be viewed as a representation of speech elements that are "the same" at a functional level, but it does not need to be an object that contains those and only those elements (features) shared by its alternants. It does not, in fact, need to have any substantive content of itself, but may instead be conceptualised as the set of alternants or variants itself, or the set of relationships between them.

1.3.1.3 Production in Exemplar Theory

While an account of speech perception is fairly straightforward in an exemplar approach (newly encountered tokens are compared to previously stored ones via the activation of similar tokens, and probability-matched to the most likely categories they belong to), it is less obvious how perception and storage relate to *production*, although a number of attempts have been made to model the production of a linguistic item (Pierrehumbert 2001; 2003b). Production involves the selection of an exemplar from the cloud (which may or may not involve calculations of 'central' values in the exemplar set, depending on the specific proposal). By storing detailed information, exemplar models are able to account for the non-trivial variability of speech production, including the control speakers seem to have over stylistic and social factors. It is not clear, however, how the auditory- or perception-based exemplar representations relate to articulation. For instance, are articulatory representations computed "on-the-fly" or are they stored with the perceptual information whenever an exemplar is encountered? Or are perceptual representations in fact of speech gestures, as is claimed by the proponents of motor theory (Liberman and Mattingly 1985) and the direct-realist theory of speech perception (Fowler 1986; 1996)? In any case, an important part of the evidence for the relationship between the auditory and articulatory representations will come from a speaker's own productions in the past, and the feedback loop that is the result of these productions. However, upon encountering realisations of stored lexical items that are different from those he or she has produced in the past, a speaker will need some kind of mechanism to translate between these incoming exemplars and subsequent productions (whether the speaker is going to emulate these realisations or not). These questions have not received a great deal of attention beyond Pierrehumbert's (2001) account, though they need to be addressed to flesh out exemplar accounts of phonological knowledge and speech performance. In fact, some of the Dutch *r* data presented in chapter 3 bear directly on these matters. As will be clarified in section 1.3.2.2, articulatory representations of the sort employed in Articulatory Phonology will form part of the account of Dutch *r*-variation to follow.

1.3.1.4 The role of probabilities

It is important to stress that probability matching plays a large role in exemplar-based approaches to the variability found in speech. Both in perception and in production, speakers are assumed to make use of statistical knowledge: in perception, any incoming token is probability-matched to the stored exemplars and perceived, categorised and stored on the basis of that matching. After activation of a category in production, selection of an exemplar from the cloud is based on a weighting of more and less strongly represented exemplars, at least according to some proposals. The relative frequencies of variants that are produced by speakers are therefore quite straightforwardly based on the relative frequencies of these variants found in the social network and the ambient speech community of these speakers. In other words, speakers' productions are predicted to reflect the patterns found in the speech community he or she is part of, under the influence of sociolinguistic factors. It will become clear in chapters 4 and 5 below that this prediction is not without its problems.

The nature of the statistical knowledge of underlying probabilities and variation is a very different one from that found in other approaches that incorporate probabilities, as mentioned in 1.2.3 above. In the theory of variable rules introduced by Labov (1969) and developed by Cedergren and Sankoff (1974), probabilities are extrinsically placed on the generative rules familiar from SPE. A speaker's individual grammar is assumed to contain a component that calculates probabilities for rule application on the basis of linguistic and extra-linguistic factors. For the latter, frequency information correlated with social parameters is deemed to be relevant, so a speaker has access to that kind of information, but it is not integral to the theories of rules or lexical storage themselves.

While Exemplar Theory was being developed over the course of the past two decades, Optimality Theory (Prince and Smolensky 1993; McCarthy and Prince 1995) became the dominant paradigm within mainstream phonology. Investigators working within the latter framework have also tried to meet the challenge of trying to include variation in it. Approaches to variation in standard Optimality Theory have especially focused on 'free' variation and linguistically-governed optionality, modelling such variation with tied, 'floating' (Nagy and Reynolds 1997; Hayes 2000) or variably ranked (Anttila 1997) constraints: allowing constraints to be variably ranked vis-à-vis each other produces a number of different categorical rankings within a speaker's grammar, which are all (in principle) equally likely to occur. If a subset of these rankings produces one output (a process applies), whereas another subset produces another (the process does not apply), then the optionality of the process follows logically from the variable ranking of the constraints in question. The frequency of application is determined by the relative numbers of rankings in each subset. While these approaches make very clear predictions as to the relative frequencies of the variants, they are limited in how well they describe patterns in the data. The alternative within OT is to fit constraint rankings directly with probabilities (cf. the rules in variable rule-based phonology), as in Stochastic OT (Boersma et al. 1998; Coetzee and Pater 2010). Here, constraints are equipped with weights along a continuous scale, which are computed each time a ranking evaluation takes place, overlaid with a small degree of noise so as to produce variable rankings in differing frequencies. The probabilities are more integral to the grammar in these models than in variable rule approaches and standard OT, as the weights are updated every time the grammar is utilised (in production and perception). This imputes the speaker with *direct* knowledge of probabilities, however, as opposed to probabilities following indirectly from factorial typology in standard OT or, in Exemplar Theory, the relative frequencies in which words with variable forms are stored. Exemplar Theory thus holds an advantage over Stochastic OT in not having to assume speakers possess probabilistic knowledge that is at the same time inside the grammar, but divorced from the experience of language use that knowledge is necessarily based on; it also holds an advantage over standard OT and its variable ranking-based typologies, however, in providing a much better fit to data with probabilistic aspects.

To summarise, usage-based phonology claims that mental representations are gradually built up through experience, and Exemplar Theory is a means of modelling this claim. Exemplar approaches account for the knowledge of phonetic detail and its associated range of variation that speakers possess in ways that are beyond the grasp of models that assume universal symbolic categories, combined with a phonetic implementation module, even if phonetic implementation is seen as language-specific. Such a module would have to contain extrinsic rules relating phonetic variation and sociolinguistic variables, while such connections come for free in Exemplar models, since they are part of storage. Apart from being able to handle the role of phonetic detail in phonology, these models account straightforwardly for recently reported effects of lexical frequency on the application of phonological processes and the gradience of well-formedness judgments, as well as prototype effects (Bybee 2001; Pierrehumbert 1999). Throughout this thesis, an Exemplar Theory view of lexical representation will be a basic assumption underlying the account of the sociophonetic, geographical and linguistic variation found with Dutch *r* as part of speakers' linguistic competence: the patterns of variation and their fine phonetic detail are shown to be under speaker control and exploited in the construction of speakers' social and geographical identities. To fully exploit the possibilities of the exemplar-based account, it needs to be combined with a model of language change to be able to explain how the patterns of variation arise in the first place, and how they evolve in time.

1.3.2 Diachronic explanations for phonological patterns

1.3.2.1 Evolutionary approaches

While the data in this thesis are new, and describe the synchronic state of affairs regarding Dutch *r*-variation, the diachronic dimension is vital to its explanation. Language variation is both the result and the source of language change. It is when change takes place that variation appears, since no change takes place simultaneously in all linguistic contexts, for all lexical items, for all speakers, at the exact same time and at the exact same rate. Change is always asymmetrical in *some* respect, and therefore creates *divergence*. In another sense, change can be said to be driven by variation: it is from the "pool" of possible variants that a particular variant can start to dominate others, and spread to more contexts, items, and dialects than where it was found before (Ohala 1981; 1993). This way, a variant may become categorical or near-categorical in at least one of these dimensions, and a process of *convergence* will have taken place.

Many recent studies from otherwise divergent theoretical viewpoints have stressed the importance of diachronic explanations for synchronic phonology, including McMahon (2000), Bybee (2001), Barnes (2002), Mielke (2004), Jansen (2004), Blevins (2004), Johnstone (2006), Croft (2006), Wedel (2007), Stausland Johnsen (2012) and Scheer (2014). Hansson (2008) provides an overview. A number of these proposals are explicitly called *evolutionary* models of linguistics. Blevins (2004), for instance, develops a model (Evolutionary Phonology) that attempts to articulate a formal theory of phonological change, claiming that such a model is also able to explain synchronic patterns in language. Even more relevant to the approach in this thesis, however, is the evolutionary model developed by Croft (2000; 2006).

In Croft's work, a functional and variationist sociolinguistic approach to describing language variation and change are integrated. His definition of functionalism in this sense is broad and brief, and resonates with the usage-based view detailed above: in his view, functionalism is "an approach to explaining linguistic structural phenomena in terms of their relationship to linguistic function. Functionalism suggests that there is a more intimate relationship between linguistic form and language function than is implied by formalism, in which explanations are sought internal to the structure of the language" (2006:68). The form-function relationship is such that phenomena in language *use* influence the representation of structure, as in Exemplar models. Croft explicitly mentions the proposals in Bybee (2001) as an instantiation of his more general model: the relevance of frequency to grammatical knowledge exemplifies the influence of use on structure. In such models, grammar is dynamic, even changing throughout the adult life of a speaker. Many formal models abstract away from (certain aspects of) variation, which, in the functionalist view, are crucial to understanding language.

In this approach, variation manifests itself at three levels in languages. First-order variation is found in combined individual instances of language use. As stated in the first paragraphs of this chapter, this kind of variation is unavoidable and may be rather large (as is also evidenced by the new data discussed in this thesis). Croft's example concerns the exact place of articulation of coronal consonants as mentioned by Ladefoged and Maddieson (1996:23): while this is often said to be alveolar-only in English, and dental only in French, studies have shown that 20-30% of French speakers actually produce alveolar [t]s, and an equally sizeable minority of English speakers realise dental [t̪]. Second-order variation arises when particular first-order variants become sociolinguistically relevant. Previously 'free' variation acquires social meaning, and certain variants therefore come to be identified with particular social (class, gender, age) groups. Finally, third-order variation is that between, not within, speech communities: particular variants have become fixed conventions in a particular speech community (and sets it off against another speech community). Variation is taken as central to a model of language, making the model naturally dynamic. It also explicitly links synchronic variation and diachronic change, as variation on the three levels identified above can be equated with a model of language change (Croft 2006:72).

The "evolutionary" aspect of Croft's model seems to be, at the same time, less formally intended but more clearly defined than in Blevins' (2004) model. An evolutionary model sees changes as arising from replication – this is the case in evolutionary biology as well as language. In language, the replication process takes place in language *use* (including during acquisition). Replication, then, produces (first-order) variation. There are furthermore two kinds of changes that may occur in replication, and Croft gives examples of both. Altered replication is the situation where, for instance, a phoneme /p/ is replicated as [ɸ] instead of [p]. Differential replication operates through the process of selection: it manifests itself as an *increase* in the use of certain variants at the expense of others. So, in the example above, the number of [ɸ] tokens vis-à-vis the number of [p] tokens may increase over time. In brief: altered replication (innovation) leads to variation, and interaction (in speech communities) leads to differential replication (the propagation of particular variants, which may acquire social meaning).

At the same time, the evolutionary model should not be seen as metaphoric or analogical with regard to biological evolution, in the sense of appealing to specific mechanisms such as adaptation. It is a general framework in which models such as the usage-based phonology of Bybee or Pierrehumbert can be accommodated. These models may then propose very different analyses of, for instance, the causes of change (about which his evolutionary model is agnostic). Not differently from many other models, usage-based approaches view language as a system of conventions. In this system, identical replication represents conformity to convention. Altered replication is a break with convention, while differential replication is the adoption of particular conventions by a speech community. Usage-based phonology sees innovation (the introduction of new variants) as arising from *functional* mechanisms, or “phonetic biases” (Wedel 2007; 2011; Baker et al. 2011; Bybee 2012; Sóskuthy 2013), while propagation (the favouring of certain variants over others) is a *social* mechanism (to be explained by variationist sociolinguistics). The evolutionary programme seeks to unite these two approaches to language variation. Note that functional factors are therefore not taken to govern propagation. This is contrary to many other “phonetically-based phonology” approaches, such as those of Flemming (2002), Kirchner (2001), and most contributions in Hayes et al. (2004), where the functional principles are built into the phonology. Croft cites evidence from sociolinguistics which shows propagation to be a gradual and socially-driven process (Croft 2006:80). While the possibility that the same features may be innovated by many different speakers at various times is left open, it is, however, only after a feature acquires a social value (prestige or stigma) that propagation will occur (which, as opposed to random repeated innovation, is structured), creating second-order variation in turn (see also Foulkes and Docherty 2006 on the role of acquisition and development in propagation).

Altered replication, or innovation, is assumed to be non-teleological. There are no intentional systemic improvements initiated by speakers, although innovation may arise out of the need for communicative improvements by speakers (such as saving time). Non-intended innovations simply arise out of the “complexity of the encoding and decoding of language”, as Croft (2006) puts it, that is, out of the imperfections in the production-perception loop. A well-known strand of research in this area is that of Ohala (1981; 1983b; 1993), which follows up on the pioneering work of Baudouin de Courtenay ([1895] 1972), where such innovations on the part of the speaker lead to sound change through “misperception” on the part of the listener. However, as Silverman (2011) argues, it is not so much phonetic *mis*perception that drives sound change, but rather the very accurate perceptions of a range of variable speech forms that listeners carry over in their productions as speakers (see also Labov 1994).

In this thesis, too, the role of the speaker rather than the listener in effecting sound change is emphasised, and specifically in terms of the process of lenition, as one of the phonetic biases that account for innovation. It will be argued that many of the Dutch *r*-variants can be fruitfully analysed as *lenition forms* vis-à-vis other variants, and that they predictably arise in specific contexts. To be able to operationalize the concept of lenition, the term first needs to be defined, which is the topic of the following subsection.

1.3.2.2 Lenition

Lenition, or weakening, is often mentioned in phonological work, but usually without there being a proper definition of the term (see Honeybone 2008 for a discussion of the history of the term; Chapter 2 of Kirchner 1997 for a comprehensive overview of lenition approaches, and the problems associated with each of them). A famous definition of lenition that can function as a starting point here, is an idea credited to Vennemann in Hyman (1975:165): "a segment X is said to be weaker than a segment Y if Y goes through an X stage on its way to zero." This is a fundamentally diachronic view of lenition, which eschews a phonetic definition of the term. This is problematic, as Bauer (1988; 2008) points out. He examines cases such as Grimm's Law, and concludes that a first difficult matter is the correct identification of a change as a fortition or a lenition: if changes occur simultaneously as in major shifts such as Grimm's Law, claims as to the fortition or lenition status of such changes are unreliable: that changes occur in tandem with others, and that some of the related changes are lenitions, does not mean that all of them are (1988:385). Furthermore, if the definition includes reference to changes being "on their way to zero", then it can really only be established when the zero stage has been reached, and, more importantly, not all changes along the way are necessarily in the same direction. Bauer gives the examples of Old Norse [θ] changing into Faroese [t] to Modern Faroese [d] (1988:387) and Southern Spanish [ʎ] → [j] → [ʥ] (2008:607). Are such changes in a single direction (and would they be "on its way to zero")?

Bauer argues for a phonetic definition instead of establishing lenition purely post-hoc. The question is then whether a phonetic definition *can* be given. Some phonologists argue that, given the disparate phonetic changes it may include, lenition should mainly be defined as a matter of phonological strength (Foley 1977), but others (such as Lass and Anderson 1975) claim that phonetic properties such as resistance to airflow are involved. In any case, some phonetic definition seems necessary, if the concept is to be saved from circularity (Bauer 1988:382). Similar to the situation surrounding the sonority hierarchy (Wright 2004:34), if a phonological strength hierarchy is used to determine whether specific changes are lenitions, but we use examples of leniting changes to set up such a strength hierarchy, its explanatory value is zero.

A problem in trying to find a phonetic definition of lenition is that a number of phonetically diverse developments have been characterised as lenitions (as in Grimm's Law), while phonetically quite similar developments have been claimed to be either lenitions or fortitions. An example of the latter is found with vowel lenition: low vowels can be considered either weak (because their greater opening means they are less resistant to airflow) or strong (because they are robust and involve jaw displacement). More importantly, rather than either high or low vowels, it is usually schwa that is the result of weakening of vowels. Another example of the difficulties in assigning a “strong” or “weak” status to a particular change is obstruent devoicing: voiceless segments are generally considered “stronger”, but devoicing occurs in “weak’ positions in the syllable. The issue if positions, rather than segments, are to be characterised as strong and weak is a separate one, though not without importance here: typical lenition processes take place in codas, especially in word-final position, but also in intervocalic onsets, especially post-tonically. Different kinds of lenition processes take place in these different contexts, but it shows that it is too simplistic to assume that codas are always and in every way weaker than onsets.

A second problem with phonetic definitions is the paradoxical tension between articulatory constriction and complexity. Bauer (2008:609) mentions the well-known example of Spanish intervocalic spirantisation (*vida* /bida/ → [biða]), in which a stop has changed into a fricative. While the loss of constriction is usually regarded as weakening, the resulting target, a fricative, is actually a more complex, more effortful, articulation, since it requires more active control of the articulators (Ladefoged and Maddieson 1996:137).

It would seem, then, that there is no clear phonetic definition possible – and the notion of lenition is inherently circular. However, Bauer (2008) sees a way out in equating lenition with articulatory undershoot. In his proposal, the failure to reach a phonetic target is crucial. A diachronic-phonetic interpretation, it moves the perspective with which lenition is regarded away from the outcome, and on the *process* that gives rise to it. This way, both voicing and devoicing can be forms of lenition, as long as the context is considered: intervocalically, voiceless consonants are “strong” (and voicing is lenition), but word-finally, the opposite is true. It also means a change such as Spanish /d/ → [ð] is indeed analysed as lenition, even if the new target is a more complex articulation synchronically.

This lenition-as-articulatory-reduction approach is not that far removed from that taken by Articulatory Phonology (Browman and Goldstein 1992), which models lenition as an operation on underlyingly present “gestures” (a phonological representation of actual physical gestures of the speech organs), and that of Lindblom’s (1990) H&H theory, in which a continuum from more to less reduced speech forms (hypo- to hyperspeech) is proposed. Lindblom (2000) considers the implications of this proposal for phonological acquisition and sound change, concluding that the reduced forms survive because children acquiring language favour “energetically low-cost” articulations (cf. the “lenition bias” of Pierrehumbert 2001, discussed in more detail in Chapter 5), and sound patterns gradually adapt to meet these needs. A likeminded proposal comes from Mowrey and Pagliuca (1995). The latter in fact advocate modelling *all* sound change affecting consonants as arising out of articulatory reduction (a reduction of constriction in the vocal tract). This is probably too strong, as it ignores the role of the listener completely, and of course it stops at the “innovation” phase of sound change, without considering the social factors that subsequently drive propagation. However, under the assumption that too strict a theory is to be preferred over one that is too permissive, the strong version will serve as the starting point for the treatment of Dutch *r*-variation. Starting the explanation from a diachronic perspective, a first attempt considers the emergence of variants as driven by articulatory reduction in casual speech. As will become clear, there are a few striking cases where a reduction analysis appears to fail. This is where other factors, perceptual or extra-linguistic, need to be invoked.

The evolutionary approach to phonology emphasises a diachronic perspective of language in trying to account for variation and change. However, it is not the case that diachrony and synchrony become confused in a single model of language. In fact, the diachronic and synchronic dimensions are kept very much distinct, as are the physical and the cognitive. A synchronic pattern is the outcome of a slow, gradual process of phonetic changes, as it is this outcome that is learned by the current generation of speakers. However, to fully *explain* the synchronic pattern, we need both perspectives. This study attempts to explain both the variation brought on by “altered replication” – which involves the identification of the possible causes of phonetic changes – and account for the variation that is the result of “differential replication” – involving a variationist sociolinguistic approach to the data.

The following section outlines the diachronic-functional model used to describe the emergence and patterning of Dutch *r*-variants in the central chapters of this thesis (Chapters 4 and 5). It starts with a return to Lindau’s (1985) model of family resemblances.

1.3.3 Modelling *r*-variation: from family resemblance to family relationships

Lindau’s (1985) diagram in Figure 1-2 may successfully capture the phonetic relationships that hold between the rhotics she investigated, but it does not mean, that this approach to rhotic classhood is immediately (that is, without modification or reinterpretation) useful for an account of the variants of Dutch *r*.

First, the Dutch data to be presented in Chapter 3 entail that the diagram in Figure 1-2 needs to be augmented considerably in order to accommodate all the /r/ allophones of Dutch. Although Lindau mentions [ə] as one of the main allophones of Southern Swedish /r/, her diagram does not include vocalic variants. This may be due to the nature of the data she uses: with the exception of *herd* for the American English data, /r/ is consistently in intervocalic position in the items used for analysis, so the *r* variants examined are almost exclusively onset allophones. Furthermore, not all the relationships between the variants are made clear: while the tap [ɾ] is connected to the trill [r] by a line indicating identity of place of articulation, it presumably shares the same property with voiceless [r̥] and approximant [ɹ] (and if the tap is not considered to share place of articulation with [ɹ] on account of their places of articulation being alveolar and post-alveolar respectively, this should also hold for the [r] ~ [ɹ] pair.

In an update of Lindau’s model that aims to separate the laryngeal/pharyngeal and oral vocal tract features of rhotics, Magnuson (2007) remedies these issues by including many more variants of *r*, including two vocalic ones, and by connecting all variants that share features (Figure 1-6). However, there are more fundamental issues with this approach to classifying rhotics, and these remain in Magnuson’s version.

An obvious issue with the approach of both Lindau and Magnuson is that while the resemblances between the rhotics are uncontroversial, the question is whether resemblance to any member in the class is enough to classify a speech sound

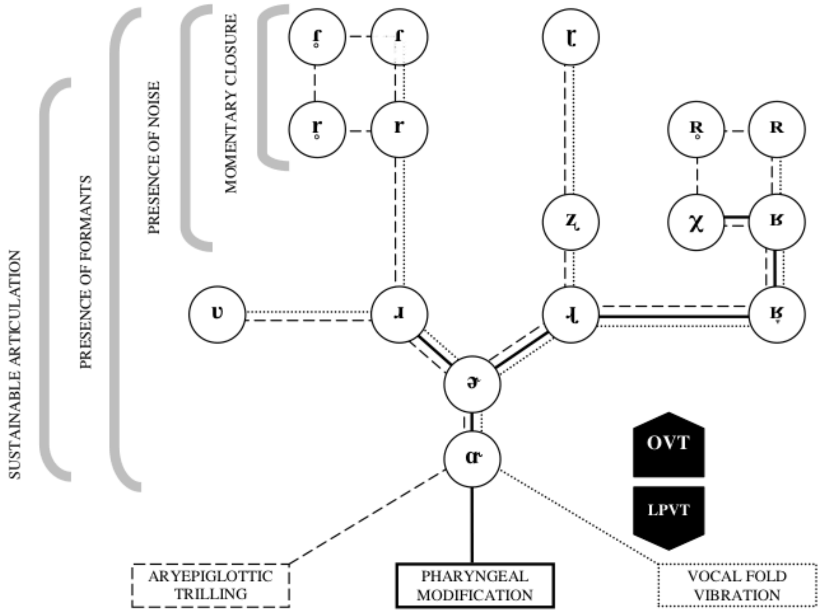

Figure 1-6 Relationships among rhotics. From Magnuson (2007:1195).

as rhotic. For instance, [s] shares both place of articulation and the presence of turbulent noise with the alveolar fricative [r̥], and [l] shares place of articulation with [ɾ], but neither [s] nor [l] are generally considered rhotics, since they do not function as such. Mere phonetic resemblance is therefore not enough to characterise a sound as rhotic, many speech sounds being similar to rhotics in at least some phonetic property.

Most importantly, the family resemblance diagram does not make any clearer how and why these disparate sounds are all able to function as rhotics in their respective languages. Nor does it make any predictions, for instance as to how much two sounds can differ for them to be able to function within the same language or variety. Lindau's diagram groups rhotics from several languages together. The data presented in this thesis show that considerable variation is possible even within an individual speaker's system, but that for many speakers the within-context variation is limited.

These problematic aspects of the 'family resemblance' approach to rhotic classhood also played a role in Ladefoged and Maddieson's (1996) negative conclusion about the unity of rhotics, quoted in section 1.1.1 above: the only unifying factors for rhotics are their shared history and their representation as *r* in the Roman alphabet. As the conclusion to a book section entitled "Factors underlying the unity of rhotics as a class", this may sound defeatist, but it in fact points the way to a successful analysis of the Dutch facts: by taking a historical view. That is, we can take charts such as that in Figure 1-6 seriously, and, instead of merely noting family resemblances, use it as a chart of a family lineage, and the connections between variants as *relationships* rather than resemblances. This will not work for Lindau's or Magnuson's charts (since not all of the languages they examine are genetically related), but it is excellently suited for explaining how the variants of *r* in Dutch may have originated. Furthermore, the distribution of the variants over different linguistic contexts needs explanation, which it will not receive from simply linking of phonetically similar variants. However, if historically related variants can be shown to predictably arise in particular contexts through common processes of language use, such an explanation can be more or less straightforwardly provided. In other words, here is where the diachronic-functional approach is expertly suited for the task of explanation.

This approach follows up on the suggestion Barry (1997) makes for explaining both the phonetic variation found with rhotics across and within languages, and their phonological stability. The proposal rests on a combined diachronic and phonetic view of the development of the diverse manifestations of rhotics. He takes the apical trill to be the base form of rhotics, in both a historical and phonetic sense. An apical trill was quite probably an early realisation of Proto-Germanic *r. Many other variants in the Germanic languages are argued to be later developments from that apical trill (Denton 2003, and see Chapter 4). Furthermore, the trilled *r*-sounds can be shown to be highly complex rhotics, in terms of articulatory configuration. The other, later variants can be viewed as 'simplifications' of some sort of this complex form. However, it is not argued (neither by Barry nor in this thesis) that these reduced forms come to be from speakers employing simplification strategies in their synchronic phonologies. Rather, reduced forms of any speech sound are predicted by theories of language use to occur in natural, casual speech (see Shockey 2003:2, who gives the English examples of "celery" pronounced in its disyllabic (rather than trisyllabic) form, and deletion of the final /t/ in "first"). Differing rates of speech and acoustic conditions lead to different results for the same gestures (Lindblom 1990), while various levels of noise impede a perfect transmission from speech source to target. Applying these notions to a Dutch-specific version of Figure 1-6 in which more constricted variants are towards the top and more open variants towards the bottom, the latter are predicted to arise as casual speech forms of variants higher up. In an Exemplar Theory view of how phonetic variation is represented, these variants will start to co-vary with the more complex ones, and become production targets themselves. Apart from Barry (1997), Schiller's (1998) account of uvular *r* variants in German is another precursor of the present approach.

Chapters 4 and 5 of this thesis discuss how the various realisations of /r/ are related to each other, specifically in terms of various types of weakening processes. They demonstrate that particular variants are expected to occur in particular phonetic environments. These predictions will be tested against the urban dialect data, with the objective of establishing the phonetic links between the *r*-variants in Dutch, and the contexts that condition their occurrence and relative frequency. New variants are argued to arise as reductive innovations, becoming production targets themselves. Chapters 4 and 5 will see the construction of a chart of rhotic relationships for present-day urban Dutch. The main difference between this chart and the diagram in Figure 1-6 will not be in the addition of even more variants (although a handful will be added), but in the establishment of the links that exist between the variants; these are not expressed in terms of family resemblances, but explicitly of family relationships.

Assuming an Exemplar Theory view of representation in which they are integrated, the gestural representations familiar from Articulatory Phonology will serve to model the production targets for *r* variants here, showing how they may lead to other variants through casual speech processes. As discussed in section 1.3.1.3, Exemplar approaches currently lack a formal means of representing the articulatory side of the phonetic knowledge speakers possess; the gestural templates of Articulatory Phonology fill this niche, and can straightforwardly express articulatory reduction as well. Combining Articulatory Phonology-like gestural representations with an Exemplar view of the lexicon is not entirely novel; a similar suggestion is already made by Bybee (2001:31), as well as Johnson (2006:494), and Watson (2007) more explicitly argues in favour of it. Other likeminded or compatible proposals come from Goldstein and Fowler (2003), who argue that gestural scores be the primitives of an emergent phonology, Lin et al. (2011), whose data on frequency effects in gestural reduction support Pierrehumbert's (2001) model of progressive lenition in Exemplar Theory, discussed in more detail in Chapter 5, and Duran et al. (2011).

To reiterate, Dutch *r*-variation is approached here from a usage-based perspective. Explanations for the current patterning of *r*-variants are sought in the diachronic domain, and particularly in lenition processes in casual speech. Assuming an Exemplar model of lexical storage (conceptualised as perceptual tokens linked to gestural production targets) underlying the production-perception loop, the emergence of particular variants is predicted on the basis of their phonetic properties. The synchronic distribution of *r*-variants is compared to these predictions in order to arrive at a model of family relationships for Dutch *r*. Of particular interest are those instances where a gradual weakening analysis appears to fail – as in the case of the emergence of uvular *r* in Dutch (discussed in Chapter 4) and that of the retroflex/bunched approximant, currently rapidly spreading in Netherlandic Dutch (Chapter 5). In these cases, other factors, which may be phonetic (perceptual) or social, are invoked.

1.4 Outline of the thesis

This thesis presents the facts concerning Dutch *r* as they arise out of the urban dialect data collected in the course of the research project, and discusses their repercussions for phonetics, phonology, and sociolinguistics. Chapter 2 gives an overview of previous accounts of Dutch *r* and its (socio)phonetic variation. The design and general results of the urban accent corpus are presented in Chapter 3. The two chapters after that consider the data in more detail, examining the phonetic and distributional properties of the different *r* variants separately, with regards to the theoretical model that has been put forward above. Chapter 4 concentrates on the 'consonantal' variants of *r* – trils, fricatives and taps, while Chapter 5 deals with the more vocalic ones – approximants and vowels – as well as with 'zero' variants (or *r*-

elision). Chapter 6 considers the phonological implications of the picture that emerges from the previous three chapters in terms of proposals for feature representations of /r/; it then takes a closer look at a phonological process (schwa-insertion) for which /r/ is one the triggers. Chapter 7 concludes with a summary and discussion of the major empirical and theoretical findings.

2 Previous accounts of *r*-variation in Dutch

2.1 Dutch dialect studies

There are two main sources describing the larger patterns of geographical variation of *r* in Dutch dialects. Weijnen (1991) contains a geographical overview of variants, based on the *RND* (*Reeks Nederlandse Dialectatlassen*), compiled by E. Blancquaert and W. Pée between 1925 and 1982. Van Reenen (1994) focuses on factors of phonological context underlying the variation of /r/ realisations in the more recent *GTRP* corpus (*Goeman-Taeldeman-van Reenen-project*), which at the time contained dialect speech from a single speaker from each of 353 towns and cities in the Netherlands. See Goeman and Taeldeman (1996) and Van den Berg (2003) for details of this corpus, which now contains speech from over 600 communities in the Netherlands and Flanders.

In the *RND* data, alveolar *r* is the dominant realisation geographically speaking, with uvular *r* dominant only in the Dutch province of Limburg, as well as the northeast of the Belgian province of the same name, along the Belgian language border that separates Dutch-speaking Flanders from French-speaking Wallonia, and in around 30 cities and towns.[2] These cities and towns include most of the largest cities in the Netherlands (Amsterdam being the notable exception), and the Dutch-speaking part of Belgium (with the exception of Antwerp). It would seem then, that apart from being a southeastern dialect phenomenon, uvular *r* is also characteristic of towns and cities. Alveolar *r*'s dominance, in other words, is more geographical than demographical.

Figure 2-1 shows the distribution of uvular *r* according to Weijnen (1991). Uvular *r* is general in the shaded southeastern area (the Dutch and Belgian provinces of Limburg), and a feature of the towns and cities indicated. That uvular *r* is in fact currently more widespread in the Dutch dialects, certainly in the Netherlands, is shown by Figure 2-2 on page 35, which shows the results from the GTRP data.

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[2] Weijnen lists The Hague, Utrecht, Zwolle, Kampen, Duinkerke, Vlissingen, Heusden, Geertruidenberg, Zaltbommel, Tiel, Grave, Helmond, Eindhoven, Diest, Tienen, Tongeren from the *RND* data, and adds (from his own observations and other sources) "the IJssel area cities from Zwolle to Arnhem", Venlo, Lochem, Ravenstein, Nijmegen, Leiden, Delft, Rotterdam, Brugge, Ghent, most of Brussels, Breda, Hulst, Den Bosch, Tilburg, cities in Twente and Varsseveld. See the map on page 2, where all these towns and cities are marked.

Figure 2-1 Uvular *r* in the *RND*; map based on Weijnen (1991).

The *GTRP* data show that in addition to the places mentioned in Weijnen (1991), *r* is usually dorsal in a large minority of southern, central and eastern dialects. Van Reenen (1994:64) makes the important observation that variation *within* cities and towns (he mentions Rotterdam, among others) is not reflected on the dialect maps, due to the design of the corpus (with typically only a single speaker per locality). A number of larger cities, such as Amsterdam and Leiden, are in fact not included in the survey at all. This means that dorsal *r* may be more widespread than the *GTRP*-based map suggests, and that outside of the south-eastern area where it is general, it is a feature of the speech of larger towns and cities, even if it is not the most common place of articulation there.

Weijnen does not discuss possible variation within towns and cities in the RND data. In fact, his use of the qualifier “mostly” when talking about the use of uvular *r* in Ghent seems to suggest that when dorsal *r* is noted elsewhere for a particular city or town without this qualification, it is assumed to be categorical there; however, it is unlikely that this is what Weijnen means. He also does not impart any more precise phonetic information about the realisation of the alveolar and uvular variants. The legend of the RND-map he refers to simply reads “[t]he articulation of the trill”. The only information about non-trilled variants of *r* comes in the form of a remark about the northeastern dialects, in which *r* is said to be very weakly realised post-vocalically, or elided.

Van Reenen (1994) examines the distribution of coronal *r* and dorsal *r* in onsets, comparing the use of both variants in words with word-initial r to those in obstruent-r clusters (/pr-, br-, dr-, tr-, kr-/). It turns out that the use of [ʀ] or [r] is not an either/or proposition for speakers, but that there are speakers who produce both (13.3%), and that this is not just a matter of code-switching between the standard language and the local dialect (whichever of the two sounds is considered the standard variant and which the dialectal one, since this too varies with the region). In part, the variation between [ʀ] and [r] for speakers who use both seems to be phonologically determined: /kr/-clusters and word-initial position seem to favour dorsal [ʀ], whereas clusters of labial and alveolar consonants+*r* favour coronal *r*. Van Reenen finds no significant effects on the place of articulation of *r* of the voicing value of the preceding consonant, nor for the place of articulation of the following vowel.

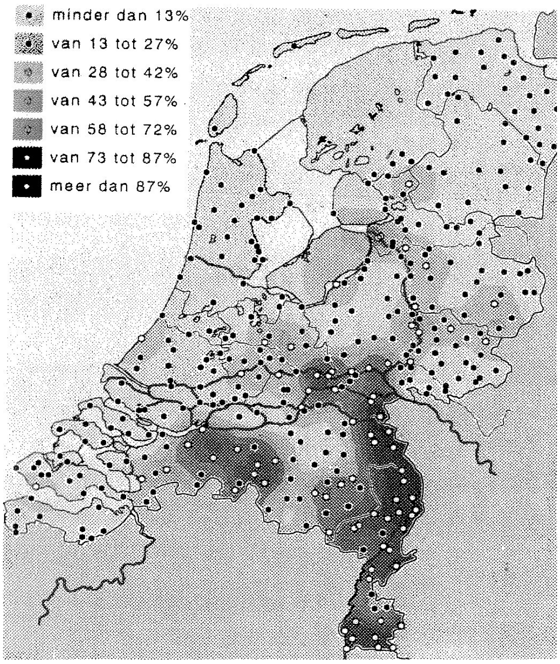

Figure 2-2 Dorsal *r* in the Netherlands in the GTRP corpus (Van Reenen 1994:68). Shading correlates with % of dorsal *r*, where darker areas (and white towns) indicate higher incidence of dorsal *r*

Apart from the variation in place of articulation of *r* variants, there is variation in manner. Apart from trills, both fricative and approximant realisations occur in the Dutch dialects. Weijnen (1991) mentions dialects in the south of the Netherlands, where (alveolar) trilled [r] is said to be accompanied by (dental) frication. This occurs in onsets as well as in coda position, and may have led to decomposition of original [r] into [rs] in the latter position in particular lexical items. Weijnen suggests this may also have been the origin of the appearance of [s] in a number of West-Flemish verbs derived from – in Standard Dutch and other dialects – *r*-final stems (e.g. *claersen* 'to clean oneself', *verdiersen* 'to make more expensive'). In Limburg, medial *–rs–* has sometimes changed into [ʃ] ([š] in Weijnen 1991).

Certain dialects of Zeeland, South-Holland and western North-Brabant (Netherlands) are said to have a retroflex *r* before alveolar consonants. A following alveolar is also said to be an important conditioning factor in the weakening process of coda *r* in north-eastern dialects.

The vocalisation of *r* in codas does not form a uniform pattern in terms of its geographical distribution, as Van Reenen's (1994:68-72) maps show. *r* before a velar or labial obstruent, as in *kerk* 'church', *verf* 'paint', is vocalised only in the north-east. When *r* is word-final (as in *bier* 'beer', *zwaar* 'heavy'), a group of eastern dialects (not including the north-eastern ones that vocalise *r* in coda clusters) vocalise or delete *r*. An exception to this pattern is the lexical item *jaar* 'year', which conforms to the pattern found with *r* + alveolar obstruent, as in *aarde* 'earth', *borst* 'chest'. In these cases, *r*-vocalisation and deletion take place on a much larger scale, with only the northwest and some central areas resisting the process. That it is dialects in the western and central areas that resist vocalisation of *r* is remarkable, since in the Standard Dutch of these areas /r/ is very often realised as no more than a slight alteration of the preceding vowel, according to Van Reenen. Also, the spread of approximant *r* variants seems to have come mostly from the western and central areas of the Netherlands (Van Bezooijen et al. 2002; Van Bezooijen 2005).

In conclusion, the considerable variation found with *r* in Dutch dialects has not gone unnoticed in the two large-scale surveys compiled of these dialects over the last century. Patterns in the geographical variation regarding place (largely confined to coronal vs. dorsal) and manner of articulation has been carefully described, although the single-speaker method used for these surveys potentially obscures the variation found within communities (or even within the speech of an individual speaker). The picture that emerges from the dialect surveys is that dorsal *r* is a feature of a large south-eastern area of the Netherlands (and an adjacent eastern area in Flanders), which is possibly spreading westward, and also of many towns and cities that have the feature to the exclusion of the dialects of the surrounding countryside. In addition, where speakers display variation in the use of dorsal and coronal variants of *r*, there is at least some correlation with the place of articulation of preceding obstruents in the choice between the two.

There is, however, also a great deal of potentially relevant information which cannot be obtained from these dialect data. Most crucially, this concerns the dialect-internal variation already remarked upon. Most of the *GTRP* data were collected by consulting a single speaker per locality, and both Van Reenen and Weijnen supplement their data by informal observation and personal communication. It is clear that, specifically in larger communities, more rigorous data collection with a larger scope is necessary. One advantage such data could offer is a more dynamic picture: if dorsal *r* is indeed spreading from the southeast and/or towns and cities, for instance, the situation around (i.e. just outside) these centres should be in a state of flux. Variability between generations and within the speech of individuals might be higher in these areas, for instance. Tops (2009) uses exactly such a methodology to track the spreading of dorsal *r* in colloquial Standard Dutch[3] in Flanders. She shows that dorsal *r* is wide-spread in the province of Limburg, in accordance with the *RND*-based map in Figure 2-1, although it is not quite as general as the map suggests in the western parts of the province. Dorsal *r* is also frequent in Ghent, along the Belgian

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[3] See Chapter 3 for a definition and further explanation of this term.

Dutch border, and along the linguistic boundary between Flanders and Wallonia. Importantly, her results also show that dorsal *r* is on the rise, since it is found more frequently with younger speakers, and that it is spreading geographically from a number of dorsal *r* centres (Limburg, Ghent, but also several areas of the provinces of Brabant and Antwerp), since the edges of these centres have higher concentrations of "mixing" speakers (speakers with both coronal and dorsal *r* realisations). It is precisely because she makes use of intra-dialectal and even intra-speaker variation data that she is able to come to more far-reaching conclusions than a sketch of the current geographical distribution of *r* variants.

More elaborate variation data from within a specific area or city simply provide a more detailed picture of the relative frequencies of *r*-variants, and, with the right methodology, make it possible to link *r*-variation to the factors that govern it, from the linguistic context to the sociolinguistic situation. The data in this thesis aim to provide just such insights, focusing on the speech of larger urban communities in the Dutch language area. Previous studies of the speech in these cities have at times touched on the realisation and variation of *r*; these are described in the following section.

2.2 Urban accents of Dutch

The primary source of data in this thesis is a large-scale survey of spoken Dutch from 10 relatively large urban communities in the Netherlands and Flanders. These varieties will henceforth be referred to as 'urban accents of colloquial Dutch' (see Chapter 3 for definitions of 'accent', 'dialect', 'Standard Dutch' and 'colloquial Dutch', and the relationships between them).

The choice to focus on urban speech communities was made for two reasons. First, it is data on variation within larger communities which was the most obvious gap in our knowledge of Dutch *r*: the *GTRP* data described in the previous section come from one speaker each in a large number of communities, big and small, and focus on the local vernacular dialects; the data described in section 2.3 are on the opposite side of the dialect-standard scale, as they focus on Standard Dutch of a relatively prestigious variety, by having either only upper middle class speakers or speakers who use language professionally (broadcasters, language teachers) as their subjects. The colloquial Dutch spoken within larger urban speech communities by non-professionals was therefore an obvious choice to supplement the data from these previous studies.

A second reason for looking at these larger communities is that they are generally considered epicentres of variation and change: urban communities are places where people of various social and geographical backgrounds meet and interact, and they exert an influence on their larger surroundings. That is, the expectation is for there to be more variation in urban communities, as well as more volatility, i.e. variation leading to change (see e.g. Trudgill 1974; Bailey et al. 1993; Foulkes and Docherty 1999; Britain 2004; Durian 2007). Tops' (2009) study makes it clear that this expectation is warranted for the patterning of *r* variation in Ghent.

The current section examines the previous literature on *r* in these specific city dialects. For several of these varieties, in fact, *r* is traditionally identified as a typical marker of the accent, both in dialect descriptions by linguists as well as in more popular media. The remaining dialects were chosen for inclusion in the speech corpus for independent reasons (see Chapter 3), and have no such status in dialectology or elsewhere. The most frequently noted aspects of *r*-realisations in these urban accents are described here.

2.2.1 The Netherlands

Among the Dutch cities in the speech corpus are the four largest cities in the Netherlands by population, in descending order: Amsterdam, Rotterdam, The Hague, and Utrecht. They are complemented by Nijmegen (#11 by population size) and Leiden (#19).

As opposed to The Hague and Amsterdam, the information regarding *r* variation in Nijmegen, Utrecht, Rotterdam and Leiden is rather scant. Van Hout's (1989) large-scale study of the Nijmegen dialect unfortunately does not include *r* as one of the variables under investigation, although he does note that it is predominantly uvular (1989:208). There seem to be no further studies that mention *r* in Nijmegen, apart from Weijnen's (1991) observation that it is always dorsal (either velar or uvular). Information on Utrecht *r* is limited to the observation that dorsal *r* is common (though not general) in Utrecht (Weijnen 1991) and that Utrecht might be a "meeting point of two [ʀ] cultures" (Van Reenen 1994:58), i.e. a dialect with two separate sources for its development of dorsal *r*, the standard language and neighbouring dialects (see Chapter 4 for more on the history of dorsal *r* in Dutch).

While *r* in Rotterdam Dutch is often said to include both coronal and dorsal realisations (Van Haeringen 1962; Van Reenen 1994), Van Oostendorp (2002) claims that an alveolar trilled [r] is not a feature of Rotterdam speech. Instead, *r* is usually "somewhere in the back of the mouth" (2002:34). Most speakers are said to have a uvular trill in onset positions. In postvocalic position, Rotterdam *r* is a glide, somewhat like [j].

Wortel (2002), on the Leiden dialect, forms part of the same popular book series as Van Oostendorp (2002) on Rotterdam. Its descriptions are informal, and make no use of technical terms or phonetic transcription. Wortel describes the realisation of *r* in Leiden as follows: in onsets, it can be likened to "Texan /r/" (2002:87). Presumably, this refers to some kind of retroflex approximant. The approximant nature of the Leiden onset *r* has been noted before (Collins and Mees 1996), although it is not usually referred to as a true retroflex. In word-final position, Wortel claims, this *r* is preceded by "a short *i* or *u*" (2002:88). From the examples Wortel gives, it is not immediately clear what these symbols denote. They may be the short Dutch vowels [ɪ] and [ʏ], but it is more likely that they refer to some secondary palatalisation and labialisation respectively (which could be heard as [i] ~ [j] and [u] ~ [w] type sounds). It is striking that Wortel does not mention uvular *r*, which several authors claim to be the main Leiden realisation of *r* (Van Haeringen 1962; Weijnen 1991).

2.2.1.1 *The Hague*

In his sociolinguistic study of the city dialect of The Hague, Elias (1977) considers the realisation of *r* in contrast with Northern Standard Dutch. There are three possible realisations of /r/ in the standard language, so Elias claims (1977:23): alveolar [r], uvular trilled [ʀ], and a variant with a velar constriction, of which he does not say whether this is fricative or approximant (or whether it includes both). He is somewhat surprised by Zwaardemaker and Eijkman's (1928) inclusion of the non-trilled velar variants as being acceptable in Standard Dutch, especially as they explicitly mention [ə] as a *non*-standard realisation of /r/ in Dutch, whereas this is not uncommon as a coda variant. Elias wonders whether the velar fricative was perhaps not stigmatised in the 1920s, as opposed to schwa. If so, Elias concludes, then the stigmatisation of the non-trilled velar variant is of fairly recent origin.

Elias states that alveolar [r] has disappeared from The Hague speech and that uvular [ʀ] is now completely general (1977:26). He cites Van Oyen's (1968) study (part of the *RND* corpus), which lists 87 postvocalic *r* tokens, of which 74 are [ʀ], 12 are zero realisations and one is [r]. The approximant and vocalic realisations Kloeke (1938) reports for The Hague and Leiden, however, are absent. Note that the fricative non-trilled dorsal variant is absent too. Elias concludes that this variant must be relatively recent: apart form it being absent in the literature, he also does not remember it was ever used as a marker for typical The Hague speech in his youth (as the monophthongal pronunciation of the Dutch diphthongs /ɛi,œy,ɑu/, for instance, was).

The results of Elias' own research show that all of the variants mentioned previously occur in the dialect. Limiting himself to postvocalic contexts only, he lists uvular [ʀ], [ʀ̥] and [ɐ]; velar [x] and a 'sharper' velar [x̟]; frictionless back variants, represented as [ə] and [ə̞]; vocalic [j], and the zero variant, Ø. In the more recent (but also more impressionistic) Elias (2002), even more variants of *r* in The Hague are mentioned: before /t/ and after 'free' vowels, /r/ surfaces as the accompanying glide of the vowel in question ([w] in the case of /y/, [j] in the case of /i/). Final /-əʀ/ surfaces as a lowered vowel resembling [ɑ], while in the item *verder*, the first *r* is said to be elided (after /ɛ/).

2.2.1.2 *Amsterdam*

In her sociolinguistic study of Amsterdam dialect speech, Schatz (1986:95-97) lists the two trills [r] and [ʀ] as the variants of Standard Dutch, and claims flapped/tapped [ɾ] is a stigmatised feature of Amsterdam speech. She bases this conclusion on the behaviour of her test subjects who, although unaware of the difference in pronunciation between [r] and [ɾ], used it when asked to imitate typical Amsterdam speech. This, along with informal observation, leads Schatz to take *r* into account as a variable in her survey. Her results show that that 2/3 of her respondents (n=24) were scored as using [ɾ]. However, it is unclear whether these are in fact all tapped realisations, since Schatz only distinguished between two realisations, stating that "[t]he two variants of /r/ are [a] uvular rolled variant [ʀ], which is the non-stigmatised pronunciation, and a flapped apico-dental pronunciation [ɾ], which is the stigmatised Amsterdam variant.” Since she had stated before that both alveolar [r] and uvular [ʀ] were non-stigmatised, i.e. Standard Dutch, variants, this statement is somewhat surprising. It may mean that in her data, Schatz only found instances of uvular trills and alveolar taps, which would be surprising given the traditional notion of Amsterdam as an alveolar trill “oasis”, one of the few larger cities where uvular [ʀ] did not replace alveolar [r] (Weijnen 1991; Kloeke 1938). It could also mean that both uvular and alveolar trills were labelled “ʀ”.

Her test subjects’ behaviour notwithstanding, it is actually surprising in itself that Schatz would claim tapped [ɾ] to be a stigmatised Amsterdam variant, as it has been widely recognised as a Standard Dutch variant, being a free variant of the alveolar trill, by many others (Damsteegt 1969; Van den Berg 1974; Gussenhoven and Broeders 1976; Gussenhoven 1992). Today in fact, as we will see in Chapter 3, it is by far the most frequent alveolar /r/ realisation in urban Dutch.

2.2.2 Flanders

The Flemish cities in the urban accent corpus are the three largest by population size (Antwerp, Ghent and Bruges), as well as the largest city in the eastern province of Limburg, Hasselt (the 8th largest city in Flanders). *r*-variation in Belgian Dutch has not been extensively described in the literature, apart from the frequent observation that, while Flanders is said to be mainly an alveolar *r* area, uvular *r* occurs in the area around and including Brussels, as well as in Ghent and Bruges, in Limburg and at the linguistic border between the Dutch-speaking and French-speaking areas of Belgium (e.g. Weijnen 1991). This would mean that, with the exception of the Limburg province, uvular *r* in Belgium is very much a city phenomenon. Tops (2009)’s more recent overview of the use of dorsal *r* in Colloquial Standard Dutch in Flanders shows that it is indeed frequent in all these areas, as well as along the Belgian-Dutch border. The limited information on *r* in Belgian Dutch apart from Tops’s study is largely concentrated on the situation in Ghent, where, since the beginning of the 20th century, uvular *r* has become much more widespread, according to various sources. The Ghent [ʀ] is possibly due to a French influence in the city (De Gruyter 1909; Rogier 1994), and has, according to some, displaced the alveolar variant completely there (Taeldeman 1985), but Tops (2009) and the data in this thesis present a more nuanced picture. Tops shows that uvular *r* never became entirely general in the city itself, although its use is still spreading outward from the city to its suburbs and surrounding towns. The data in Chapter 3 also show that there is still a large minority of Ghent speakers with alveolar *r*, at least in their colloquial Standard Dutch.

The other three cities in the corpus may all display change in progress as well, if the picture that emerges from the available literature is correct. Alveolar *r* has always been predominant in Antwerp, but according to De Schutter (1999) this could well be subject to change soon. Uvular [ʀ] may, in fact, be losing its stigma as a speech defect in the whole of Flanders (Van de Velde 1998). Weijnen (1991) mentions Bruges as one of the places in Flanders where uvular *r* is found, although he notes it is not general there. Finally, while uvular *r* is the most frequent realisation in the eastern province of Limburg (see above), alveolar [r] is said to be the main variant in its capital Hasselt (Grootaers and Grauls 1930).

2.3 Standard Dutch

It should be clear by now that there is a great deal of variation in /r/ realisations in varieties of Dutch, across different dialects, within dialects across different speakers, and across different phonological contexts for individual speakers. One more remarkable thing about the variation found with *r* is that many of these variants seem to be acceptable in the standard language, instead of being viewed as dialectal, geographical phenomena only. It seems as if this attitude is a relatively recent development, and still in the process of change. There have not been many comprehensive studies into the variation found in Standard Dutch: the few large-scale data studies have focused on dialect speech, whereas descriptions of Standard Dutch in the phonological literature, for instance, have mostly been based on the intuitions of the author in question. In order to examine the extent of *r*-variation found in Standard Dutch, this section takes a brief look at a number of accounts of what has been considered acceptable in Standard Dutch over the last century. Since it seems to be the case that more and more realisations of /r/ have come to be considered Standard Dutch, these studies will be reviewed largely in chronological order. Following this overview, a number of relatively recent, instrumental studies into *r*-variation will serve to illustrate the current situation.

2.3.1 Increasing variation of *r* in Standard Dutch?

Zwaardemaker and Eijkman (1928) and Blanquaert (1934), descriptive and prescriptive accounts of Standard Dutch respectively, considered both alveolar and uvular trills as Standard Dutch realisations of /r/. It is significant that the more prescriptivist Blanquaert finds the uvular trill acceptable, as his view of the standard language is otherwise thoroughly conservative. Especially in Flanders, the uvular trill has often been regarded as a speech defect, and was until not long ago regarded as unacceptable for broadcasters working at the Flemish public broadcasting corporation *BRT* (now *VRT*) (Van de Velde 1996). Other variants of *r* are indeed considered speech defects by Blanquaert; this includes an ‘exaggerated’ alveolar trill (too loudly articulated or with too many lingual contacts) and those uvulars that are either too ‘raspy’ (presumably this refers to the fricative trill), or too ‘feeble’ (probably the non-trilled uvular fricative or approximant). Blanquaert mentions speakers (children) in whose speech /x/, /ɣ/ and /ʀ/ are not distinguishable, and who use the same articulation for all three. For Zwaardemaker and Eijkman, these are all acceptable dorsal *r* variants.

Cohen et al. (1961:39) are the first to mention a non-trilled, dorsal, back and non-rounded approximant. This probably refers to a retroflex or bunched approximant (often referred to as *Gooise r* in popular media[4], as well as in some linguistic literature; see chapters 3 and 5), as they claim it "differs from [j] only in place of articulation", but could also be a velar or uvular approximant. Damsteegt (1969:10) claims that there are at least six *r* variants in (Standard) Dutch: two trilled ones (alveolar and uvular), an alveolar flap, a dorsal fricative close to [x], a vowel-like sound and a zero realisation.

Van den Berg (1974) adds a "mediopalatal" fricative to the Dutch *r* repertoire. This is probably what will be referred to as a post-alveolar fricative in this dissertation (see chapter 3). Gussenhoven and Broeders (1976) are the first to explicitly distinguish a uvular approximant [ʁ̞] from the fricative at the same place of articulation. They also mention a 'palatal approximant', which may refer to the *Gooise r*, but also to the [j]-like realisation that Kloeke (1938) notes he finds for *zwart* /zʋɑrt/ 'black' in The Hague and Leiden.

Mees and Collins (1982) claim alveolar *r* is most usually a tap or a weak fricative in Standard Dutch, not a trill. They specifically mention *Gooise r*, as the coda variant for both alveolar and uvular *r* speakers of Standard Dutch in the Netherlands. They further mention reduction variants, such as a close schwa-like or, after non-high vowels, [ɾ]-like glide. Uvular *r* is claimed to be usually realised as a pre-uvular approximant in onset positions: [ʁ̞˖], while voiceless, non-trilled uvular fricatives are associated with upper socially-marked or affected varieties of Northern Standard Dutch (1982:10).

Within the space of half a century, then, Standard Dutch *r* in the literature has come to include, apart from the alveolar trill, variants such as an alveolar tap and a weak fricative; a palatal fricative and two distinct approximants; a velar fricative; a uvular trill, fricative and approximant; front and central vowels; and a non-realisation. Research will now have to concentrate on questions of how these variants are distributed, both in space (as Standard Dutch is not a rigid model of pronunciation, but allows some regional variation – see section 3.1), and across linguistic contexts. The following section discusses three studies that have tried to answer these questions.

2.3.2 Recent studies of *r*-variation in Standard Dutch

A number of studies published in the past two decades have looked at the variation and change concerning *r* within Standard Dutch. Three of these focus on Standard Dutch as spoken in the Netherlands (henceforth Netherlandic Standard Dutch) (Vieregge and Broeders 1993; Voortman 1994; Smakman 2006), while Van de Velde (1996) and Verstraeten and Van de Velde (2001) also take into account the southern standard, as spoken in Flanders (Belgian Standard Dutch). The methodology of these studies varies greatly, in a number of ways: in how the data were collected (from

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[4] The region of *Het Gooi*, to the southeast of Amsterdam, is the centre of Dutch television broadcasting (particularly the city of Hilversum), as well as a region of considerable affluence (especially towns such as Bussum and Naarden). The *Gooise r* was popularly considered a striking feature of "television speech" in the recent past.

forming a new corpus through interviews to using radio and television recordings), the type of speech (from spontaneous to read), the number of speakers (from 7 to 68), and the criteria for selection of the speakers (from their being professional speakers to simply being members of a specific social group). This makes their somewhat disparate results hard to compare.

Vieregge and Broeders (1993) elicited relatively spontaneous speech (subjects were asked to give detailed descriptions of drawings) from seven male speakers, in order to look into the influence of syllable position on /r/ realisations. Classifying variants according to relative strength (2.1), they show that "stronger" variants are preferred in onsets, and "weaker" ones in codas. Furthermore, stronger realisations tend to occur more in stressed syllables than in unstressed ones.

(2.1) Categories of relative strength of *r*-realisations
(Vieregge and Broeders 1993)

- variants with friction or otherwise turbulent airflow (fricatives, voiceless trills and taps)
- variants with weak or near contact between the articulators (uvular and palatal approximants, r-coloured vowels)
- vocalic variants (vowels without *r*-colouring, mostly schwa)
- zero realisations

The variant that is used most by all seven speakers turns out to be a uvular approximant, at least in all three onset positions, while in coda position, rhoticized schwa, zero, and the uvular approximant are the preferred variants. They do not include a list of all variants they distinguished between, unfortunately, so that the intra-speaker variation they discuss is hard to interpret. The between-speaker variation is also difficult to assess, due to the small number of subjects and the lack of systematicity with respect to their selection (as colleagues of the authors, they cannot betaken as representative of Standard Dutch speakers in general).

In her sociolinguistic study of upper middle class Dutch[5], Voortman (1994) distinguishes between five different variants of *r*:

1. alveolar [r], presumably including the alveolar tap;
2. uvular [ʀ];
3. approximant [ɹ] (*Gooise r*) and vocalic variants (including "weak schwa");
4. [ʀχ], or trilled uvular /r/ leading into a homorganic fricative;
5. [χ], uvular fricative without trilling.

Data come from outside the western *Randstad* area, a popular term commonly used for the region bordered by and including Amsterdam, The Hague, Rotterdam and Utrecht. Voortman's subjects are 15 speakers each from Middelburg (Zeeland, in the southwest of the country), Zutphen (in the east of the Netherlands), and Roermond

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[5] The subjects in Voortman's study are mostly doctors, lawyers and notaries.

(Limburg, in the southeast). Her results show that the variation is geographical, as well as individual, and linguistic context-bound. The use of alveolar vs. uvular *r*, for instance, is mostly speaker-dependent ("barring a few exceptions", 1994:119), cutting across the communities, but showing clear geographical effects as well. Alveolar [r] is used in the majority of cases (58%) in all positions in Middelburg, and in relatively large numbers in Zutphen (around 35%) and Roermond (18% in word-initial onsets, 12% in word-internal ones and codas). Uvular [ʀ] is used in over 40% of all tokens in Middelburg in all positions, is the dominant variant in Roermond (68% in codas, over 80% in onsets) and also big in Zutphen (44% in coda, over 60% in onsets). This situation contrasts with the largely context-dependent use of the approximant and fricative variants (which are mainly coda phenomena): these are used by almost all speakers of the relevant communities (Zutphen for the approximant, Roermond for the fricatives). In fact, in Roermond, 14 of the 15 speakers use one of the fricative variants in codas.

Distinguishing between 10 different variants of *r*, Van de Velde (1996) shows that *r* variation is much greater in the Netherlands than it is in Flanders. While the only /r/ realisations that are acceptable in Belgian Standard Dutch are the trilled ones, many more realisations are acceptable in modern-day Netherlandic Standard Dutch (1996:126). His data largely corroborate the picture that emerged from the earlier literature, regarding the expansion of the number of /r/ realisations found in Standard Dutch, especially in coda position. The corpus used is a database of radio recordings, mostly live reports of events such as football matches, coronations and royal weddings. The discrepancies between the variation found in the data and what has been described as acceptable as Standard Dutch in the literature are attributed to the “somewhat normative” approach taken by many writers (1996:142).

The results for Belgium show that [r] is overwhelmingly the most frequently used variant of *r*, although in the most recent data (from 1993) it has run into some competition, from [ʀ]. These two variants make up 80.8% and 16.7% of the 1993 data, and are thus effectively the only variants found in southern Standard Dutch (the remaining 2.5% are cases of *r*-deletion). Van de Velde concludes that virtually no change has taken place in the realisation of *r* in southern Standard Dutch. While there is in fact an increase in [ʀ] realisations over this period in his data, these are mainly due to a single speaker who uses this variant exclusively. Perhaps, therefore, it is not so much the use of dorsal *r* variants that has increased, as its acceptance on national radio.

The use of [r] and [ʀ] in codas in Standard Dutch in the Netherlands shows a dramatic decline over the same period, that is between 1935 and 1993. The two trilled variants go from 21.8% each in 1935 to 4.1% and 2.0% respectively in 1993. Tapped [ɾ] remains strong throughout, however: 20.1% in 1935, 22.9% in 1993. Clearly on the increase are the vocalic variants: schwa, alveolar and retroflex approximants (see Chapter 5), and the ‘zero’ variant, or *r*-deletion, take the place of the trills in coda. Netherlandic Standard Dutch, in other words, shows much greater change than Belgian Standard Dutch over the 60-year period in which the data were collected, and shows more current-day variation.

A similar corpus study, but only for the Netherlands, was carried out by Smakman (2006). His corpus consists of 10 minutes of speech from each of four television newsreaders and three radio presenters, who were selected on the basis of a large-scale survey, which showed that non-linguist Dutch native speakers considered their speech to be good examples of Standard Dutch. In these 40 minutes of speech from only seven subjects, he distinguished 24 different variants of *r*. His data support those from Voortman (1994) in identifying the choice of alveolar vs. uvular variants as mainly a speaker-specific phenomenon (place of articulation was relatively consistent between speakers), whereas the use of approximant and vocalic variants vs. more constricted ones is context-specific: all speakers predominantly realise coda /r/ as a vowel or approximant, irrespective of their onset realisation.

Smakman (2006:241) hypothesises that the place of articulation in onsets is indicative of the social and/or regional background of the speakers (whose speech is otherwise relatively homogeneous). However, he does not specify how the use of one or the other could identify a speaker's social or regional background (and it is obvious from the other studies that there is considerable variation within socially or regionally demarcated speech communities). It is further noteworthy that five of his seven speakers have at least one token of *r* with the alternative place of articulation, i.e. are to some extent variable with respect to place of articulation. All in all, Smakman's study shows a great deal of variation in current-day Northern Standard Dutch, especially considering the fact that his data come from a very restricted, stable and homogeneous set of speakers.

2.3.3 Conclusion: Standard Dutch and variability

What the four recent studies of Standard Dutch make most clear is that there is abundant variation in, especially, Netherlandic Standard Dutch, which can be uncovered as long as the categories used during analysis are made sufficiently fine-grained. It is not likely that Smakman's (2006) speakers (24 variants) were really that more variable than those in Voortman's (1994) study (5 variants); the more likely explanation for the discrepancy in the variation noted is in the choice of variants that were grouped together. Several other studies (including recent ones) of variation and change of Dutch *r* in fact assume even larger categories: Van Bezooijen (2005), for instance, states that "[a]t present, three variants of /r/ co-occur in northern Standard Dutch". As the data in the present study show, this potentially obscures a great deal of variation which may be relevant to the issues surrounding *r* in Dutch.

There may be many reasons behind ignoring a large part of the realisational variation found in speech (and this is not limited to that found with *r*): certain variation may not be deemed relevant for the process under investigation, it may escape the perception of the transcriber, or it may be forced by preconceived categories (such as a particular phonological feature theory or the availability of distinct IPA symbols) (See e.g. Simpson 1999; Lodge 2009 for more elaborate criticism of using IPA-based segmental transcriptions as a basis for analysis). Any formation of categories prior to analysis, in any case, seems dangerous with large-scale sociophonetic data. Although Van de Velde (1996) and Smakman (2006) also use IPA transcriptions, they also make extensive use of diacritics, and have an elaborate description of what the categories stand for (and how much variation, if any, is ignored within these categories).

Van de Velde's work was to a large extent the inspiration for the present study, and his categories (identifying 10 *r*-variants) were the starting point for its data transcription and analysis. However, as the initial data analysis was exploratory, the eventual categorisation was the result of a fluid process. The design of the corpus and a summary of the principal quantitative results will be the topics of the following chapter.

3 *r*-variation in urban accents of Dutch

The studies discussed in the previous chapter provide some insight into the realisational variation found with Dutch *r*. They show that there is large-scale variation along geographical lines, both in traditional dialects (e.g. Van Reenen 1994; Goeman and Van de Velde 2001, on the GTRP corpus) and in Standard Dutch (e.g. Verstraeten and Van de Velde 2001, on the VNL corpus). They even show considerable variation when the geographical area, social group and register are more restricted (Voortman 1994; Van de Velde 1996; Smakman 2006). Finally, they show considerable change in progress (Van de Velde 1996). However, they are each limited in methodological scope in their own way. While the *GTRP* corpus has a large number of localities, there is only one speaker per locality and the target variety is the local traditional dialect. On the other hand, the *VNL* and Smakman corpora target modern-day Standard Dutch, but in fairly formal settings and accompanying register. The aim of the current study is to tap into relatively colloquial speech in locally-accented Standard Dutch, and to focus on variation *within* local speech communities, as well as between them. This will fill the most important gap in our knowledge of Dutch *r*-variation: that in urban accents of Dutch. To this end, a large-scale speech corpus was assembled containing data specifically intended to study *r*-variation. The collection of in the “field”, high-quality data of a relatively large number of speakers from within 10 urban speech communities (relatively large cities in the Netherlands and Flanders), makes it possible to combine investigations of dialectal, social, individual, and phonological variation. The design and method of analysis of this data collection are presented in section 3.1 of this chapter; they are followed by an overview of the *r*-variants identified (and consequently distinguished between) in the data (3.2) and a section that summarises the large-scale quantitative results from this study, focussing on the differences among the urban accents (3.3). These differences will be presented in terms of the frequencies of individual variants, but the larger patterns will be more clearly brought out by means of *index scores*, a well-known method in sociolinguistic research going back to Labov (1963), for the quantification of linguistic variation. The four scores used here index place of articulation, consonantality or manner of articulation, use of the retroflex/bunched approximant, and the occurrence of post-*r* schwa-insertion, respectively. Section 3.2.2 introduces the index scores and describes how they are calculated, and they are used extensively in the section describing the overall results across speech communities, 3.3. Finally, the variation *within* the various speech communities and the relevant social factors underlying it form the topic of section 3.4.

The complex patterns of variation that become visible from the data presented in this chapter will also form the starting point in asking questions related to the phonetics and phonology of Dutch *r*. These questions – relating the phonetics of the *r*-variants to their distribution, and thereby to their likely diachronic origins – form the heart of this thesis, and they will be addressed in chapters 4 and 5.

3.1 Design of the *HEMA* urban accent corpus

The large-scale speech data corpus assembled for this thesis comes from 10 urban accents of Dutch in the Netherlands and Flanders. The reasons for focussing on urban accents were given in the previous chapter and above, but this did not include a discussion of what is meant by the term. Section 3.1.1 will give a definition of urban accents as used in this thesis, and describe how they relate to Standard Dutch on one hand, and to more traditional dialectal vernacular speech on the other. This discussion is followed by sections on the design and methodology of the study (speech communities, speakers, stimuli, data processing).

3.1.1 Definitions of Standard Dutch and urban accents

The difference between 'accent' and 'dialect' in sociolinguistic studies, if such a difference is made, is in which linguistic features set the variety apart from others (Chambers and Trudgill 1998:5; Foulkes and Docherty 1999). Dialects may of course differ at various linguistic levels. The term 'dialect' is used primarily to set apart those language varieties that display lexical and morphosyntactic differences. Phonologically and phonetically different varieties of a language that have largely the same vocabulary and syntax are termed different 'accents' of one and the same dialect (see also Laver 1994:55-56). In this thesis, the varieties under discussion will be called 'urban accents of Standard Dutch' in accordance with this now common practice. This has the additional benefit of avoiding any connotation the word 'dialect' might have with so-called 'broad' vernacular speech far removed (lexically and syntactically) from the standard language. In fact, all the lexical items that were used to elicit *r*-tokens in the two tasks during data collection are part of the standard language, and any dialectal lexemes that were given as response to the picture task were disregarded. Furthermore, the subjects in the study were approached in Standard Dutch by their interviewers. In other words, the speech in this study concerns attempts at Standard Dutch words in various local (urban) accents.

In the Dutch linguistic tradition, however, *Standaardnederlands*, or Standard Dutch, is also used to denote a specific accent or pronunciation model of Dutch: *Algemeen Beschaafd Nederlands* (ABN, lit. 'General Civilised Dutch'). This social accent of Dutch is often used as a model for second language learners, and is still viewed by many (especially in the Netherlands) as a high-prestige norm for Standard Dutch pronunciation (Smakman 2006). It developed during the 19th century, was based largely on higher class speech of Holland (i.e. the northwest of the Netherlands), and spread from there to higher social circles in the rest of the

Netherlands (Van Haeringen 1951; Goudsblom 1964; Van de Velde 1996). As it has come to be regarded as a social accent instead of a regional one, it is supposed to be impossible to tell the origin of an ABN speaker (Van Haeringen 1924; cf. Van Heuven and Van de Velde 2010).

However, as Van de Velde (1996) makes clear, considerable variation in terms of pronunciation is found even within what is usually regarded as ABN. The pronunciation of *r* is in fact a typical example of this. Mees and Collins (1982), in their description of ABN Dutch, explicitly allow for a variety of /r/ realisations: alveolar and uvular trills, fricatives and approximants. The deletion of *r* after schwa is also mentioned as a feature of ABN Dutch.

The situation in Flanders is slightly different, as the northern standard accent did not spontaneously spread to there in the same way it spread through the higher social circles in the Netherlands. In fact, in the 19th century, the upper and upper middle classes of Flanders spoke French, and only in 1932 was Dutch given the status of the only official language in the Flemish provinces of Belgium (Willemyns and Daniels 2003). A standard pronunciation was first codified in Blanquaert's (1934) pronunication guide, which closely followed the northern (Netherlandic) Dutch norms, but deviated in not incorporating recent sound changes. More recently, norms propagated by the Flemish Broadcasting Corporation (VRT) have become generally accepted as the target accent for Standard Belgian Dutch. Apart from 'VRT Dutch', this is often called *Algemeen Nederlands* (AN). See Van der Wal and van Bree (1992), Van de Velde (1996:25-38) and Willemyns and Daniels (2003) for the history of Standard Dutch in the Netherlands and Flanders.

For the *HEMA* corpus study described in this chapter (and used as the primary data source throughout this thesis) it has not been the intention to capture any 'pure' or traditional form of the local dialect (as was the case for the *GTRP* data that some of the studies described in chapter 2 are based on), nor to elicit speech as close as possible to the prestige accent (as is the case for the *VNL* corpus, also described in chapter 2). Rather, the goal was to capture the naturally occurring variation in colloquial Dutch as spoken in these communities. In fact, as Willemyns (2004) argues, Colloquial Dutch may be seen as a variety in its own right, intermediate between strongly regionally-coloured dialect speech and Standard Dutch. He uses the German term *Umgangssprache*, which may be translated as 'colloquial speech' (cf. Lenz 2008).

3.1.2 Cities in the corpus

Six cities in the Netherlands were selected for inclusion in the *HEMA* corpus. Amsterdam, Rotterdam, The Hague, and Utrecht are the four largest cities in the Netherlands, and the expectation was for there to be considerable variation if only because of these cities' sizes. Leiden was included because, despite the lack of any instrumental studies to corroborate this, it is popularly known for its idiosyncratic, approximant *r* in onsets (cf. Wortel 2002). The focus of attention in the Netherlands is thus mainly on the western *Randstad* area, the economic and cultural centre of the country. In addition, Nijmegen was included as a typical larger town outside the Randstad.

The Flemish cities are evenly divided over the four main dialect regions of Flanders: Bruges in West-Flanders, Ghent in East-Flanders, Antwerp in the province of Antwerp (part of the Brabant dialect region) and Hasselt in Limburg. Antwerp, Ghent and Bruges are also the three largest cities in Flanders, while Hasselt is the largest city in Limburg, the 8th largest in Belgium, though it is the smallest city in the corpus, at 75.500 inhabitants (figures from Statistics Belgium 2014). The Belgian capital, Brussels, was not included in the corpus because, while officially bilingual, it is in practice mainly French-speaking, which would have made it too difficult to find a group of Dutch-speaking subjects comparable to the informants in other cities. A map showing the ten cities in the corpus is in Figure 3-1 (repeated from Figure 1-1 in Chapter 1).

Figure 3-1 Locations of the cities in the corpus within the Dutch language area.

Descriptions of most of the city dialects in the survey exist, from dialectological and sociolinguistic studies as well as more popular literature, and some city accents are even noted for their particular realisations of /r/ (see the section on urban accents in Chapter 2), but these may be strongly vernacular or even stereotypical realisations. Given the results that have emerged from sociolinguistic studies of large towns and cities in recent years (e.g. Foulkes and Docherty 1999), the expectation is that there will be considerable variation in *r*-realisations.

3.1.3 The speakers

The *HEMA* corpus was set up to have a (partly socially stratified) collection of speech from the major urban communities. That is, speakers in the survey were required to have been born and grown up in the city concerned, and to currently be a resident. Furthermore, sex and age were factored in as categories for stratification. The aim was to have equal numbers of men and women, and equal numbers of speakers in two age categories: those born after 1961 (younger than forty at the time data collection began), and those born before that date; these will be referred to as "younger" and "older" speakers, respectively. The target was to fill each of the four cells with 10 speakers. This target was not met for all cells, although a minimum of nine was possible for all but the older men in The Hague, of which there are only six, and the younger men in Amsterdam and Nijmegen, of which there are seven and eight, respectively. The total number of speakers in the corpus is 408. Speaker numbers per cell per city in the dataset are in Table 3-1.

Table 3-1 Design of the *HEMA* corpus.

city	*men*		*women*	
	older	*younger*	*older*	*younger*
Antwerp	10	10	12	9
Bruges	9	12	12	10
Ghent	10	10	12	10
Hasselt	10	10	10	10
Amsterdam	12	7	11	10
Rotterdam	11	9	9	14
The Hague	6	11	10	9
Utrecht	11	9	10	10
Leiden	10	10	13	9
Nijmegen	11	8	13	9
totals	100	96	112	100

Social class was not taken into consideration for the stratification of the speaker pool. This clearly limits the scope of the study and it is possible that certain generalisations will be missed. However, although *r* is the most famous social class variable in urban sociolinguistics, due to Labov's (1972a) New York department store study (in which he showed that the frequency with which *r* was realised as an approximant, rather than a vocalic off-glide was correlated with the social status of the department stores his informants worked in), there are reasons to believe that class may not play as vital a role in Dutch. For instance, while the rise of approximant *r* in Netherlandic Dutch is usually attributed to young urban women (Stroop 1998), it is not generally associated with class distinctions. Similarly, the rise of uvular *r* in the Dutch speaking part of Belgium seems to be a clearly urban phenomenon, as well as age-graded, but there is no evidence for class playing a role (Taeldeman 2005). This does of course not take away from the fact that it would have been preferable to include social class as a predictor in the data. However, the main reason it was not taken into account because it was not compatible with the design of the study. Data collection was carried out in the cafeterias of *HEMA* department stores. All of the informants were anonymous volunteers. As questions about education or income would have made the interview more invasive, it would have been much more difficult to collect as much data in the same amount of time. Instead, it was decided to aim for a relatively homogeneous group of speakers, in keeping with the specific variety of Dutch (urban accents of colloquial Standard Dutch) under investigation. The clientele of *HEMA*'s cafeteria was estimated to be dominated by people with a lower middle class background, although the store's wide popularity means the speakers will also include people with working class and middle middle class backgrounds.

3.1.4 The *r*-items

The criteria on which the *r*-items were chosen are the following. The items were first chosen such that as many as possible different phonological contexts for *r* could be included:

- *r* in word-initial singleton onsets
- *r* in word-initial onset clusters preceded by:
    - labial obstruent
    - coronal obstruent
    - dorsal obstruent
- *r* in word-internal singleton onsets with:
    - stress preceding r
    - stress following r
- r in word-final coda clusters followed by:
    - coronal obstruents
    - labial obstruent
    - labial sonorant
    - dorsal obstruent
- *r* in word-final singleton codas
- Vowels preceding and following *r*:
    - High
    - Mid
    - Low
    - Front
    - Central
    - Back

The items were chosen so as to represent easily recognisable, concrete objects in order to speed up data collection during the picture naming task, and not make it too effortful for the participants. For the picture naming task drawings from a database made available by the Max Planck Institute in Nijmegen were used. As the *HEMA* corpus was originally intended to supplement the data in the *GTRP* database, see section 2.2), an attempt was made to include as many items as possible that are also part of that corpus. Finally, the number of *r*-items included in the survey was limited so that the full interview could be conducted well within 10 minutes. This was done in order to ensure a sufficient number of volunteers. Therefore, the number of items in the two tasks was limited to 43 (word list) and 40 (picture naming task), including distracters.

Table 3-2 *r*-items in the *HEMA* urban accent corpus.

Item	*IPA*	*gloss*
word-initial onsets (8)		
riem	/rim/	'belt'
rok	/rɔk/	'skirt'
brood	/brod/	'bread'
trein	/trɛin/	'train'
strik	/strɪk/	'bow-tie'
kruk	/krʏk/	'stool'
schrift	/sxrɪft/	'notebook'
gras	/ɣrɑs/	'grass'
intervocalic onsets (6)		
beroep	/bə.ˈrup/	'profession'
beraad	/bə.ˈrad/	'counsel'
giraffe	/ʒi.ˈrɑf/	'giraffe'
bureau	/by.ˈro/	'desk'
beren	/ˈbe.rən/	'bears'(n)
sturen	/ˈsty.rən/	'steering-wheels'
word-final codas (10)		
peer	/per/	'pear'
boer	/bur/	'farmer'
schaar	/sxar/	'scissors'
suiker	/ˈsœy.kər/	'sugar'
emmer	/ˈɛ.mər/	'bucket'
bord	/bɔrd/	'plate'
paard	/pard/	'horse'
worst	/ʋɔrst/	'sausage'
kers	/kɛrs/	'cherry'
kaars	/kars/	'candle'
schwa-insertion context (4)		
harp	/hɑrp/	'harp'
kerk	/kɛrk/	'church'
berg	/bɛrɣ/	'mountain'
arm	/ɑrm/	'arm'

For both picture naming task and word list, four different orders were used to avoid order-of-presentation effects. The items were mixed with a number of distracter words in the elicitation task as well as in the reading task. The total number of r-items in the picture naming task was 25; the number of r-less distracter words 15, so the total number of items in the task was 40. The total number of words in the reading task was 43, as *beroep*, *beraad* and *suiker* were added to the list which otherwise consisted of the same 40 items as the picture naming task. Table 3-2 contains a list of the r-items, their broad transcription and glosses, and their distribution over the major linguistic (syllabic) contexts.

The division into the major syllabic contexts corresponds to expected differences in *r*-realisations. First, there is a division into onset (14 items) and coda (14): cross-linguistically, onset-*r* and coda-*r* display a variety of allophonic patterns, which usually involve some kind of weakening or vocalisation in the coda (as for instance in German, see the brief discussion in Chapter 1; and this has also been noted for Dutch, see e.g. Plug and Ogden 2003; Torre 2003). Secondly, intervocalic onsets (6) are expected to differ from word-initial onsets (8) both phonetically and phonologically; for instance, different aerodynamic conditions apply to word-initial positions vis-à-vis intervocalic ones, and intervocalic position is a weakening site phonologically (though in a different manner from the coda position), whereas word onset is a strong position or fortition site. Finally, a distinction is made between, on one hand, *r* in absolute word-final position or as part of a word-final cluster with one or more coronal obstruents (5 each), and on the other hand *r* followed by a nasal or by a non-coronal obstruent (4). In the latter context, but not in the former, an optional process of schwa-insertion is said to take place (Trommelen 1984; 1993; Booij 1995).

The appearance of a vocalic element between *r* and the following consonant means that the *r* in fact occurs in an onset position (*harp* /hɑrp/ → [hɑ.rəp], approximately), at least from a phonetic point of view (whether it also does so phonologically is a more controversial matter, to be addressed in Chapter 6). Therefore, *r* in this context is expected to show behaviour that is both onset- and coda-like (as it is like intervocalic onsets in some ways, and like coda positions in others). Schwa-insertion as a process is discussed in more detail in Chapter 6.

3.1.5 Data collection and processing

The data collection took place in 2002-2003. Patrons of the *HEMA* cafeteria were approached randomly with the question whether they wanted to participate in the study, until one or more of the cells in each city was filled; after that, a more targeted selection (e.g. only men, or only younger-looking people) took place. Subjects who participated in the study received a coupon for a free cup of coffee at the cafeteria.

Two types of speech were elicited. The subjects were first given a picture naming task, and were then asked to read out a list of words. Thus, apart from the three external factors of origin, age and sex of the informants, a fourth potential factor was introduced: the manner of elicitation of the words. However, since no significant differences were found in speakers' performance between the two tasks in any of the statistical procedures described in this chapter or the following, this factor is not taken into account in any of the analyses that follow.

The speech of the informants was recorded on digital audio tape (DAT) using a portable TASCAM DA-P1 recorder and an AKG C420 head-worn microphone. By using a headset miniature condenser microphone which is sensitive to direction, relatively high quality recordings were possible, with limited pop noise and the distance between the speaker's mouth and the microphone constant. The mono recordings were digitalised on a PowerMacintosh G4 with an Audiomedia III PCI sound card and Pro Tools LE software and downsampled to 16 kHz (16 bits) with the same software.

The total number of tokens was potentially 21624 – the number of speakers (408) x the number of *r*-items in the two tasks (25+28). However, 618 tokens were discarded during data analysis, usually on the basis of poor quality of the recording. Despite the possibility of relatively high quality recordings mentioned in the previous paragraph, circumstances beyond the control of the interviewers led to individual tokens or whole recordings of a task not meeting the minimum standards required for data analysis. These circumstances included background noise (the recording environment was a cafeteria) and improper handling of the microphone during speaking (these were worn by the subjects and therefore under their control). Apart from poor quality recordings, a number of tokens were discarded because speakers misread items in the word list or misidentified pictures in the picture naming task. Table 3-3 lists recordings of whole tasks that were discarded; tokens discarded on an individual basis are not listed, as they were randomly and relatively evenly distributed over speakers and items.

Table 3-3 Discarded recordings (full task).

speaker code	*speaker characteristics*	*task*	*tokens*
AN13m34	older male; Antwerp	word	28
BR33m26	older male; Bruges	word	28
BR19m62	younger male; Bruges	word	28
LE10m84	younger male; Leiden	picture	25
LE21m59	older male; Leiden	word	28
LE35m50	older male; Leiden	word	28
NI42m41	older male; Nijmegen	word	28
NI08m35	older male; Nijmegen	picture	25
NI40m31	older male; Nijmegen	word	28
number of discarded tokens			246

The *r*-tokens were labelled by two phonetically-trained linguists (Evie Tops, VUB Brussels, and the author), as belonging to a class of variants, e.g. "alveolar approximant" or "uvular fricative". The number of classes was considered open, and re-categorisation of previously labelled variants took place whenever the addition of a class label necessitated this. Labelling took place on the basis of auditory analysis, as well as the visual inspection of spectrograms and waveforms using *PRAAT* (Boersma and Weening 2001), working on the assumption that both of these methods are an "essential complement" to the other (Barry 1996:115). All tokens were initially classed separately by the two transcribers; all cases of disagreement between the transcribers were discussed so as to arrive at a consensus transcription.

3.2 Distinguishing *r*-variants

The r-variants that were distinguished in earlier variationist literature on Dutch *r* (specifically Van de Velde 1996; Van de Velde and Hout 1999) were used as a basis to score the *r* tokens in the data. These studies form a good starting point because they describe more variation than any other study on Dutch *r*.[6] Van de Velde (1996) uses 10 variants of *r* in Dutch, and his classification served as the main point of departure. It turned out to be possible to make even finer distinctions between different types of *r*. Differences between tokens that were systematically noticeable for both transcribers led to the introduction of further variants. This meant that variants that had not been previously reported on were included, such as a partially devoiced alveolar trill in Flanders and a range of vowel variants in the Netherlands. Table 3-4 is an overview of the *r*-variants that were eventually distinguished between, with their IPA symbols.

Table 3-4: *r*-variants in the urban accent corpus.

IPA	*descriptive label*
r	voiced alveolar trill
r͡r̥	partially devoiced alveolar trill
r̥	voiceless alveolar trill
r͡ɹ̝	alveolar trill/tap followed by homorganic frication
ɹ̝	voiced (post)alveolar fricative
ɹ̝̊	voiceless (post)alveolar fricative
ɾ	voiced alveolar tap
ɾ̥	voiceless alveolar tap
ɹ	alveolar approximant
ʀ	uvular trill
ʀ̝	uvular fricative trill
ʁ	uvular fricative
ʁ̞	uvular approximant
ɻ	retroflex/bunched approximant
j	palatal approximant
ɛ	low-mid front vowel
ə	central vowel (schwa)
ɐ	low vowel
ØC̠	elision of /r/ with retraction of the following C
Ø	elision of /r/

It turned out that a systematic analysis of the acoustics of *r* led to a classification where single phonetic parameters (e.g. the question whether there was frication involved) could be used to make much more fine-grained distinctions than

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[6] Smakman (2006) distinguishes even more; his work appeared after the data analysis for the present study had been completed.

had previously been used by sociolinguistic researchers, for whom the concept of the variant is a central one. If the variant (in many cases a segment-sized unit) is the primitive of the investigation, the separate phonetic features that make up a sound are collapsed, which may lead to losing potentially relevant distinctions. It was decided, however, to maintain the use of variants as shorthand for particular combinations of features, while simultaneously introducing fine-grained distinctions.

A phonetic parameter that warrants mentioning here is the voicing value of the *r*-variant. To a large extent voicing in the *r*-variants is predictable: fricative realisations of *r* conformed to the general pattern of fricatives cross-linguistically, i.e. they are voiceless in clusters with voiceless obstruents and in codas, whereas they are usually voiced in intervocalic positions. Approximant variants on the other hand are always voiced. Trills largely conform to the obstruent pattern, being devoiced (and almost invariably fricative) in voiceless clusters and codas. However, the confluence of voicing and frication in (alveolar) trills is a more complex issue, and turned out to be a feature separating particular accents and speakers (see Chapter 4). This is why there is a relatively large number of alveolar variants distinguished only by their voicing value.

The remainder of this section consists of examples from the urban accent data of each of the variants that were eventually distinguished between. Typical realisations of each variant are illustrated by waveforms and spectrograms from PRAAT, along with a brief description of their characteristic features, used for classification of the variants. Where possible, the articulatory properties of the *r* variants are discussed in more detail in chapters 4 and 5.

3.2.1 An acoustic description of the variants

3.2.1.1 The voiced alveolar trill [r]

A voiced alveolar trill [r] is often considered the quintessential *r*-sound, in general as well as specifically in Dutch (see Chapter 1), although it turns out to form only a small minority of Dutch /r/ realisations. Pictured in Figure 3-2 is a typical realisation of the voiced alveolar trill from a token of the item *riem* /rim/, produced by an older female Antwerp speaker.

The voiced trill is identified by the repetitive pattern noticeable in both the waveform and the spectrogram. The closed phases of the trill (i.e. the instances of tongue-tip contact) appear as light vertical bars in the spectrogram, indicating a minimal amount of energy, whereas the open phases show formant structure (in this case visibly different from that of the following vowel). Note that there is an approximant/vowel phase that precedes the trill. In this case it is roughly equal in length to the open phases of the trill.

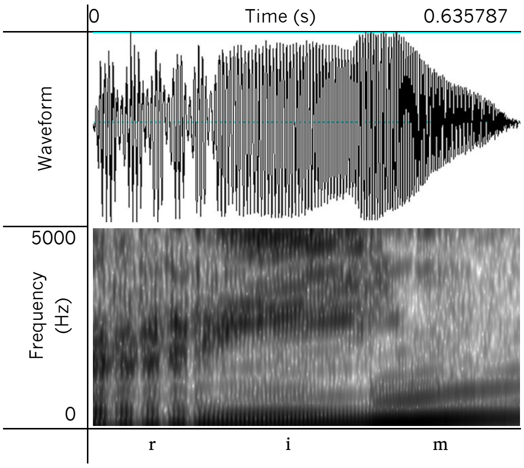

Figure 3-2: Voiced alveolar trill in *riem* /rim/ speaker AN01v53

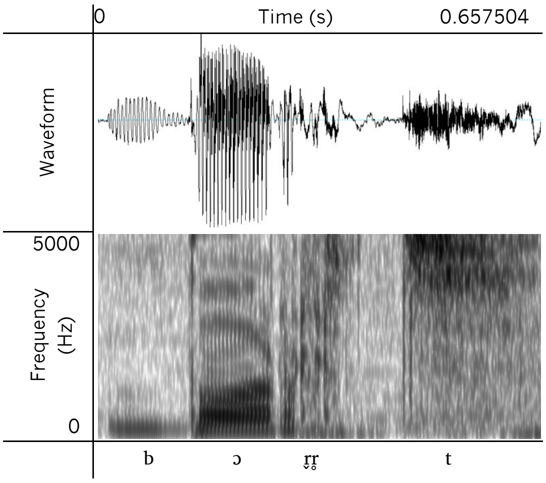

Figure 3-3 Partially devoiced alveolar trill in *bord* /bɔrd/, speaker AN17v71

3.2.1.2 The partially devoiced alveolar trill [r͡r̥]

The token in Figure 3-3 is of a partially devoiced alveolar trill in *bord* /bɔrd/. The token is from a younger female speaker from Antwerp. This variant shows a repetitive trill pattern similar to that of the voiced alveolar trill. Voicing is present only during the first two contacts of the trill, and the open phase in between them. The second contact has a fricative release, as does the completely voiceless third contact, with a larger degree of high frequency energy (noise, cf. the aperiodic waveform) going into the silence of the following stop.

3.2.1.3 The voiceless alveolar trill [r̥]

The image in Figure 3-4 shows a voiceless alveolar trill in the item *worst* /ʋɔrst/. The token is from a younger female Antwerp speaker.[7]

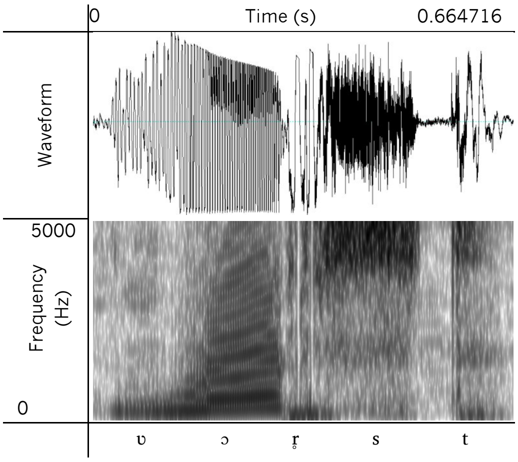

Figure 3-4 Voiceless alveolar trill in *worst* /ʋɔrst/, speaker AN22v71

The trill pattern is visibly present as alternating absence/presence of energy on the spectrogram. In contrast with voiced trills, there is high frequency energy in the open phases and a less clear formant structure, reflecting a somewhat fricative release. The phases are also shorter than those of the voiced trill, i.e. the trill frequency is higher.

3.2.1.4 The alveolar trill or tap with homorganic frication [r͡ɹ̝]

The image in Figure 3-5 is of a voiceless alveolar trill with homorganic frication in *schaar* /sxar/. It is from an older female speaker from Antwerp. This *r*-variant is characterised acoustically by the presence of one or more closure phases with voiceless, usually fricative release, terminating in a relatively long (apical) alveolar non-trilled fricative. In this token, there are two contacts; the second of these is very

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[7] The spectrogram here appears to show low frequency energy during the [r̥], which is normally indicative of voicing. However, there are no other indications of voicing, either acoustically or perceptually, and it may be an artefact of the spectrogram image rendering or background noise (note also the presence of similar low frequency energy in the release of the [t], which is a great deal less likely to be due to voicing). However, Ladefoged and Maddieson (1996:221) discuss the possibility of voiceless trills in fact having voiceless closure phases and voiced open phases.

short and leads into a fricative which is spectrally similar to the item-initial /s/, although its energy is slightly less concentrated towards the high end of the frequency spectrum, likely reflecting apicality or a somewhat more retracted articulation.

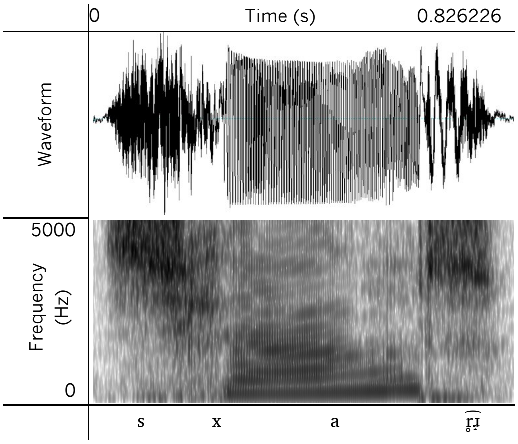

Figure 3-5 Alveolar trill followed by homorganic frication in schaar /sxar/, speaker AN18v59

3.2.1.5 *The voiced (post)alveolar fricative [ɹ̝]*

Figure 3-6 shows a voiced alveolar fricative in a token of the item *riem* /rim/, from a younger female speaker from Ghent.

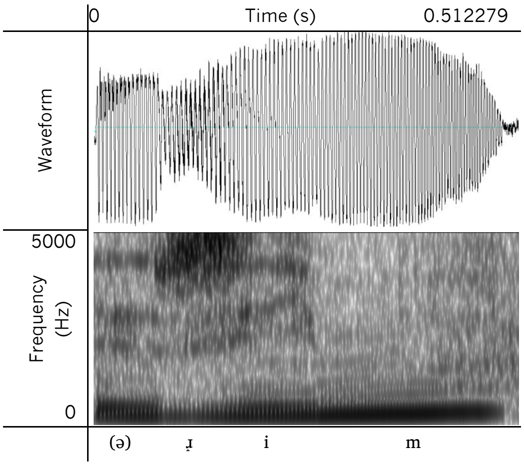

Figure 3-6 Voiced alveolar fricative in *riem* /rim/, speaker GE24v84

The voiced alveolar or postalveolar fricative displays relatively high frequency energy in line with alveolar fricatives, in addition to an approximant-like weak formant structure. This token shows the transition of the second and third formant from their position in the preceding central vowel to that in the following /i/.

3.2.1.6 The voiceless (post)alveolar fricative [ɹ̝̊]

The image in Figure 3-7 is of a voiceless postalveolar fricative in the item *peer* /per/. The token is from an older female Antwerp speaker.

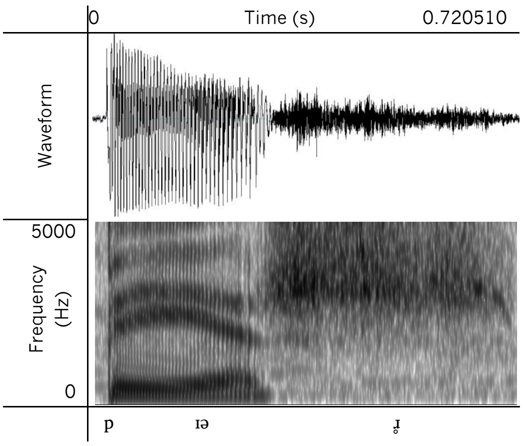

Figure 3-7 Voiceless postalveolar fricative in *peer* /per/, speaker AN05v48

There is no closure phase in this variant; it is a pure fricative. There is no voicing, and hardly any visible formant structure. Note the relatively diffuse (but generally high-frequency) spectral energy in [ɹ̝̊], indicating a postalveolar or palatoalveolar place of articulation (Ladefoged and Maddieson 1996:173-77). Tongue position may be apical or laminal. It is also possible that this category includes retroflex tokens, which would show a similar spectral pattern (Hamann 2003:57).

3.2.1.7 The voiced alveolar tap [ɾ]

Figure 3-8 shows a token of a voiced alveolar tap in the item *rok* /rɔk/. The speaker is an older male from Amsterdam.

The closure that characterises the tap appears on the spectrogram as a brief period of absence of energy, in between the preceding weak vocoid (with a central vowel quality) and the following /ɔ/. Voicing is present for most of the closure. The presence of the vocoid phase is almost entirely general for word-initial alveolar taps: out of the 267 voiced alveolar taps in the items *riem* and *rok*, only three tokens were transcribed as not having this preceding vocalic phase. Almost all voiced alveolar taps are therefore in effect intervocalic.

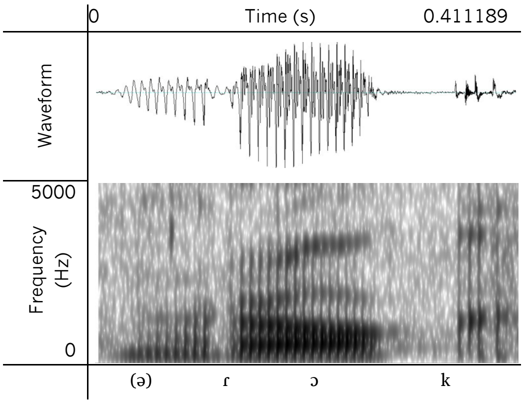

Figure 3-8 Voiced alveolar tap in *rok* /rɔk/, speaker AM07m61

3.2.1.8 The voiceless alveolar tap [ɾ̥]

Figure 3-9 shows the voiceless alveolar tap in a token of the item *emmer* /ɛmər/from an older female speaker from Amsterdam.

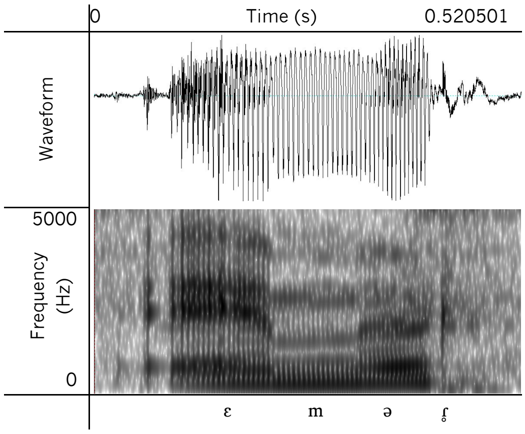

Figure 3-9 Voiceless alveolar tap in *emmer* /ɛmər/, speaker AM12v39

The voiceless tap is characterised by a single closure during which voicing is absent, and a fricative release, both of which distinguish this variant from the voiced alveolar tap. The main difference with the alveolar tap or trill with homorganic frication is the absence here of an extended fricative phase.

3.2.1.9 The alveolar approximant [ɹ]

Figure 3-10 shows the alveolar approximant in the item *beren* /berən/. The token is from the same Amsterdam speaker as the voiced tap token above.

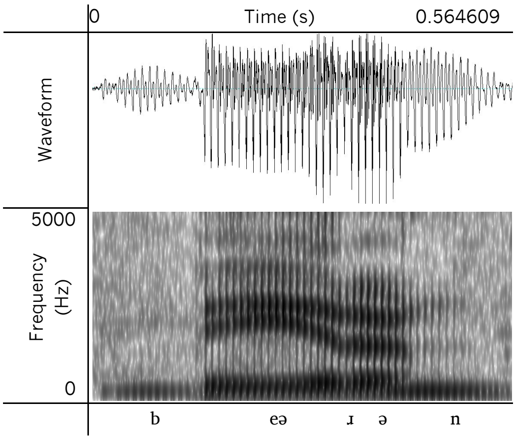

Figure 3-10 Alveolar approximant in *beren* /berən/, speaker AM07m61

The alveolar approximant typified here is visible on the spectrogram as a general weakening of energy during the transition between the /e/ and /ə/ vowels. The approximant has a very short duration, similar to that of the tap, but there is no full closure.

3.2.1.10 The uvular trill [ʀ]

Figure 3-11 shows an example of a voiced uvular trill in the item *rok* /rɔk/. The token is from a younger female Rotterdam speaker.

The uvular trill is characterised by the repetitive pattern also present for the alveolar trill. It is also preceded by a (weak) vocalic element, similar to – but longer than – the open phases of the trill. The open phases in this particular token are noticeably longer than those of the closed phases, and they are somewhat longer than those of the alveolar trill. This is not necessarily the case, however, neither in the urban accent data as a whole nor as a cross-linguistic tendency. See Chapter 4, section 4.2.1 for more detail.

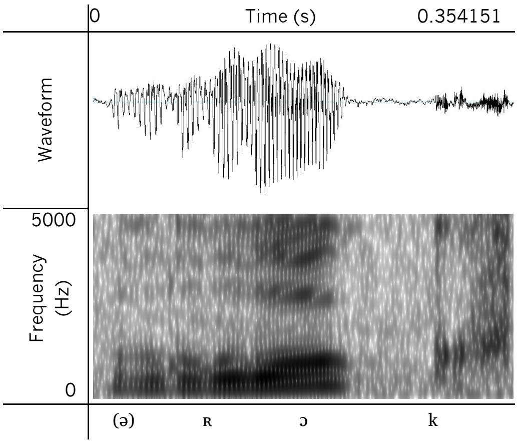

Figure 3-11 Voiced uvular trill in *rok* /rɔk/, speaker RO29v79

3.2.1.11 *The uvular fricative trill [ʀ̝]*

The image in Figure 3-12 shows a uvular fricative trill in the item *peer* /per/. The token is from a younger female speaker from Ghent.

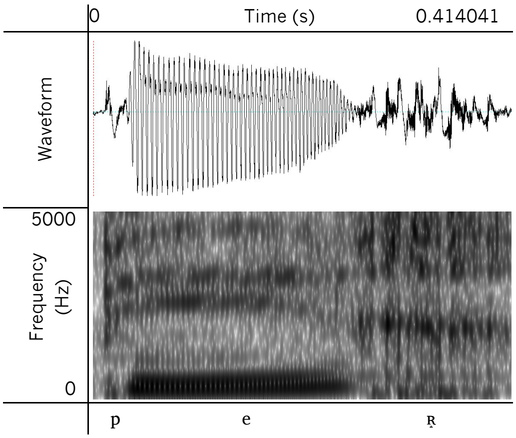

Figure 3-12 Uvular fricative trill in *peer* /per/, speaker GE03v84

The uvular fricative trill is characterised by a repetitive pattern similar to that of the sonorant trills, but with a higher trill frequency, a less clear formant structure, and the presence of noise (aperiodicity, clearly visible in the waveform). The formant structures of both the uvular trill and uvular fricative trill display a relatively high F3. Vocal fold vibration is generally absent throughout the fricative trill's duration.

3.2.1.12 The uvular fricative [ʁ]

Figure 3-13 shows a uvular fricative in a token of the item *peer* /per/. The speaker is a younger female Hasselt speaker.

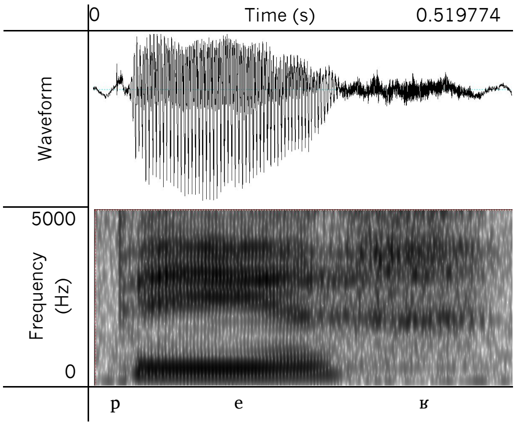

Figure 3-13 Uvular fricative in *peer* /per/, speaker HA10v86

The uvular fricative is identified acoustically by the presence of aperiodic energy or noise, with a low frequency spectral peak (below 2000 Hz), which is in accordance with cross-linguistic findings of (non-rhotic) uvular fricatives (Jassem 1968; Ladefoged and Maddieson 1996:173; Gordon et al. 2002; see also Van der Harst et al. 2007). Word-final uvular fricatives are overwhelmingly voiceless throughout their articulation, as is the token in Figure 3-13.

3.2.1.13 The uvular approximant [ʁ̞]

Figure 3-14 shows a typical uvular approximant, in the item *beren* /berən/. The token is from a younger male Nijmegen speaker.

The uvular approximant shows up on the spectrogram as a weakening of all formants between the [e] and [ə] vowels, much as in the case of the alveolar approximant. The formant structure is largely identical to, or anticipates that of, the following schwa vowel. There is voicing throughout and no closure.

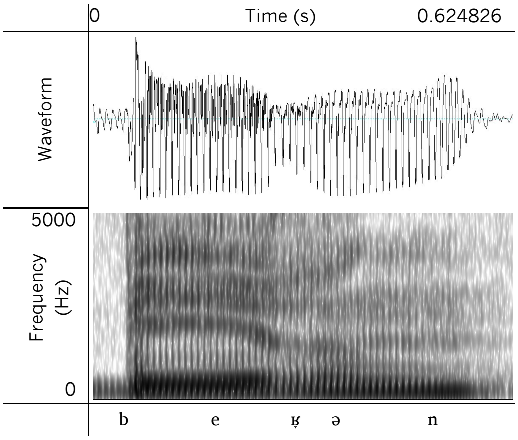

Figure 3-14 Uvular approximant in *beren* /berən/, speaker NI02m84

3.2.1.14 The retroflex or bunched approximant [ɻ]

Figure 3-15 shows an example of a retroflex or bunched approximant in a token of the item *boer* /bur/, as produced by a younger female speaker from Rotterdam.

This variant is an approximant, but differs strongly from the alveolar and uvular approximants above, both in duration and spectral structure. Whereas the latter approximants showed a brief weakening of all formants, the retroflex/bunched approximant is longer and has clearly defined formants. In fact, the most obvious identifying characteristic of this variant is the strong convergence of F2 and F3, almost to the point of conflation. In this token, the vowel preceding *r*, the transition phase between the vowel and *r*, and the approximant itself are of roughly equal length, but there is a great deal of variation in this respect, as well as in the absolute duration of the [ɻ]. The label of this variant reflects the uncertainty about its articulatory properties; the acoustic signature described here may be arrived at with very different articulatory strategies, and involve either bunching of the tongue dorsum, or retroflexion of the tongue tip (see chapter 5 for a detailed articulatory study of this variant). This variant has a relatively high sociolinguistic salience in the Netherlands and Flanders, and is commonly known as "Gooise *r*" (see section 2.3.1).

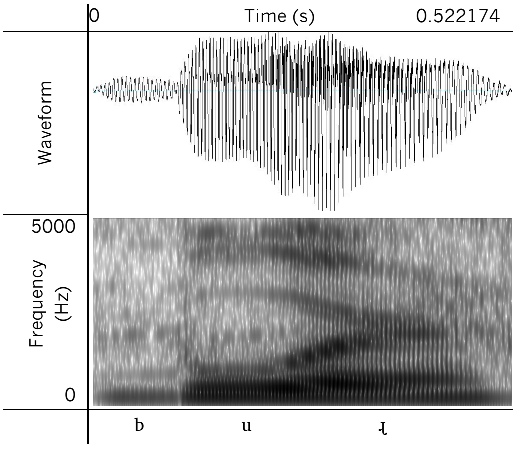

Figure 3-15 Retroflex/bunched approximant in *boer* /bur/, speaker RO32v78

3.2.1.15 The palatal approximant [j]

Figure 3-16 shows a palatal glide in the item *schaar* /sxar/. The speaker is an older female from Rotterdam.

The acoustic makeup of the palatal glide shows some similarity with the retroflex/bunched approximant in that F2 and F3 approach each other, although F3 is much less strongly present. Instead, F2 is seen to move upward, from a position close to F1 in the low vowel, to a position consistent with the perceptual effect of a high front-central vowel [ɪ] or palatal glide [j].

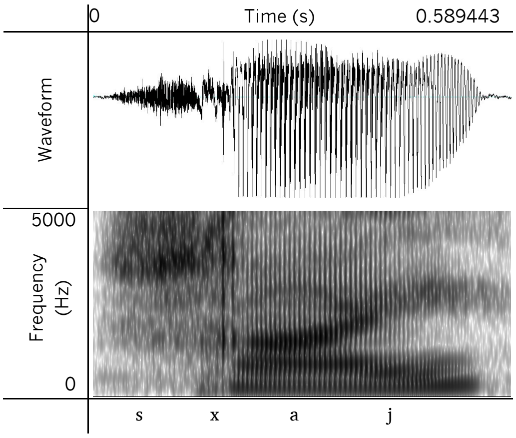

Figure 3-16 Palatal approximant in *schaar* /sxar/, speaker RO01v55

3.2.1.16 The low-mid front vowel [ɛ]

The image in Figure 3-17 is of a low-mid front vowel realisation of *r* in the item *schaar* /sxar/. The token is from a younger male Rotterdam speaker.

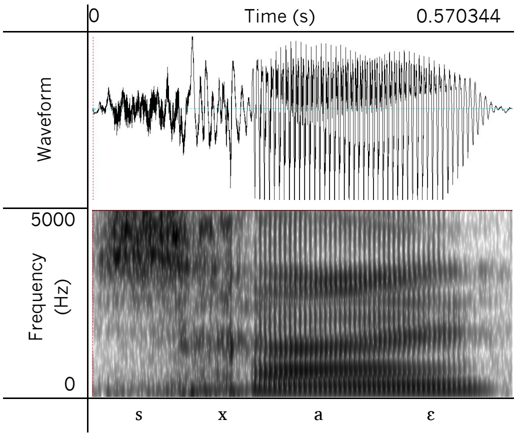

Figure 3-17 Mid-open front vowel in *schaar* /sxar/, speaker RO44m80

This vocalic variant is characterised by the presence of a formant pattern consistent with its perceptual properties as a front vowel without the obvious palatal quality of the previous vocalic variant. The second formant rises gradually from its low vowel position in /a/.

3.2.1.17 The central vowel [ə]

Figure 3-18 shows a central vowel realisation in the item *boer* /bur/. This token is from an older female speaker from Utrecht.

The central vowel is characterised by a transition to fairly evenly spaced formants. In this case the F2 and F3 approach each other (which might be indicative of a retroflex or bunched tongue configuration, see above and chapter 5), but not as strongly as for the approximant described above, leaving the perceptual result of a schwa-like vowel.

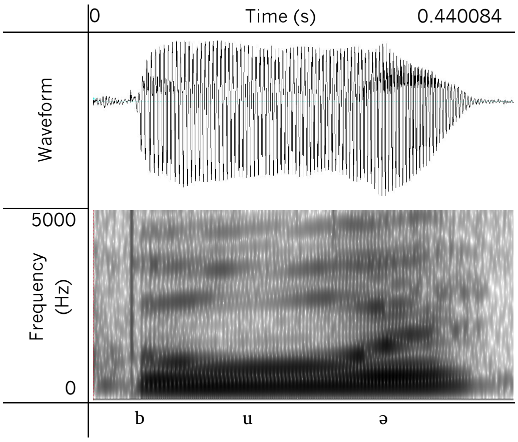

Figure 3-18 Central vowel in *boer* /bur/, speaker UT22v47

3.2.1.18 The low vowel [ɐ]

The figure below shows a low vowel realisation of /r/ in the item *boer* /bur/. The token is from an older female speaker from Nijmegen.

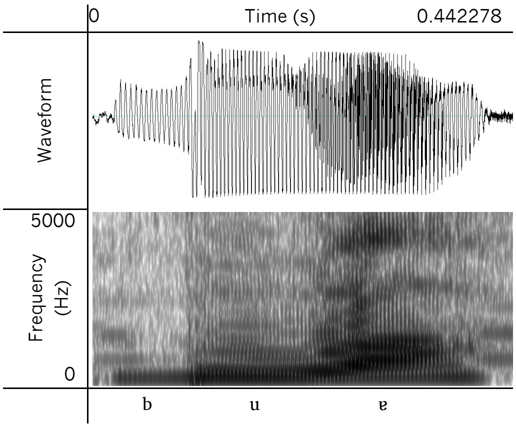

Figure 3-19 Low vowel in *boer* /bur/, speaker NI23v52

This variant displays a formant structure typical of a low central or low back vowel: a relatively high F1, and an F2 that is close to F1. This might also indicate a degree of pharyngealisation.

3.2.1.19 Elision of r with retraction of the following consonant: ØÇ

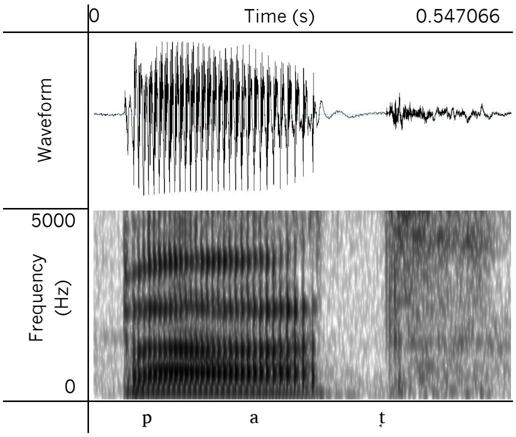

Figure 3-20 Elision of /r/ with retraction of the following consonant in *paard* /pard/, speaker NI43m42

In the final two variants *r* is impossible to identify at the segmental level on the spectrogram. In the variant exemplified in Figure 3-20, however, there is some evidence of its presence in the place of articulation of the following consonant, which is retracted vis-à-vis its articulation in *r*-less words. This is a token of the item *paard* /pard/ from an older male speaker from Nijmegen.

There are no acoustic cues that indicate the presence of *r*, neither by a trill pattern, frication noise, weakening of energy or a shift in formants. The distribution of spectral energy present in the release burst of the stop, however, is somewhat different from its usual pattern in non-*r* words: it is more diffuse, indicating either fronting or retraction; the lower first spectral peak confirms the perceptual impression of a retracted articulation. It seems to be the case, therefore, that rhoticity is expressed on the following consonant.

3.2.1.20 Elision of r: Ø

The total absence of spectral cues for /r/ (in other words, its elision) is exemplified by the token of *paard* /pard/ in Figure 3-21 from an older female Nijmegen speaker. As with the previous variant, nothing indicates the presence of a segmental *r* of any kind; here, the frication noise present in the release burst of the closing alveolar stop is consistent with that in *r*-less words, i.e. concentrated in the higher frequency regions.

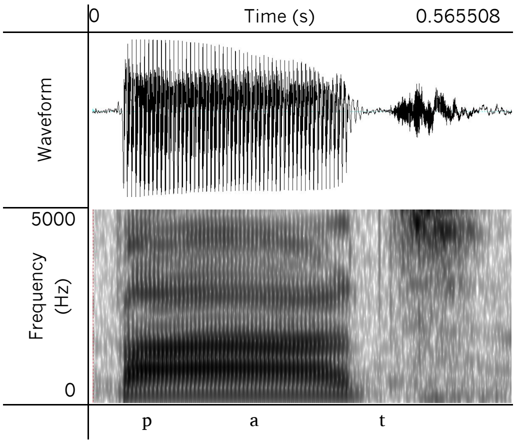

Figure 3-21 Elision of /r/ in *paard* /pard/, speaker NI23v52

3.2.2 A description of the index scores used

Section 3.3 of this chapter presents the results of a statistical analysis of the data, showing how the variants described in the previous section are distributed socially, geographically, and linguistically. As outlined above, while more fine-grained distinctions have been made than in any previous study of Dutch *r*, the labels used for the variants still capture several phonetic parameters at once, including place and manner of articulation. To provide a first impression of the differences between the urban accents regarding these major characteristics of *r* realisations, the results section will make use of index scores for place (front vs. back) and manner (consonantal vs. vocalic) of articulation. In addition, index scores for the use of the purportedly innovative retroflex/bunched approximant and for the incidence of schwa insertion are used. Their relevance is explained in more detail in chapters 5 and 6, respectively, but it will become clear in section 3.3 that they reflect important differences between the various urban accents. All the index scores were calculated for individual speakers first, after which averaging over all speakers of a given accent yielded the score for that accent, or speech community.

3.2.2.1 An index score for place

An index score for place of articulation (along the front-back dimension) was calculated by giving a score of 0 to front (dental/alveolar/post-alveolar) variants, a score of 50 to central (palatal/velar) variants, and 100 to back (uvular) variants, yielding a score for 'backness'. An overview of the variants and their respective weightings is in Table 3-5.

Table 3-5 Place of articulation index score weightings.

label	*variants*	*weight*
front	voiced alveolar trill, partially devoiced alveolar trill, voiceless alveolar trill, alveolar trill/tap followed by homorganic frication, voiced (post)alveolar fricative, voiceless (post)alveolar fricative, voiced alveolar tap, voiceless alveolar tap, alveolar approximant	0
mid	retroflex/bunched approximant, palatal approximant, low-mid front vowel, central vowel	50
back	uvular trill, uvular fricative trill, uvular fricative, uvular approximant, low vowel	100

3.2.2.2 An index score for consonantality

This index score characterises the main manner of articulation parameter, consonantality, or the degree of constriction between the active and passive articulators. It was calculated by giving trilled and fricative variants a weight of 100 and vocalic variants a weight of 0. Approximant variants were split between “consonantal approximants” (weighted at 66) and “vocalic approximants” (33), based on their acoustic characteristics (see section 0 for details and chapter 5 for further explanation). The variants and their respective weightings are in Table 3-6.

Table 3-6 Consonantality index score weightings.

label	*variants*	*weight*
consonant	voiced alveolar trill, partially devoiced alveolar trill, voiceless alveolar trill, alveolar trill/tap with homorganic frication, voiced (post)alveolar fricative, voiceless (post)alveolar fricative, voiced alveolar tap, voiceless alveolar tap, uvular trill, uvular fricative trill, uvular fricative	100
consonantal approximant	Alveolar approximant, uvular approximant	66
vocalic approximant	retroflex/bunched approximant, palatal approximant	33
vowel	low-mid front vowel, central vowel, low vowel	0

3.2.2.3 An index score for the incidence of the retroflex/bunched approximant

Since the retroflex/bunched approximant is currently a widely discussed variant of *r* in Dutch (see chapter 2), it was decided to calculate an index score specifically targeting its use by the speakers in the *HEMA* corpus. This was done straightforwardly by weighting the retroflex/bunched approximant as 100, and awarding all other variants a score of 0.

3.2.2.4 An index score for the incidence of schwa-insertion

The phonetics of the process of schwa-insertion – the appearance of an epenthetic or intrusive vowel between *r* and a following nasal or non-coronal obstruent, see section 3.1.4 – as well as its implications for phonological theory, is the topic of further discussion in section 6.3 of Chapter 6. The focus in this chapter is on differences between the urban accents in the incidence of this phenomenon, expressed by the index score here. The index score was calculated by weighting every *r* variant that was followed by a vocalic element as 100, and all instances where this was not the case, as

0. Schwa-insertion only occurs after a subset of the variants, which are listed in Table 3-7. For this index score, only the schwa-insertion context items (*harp, kerk, berg, arm*) were included.

Table 3-7: *r*-variants with which schwa-insertion occurs.

- voiced alveolar trill
- voiced (post)alveolar fricative
- voiced alveolar tap
- alveolar approximant
- uvular trill
- uvular fricative trill
- uvular fricative
- uvular approximant

- retroflex/bunched approximant

3.3 Results

3.3.1 Frequency of variants in the corpus

Table 3-8 provides a first indication of the distribution of *r* variants in the urban accent data, as it gives the token frequency, in absolute and relative numbers, of all variants across contexts and speakers, as well as the number of speakers that use it at least once and the number of urban accents in which it is used at least once. Note that the numbers and percentages in this table consequently mean something different for each of these frequency counts: whereas the token frequency percentages add up to 100 (and the natural numbers to 21006 tokens), the speaker percentages represent overlapping groups of speakers out of the 408 in the study.

Looking at token frequency alone, a first striking result that is visible in the table is that what is usually considered to be the prototypical *r* sound, the voiced alveolar trill, only makes up 4.3 % of all *r*-tokens in the data. The most frequent alveolar *r* variant is the voiced tap, making up over 20% of all *r*-realisations. The voiceless trill or tap with homorganic frication is another major alveolar *r*-variant. Among the uvular variants, the voiced trill has a stronger position than its counterpart in the alveolars. Here, too, however, it is the non-trilled variants that are most frequent, the uvular approximant having the highest token frequency. The vocalic variants form a relatively small minority, with the exception of the retroflex/bunched approximant, which by itself makes up 14% of all *r*-variants. Perhaps the most noticeable result is that, despite the wide-ranging variation, the four most frequent variants – the alveolar tap, the uvular trill, uvular approximant, and the retroflex/bunched approximant – make up almost 65% of all tokens.

A somewhat different picture emerges when comparing token frequency and the number of speakers that use particular variants. Whereas the voiced alveolar trill is relatively infrequent in terms of the number of tokens, a third of all speakers use it at least once. All four uvular variants are well-represented among speakers, including the fricative ones, despite their relatively lower token frequency. This hints at a more context-sensitive distribution for the fricative variants than for the trill and the uvular approximant. That is, it suggests that while many speakers have fricative variants of *r*, they use them in a relatively restricted set of contexts. It is also clear that vocalic variants are more widespread than their token frequencies suggest, as a good 30% of speakers have schwa realisations of *r*, and the retroflex/bunched approximant is used by over 50%. So while a small number of variants make up a large proportion of the *r* token set, the variation is distributed over a large number of speakers.

Table 3-8 Token frequency (*N*=21006), number of speakers (*N*=408) and urban accents (*N*=10) of all variants.

		token frequency		*number of*		
IPA	*descriptive label*			*speakers*		*accents*
		n	*%*	*n*	*%*	*n*
r	voiced alveolar trill	906	4.3	140	34.3	10
r͡r̥	partially devoiced alv trill	118	0.6	60	14.7	8
r̥	voiceless alveolar trill	189	0.9	73	17.9	7
r͡ɹ̝	vl alv trill/tap w/ frication	929	4.4	130	31.9	9
ɹ̝	voiced (post)alv fricative	199	0.9	61	15.0	9
ɹ̝̊	voiceless (post)alv fricative	128	0.6	55	13.5	8
ɾ	voiced alveolar tap	4354	20.7	185	45.3	9
ɾ̥	voiceless alveolar tap	389	1.9	118	28.9	9
ɹ	alveolar approximant	659	3.1	133	32.6	10
ʀ	uvular trill	2810	13.4	216	52.9	10
ʀ̝	uvular fricative trill	1367	6.5	181	44.4	10
ʁ	uvular fricative	1624	7.7	217	53.2	10
ʁ̞	uvular approximant	3417	16.3	250	61.3	10
ɻ	retroflex/bunched approx	2939	14.0	214	52.5	7
j	palatal approximant	141	0.7	50	12.3	6
ɛ	mid-open front vowel	55	0.3	30	7.4	5
ə	central vowel (schwa)	351	1.7	125	30.6	9
ɐ	low vowel	68	0.3	34	8.3	4
ØC̠	elision with retraction of C	66	0.3	46	11.3	6
Ø	elision of /r/	297	1.4	136	33.3	10

The vocalic variants that seem to be most confined to a subset of accents, with the more open vowels [ɛ,ɐ] occurring in five and four urban accents, respectively. Most other variants are found in all or almost all accents (though in widely differing numbers, as section 3.4 will show).

Possibly the most important implication of the results in the table above is that there is a large amount of variation within all urban accents, and among individual speakers; it is not the case that variation is a fringe phenomenon, with most speakers displaying limited variation. While some variants are clearly more frequent than others (the tap, the uvular approximant, the retroflex/bunched approximant), and some variants are quite marginal (most vocalic variants, for instance), the number of speakers for each variant make it clear that even these marginal variants are in widespread use among speakers (and conversely, that even the most frequent ones do not amount to more than one in every five or six *r* tokens.

3.3.2 Allophonic variation: frequency of variants by syllabic context

A more precise characterisation of the distribution of variants in the data involves locating the dimensions of variation outlined in Chapter 1: linguistic/allophonic, social, and geographical. A first look at the influence of linguistic context on *r*-variation is given in the following two tables, where a distinction is made between the four main syllabic contexts identified in section 3.1.4: word-initial onsets, word-internal intervocalic onsets, the schwa-insertion coda context (*r* followed by a non-coronal obstruent or by a nasal), and other codas (word-final *r* and coda clusters with *r* followed by coronal obstruents). These four contexts were chosen on the assumption that they would condition the largest possible allophonic variation. Table 3-9 contains an overview of all variants and their distribution over these four syllabic contexts by token frequency.

Table 3-9 Token frequency of variants by syllabic context (*N*=21006).

descriptive label	*word onset*		*intervocalic*		*ə-insertion*		*coda*	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*
vd alveolar trill	424	6.7	108	2.8	175	5.5	199	2.6
partially devcd alv trill	0	0	0	0	4	0.1	114	1.5
vl alveolar trill	0	0	0	0	16	0.5	173	2.3
vl alv trill/tap w/ frictn	0	0	1	0.0	12	0.4	916	12.1
vd (post)alv fricative	105	1.7	63	1.6	9	0.3	22	0.3
vl (post)alv fricative	1	0.0	0	0	0	0	127	1.7
vd alveolar tap	1876	29.6	1226	31.3	969	30.3	283	3.7
vl alveolar tap	0	0	0	0	21	0.7	368	4.9
alveolar approximant	204	3.2	219	5.6	76	2.4	160	2.1
uvular trill	1425	22.5	849	21.6	374	11.7	162	2.1
uvular fricative trill	445	7.0	117	3.0	144	4.5	661	8.8
uvular fricative	463	7.3	227	5.8	172	5.4	762	10.1
uvular approximant	1318	20.8	1092	27.8	703	22.0	304	4.0
retr/bunched approx	19	0.3	19	0.5	502	15.7	2399	31.8
palatal approximant	0	0	0	0	9	0.3	132	1.7
mid-open front vowel	0	0	0	0	0	0	55	0.7
central vowel (schwa)	0	0	0	0	10	0.3	341	4.5
low vowel	0	0	0	0	2	0.1	66	0.9
elision with retr of C	0	0	0	0	0	0	66	0.9
elision of /r/	54	0.9	1	0.0	1	0.0	241	3.2
totals	6334	100	3922	100	3199	100	7551	100

The table clearly shows how certain variants are strongly context-dependent: devoiced and voiceless alveolar variants are, for instance, typically coda (and to a lesser extent, schwa-insertion context) variants, as are the vocalic variants in the bottom third of the table (although there is a small number of retroflex/bunched approximants in onset positions as well). In contrast, voiced trills and fricatives are much more common in onsets, although they also occur in coda positions. An important thing to note is that, as opposed to its occurrence in codas, the "zero" variant, or *r*-elision, in onsets invariably concerns cases of *r* preceded by a velar fricative (in the items *gras* and *schrift*). Here, a uvular fricative *r* appears to have merged with that preceding fricative, leaving a single segmental portion. These have been scored as cases of *r*-elision to set them off from all other variants, but, as will be discussed in Chapter 5, they are more likely analysed differently: as instances of uvular fricative *r* accompanied by deletion of the preceding velar fricative, or as a coalescence of /x/ and /r/ without deletion of either.

Table 3-10 Number of speakers per variant per syllabic context (*N*=408).

descriptive label	*word onset*		*intervocalic*		*ə-insertion*		*coda*	
	n	%	*n*	%	*n*	%	*n*	%
vd alveolar trill	101	24.8	69	16.9	72	17.6	69	16.9
partially devcd alv trill	0	0.0	0	0.0	4	1.0	59	14.5
vl alveolar trill	0	0.0	0	0.0	8	2.0	70	17.2
vl alv trill/tap w/ frictn	0	0.0	1	0.2	10	2.5	130	31.9
vd (post)alv fricative	51	12.5	39	9.6	4	1.0	18	4.4
vl (post)alv fricative	1	0.2	0	0.0	0	0.0	55	13.5
vd alveolar tap	185	45.3	179	43.9	178	43.6	67	16.4
vl alveolar tap	0	0.0	0	0.0	12	2.9	117	28.7
alveolar approximant	64	15.7	99	24.3	44	10.8	67	16.4
uvular trill	197	48.3	177	43.4	107	26.2	57	14.0
uvular fricative trill	138	33.8	59	14.5	35	8.6	106	26.0
uvular fricative	159	36.5	101	24.8	42	10.3	136	33.3
uvular approximant	222	54.4	212	52.0	150	36.8	104	25.5
retr/bunched approx	15	3.7	16	3.9	100	24.5	213	52.2
palatal approximant	0	0.0	0	0.0	6	1.5	49	12.0
mid-open front vowel	0	0.0	0	0.0	0	0.0	30	7.4
central vowel (schwa)	0	0.0	0	0.0	9	2.2	121	29.7
low vowel	0	0.0	0	0.0	1	0.2	34	8.3
elision with retr of C	0	0.0	0	0.0	0	0.0	46	11.3
elision of /r/	39	9.6	1	0.2	1	0.2	107	26.2

A division of variants over these syllabic contexts by the number of speakers that use a particular variant is given in Table 3-10, which shows again that certain variants are strongly context-dependent, and – in comparison with Table 3-8 – that some variants are strongly context- *and* speaker-dependent. For instance, while 214 speakers use the retroflex/bunched approximant, almost all (213) of them use it in the coda context, whereas only 100 also have this variant in the schwa-insertion context (which is generally assumed to also constitute a coda phonologically). A very different situation occurs with the voiced alveolar trill: while 34.3% of speakers (140) have this variant, it is not general in any context: in word onsets, it is used by 101 speakers, whereas only around 70 (in other words, half of the alveolar trill speakers) use it in any of the other contexts. Finally, what Table 3-9 and Table 3-10 both show is that coda position is most conducive to variation: while 11 of our 20 variants are found in the two onset contexts, 17 appear in the schwa-insertion context, and all 20 in the coda. In addition, while in word-initial onsets, five variants are found with more than a third of the speakers, and only three variants have between 10-33% of speakers, in word-final codas there are only two variants with over 1/3 of speakers, and 15 variants are found with 10-33% of speakers. In other words, not only are there more variants in coda positions, their pattern of use is also much less uniform.

3.3.3 Geographical, social and allophonic variation: index scores

The index scores introduced and discussed in section 3.2.2 are now used to compare the urban accents with respect to the phonetic parameters of place of articulation and consonantality (the operationalisation of manner of articulation), as well as the incidence of the retroflex/bunched approximant and the process of schwa-insertion. As explained above, these index scores allow us on the one hand to generalise over variants by grouping them together, and on the other to zoom in on particular features that are packaged up with others under the variant labels. Statistical analysis (ANOVA) of these index scores gives relatively straightforward insight into the influence of geographical, social and allophonic variation on these broader phonetic parameters.

3.3.3.1 Place of articulation

The first index score characterises the main place of articulation distinction in *r* sounds: front vs. back (Table 3-11). The higher the score, the larger the average number of back variants relative to front variants per speaker in the accent. See 3.2.2.1 for full details of how this index score was calculated.

A first cursory look at the index scores for place of articulation shows that there is wide-ranging variation: there are extremely “front” cities (Antwerp and Bruges), extreme “back” cities (Nijmegen especially), and everything in-between. An analysis of variance and post-hoc testing revealed a number of significant differences between urban accents.[8]

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[8] Levene’s test of equality of error variances turned out to be significant ($F(39,368)=9.40$, $p<.001$), which means equality of variance cannot be assumed. While the sample size is large and group sizes are equal (with N between 36 and 43), this necessitates a post-hoc test assuming unequal variances; Tamhane’s T2 test was used here, and will be in other analyses whenever this was the case.

Table 3-11 Place of articulation of *r* by urban accent. Number of speakers, mean index scores and standard deviations (min=0 [all alveolar], max=100 [all uvular]).

	N	*mean*	*stdev*
Antwerp	41	9.8	29.0
Bruges	43	7.1	25.7
Ghent	42	74.9	40.3
Hasselt	40	63.8	47.5
Amsterdam	40	29.1	34.8
Rotterdam	43	46.1	30.3
Utrecht	40	71.2	30.4
Leiden	42	66.6	22.0
The Hague	36	79.8	6.3
Nijmegen	41	90.2	5.4
all cities	408	53.4	40.9

An analysis of variance with the index score as a dependent variable shows a significant effect of accent (speech community) ($F(9{,}368)=39.31$, $p<.001$, $\eta_p^2=.490$), and no other effects for social factors. See Table 3-12 for a summary of the ANOVA results.

Table 3-12 Overview of ANOVA results; dependent variable = place.

factor	*df*	*F*	*p*	*partial* $\eta2$
accent	9,368	39.31	.000	.490
sex	1,368	0.03	.871	.000
age	1,368	2.98	.085	.008
accent*sex	9,368	1.20	.291	.029
accent*age	9,368	1.89	.052	.044
sex*age	1,368	0.11	.735	.000
accent*sex*age	9,368	0.48	.890	.012

Table 3-13 *p*-values of pairwise comparisons (Tamhane's T2 post-hoc) of speech communities on place index score.

Bru	Ant	Ams	Rot	Has	Ldn	Utr	Gnt	Hag	Nmg
Bru	1.000	.076	.000	.000	.000	.000	.000	.000	.000
	Ant	.310	.000	.000	.000	.000	.000	.000	.000
		Ams	.605	.017	.000	.000	.000	.000	.000
			Rot	.896	.026	.014	.017	.000	.000
				Has	1.000	1.000	1.000	.845	.051
					Ldn	1.000	1.000	.023	.000
						Utr	1.000	.983	.016
							Gnt	1.000	.582
								Hag	.000
									Nmg

Tamhane's T2 post-hoc test revealed significant differences between subsets of speech communities (see Table 3-13).[9]

There is a complex of overlapping homogeneous subsets: Table 3-13 shows that the index scores for place of articulation do not significantly differ between Antwerp, Bruges and Amsterdam; Amsterdam and Rotterdam; Leiden, Utrecht, and Ghent; Utrecht, Ghent, and The Hague; Ghent, The Hague and Nijmegen; while Hasselt does not differ significantly from Leiden, Utrecht, Ghent, The Hague and Nijmegen. What this overview mostly shows is, again, that there are large differences between the cities in the corpus when it comes to place of articulation of *r*. It is also clear that cities do not cluster together geographically: while the Belgian cities of Antwerp and Bruges (83km apart) are not significantly different with respect to this index score, Ghent – which is located roughly halfway between these two cities – is found at the opposite end of the spectrum, clustering together with Hasselt (113km east), as well as a number of Dutch cities much further away. In other words, large-scale variation in place of articulation of *r* is clearly a very local phenomenon for these cities, and not part of a larger geographical dialect pattern, as that described in Chapter 2. Section 3.4 will provide a look into the individual urban accents, and how their respective index scores for place may correlate with the social factors of sex and age within these communities.

Finally, the effect of syllable position on place of articulation was determined by a repeated measures ANOVA with the index score as the dependent variable and syllable position as the within-subjects factor (and accent, sex and age as between-subjects factors). Syllable position is significant ($F(2.01,740.6)=87.32$, $p<.001$, $\eta_p^2=.175$ Greenhouse-Geisser corrected).[10] The index score is significantly higher for onsets (word-initial: 59.3, intervocalic: 59.2; these are not significantly different from each other) than that for the schwa-insertion context (49.2), and that for the word-final coda context is lowest of all (43.4), and significantly different from all others. The significant differences are summarised in Table 3-14.

Table 3-14 *p*-values of pairwise comparisons (Bonferroni-adjusted) of syllable position on the place of articulation index score

Onset	Intervocalic	Schwa	Coda
Onset	1.000	.000	.000
	Intervocalic	.000	.000
		Schwa	.001
			Coda

3.3.3.2 Consonantality

The following index characterises the main *manner* of articulation parameter, *consonantality*. The higher the score, the more consonantal (constricted) variants are

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[9] In this and all other tables reporting exact *p*-values, .000 stands for values smaller than .0005, and 1.000 stands for values greater than or equal to .9995.

[10] Mauchly's *W* test for sphericity was significant ($X^2=708.19$, $p<.001$), indicating a violation of the assumption of sphericity; therefore, Greenhouse Geisser-corrected F and p values are reported.

used, relative to vocalic variants. For full details of how the score was calculated, see section 3.2.2.1. The results averaged over all speakers of the relevant accents are in Table 3-15.

Table 3-15 Consonantality of *r* by accent. Number of speakers, mean index score and standard deviation (min=0 [all vocalic], max=100 [all consonantal]).

	N	*mean*	*st dev*
Antwerp	41	95.6	6.7
Bruges	43	97.5	3.3
Ghent	42	93.2	6.6
Hasselt	40	94.6	5.7
Amsterdam	40	80.2	14.8
Rotterdam	43	68.1	9.1
Utrecht	40	69.8	11.9
Leiden	42	66.7	9.4
The Hague	36	62.4	8.4
Nijmegen	41	66.0	10.4
total	408	79.6	16.4

Analysis of variance[11] with the index score as a dependent variable shows significant effects of accent (speech community) ($F(9,368)=102.46$, $p<.001$, $\eta_p^2=.727$) and age ($F(1,368)=4.18$, $p=.042$, $\eta_p^2=.011$). See Table 3-16 for a summary of the ANOVA results.

Table 3-16 Overview of ANOVA results; dependent variable = consonantality.

factor	*df*	*F*	*p*	*partial $\eta 2$*
accent	9,368	102.46	.000	.727
sex	1,368	3.76	.053	.010
age	1,368	4.18	.042	.011
accent*sex	9,368	1.30	.236	.031
accent*age	9,368	1.09	.372	.026
sex*age	1,368	0.00	.997	.000
accent*sex*age	9,368	1.39	.190	.033

The effect of age is small, and indeed, calculated across all accents, there is only a small difference between the means for older (80.5) and younger speakers (78.7). While this significant but small effect cannot lead to blanket statements of the type “older speakers have more consonantal variants”, an examination of individual accents will show (in section 3.4) that such a statement is true for half of the accents in the corpus (most of the Netherlandic ones), while the others show no such effect, or even a weak effect in the opposite direction.

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[11] Levene’s test of equality of error variances indicated inequality of variances ($F(39,368)=3.64$, $p<.001$).

Tamhane's T2 post-hoc test revealed significant differences between subsets of speech communities (see Table 3-17).

Table 3-17 *p*-values of pairwise comparisons (Tamhane's T2 post-hoc) of speech communities on consonantality index score.

Bru	Ant	Has	Gnt	Ams	Utr	Rot	Ldn	Nmg	Hag
Bru	.992	.236	.011	.000	.000	.000	.000	.000	.000
	Ant	1.000	.988	.000	.000	.000	.000	.000	.000
		Has	1.000	.000	.000	.000	.000	.000	.000
			Gnt	.000	.000	.000	.000	.000	.000
				Ams	.042	.002	.000	.000	.000
					Utr	1.000	1.000	.998	.101
						Rot	1.000	1.000	.110
							Ldn	1.000	.221
								Nmg	.991
									Hag

Table 3-17 shows that the index scores for consonantality do not significantly differ between Bruges, Antwerp and Hasselt; Antwerp, Hasselt and Ghent; Utrecht, Rotterdam, Leiden, Nijmegen and The Hague. This creates homogeneous subsets of Belgian Dutch and Netherlandic Dutch accents respectively. Amsterdam differs significantly from all other accents and forms a group on its own. Section 3.4 will provide a look into the individual urban accents, and how their respective index scores for consonantality may correlate with the social factors of sex and age.

The effect of syllable position on consonantality, determined by a repeated measures ANOVA with the index score as the dependent variable and syllable position as the within-subjects factor, was found to be significant ($F(2.24,825.5)=522.20$, $p<.001$, $\eta_p^2=.587$ Greenhouse-Geisser corrected).[12] The index score is higher for word-initial onsets (90.8) than for intervocalic ones (88.2), and the schwa-insertion context (80.4), while that for the word-final coda context is lowest of all (65.0). The four contexts are all significantly different from each other ($p<.001$).

3.3.3.3 The retroflex/bunched approximant

The index score for the retroflex/bunched approximant is more straightforward than the ones for place and consonantality, as it simply calculates the incidence of this variant relative to all other variants used by speakers of a particular urban accent. The results are in Table 3-18.

The table shows that the retroflex/bunched approximant is simply not a feature of a number of accents, and here there is a clear geographical clustering: the Belgian cities all have index scores of 0, whereas those for the Netherlands increase when moving from the southeast (Nijmegen) and north (Amsterdam) towards the west coast (Leiden, The Hague).

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[12] Mauchly's *W* test for sphericity was significant ($X_2=348.19$, $p<.001$), indicating a violation of the assumption of sphericity; therefore, Greenhouse Geisser-corrected F and p values are reported.

Table 3-18 Incidence of the retroflex/bunched approximant in the urban accents. Number of speakers, mean index score and standard deviation (min=0 [no retroflex/bunched approximant tokens], max=100 [all tokens are retroflex/bunched approximants]).

	N	*mean*	*st dev*
Antwerp	41	0.0	0.0
Bruges	43	0.0	0.0
Ghent	42	0.0	0.3
Hasselt	40	0.0	0.0
Amsterdam	40	17.9	16.9
Rotterdam	43	23.6	15.8
Utrecht	40	20.2	12.6
Leiden	42	38.0	12.1
The Hague	36	34.8	15.1
Nijmegen	41	7.4	8.2
total	408	14.0	9.0

An ANOVA with the index score as dependent variable showed significant effects for a range of factors: speech community, sex, and age, as well as interactions between speech community and sex, and speech community and age.[13] The results are summarised in Table 3-19.

Table 3-19 Overview of ANOVA results. Dependent variable = index score for retroflex/bunched approximant.

factor	*df*	*F*	*p*	*partial η2*
accent	9,368	100.80	.000	.711
sex	1,368	12.49	.000	.033
age	1,368	47.50	.000	.114
accent*sex	9,368	3.75	.000	.084
accent*age	9,368	5.96	.000	.127
sex*age	1,368	1.09	.297	.003
accent*sex*age	9,368	1.85	.058	.043

The strongest effect by far is that for speech community (accent), though there are also clear differences between the sexes and the two age groups. The means for older vs. younger speakers across all accents are 10.8 and 17.4, respectively, while the means for men and women are 12.3 and 15.5, respectively. Both of these social factors show significant interactions with accent. This indicates differences between the accents as to how sex and age relate to the use of the retroflex/bunched approximant. As section 3.4 will show, some of the urban accents display very large differences for these factors, while others show none. (There are no accents, however, in which these factors show effects in the opposite direction.) Differences within the individual accents are examined further in section 3.4. Comparisons of the speech communities with respect to the index score are in Table 3-20.

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[13] Levene's Test showed inequality of error variances ($F(39,368)=10.90$, $p<.001$).

Table 3-20 p values of pairwise comparisons (Tamhane's T2 post-hoc) of speech communities on retroflex/bunched approximant index score.

Bru	Ant	Has	Gnt	Nmg	Ams	Utr	Rot	Hag	Ldn
Bru			1.000	.000	.000	.000	.000	.000	.000
	Ant		1.000	.000	.000	.000	.000	.000	.000
		Has	1.000	.000	.000	.000	.000	.000	.000
			Gnt	.000	.000	.000	.000	.000	.000
				Nmg	.033	.002	.000	.000	.000
					Ams	1.000	.994	.001	.000
						Utr	1.000	.001	.000
							Rot	.098	.008
								Hag	1.000
									Ldn

The homogeneous subsets in these data are Bruges, Antwerp, Hasselt, Ghent; Amsterdam, Utrecht, Rotterdam; Rotterdam and The Hague; The Hague and Leiden. Nijmegen is significantly different from all other accents.

Unsurprisingly, the effect of syllable position on consonantality, finally, was found to be significant, as determined by a repeated measures ANOVA ($F(1.40,513.8)=752.34$, $p<.001$, $\eta_p^2=.672$ Greenhouse-Geisser corrected).[14] The index score is close to zero for word-initial and intervocalic onsets, and these are not significantly different from each other (mean index scores 0.04 in both cases, $p\geq.999$). They are different ($p<.001$) from the schwa-insertion context (1.2) and the word-final coda (5.9), which are also significantly different from each other ($p<.001$).

3.3.3.4 *Schwa-insertion*

An index score for schwa-insertion in coda clusters of *r* with a non-coronal obstruent (in these data: *harp*, *arm*, *kerk*, *berg*) reveals that there are large differences between the urban accents not only in terms of the realisation of *r* itself, but also in the processes that are triggered by its presence. The results are in Table 3-21.

An ANOVA with the index score as dependent variable showed significant effects for speech community ($F(9,368)=30.15$, $p<.001$, $\eta_p^2=.424$) and age ($F(1,368)=25.10$, $p<.001$, $\eta_p^2=.064$), as well as interactions between speech community and sex, and speech community and age.[15] Full results are in Table 3-22.

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[14] Mauchly's *W* test for sphericity was significant ($X_2=1760.35$, $p<.001$), indicating a violation of the assumption of sphericity; therefore, Greenhouse Geisser-corrected *F* and *p* values are reported.

[15] Levene's Test showed inequality of error variances ($F(39,368)=5.95$, $p<.001$).

Table 3-21 Schwa insertion in coda clusters of *r*+non-coronal obstruent. Number of speakers, mean index scores, standard deviation (min=0 [no schwa-insertion], max=100 [comprehensive schwa-insertion]).

	N	*mean*	*st dev*
Antwerp	41	95.1	14.5
Bruges	43	84.1	26.8
Ghent	42	20.5	24.7
Hasselt	40	87.5	18.3
Amsterdam	40	80.9	31.9
Rotterdam	43	67.4	42.3
Utrecht	40	85.0	30.5
Leiden	42	49.3	39.5
The Hague	36	45.4	45.3
Nijmegen	41	92.6	17.0
total	408	70.9	38.4

Table 3-22 Overview of ANOVA results. Dependent variable = index score for schwa insertion in non-homorganic coda clusters.

factor	*df*	*F*	*p*	*partial η2*
accent	9,368	30.15	.000	.424
sex	1,368	1.98	.160	.005
age	1,368	25.10	.000	.064
accent*sex	9,368	3.51	.000	.079
accent*age	9,368	4.89	.000	.107
sex*age	1,368	2.25	.135	.006
accent*sex*age	9,368	0.59	.805	.014

The effect of the factor age across all accents is reflected in the difference between the mean index scores for older (77.7) and younger speakers (63.4). This age effect is partly related to that found with the previous index score, for use of the retroflex/bunched approximant. In the Netherlandic accents, the question of whether schwa insertion takes place in these contexts is strongly correlated with the use of the retroflex/bunched approximant; correlation figures are in Table 3-23.

Table 3-23 Correlation between index scores for retroflex/bunched approximant and schwa-insertion in schwa-insertion context in the six Dutch cities. Number of speakers, Pearson correlation coefficient, *p*-value (two-tailed *t*-test).

city	*N*	*Pearson's r*	*p*
Amsterdam	40	-.984	.000
Rotterdam	43	-.976	.000
Utrecht	40	-.936	.000
Leiden	42	-.972	.000
The Hague	36	-.994	.000
Nijmegen	41	-.840	.000

In short, the realisation of *r* as a retroflex/bunched approximant makes the appearance of schwa in these contexts highly unlikely. As use of the retroflex/bunched approximant itself also shows significant effects of age (it being more frequent among younger speakers), the age effects here are not unexpected. Schwa-insertion is discussed in more detail in Chapter 6.

The strongest effect found with this index score is, again, that of speech community. The differences between speech communities and subsets are in Table 3-24.

Table 3-24 *p* values of pairwise comparisons (Tamhane's T2 post-hoc) of speech communities on schwa-insertion index score.

Gnt	Hag	Ldn	Rot	Ams	Bru	Utr	Has	Nmg	Ant
Gnt	.197	.007	.000	.000	.000	.000	.000	.000	.000
	Hag	1.000	.742	.010	.002	.002	.000	.000	.000
		Ldn	.872	.007	.000	.001	.000	.000	.000
			Rot	.992	.767	.771	.245	.028	.007
				Ams	1.000	1.000	1.000	.871	.447
					Bru	1.000	1.000	.981	.625
						Utr	1.000	1.000	.943
							Has	1.000	.845
								Nmg	1.000
									Ant

Differences are not significant, creating homogeneous subsets, between Ghent and The Hague; The Hague, Leiden, and Rotterdam; Rotterdam, Amsterdam, Bruges, Utrecht, and Hasselt; Amsterdam, Bruges, Utrecht, Hasselt, Nijmegen, and Antwerp. Ghent has by far the lowest score (20.5), which sets it markedly apart from the other Flemish cities, which all have scores on the higher end of the scale. In the Netherlands, The Hague, Leiden and Rotterdam have relatively low scores (though none as low as Ghent), which sets them apart from Amsterdam, Utrecht and Nijmegen.

3.3.3.5 Index scores: summary of results

This first exploration of the four index scores shows some of the larger patterns of *r*-variation among the urban accents. At times, the chosen parameters reflect larger geographical patterns, or appear strongly connected with the wider speech community (Flanders vs. the Netherlands). This is most clearly the case with the score for the retroflex/bunched approximant, the only index that concentrates on a single variant. This is almost completely absent from the Belgian Dutch accents, and most frequent in the south-western Netherlandic accents of Rotterdam, The Hague and Leiden. The consonantality index shows a similar geographical pattern: the Flemish cities have very high scores, most of the Dutch cities considerably lower, with Amsterdam in-between the two. The other indices do not pattern as neatly, and the differences between accents are more gradient, but there are obvious extremes: for place of articulation, Bruges and Antwerp are at one end with almost only 'front' realisations, with Nijmegen at the opposite end and almost exclusively 'back' variants.

For schwa-insertion, on the other hand, Antwerp patterns with Nijmegen (with schwa-insertion very frequent in both urban accents), and Ghent is alone at the opposite end.

The analysis of the index scores also shows that for the major phonetic parameters of place and manner of articulation, there is little effect of social factors. Place shows no effect at all, while the effect of age on consonantality is weak. The effects are much stronger for the other two index scores, with sex and age playing a role either as main effects, or in interaction with speech community (accent). The effects of social factors on the index scores *within* each of the urban accents is one of the topics of the following section, which takes a look at the distribution of *r*-variants in each individual speech community.

3.4 Patterns of *r*-variation in urban accents

The overview of the results from the *HEMA* data in the previous section showed that there are large differences between the various city accents. This section will briefly review the main *r*-patterns in each of the 10 cities in the data. It will make clear that, despite the differences, many of the patterns found in the data can be found in several – or even all – of the cities and therefore reflect general facts about Dutch *r*. The description for each city will start with the frequency counts and number of speakers of all variants found in the accent. This is followed by an examination of the factors relevant to explaining the variation. Per index score, a General Linear Model was run for each of the urban accents separately, with syllable position as a within-subjects factor and speaker age and sex as between-subjects factors. The results of these analyses show the relative contributions of these factors on the index scores within each city accent. The distribution of *r*-variants across the four major syllable contexts (word onset, intervocalic onset, coda, and the schwa-insertion context) is examined in more detail at the end of each section, for which the two onset contexts and the two coda contexts, respectively, are combined in subsections.

3.4.1 Antwerp

Consonantal alveolar variants make up almost 90% of all *r* tokens in Antwerp. This does not mean that there are no relevant allophonic patterns, however. Table 3-25 shows the absolute and relative token frequency and number of speakers of each of the variants found in Antwerp.

By far the most common realisation of *r* in Antwerp is the voiced alveolar tap, which is found with over 90% of all Antwerp speakers in the data, and makes up over 45% of all *r*-tokens in Antwerp. Other alveolar variants make up almost another 45%, and uvular variants almost 10%. There are four uvular *r* speakers, one of whom has occasional alveolar *r* realisations, and there is one alveolar *r* speaker with occasional uvular *r* (in other words, there are three categorical uvular *r* speakers). The four predominantly uvular *r* speakers will not be discussed here, as their number is simply too small to make relevant generalisations. However, their *r* patterns differ little from those of the larger groups of uvular *r* speakers in Hasselt and Ghent; this means that the general patterns identified there for uvular *r* speakers can be taken to be representative of those in Antwerp also.

Table 3-25 Token frequency and number of speakers of *r*-variants in Antwerp. All contexts (*N*=2109), all Antwerp speakers (*N*=41).

descriptive label	*token frequency*		*number of speakers*	
	n	*%*	*n*	*%*
voiced alveolar trill	159	7.5	31	75.6
voiceless alveolar trill	75	3.6	22	53.7
partially devoiced alv trill	37	1.8	18	43.9
vl alv trill/tap w/ frication	348	16.5	37	90.2
voiceless (post)alv fricative	68	3.2	23	56.1
voiced (post)alv fricative	34	1.6	15	36.6
voiceless alveolar tap	46	2.2	23	56.1
voiced alveolar tap	965	45.9	37	90.2
alveolar approximant	161	7.6	29	70.7
uvular trill	51	2.4	3	7.3
uvular fricative trill	25	1.2	5	12.2
uvular fricative	42	2.0	5	12.2
uvular approximant	90	4.3	5	12.2
central vowel	4	0.2	3	7.3
elision of *r*	4	0.2	4	9.8

3.4.1.1 Index scores: social factors

The index scores for place of articulation differ significantly between men and women ($F(1,37)=4.63$, $p=.038$, $\eta_p^2=.111$), with the score for men at 19.3, and that for women 0.7 (the overall score for Antwerp is 9.8), lower scores indicating more front articulations. This is to a large extent explained by the fact that the uvular *r* speakers are all men; there is one female speaker with a small number of uvular tokens. There is no effect of age for place of articulation.

The index scores for consonantality and schwa-insertion do not differ significantly between men and women, nor between older and younger speakers; those for the retroflex/bunched approximant are not applicable as no speakers in Antwerp have this variant.

3.4.1.2 Index scores: the effect of syllable position

The index score for place of articulation shows no effect of syllable position. There is, on the other hand, a significant effect of syllable position on consonantality ($F(2.22,82.1)=7.22$, $p=.001$, $\eta_p^2=.163$ Greenhouse-Geisser corrected). The score for consonantality is lower for *r* in intervocalic position (93.2), i.e. realisations of *r* are less consonantal in that context than elsewhere (word-initial onsets: 95.8, schwa-insertion context: 96.2, coda: 96.7). Note that scores are high across the board in Antwerp: as Table 3-25 makes clear, the overwhelming majority of tokens in Antwerp are consonantal *r*-variants. The effect of position on schwa-insertion is significant ($F(3,111)=1548.39$, $p<.001$, $\eta_p^2=.977$), as expected: it takes place mainly in the schwa-insertion context (with a score of 95.1), only to a limited extent in the coda context (score of 1.7), and not at all in the onset contexts (both 0.0). The index score for the retroflex/bunched approximant is not relevant for Antwerp as it does not occur there. The following two sections take a closer look at the distribution of variants within the four syllable contexts.

3.4.1.3 Onsets

Taps are by far the most common onset realisation for alveolar *r* speakers, as is clear from Table 3-26. When in prevocalic (as opposed to intervocalic) position, they are almost invariably preceded by a short vocoid element with a central vowel quality. In other words, taps are phonetically almost always intervocalic (see Chapter 4 for more on the phonetics of taps).

The relative frequency of alveolar approximants is high compared to that for alveolar *r* speakers in other cities in the corpus. Note that trills are a minority among the alveolar variants, despite the common description of Dutch onset *r* as an alveolar trill in the literature. They are relatively frequent in word onset position, though, with 14% of all *r* tokens.

Table 3-26 Token frequency of *r*-variants in Antwerp. Word-onset (n=636) and intervocalic (*n*=395) positions. No. of speakers: 41.

descriptive label	*word onset*		*intervocalic*	
	n	%	*n*	%
vd alveolar trill	89	14.0	22	5.7
vl alv trill/tap w/ frictn			1	0.3
vd (post)alv fricative	23	3.6	7	1.8
vd alveolar tap	418	65.7	271	68.6
alveolar approximant	48	7.5	56	14.2
uvular trill	21	3.3	12	3.0
uvular fricative trill	1	0.2		
uvular fricative	2	0.3	2	0.5
uvular approximant	34	5.3	24	6.1

3.4.1.4 Codas

Antwerp speakers have largely voiceless and fricative alveolar realisations of coda *r*, although there is a substantial minority of voiced trills, taps and approximants as well. By far the most common variant in the coda position is the voiceless tap or trill followed by homorganic frication, while the schwa-insertion context shows its similarity with the intervocalic onset context, with a majority of voiced alveolar taps (recall from section 3.3.3.4 that the incidence of schwa-insertion is particularly high in Antwerp).

Antwerp is one of only two cities in the corpus with a majority of consonantal alveolar variants in coda; Bruges is the other. A comparison between the two shows a large degree of similarity, but also some interesting differences in the phonetic detail; such a comparison forms part of the section on coda-*r* in Bruges (3.4.2.4) below.

What the figures in Table 3-27, and the similar tables for the other cities that are to follow, do not show is the distribution of variants across speakers. For instance, are the 46% alveolar trills or taps with frication found in Antwerp the result of all or almost all speakers realising *r* this way roughly 46% of the time, or is there a smaller subset of speakers who realise coda *r* almost categorically this way, and another subset that never do? Part of the answer to such questions may be read off from the rightmost column in Table 3-25, and it is likely that the answer will be closer to the former situation than to the latter. However, included in the calculations in Table 3-25 are *all* speakers for whom there is at least a single instance of this variant, and this consequently creates some noise in the data. A more thorough exploration of the distribution of variants over speakers forms part of the analysis in Chapters 4 and 5.

Table 3-27 Token frequency of *r*-variants in Antwerp. Coda (*n*=756) and schwa-insertion context (*n*=322). No. of speakers: 41.

descriptive label	*coda*		*schwa-ins*	
	n	%	*n*	%
voiced alveolar trill	20	2.6	28	8.7
voiceless alveolar trill	69	9.1	6	0.8
partially devoiced alv trill	37	4.9		
vl alv trill/tap w/ frication	347	45.9		
voiceless (post)alv fricative	68	9.0		
voiced (post)alv fricative	4	0.5		
voiceless alveolar tap	46	6.1		
voiced alveolar tap	40	5.3	236	73.3
alveolar approximant	38	5.0	19	5.9
uvular trill	3	0.4	15	4.7
uvular fricative trill	24	3.2		
uvular fricative	38	5.0		
uvular approximant	14	1.9	18	5.6
central vowel	4	0.5		
elision of *r*	4	0.5		

3.4.2 Bruges

The general pattern in Bruges is highly similar to that of Antwerp: a large majority of speakers (93%) have voiced apico-alveolar taps and trills in onsets, and mostly voiceless alveolar consonantal variants in codas (see Table 3-28). In Bruges, too, there is a small minority of uvular *r* speakers (3 out of 43, all categorically uvular). As was the case for Antwerp, this is too small a number to be able to generalise over, while they appear to be very similar to other Flemish uvular *r* speakers; since the numbers in Hasselt and Ghent are far greater, uvular *r* in Flanders will be discussed there exclusively.

3.4.2.1 Index scores: social factors

The factors of sex and age do not show any significant effects for the four indices defined in section 3.2.2. Place of articulation shows no significant differences, as the index is uniformly low for all groups (older speakers and men have somewhat higher scores, but standard deviations are large). The indices for consonantality and schwa-insertion both also show uniform (high) scores around the city means and there are therefore no significant effects for social groups. The retroflex/bunched approximant is not a variant of *r* in Bruges *r* at all.

Table 3-28 Token frequency and number of speakers of *r*-variants in Bruges. All contexts (N=2151), all Bruges speakers (N=43).

descriptive label	*token frequency* *n*	*token frequency* %	*number of speakers* *n*	*number of speakers* %
voiced alveolar trill	282	13.1	40	93.0
voiceless alveolar trill	41	1.9	21	48.8
partially devoiced alv trill	45	2.1	23	53.5
vl alv trill/tap w/ frication	230	10.7	34	79.1
voiceless (post)alv fricative	22	1.0	11	25.6
voiced (post)alv fricative	33	1.5	18	41.9
voiceless alveolar tap	130	6.0	33	76.7
voiced alveolar tap	1115	51.8	40	93.0
alveolar approximant	91	4.2	30	69.8
uvular trill	34	1.6	3	7.0
uvular fricative trill	50	2.3	3	7.0
uvular fricative	39	1.8	4	9.3
uvular approximant	32	1.5	3	7.0
central vowel	3	0.1	2	4.7
elision of *r*	4	0.2	3	7.0

3.4.2.2 Index scores: the effect of syllable position

As in Antwerp, the index score for place of articulation in Bruges shows no effect of syllable position. There is a significant effect of syllable position on consonantality ($F(2.06,80.2)=3.42$, $p=.036$, $\eta_p^2=0.81$, Greenhouse-Geisser corrected). It is, however, a very weak effect, given that scores are simply high across the board: in Bruges, the schwa-insertion position is significantly more consonantal (score of 99.3) than the word-initial (97.2) and intervocalic onsets (96.8), while coda position (97.6) is not significantly different from any of the other positions. The schwa-insertion index also shows an effect of position ($F(1.52,59.2)=311.84$, $p<.001$, $\eta_p^2=.889$, Greenhouse-Geisser corrected), but Bruges is strikingly different from Antwerp in this respect. As in Antwerp, the onset contexts have a score of 0.0, but the schwa-insertion context (84.1) and the coda context (14.7) are closer together in Bruges. In other words, while there is a lower rate of schwa-insertion in its usual context, there is a considerably higher one in a context where it is not predicted to occur (see Chapter 6 for more discussion of this issue). The index score for the retroflex/bunched approximant, finally, is not relevant for Bruges. Sections 3.4.2.3 and 3.4.2.4 expand on the four syllable positions.

3.4.2.3 Onsets

Table 3-29 Token frequency of *r* variants in word-initial (*n*=648) and intervocalic onsets (*n*=391) in Bruges. No. of speakers: 43.

descriptive label	*word onset*		*intervocalic*	
	n	%	*n*	%
voiced alveolar trill	90	13.9	25	6.4
voiced (post)alv fricative	14	2.2	12	3.1
voiced alveolar tap	461	71.1	296	75.7
alveolar approximant	38	5.9	30	7.7
uvular trill	18	2.8	11	2.8
uvular fricative trill	8	1.2	4	1.0
uvular fricative	3	0.5	4	1.0
uvular approximant	16	2.5	9	2.3
total	648	100	391	100

Much like in Antwerp, taps are the most common onset realisation for alveolar *r* speakers, in an even larger majority here. In word onsets, they are almost invariably preceded by a short vocoid, and all onset taps are voiced. The biggest difference between Antwerp and Bruges in terms of onset *r* is the relative frequency of alveolar approximants, which is much higher in Antwerp. The relative contribution of trills is very similar: around 14% of all word onset tokens, and around 6% of all intervocalic ones.

3.4.2.4 Codas

The coda and schwa-insertion context variants of *r* in Bruges are in Table 3-30. They show considerable variation even among alveolar speakers, although the most frequent variants are all alveolar taps and trills.

While the coda contexts in Bruges look superficially similar to those of Antwerp (largely apico-alveolar consonantal variants), a more in-depth comparison brings some larger differences to light. While indeed a large majority of the tokens can be classed as apical consonantal variants of *r*, a more fine-grained look at the variation within this category reveals that this is not the whole story. That there are differences in the relative frequencies of the alveolar variants in terms of manner is clear when comparing Table 3-27 and Table 3-30: Bruges speakers retain the traditional voiced consonantal *r* types (trills and taps) to a relatively large degree in coda (36.8% in Bruges vs. 14.4% in Antwerp), whereas Antwerp speakers have more voiceless and fricative realisations (63.5% in Antwerp vs. 47.4% in Bruges), as well as a fair number of approximants. This is a good example of how patterns that look superficially similar may in fact reveal systematic differences when studied at a level of more phonetic detail (noting that even here, we are dealing with fairly crude category labels abstracting away from much of the even finer detail).

Table 3-30 Token frequency of *r* variants in coda (n=780) and schwa-insertion context (n=332) in Bruges . No. of speakers: 43.

descriptive label	*coda*		*schwa-ins*	
	n	%	*n*	%
voiced alveolar trill	99	12.7	68	20.5
voiceless alveolar trill	38	4.9	3	0.9
partially devoiced alv trill	44	5.6	1	0.3
vl alv trill/tap w/ frication	223	28.6	7	2.1
voiceless (post)alv fricative	22	2.8		
voiced (post)alv fricative	4	0.5	3	0.9
voiceless alveolar tap	124	15.9	6	1.8
voiced alveolar tap	144	18.5	214	64.5
alveolar approximant	17	2.2	6	1.8
uvular trill			5	1.5
uvular fricative trill	29	3.7	9	2.7
uvular fricative	24	3.1	8	2.4
uvular approximant	5	0.6	2	0.6
central vowel	3	0.4		
elision of *r*	4	0.5		
total	780	100	332	100

Interestingly, the situation concerning voiced vs. voiceless/fricative variants in Antwerp and Bruges may be a change in progress. An index score for voicing in codas was calculated by weighting all voiced variants as 100, all voiceless variants as 0, and the partially devoiced trill as 50.[16] This index shows a significant effect of age in Antwerp: older speakers produce more voiced trills and taps in coda than younger speakers ($F(1,37)=4.15$, $p=.049$, $\eta_p^2=.101$), while there is no such effect in Bruges. It looks as if a sound change is underway in Antwerp, creating a more dichotomous pattern in the onset and coda allophones of /r/. This exemplifies the types of changes

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[16] In contrast to the four main index scores used throughout this chapter, the index for voicing is only used here, as it does not yield relevant results for any of the other urban accents.

that will be the main focus of chapters 4 and 5, where it is argued that they reflect a process of phonetic biases creating, at first, low-level phonetic variation, and later, via an age-graded pattern, increasingly robust allophonic patterns. In fact, the aim of those chapters is to account for all of the *r*-variation in the urban accent corpus by reference to the fine phonetic detail of the variants, and relating it to the contexts in which they appear. At this point, however, it suffices to note the patterns in coda-*r* in Antwerp and Bruges, and how their superficial resemblance depends on how closely they are examined.

Finally, the schwa-insertion context shows both similarities and differences between Antwerp and Bruges, although the picture is somewhat more complex than that of the word-final and pre-coronal contexts. In both cities, the dominant pattern for alveolar *r* speakers is to have schwa-insertion in these items and realise *r* as an alveolar tap. The divergence between the cities is evidenced in the minority variants: Bruges seems to favour more consonantal variants. First, alveolar trills (with schwa insertion) are more frequent in Bruges relative to taps. Secondly, Bruges speakers realise these items more often *without* schwa-insertion; and in such cases, they often have a fricative realisation of *r*.

3.4.3 Ghent

Uvular *r* speakers form the majority in Ghent, but there are 6 speakers (out of 42) who categorically realise *r* as alveolar, and 11 speakers use both places of articulation (of which 3 are dominantly alveolar). In a sense, it is the mirror image of Amsterdam, which shows dominance of alveolar *r*, a minority of uvular *r* speakers, and a relatively large group of 'mixing' speakers (see 3.4.5 below). The focus of this section will be on the uvular *r* speakers. Mirroring the treatment of the uvular *r* speakers in the previous two sections, in this case the *alveolar* speakers' patterns are very similar to those in Bruges and, especially, Antwerp, and do not warrant further discussion, due to their low number.

The overview across all contexts in Table 3-31 shows that the voiced trills are in a relatively small minority among the uvular r tokens, although they are used at least once by the large majority of speakers, mirroring the case of voiced alveolar trills in Antwerp and Bruges. Another notable thing is that uvular fricative variants, either with or without trilling, make up almost half of all r tokens in Ghent.

3.4.3.1 Index scores: social factors

The social factors sex and age do not show any significant differences when it comes to consonantality or schwa-insertion, nor for the retroflex/bunched approximant. The retroflex/bunched approximant occurs exactly once, and can therefore not yield any interpretable results. Place of articulation also shows no effects for either social factor. The fact that there is no age effect for place of articulation suggests that uvular *r* is not an innovation so recent that it shows in an apparent-time study like this. Tops (2009) finds the same in her study of *r* in central Ghent, although she does find such age effects in its suburbs and neighbouring towns. She concludes that uvular *r* is still spreading geographically outward from Ghent, but has become so general in the city centre that differences between the generations have been obliterated (see also Taeldeman 1985). On the other hand, uvular *r* is not general in the sense that there is no variation: in the *HEMA* data, 17 Ghent speakers realise some *r* as alveolar, and 6 speakers have categorical alveolar *r*. This, too, is mirrored by Tops's (2009) results, as she finds more variation (i.e. more alveolar *r*) in the city centre than in suburban Ghent. Other social factors (such as class) may be at the heart of this variation, but neither Tops's methodology nor that of the *HEMA* corpus were able to take this into account. What both studies make clear, however, is that the situation regarding place of articulation is a relatively stable one for the current cohort of speakers.

Table 3-31 Token frequency and number of speakers of *r*-variants in Ghent. All contexts (*N*=2205), all Ghent speakers (*N*=42).

descriptive label	*token frequency*		*number of speakers*	
	n	*%*	*n*	*%*
uvular trill	276	12.5	30	71.4
uvular fricative trill	503	22.8	33	78.6
uvular fricative	455	20.6	35	83.3
uvular approximant	409	18.5	33	78.6
voiced alveolar trill	56	2.5	12	28.6
alveolar tap	247	11.2	15	35.7
voiced alveolar fricative	41	1.9	12	28.6
alveolar approximant	9	0.4	6	14.3
partially devoiced alveolar trill	9	0.4	4	9.5
voiceless alveolar trill	27	1.2	8	19.0
alveolar trill/tap w/frication	103	4.7	13	31.0
voiceless tap	48	2.2	11	26.2
voiceless alveolar fricative	10	0.5	4	9.5
palatal glide	2	0.1	1	2.4
retroflex/bunched approximant	1	0.0	1	2.4
central vowel	5	0.2	3	7.1
r-elision	4	0.2	3	7.1

3.4.3.2 Index scores: the effects of syllable position

There are no effects of position for place of articulation in Ghent. Syllable position is significant for the consonantality index, however ($F(1.94,73.7)=25.79$, $p<.001$, $\eta_p^2=.404$, Greenhouse-Geisser corrected): all four syllable positions are significantly different from one another in this respect, with means of 87.2 (intervocalic), 90.9 (onset), 93.8 (schwa-insertion) and 98.0 (coda). The index score for schwa-insertion shows significant effects for position as well ($F(3,114)=31.62$, $p<.001$, $\eta_p^2=.454$). The scores in Ghent are the lowest of all the cities in the corpus: 21.0 in the schwa-insertion context, 0.9 in the coda context (and 0.0 in the onset contexts). This means that schwa-insertion takes place in only about 1 in 5 possible instances. Finally, there are no positional effects for the retroflex/bunched approximant, which has only a single token in Ghent.

3.4.3.3 *Onsets*

As is clear from Table 3-32, uvular trills and approximants are the most frequent *r* variants in onsets, making up over half of the tokens here. Approximants, especially, are more frequent intervocalically than in word onsets, whereas the uvular fricative variants show the opposite pattern.

Table 3-32 Token frequency of *r* variants in word-initial (*n*=668) and intervocalic onsets (*n*=414) in Ghent. No. of speakers: 42.

descriptive label	*word onset*		*intervocalic*	
	n	%	*n*	%
uvular trill	146	21.9	99	23.9
uvular fricative trill	95	14.2	31	7.5
uvular fricative	80	12.0	21	5.1
uvular approximant	181	27.1	151	36.5
voiced alveolar trill	28	4.2	6	1.4
alveolar tap	118	17.7	83	20.0
voiced alveolar fricative	18	2.7	18	4.3
alveolar approximant	2	0.3	4	1.0
r-elision			1	0.2
total	668	100	414	100

3.4.3.4 *Codas*

Word-final and pre-coronal codas for uvular *r* speakers in Ghent are characterised by the dominance of (voiceless) fricative variants. Trilled and non-trilled fricatives are represented almost equally in the data. The distribution over contexts of trilled and non-trilled uvular fricatives is further discussed in Chapter 4.

Finally, a look at the schwa-insertion context reveals the major difference between Ghent and the other Flemish cities (see especially the also uvular *r*-dominant Hasselt). Schwa-insertion is the exception in Ghent, whereas in the other Flemish urban accents it is the norm (see section 3.3.3.4). The most frequent realisations of /r/ in this context for uvular *r* speakers in Ghent are non-trilled fricatives, whereas in Hasselt, for instance, approximants and voiced trills are much more frequent. In other words, in Ghent the schwa-insertion context behaves more like the other coda context (in which fricative variants also dominate), whereas in Hasselt (and the alveolar *r* cities of Bruges and Antwerp) it more closely resembles the intervocalic onset context (in which taps and approximants dominate).

Table 3-33 Token frequency of *r* variants in coda (*n*=788) and schwa-insertion context (*n*=335) in Ghent. No. of speakers: 42.

descriptive label	*coda*		*schwa-ins*	
	n	%	*n*	%
uvular trill	13	1.6	18	5.4
uvular fricative trill	284	36.0	93	27.8
uvular fricative	270	34.3	84	25.1
uvular approximant	27	3.4	50	14.9
voiced alveolar trill	8	1.0	14	4.2
alveolar tap	7	0.9	39	11.6
voiced alveolar fricative	2	0.3	3	0.9
alveolar approximant	2	0.3	1	0.3
partially devoiced alveolar trill	7	0.9	2	0.6
voiceless alveolar trill	20	2.5	7	2.1
alveolar trill/tap w/frication	98	12.4	5	1.5
voiceless alv tap	33	4.2	15	4.4
voiceless alveolar fricative	10	1.3		
palatal glide	1	0.1	1	0.3
retroflex/bunched approximant	1	0.1		
schwa	3	0.4	2	0.6
r-elision	2	0.3	1	0.3
total	788	100	335	100

3.4.4 Hasselt

Uvular *r* speakers constitute the majority in Hasselt, though there are 14 (out of 40) speakers who have categorical alveolar *r*. The number of speakers who mix both places of articulation is four (of which two are dominantly alveolar, and the other two are basically uvular *r* speakers with a single alveolar *r* token each). This differentiates Hasselt from Ghent: there, 11 speakers are ‘mixing’, and only four of those are dominantly uvular.

Hasselt, in other words, has a rather stable speaker pattern for place of articulation of *r*: there is a (roughly) 65-35 division between uvular and alveolar *r* speakers, and very little in-between. As with Ghent, the focus of this section will be on the uvular *r* speakers, for reasons discussed above.

Table 3-34 Token frequency and number of speakers of *r*-variants in Hasselt. All contexts (*N*=2101), all Hasselt speakers (*N*=40).

descriptive label	*token frequency*		*number of speakers*	
	n	%	*n*	%
uvular trill	354	16.8	25	62.5
uvular fricative trill	367	17.5	26	65.0
uvular fricative	329	15.7	26	65.0
uvular approximant	296	14.1	26	65.0
voiced alveolar trill	98	4.7	15	37.5
alveolar tap	341	16.2	16	40.0
voiced alveolar fricative	51	2.4	13	32.5
alveolar approximant	38	1.8	12	30.0
partially devoiced alveolar trill	1	0.0	1	2.5
voiceless alveolar trill	10	0.5	8	20.0
alveolar trill/tap w/frication	145	6.9	15	37.5
voiceless tap	50	2.4	15	37.5
voiceless alveolar fricative	19	0.9	10	25.0
r-elision	2	0.1	2	5.0

What is immediately apparent is that all of the uvular variants occur in roughly equal numbers across all contexts, and that almost all uvular *r* speakers use all of them. Among the alveolar *r* speakers, taps are dominant.

3.4.4.1 Social factors

There is an effect of age on the index scores for place of articulation: younger speakers have a considerably higher score (81.6) than older speakers (46.0). This difference is significant ($F(1,36)=6.25$, $p=.017$, $\eta_p^2=.148$). The index scores per social group are in Table 3-35. This suggests that a change is underway towards uvular variants of *r* in Hasselt, with more alveolar *r* speakers among the older age group, and more uvular *r* among the younger speakers.

Table 3-35 Index scores for place of articulation.

	men	women	all
young	73.2	90.0	81.6
old	51.9	40.0	46.0
all	62.6	65.0	63.8

The index scores for consonantality and schwa-insertion show no significant effects, and that for the retroflex/bunched approximant is not relevant, as there are no such realisations of *r* in the data for Hasselt.

3.4.4.2 Index scores: the effects of syllable position

Place of articulation shows no significant effects of syllable position in Hasselt, while consonantality does ($F(2.23,80.4)=13.32$, $p<.001$, $\eta_p^2=.270$, Greenhouse-Geisser corrected). Here, it is the coda position which is significantly different from all other positions: the coda has a higher score for consonantality (98.6) than the other contexts (onset: 93.5, intervocalic: 91.7, schwa-insertion: 90.8), although, as in the other Flemish cities, scores are consistently high.

Schwa-insertion index scores also differ significantly across contexts, as is to be expected ($F(3,108)=863.11$, $p<.001$, $\eta_p^2=.960$). The score for schwa-insertion in the schwa-insertion context itself is 87.5, whereas that in the word-final coda context is 0.5 (and onsets are 0.0). The retroflex/bunched approximant does not occur in Hasselt.

3.4.4.3 Onsets

Table 3-36 shows that trills, followed by approximants, are the most frequent uvular *r* variants in onsets. There are relatively few differences between the two onset contexts; the uvular fricative trill is less frequent in intervocalic position than in word-initial onsets, while voiced uvular trills are somewhat more frequent there.

Table 3-36 Token frequency of *r* variants in word-initial (n=635) and intervocalic (n=390) onsets in Hasselt. No. of speakers: 40.

descriptive label	*word onset*		*intervocalic*	
	n	%	*n*	%
uvular trill	145	22.8	110	28.2
uvular fricative trill	94	14.8	24	6.2
uvular fricative	54	8.5	37	9.5
uvular approximant	115	18.1	77	19.7
voiced alveolar trill	43	6.8	11	2.8
alveolar tap	149	23.5	93	23.8
voiced alveolar fricative	25	3.9	20	5.1
voiceless (post)alveolar fricative	1	0.2		
alveolar approximant	9	1.4	18	4.6
total	635	100	390	100

3.4.4.4 Codas

While there is a larger group of alveolar *r* speakers in Hasselt, which has its impact on how the numbers in the table work out, the distribution of coda *r* variants is roughly similar to that in Ghent. For uvular *r* speakers, (voiceless) fricative variants are dominant in word-final position and word-final clusters of /r/ + coronal obstruent. Trilled and non-trilled fricatives are represented in largely equal numbers in the data.

Finally, a look at the schwa-insertion context shows that in Hasselt (where, contrary to Ghent, schwa-insertion is the norm for most speakers), uvular trills and approximants are roughly equally frequent realisations of /r/ in this context, while in

Ghent these were clearly outnumbered by fricative variants. This suggests that when schwa-insertion applies, it creates an onset-like context, so that onset variants of *r* are realised here, whereas in the absence of schwa-insertion, the context is more like a word-final coda cluster, and the variants that appear are similar to those used in other codas. Chapter 6 contains a closer look at schwa-insertion, with a comparison between various accents.

Table 3-37 Token frequency of *r* variants in coda (*n*=758) and schwa-insertion context (*n*=318) in Hasselt. No. of speakers: 40.

descriptive label	*coda*		*schwa-ins*	
	n	%	*n*	%
uvular trill	26	3.4	73	23.0
uvular fricative trill	231	30.5	18	5.7
uvular fricative	213	28.1	25	7.9
uvular approximant	21	2.8	83	26.1
voiced alveolar trill	19	2.5	25	7.9
alveolar tap	13	1.7	86	27.0
voiced alveolar fricative	3	0.4	3	0.9
alveolar approximant	6	0.8	5	1.6
partially devoiced alveolar trill	1	0.1		
voiceless alveolar trill	10	1.3		
alveolar trill/tap w/frication	145	19.1		
voiceless tap	50	6.6		
voiceless alveolar fricative	18	2.4		
r-elision	2	0.3		
total	758	100	318	100

3.4.5 Amsterdam

The most frequent *r*-variants in Amsterdam are the voiced alveolar tap and the retroflex/bunched approximant, which together make up over 50% of all *r*-tokens. Table 3-38 reveals that *r* in Amsterdam is predominantly alveolar, with the frequency of both uvular and vocalic variants at just below 20% each.

3.4.5.1 Index scores: social factors

The index scores for place of articulation, consonantality, use of the retroflex/bunched approximant and schwa-insertion show no significant effects for social factors in Amsterdam.

3.4.5.2 Index scores: the effects of syllable position

The index score for place of articulation shows no effect of syllable position in Amsterdam. There is, however, an effect of syllable position on the index score for consonantality ($F(2.07,74.5)=44.11$, $p<.001$, $\eta_p^2=.551$, Greenhouse-Geisser corrected). The *r*-variants in onsets (index scores of 92.1 for the word onset and 90.1 for the intervocalic onset) are more consonantal than those in the schwa-insertion context (82.0), and these are all more consonantal than those in the coda (64.0). This illustrates a major difference between Amsterdam (and, as will be shown below, the other Dutch cities in the corpus) on the one hand, and the Flemish cities on the other. In the Flemish cities the general pattern was one of trills and taps in onsets, and voiceless and/or fricative variants of these in codas; in Amsterdam, the onset is not very different, but the low consonantality score for codas reflects that, in addition to fricatives, approximant and vocalic variants are frequent in this context.

Table 3-38 Token frequency and number of speakers of *r*-variants in Amsterdam. All contexts (*N*=2071), all speakers (*N*=40).

descriptive label	*token frequency*		*number of speakers*	
	n	*%*	*n*	*%*
uvular trill	159	7.7	13	32.5
uvular fricative trill	19	0.9	6	15.0
uvular fricative	13	0.6	6	15.0
uvular approximant	207	10.0	14	35.0
voiced alveolar trill	131	6.3	22	55.0
voiced alveolar tap	760	36.7	31	77.5
voiced alveolar fricative	19	0.9	12	30.0
alveolar approximant	159	7.7	26	65.0
partially devoiced alveolar trill	17	0.8	8	20.0
voiceless alveolar trill	29	1.4	11	27.5
alveolar trill/tap w/frication	71	3.4	19	47.5
voiceless alveolar tap	70	3.4	24	60.0
voiceless alveolar fricative	6	0.3	4	10.0
retroflex/bunched approximant	375	18.1	31	77.5
schwa	6	0.3	5	12.5
r-elision with cons retraction	11	0.5	7	17.5
r-elision	19	0.9	10	25.0

The score for schwa-insertion differs significantly over contexts, as elsewhere ($F(3,108)=218.91$, $p<.001$, $\eta_p^2=.859$). In Amsterdam, schwa-insertion in the eponymous context is fairly frequent, as shown by a score of 80.2, whereas it is infrequent in the coda context (5.0) and absent from the others (0.0). The index score for the retroflex/bunched approximant also shows strong effects of syllable position ($F(1.69,60.7)=35.97$, $p<.001$, $\eta_p^2=.500$, Greenhouse-Geisser corrected). The word onset (0.3) and intervocalic (0.7) positions are not significantly different from each other, while the schwa-insertion (18.4) and coda contexts (41.7) are significantly different from all other contexts. The retroflex/bunched approximant is clearly mostly a coda phenomenon. The following two sections describe the patterning of *r*-variants in the four syllable contexts in more detail.

3.4.5.3 Onsets

Table 3-39 is an overview of the onset variants in Amsterdam, calculated over all speakers (therefore collapsing the three identified patterns). Voiced alveolar *r* variants form the main realisation in onsets, accounting for over 70% of the tokens in the data; these are overwhelmingly alveolar taps. Voiced uvular *r* variants (approximants and trills) are a significant minority in onsets.

Table 3-39 Token frequency of *r* variants in word-initial (*n*=622) and intervocalic (*n*=386) onsets in Amsterdam. No. of speakers: 40.

descriptive label	*word onset*		*intervocalic*	
	n	%	*n*	%
uvular trill	60	9.6	41	10.5
uvular fricative trill	9	1.4	2	0.5
uvular fricative	3	0.5	2	0.5
uvular approximant	95	15.3	61	15.6
voiced alveolar trill	74	11.9	15	3.8
alveolar tap	323	51.9	211	53.8
voiced alveolar fricative	11	1.8	4	1.0
alveolar approximant	43	6.9	47	12.0
retroflex/bunched approximant	2	0.3	3	0.8
r-elision	2	0.3		
total	622	100	386	100

Not taking the individual *r*-tokens but the speakers as a starting point, it transpires that 62.5% (25 out of 40) of the Amsterdam speakers use apico-alveolar variants in onsets. 20% use uvulars, and the remaining 17.5% alternate between the two places of articulation.

Most common among the alveolar variants is the alveolar tap (53.0% of all onset realisations in the Amsterdam data, 72.7% of all apico-alveolar ones), which, as in other cities, is preceded by a short vocoid element (or vocalic/approximant phase) in word-initial onsets. In other words, the tap is almost always (in 95.9% of all cases) phonetically intervocalic. Trill realisations are a minority – as is the case in each of the urban accents studied here – accounting for no more than 8.8% of all /r/ realisations in Amsterdam.

The Amsterdam uvular *r* speakers pattern somewhat differently from those in other cities, as fricative realisations are marginal (5.9% of all uvular realisations in onset). Fricative *r* is more common with uvular *r* speakers from the Flemish cities, as well as those of, for instance, Utrecht and Rotterdam, to be discussed below.

3.4.5.4 *Codas*

Table 3-40 Token frequency of *r* variants in coda (*n*=747) and schwa-insertion context (*n*=316) in Amsterdam. No. of speakers: 40.

descriptive label	*coda*		*schwa-ins*	
	n	*%*	*n*	*%*
uvular trill	35	4.7	23	7.3
uvular fricative trill	8	1.1		
uvular fricative	8	1.1		
uvular approximant	18	2.4	33	10.4
voiced alveolar trill	29	3.9	13	4.1
voiced alveolar tap	54	7.2	172	54.4
voiced alveolar fricative	4	0.5		
alveolar approximant	55	7.4	14	4.4
partially devoiced alveolar trill	16	2.1	1	0.3
voiceless alveolar trill	29	3.9		
alveolar trill/tap w/frication	71	9.5		
voiceless alv tap	70	9.4		
voiceless alveolar fricative	6	0.8		
retroflex/bunched approximant	310	41.5	60	19.0
schwa	6	0.8		
r-elision with cons retraction	11	1.5		
r-elision	17	2.3		
total	747	100	316	100

In codas, the retroflex/bunched approximant is the most frequent realisation of /r/ (over 40%). This realisation is common with both uvular *r* and alveolar *r* speakers. Amsterdam speakers with uvular *r* in onsets in fact have a retroflex/bunched approximant in coda in 59% of all their coda tokens, but many speakers with alveolar *r* in onsets realise the majority of their coda *r* as a consonantal alveolar variant. Many of these speakers alternate between these two types of variants in their realisations of coda *r*. However, speaker-by-speaker examination of the Amsterdam data suggests that most speakers in fact have a clear preference for one or the other. This is not explored here in further detail; the distribution of *r*-variants over contexts and speakers is the topic of Chapters 4 and 5.

3.4.6 Rotterdam

Table 3-41 presents an overview of the *r*-variants found in Rotterdam.

Table 3-41 Token frequency and number of speakers of *r*-variants in Rotterdam. All contexts (*N*=2243), all Rotterdam speakers (*N*=43).

descriptive label	*token frequency*		*number of speakers*	
	n	%	*n*	%
uvular trill	344	15.3	21	48.8
uvular fricative trill	40	1.8	14	32.6
uvular fricative	46	2.1	18	41.9
uvular approximant	198	8.8	23	53.5
voiced alveolar trill	111	4.9	24	55.8
voiced alveolar tap	552	24.6	26	60.5
voiced alveolar fricative	6	0.3	5	11.6
alveolar approximant	93	4.1	19	44.2
partially devoiced alveolar trill	4	0.2	2	4.7
alveolar trill/tap w/frication	6	0.3	3	7.0
voiceless tap	10	0.4	4	9.3
voiceless alveolar fricative	1	0.0	1	2.3
palatal glide	106	4.7	27	62.8
retroflex/bunched approximant	533	23.8	41	95.3
central vowel	90	4.0	31	72.1
mid front vowel	31	1.4	15	34.9
low vowel	2	0.1	2	4.7
r-elision with cons retraction	6	0.3	5	11.6
r-elision	64	2.9	25	58.1

In Rotterdam, the voiced alveolar tap just edges out the retroflex/bunched approximant as the most frequent variant. Other alveolar variants are relatively infrequent. Uvular variants make up around 28% of all tokens, while there is also a relatively large number of vocalic variant tokens: apart from the retroflex/bunched approximant, these include palatal glides and central and front vowels. Rotterdam is otherwise noteworthy for running almost the complete gamut of variation found in the Dutch *r* data overall.

3.4.6.1 Social factors

The index score for place of articulation shows no significant effects of age or sex. The score for consonantality shows scores of 65.8 for younger and 70.7 for older speakers, respectively (i.e. younger speakers have fewer consonantal variants), but this difference is not significant. These scores are likely, however, to be related to those for the use of the retroflex/bunched approximant, which do in fact show very strong age and sex effects. Younger speakers are more than twice as likely to realise /r/ as a retroflex/bunched approximant than older speakers ($F(1,39)=20.91$, $p<.001$, $\eta_p^2=.349$), and women use this variant almost twice as much as men ($F(1,39)=7.43$, $p=.010$, $\eta_p^2=.160$). The relevant index scores are in Table 3-42.

Table 3-42 Index scores for the retroflex/bunched approximant in Rotterdam (sex and age groups).

	men	women	all
young	21.0	39.1	32.0
old	11.7	16.6	13.9
all	15.9	30.3	23.6

Another index score that is likely to be related to the use of the retroflex/bunched approximant is that for schwa-insertion, as this process rarely coincides with the appearance of the variant (see Chapter 5 for more detail on the phonetics of the retroflex/bunched approximant, and Chapter 6 for a discussion of schwa-insertion). The index score for schwa-insertion shows an effect of age, with that of older speakers close to maximum scores, and that of younger speakers below 50. This effect is significant ($F(1,39)=12.93$, $p=.001$, $\eta_p^2=.249$). The scores for age and sex groups are in Table 3-43.

Table 3-43 Index scores for schwa-insertion in Rotterdam (sex and age groups).

	men	women	all
young	55.6	42.0	47.3
old	95.3	84.7	90.5
all	77.4	58.7	67.4

3.4.6.2 *Index scores: the effects of syllable position*

The index scores for place of articulation show no effects of syllable position. There is an effect of syllable position on the index scores for consonantality ($F(1.72,66.90)=177.73$, $p<.001$, $\eta_p^2=.820$, Greenhouse-Geisser corrected) and a significant interaction of syllable position with speaker age ($F(1.72,66.90)=8.17$, $p=.001$, $\eta_p^2=.173$). As in Amsterdam, the schwa-insertion and coda contexts are significantly different from all other contexts, while the two onset contexts are not significantly different from each other. Consonantality is high in the onset contexts (index scores of 93.4 and 91.3 respectively), lower in the schwa-insertion context (74.7), and lower still in codas (31.7). The interaction with speaker age is especially apparent in the schwa-insertion context, where the score for older speakers is almost as high as that in onset contexts (85.8), whereas that for younger speakers is considerably lower (63.6).

As elsewhere, the schwa-insertion index scores differ significantly between syllable contexts ($F(3,117)=144.07$, $p<.001$, $\eta_p^2=.787$), and there is again a significant interaction between syllable position and age ($F(3,117)=12.47$, $p=.001$, $\eta_p^2=.242$). Unsurprisingly, the schwa-insertion score is highest for the schwa-insertion context (69.4), while there is a very low score in the coda context (1.0) (onset contexts are 0.0). The interaction with age repeats the results reported under 0: older speakers have a much larger proportion of schwas (score: 90.0) than younger speakers (48.8) in the schwa-insertion context, while they differ very little in the other contexts.

Finally, the scores for use of the retroflex/bunched approximant show a significant effect of syllable position ($F(1.87,72.98)=52.01$, $p<.001$, $\eta_p^2=.571$, Greenhouse-Geisser corrected), and significant interactions of position with sex

($F(1.87,70.98)=4.50$, $p=.016$, $\eta_p^2=.103$, Greenhouse-Geisser corrected) and age ($F(1.87,70.98)=9.66$, $p<.001$, $\eta_p^2=.197$, Greenhouse-Geisser corrected). The score is highest in codas (49.4), lower in the schwa-insertion context (26.5), and minimal in the two onset contexts (0.8 and 0.7). The interactions show higher scores for women and younger speakers than for men and older speakers, respectively in the two coda contexts (while in onsets they are similarly low). In addition, older speakers have a much larger difference between the index scores for the schwa-insertion context and the coda, whereas for younger speakers they are more similar. In other words, younger speakers more often treat the schwa-insertion context as simply another coda context, where they do not insert schwa, and realise /r/ similarly to other coda contexts.

The following two sections will take a closer look at the variants used in the four syllable contexts, revealing a strongly dichotomous pattern of allophony across speakers. In onsets, the numbers of alveolar and uvular *r* speakers – as well as the numbers of alveolar and uvular *r* tokens – are almost equal (53% alveolar, 47% uvular for the tokens). In codas, however, these two subgroups converge to a considerable degree: for both, the large majority of coda realisations are approximant and vocalic variants, while consonantal variants are sporadic and highly speaker-specific. Moreover, the most frequent of these approximant variants are the same for both groups (retroflex/bunched and palatal approximants), thus converging in place, as well as in manner, of articulation.

3.4.6.3 Onsets

Table 3-44 Token frequencies of *r* variants in word-initial (*n*=672) and intervocalic onsets (*n*=425) in Rotterdam. No. of speakers: 43.

descriptive label	*word onset*		*intervocalic*	
	n	%	*n*	%
uvular trill	179	26.6	102	24.0
uvular fricative trill	29	4.3	8	1.9
uvular fricative	25	3.7	12	2.8
uvular approximant	85	12.6	70	16.5
voiced alveolar trill	69	10.3	22	5.2
alveolar tap	245	36.5	177	41.6
voiced alveolar fricative	4	0.6		
alveolar approximant	30	4.5	31	7.3
retroflex/bunched approximant	5	0.7	3	0.7
r-elision	1	0.1		
total	672	100	425	100

Table 3-44 shows the relative frequencies of onset *r* variants in Rotterdam. Trills and approximants are the most frequent uvular realisations; fricative variants are relatively rare. As is the case in Amsterdam, a tap articulation is by far the most frequent of the alveolar variants. The table somewhat obscures the fact that, while a clear majority of speakers consistently realises /r/ as either alveolar or uvular, there is also a group (6 out of the 43 speakers) who vary between both places of articulation; this may even be the case in two tokens of the same word during the two elicitation tasks.

3.4.6.4 Codas

The relatively large amount of uniformity in codas is interesting given the division of speakers into almost non-overlapping groups observed in onset contexts. Over 75% of the coda tokens concern retroflex/bunched approximants, palatal approximants and central vowel realisations. A minority of consonantal realisations is also present; in these cases, speakers adhere to the main place of articulation they use for their onset *r*.

Table 3-45 Token frequencies of *r* variants in coda (*n*=803) and schwa-insertion (*n*=343) contexts in Rotterdam. No. of speakers: 43.

descriptive label	*coda*		*schwa-ins*	
	n	%	n	%
uvular trill	19	2.4	44	12.8
uvular fricative trill	1	0.1	2	0.6
uvular fricative	5	0.6	4	1.2
uvular approximant	12	1.5	31	9.0
voiced alveolar trill	5	0.6	15	4.4
alveolar tap	10	1.2	120	35.0
voiced alveolar fricative	2	0.2		
alveolar approximant	17	2.1	15	4.4
partially devoiced alveolar trill	4	0.5		
alveolar trill/tap w/frication	6	0.7		
voiceless tap	10	1.2		
voiceless alveolar fricative	1	0.1		
palatal glide	99	12.3	7	2.0
retroflex/bunched approximant	423	52.7	102	29.7
schwa	87	10.8	3	0.9
mid front vowel	31	3.9		
low vowel	2	0.2		
r-elision with cons retraction	6	0.7		
r-elision	63	7.8		
total	803	100	343	100

In around two thirds of the tokens for the schwa-insertion context items in Rotterdam, the potential schwa is indeed present. The percentage of speakers that actually consistently realise schwa in these contexts is in fact lower: 51% (22 of the 43 speakers). 21% consistently realise /r/ in this context as an approximant or vocalic variant, and do not insert schwa. 28% of speakers vary between the two options. Alveolar *r* speakers have more cases of schwa-insertion (and a consonantal *r* realisation, mainly the alveolar tap), compared to uvular *r* speakers, who realise the relevant items without schwa-insertion and an approximant or vocalic variant of *r*.

3.4.7 Utrecht

The main *r*-pattern in Utrecht Dutch is one of uvular variants in onsets (mainly approximants and trills), combined with the retroflex/bunched approximant in coda. Many speakers with this general pattern also have a number of uvular, often fricative, coda realisations.

Table 3-46 Token frequency and number of speakers of *r* variants in Utrecht. All contexts (*N*=2083), all Utrecht speakers (*N*=40).

descriptive label	*token frequency*		*number of speakers*	
	n	%	*n*	%
uvular trill	483	23.2	32	80.0
uvular fricative trill	59	2.8	22	55.0
uvular fricative	106	5.1	24	60.0
uvular approximant	526	25.3	33	82.5
voiced alveolar trill	21	1.0	7	17.5
alveolar tap	197	9.5	13	32.5
voiced alveolar fricative	8	0.4	3	7.5
alveolar approximant	61	2.9	9	22.5
partially devoiced alveolar trill	3	0.1	3	7.5
voiceless alveolar trill	6	0.3	2	5.0
alveolar trill/tap w/frication	15	0.7	6	15.0
voiceless tap	21	1.0	5	12.5
voiceless alveolar fricative	1	0.0	1	2.5
retroflex/bunched approximant	425	20.4	39	97.5
palatal glide	5	0.2	4	10.0
schwa	57	2.7	19	47.5
mid front vowel	6	0.3	3	7.5
low vowel	5	0.2	4	10.0
r-elision with cons retraction	26	1.2	17	42.5
r-elision	52	2.5	19	47.5

A minority of speakers (15%) have alveolar variants in onsets (mainly taps), and a mix of retroflex/bunched approximants and alveolar consonantal variants in codas. There are 8 speakers who vacillate between both main places of articulation for onset *r*, but these are different from the ‘mixing’ speakers in Amsterdam, Rotterdam and Leiden, in that they are predominantly either alveolar (1) or uvular (7) speakers, with only one or two tokens at the other place of articulation, rather than freely mixing the two in sometimes almost 50/50 proportions, as is the case for these other accents. An overview of Utrecht *r*-variants in all contexts is in Table 3-46.

3.4.7.1 Index scores: social factors

There are significant differences between men and women in their index scores for place of articulation ($F(1,36)=4.68$, $p=.037$, $\eta_p^2=.115$), with the mean score for men at 60.9, and that for women 81.5 (the overall score for Utrecht is 71.2). The score for the men is brought down by the six speakers without any uvular *r*-realisations at all, as these are all men. There is only one woman with predominantly alveolar realisations of *r*; she is one of the nine 'mixing' speakers (speakers that have both alveolar and uvular realisations among their *r* tokens), the other eight of which (four women, four men) all have predominantly uvular realisations, only a few alveolar ones, and vocalic (neither alveolar nor uvular) ones in coda positions.

The differences in place of articulation scores *within* age groups are large, obliterating any between-group effects. For instance, despite a large difference in mean index scores for place between older (65.3) and younger speakers (77.7), there is no main effect of age, presumably due to the large standard deviations (34.2 and 24.8, respectively).

The index scores for consonantality and use of the retroflex/bunched approximant do not differ significantly between men and women, nor between older and younger speakers. The same is true for the index score for schwa-insertion (while the difference in average between men and women is large (77.5 vs. 92.4), this is non-significant, probably due to the large standard deviation for men (38.8)).

3.4.7.2 Index scores: the effects of syllable position

The index score for place of articulation shows an effect of syllable position ($F(1.63,58.8)=32.08$, $p<.001$, $\eta_p^2=.741$, Greenhouse-Geisser corrected). The score for coda position (54.3) is significantly different from the two onset positions (word onset: 80.9, intervocalic: 82.3) and the schwa-insertion context (75.5), while the latter three are not significantly different from each other. In other words, place of articulation of *r* in the coda positions is significantly less back than that in the other contexts, which most likely reflects the occurrence of more consonantal variants in the onset and schwa-insertion contexts (since the majority of these consonantal variants are uvular) versus the more vocalic ones in codas. This is corroborated by the effect of syllable position on the index scores for consonantality ($F(1.92,69.3)=80.70$, $p<.001$, $\eta_p^2=.692$, Greenhouse-Geisser corrected), with a slightly more complex picture: coda position (44.0) is significantly different from all other positions, but while the schwa-insertion context (78.6) is not significantly different from the intervocalic onset context (85.0), and the two onset contexts are not significantly different from each other, the schwa-insertion context is significantly different from the word-initial onset context (86.2).

The index for schwa-insertion shows the expected positional effects ($F(3,108)=305.55$, $p<.001$, $\eta_p^2=.895$). There is schwa-insertion in the expected context (84.9), and only to a very limited degree in the coda (1.7) (onset contexts 0.0). Finally, the retroflex/bunched approximant index score shows syllable position effects ($F(1.95,70.1)=57.78$, $p<.001$, $\eta_p^2=.616$). Here, the coda context (score: 52.6) is significantly different from all others (scores close to zero in onsets, and 10.7 for the schwa-insertion context, which is non-significantly different from the onset contexts). Of course, the positional effects found with the index scores for consonantality, schwa-insertion and use of the retroflex/bunched approximant are not independent of each other: in the coda context, specifically, retroflex/bunched approximants abound (as section 3.4.7.4 will illustrate), which also leads to low scores on consonantality and schwa-insertion (as the approximant rarely occurs with schwa). The following two sections show how all index scores translate into the variants used within the four major syllable contexts.

3.4.7.3 Onsets

Uvular variants are dominant, with trill and approximant realisations most frequent. Alveolar variants (mostly taps) are mainly restricted to a minority of 6 out of the 40 Utrecht speakers. See Table 3-47 for details.

Table 3-47 Token frequencies of *r* variants in word-initial (*n*=630) and intervocalic (*n*=392) onsets in Utrecht. No. of speakers: 40.

descriptive label	*word onset*		*intervocalic*	
	n	%	*n*	%
uvular trill	220	34.9	150	38.3
uvular fricative trill	34	5.4	4	1.0
uvular fricative	25	4.0	11	2.8
uvular approximant	220	34.9	155	39.5
voiced alveolar trill	15	2.4	1	0.3
alveolar tap	86	13.7	48	12.2
voiced alveolar fricative	4	0.6	2	0.5
alveolar approximant	19	3.0	20	5.1
retroflex/bunched approximant	1	0.2	1	0.3
r-elision	6	1.0	0	0.0
total	630	100	392	100

3.4.7.4 Codas

The majority of /r/ realisations in coda position are approximants and vowels, of which the retroflex/bunched approximant is by far the most frequent. Utrecht shows some diversity, however, with consonantal realisations for both alveolar and uvular *r* speakers adding up to 28% of the coda *r* tokens. An overview of coda variants in Utrecht is in Table 3-48.

The schwa-insertion context shows the largest differences between Utrecht and the other Western cities where uvular *r* is dominant: instead of the retroflex/bunched approximant, in Utrecht uvular and alveolar consonantal variants

– with concurrent [ə]-insertion – dominate. In other words, schwa-insertion appears to have a stronger position in Utrecht, blocking the appearance of the retroflex/bunched approximant in this context.

Table 3-48 Token frequencies of Utrecht *r*-variants in coda (*n*=746) and schwa-insertion (*n*=315) contexts. Number of speakers: 40.

descriptive label	*coda*		*schwa-ins*	
	n	%	*n*	%
uvular trill	29	3.9	84	26.7
uvular fricative trill	17	1.9	4	1.3
uvular fricative	61	8.2	9	2.9
uvular approximant	28	3.8	123	39.0
voiced alveolar trill	3	0.4	2	0.6
alveolar tap	12	1.6	51	16.2
voiced alveolar fricative	2	0.3	0	0.0
alveolar approximant	15	2.0	7	2.2
partially devoiced alveolar trill	3	0.4	0	0.0
voiceless alveolar trill	6	0.8	0	0.0
alveolar trill/tap w/frication	15	2.0	0	0.0
voiceless tap	21	2.8	0	0.0
voiceless alveolar fricative	1	0.1	0	0.0
retroflex/bunched approximant	388	52.0	35	11.1
palatal glide	5	0.7	0	0.0
schwa	57	7.6	0	0.0
mid front vowel	6	0.8	0	0.0
low vowel	5	0.7	0	0.0
r-elision with cons retraction	26	3.5	0	0.0
r-elision	46	6.2	0	0.0
total	746	100	315	100

3.4.8 Leiden

The main pattern in Leiden is similar to that of Utrecht: uvular variants in onsets (trills, approximants and fricatives) combine with vocalic variants in coda (overwhelmingly the retroflex/bunched approximant). The differences are in the details: onset approximants are less frequent in Leiden than in Utrecht, while fricatives are more frequent; there is a much smaller minority of uvular consonantal realisations in codas in Leiden than in Utrecht. There is a small minority (7%) of speakers with alveolar variants in onsets, and eight speakers out of 42 have both alveolar and uvular realisations (three of which are predominantly uvular, one alveolar, and four show no strong preference for either).

Table 3-49 Token frequency and number of speakers of *r*-variants in Leiden. All contexts (*N*=2084), all speakers (*N*=42).

descriptive label	*token frequency*		*number of speakers*	
	n	%	*n*	%
uvular trill	431	20.7	33	78.6
uvular fricative trill	81	3.9	30	71.4
uvular fricative	181	8.7	35	83.3
uvular approximant	256	12.3	37	88.1
voiced alveolar trill	43	2.1	6	14.3
alveolar tap	168	8.1	13	31.0
voiced alveolar fricative	6	0.3	4	9.5
alveolar approximant	42	2.0	12	28.6
partially devoiced alveolar trill	2	0.1	1	2.4
voiceless alveolar trill	1	0.0	1	2.4
alveolar trill/tap w/frication	9	0.4	2	4.8
voiceless tap	13	0.6	2	4.8
voiceless alveolar fricative	1	0.0	1	2.4
retroflex/bunched approximant	793	38.1	41	97.6
palatal glide	3	0.1	3	7.1
schwa	14	0.7	10	23.8
mid front vowel	2	0.0	2	4.8
r-elision with cons retraction	3	0.1	3	7.1
r-elision	36	1.7	24	57.1

3.4.8.1 *Social factors*

The index score for place of articulation shows no significant differences for sex and age. While the averages for men vs. women, and especially for younger vs. older speakers differ widely, the standard deviations are too high.

Table 3-50 Index scores for consonantality in Leiden (sex and age groups).

	men	women	all
young	62.0	65.4	63.6
old	63.2	73.8	69.2
all	62.6	70.4	66.7

The index score for consonantality shows significant differences between younger and older speakers (*F*(1,38)=6.42, *p*=.016), as well as between men and women (*F*(1,38)=7.16, *p*=.011). Older speakers (69.2) and women (70.4) have more consonantal variants than younger (63.6) and male speakers (62.6). It appears, then, that men are here ahead in a change toward more vocalic variants.

The index score for use of the retroflex/bunched approximant shows a similar age-related pattern, with younger speakers scoring higher (22.0) than older speakers

(16.0). The difference is significant ($F(1,38)=17.54$, $p<.001$, $\eta_p^2=.316$). There is no effect of sex, however.

Table 3-51 Index scores for the retroflex/bunched approximant in Leiden (sex and age groups).

	men	women	all
young	44.3	44.4	44.4
old	34.5	31.5	32.8
all	39.4	36.8	38.0

A very clear age-related pattern is shown by the index for schwa-insertion in Leiden; whereas older speakers have a score of 72.0, younger speakers clearly favour no schwa-insertion, with a score of 21.9. This difference is significant ($F(1,41)=27.90$, $p<.001$, $\eta_p^2=.423$). This age effects of schwa-insertion and the incidence of the retroflex/bunched approximant are no doubt related, as it was in the case of Utrecht (see also the next section on syllable position effects).

Table 3-52 Index scores for schwa-insertion in Leiden (sex and age groups).

	men	women	all
young	13.3	31.4	21.9
old	78.6	66.9	72.0
all	46.0	52.4	49.3

3.4.8.2 Index scores: the effects of syllable position

The index score for place of articulation shows an effect of syllable position in Leiden ($F(2.18,82.8)=50.12$, $p<.001$, $\eta_p^2=.569$, Greenhouse-Geisser corrected). The two onset contexts are significantly different from the two coda contexts, with higher scores indicating more back variants in onsets (word onset: 84.2, intervocalic: 84.4) than in the schwa-insertion (57.7) and coda (48.8) contexts.

Syllable position is also significant when it comes to the scores for consonantality ($F(2.14,81.29)=156.61$, $p<.001$, $\eta_p^2=.805$, Greenhouse-Geisser corrected), and there is a significant interaction of position with age ($F(2.14,81.29)=15.00$, $p<.001$, $\eta_p^2=.283$). As in the other accents where syllable position affects consonantality, the two onset contexts are not significantly different from each other, while the two coda contexts are significantly different from all others. In Leiden, too, the onset contexts show high scores reflecting mostly consonantal variants (word onset: 88.8, intervocalic: 87.1), whereas the schwa-insertion context has a lower score (62.9), and that of the coda context is lower still (37.5), reflecting the use of more vocalic variants. The interaction of position and age shows that for older speakers, the score for the schwa-insertion context is closer to that of the onset positions (77.5), whereas for younger speakers it patterns with the coda context (48.2). That is, older speakers use more consonantal variants in the schwa-insertion position.

The score for schwa-insertion itself shows the expected contextual effects ($F(3,114)=97.21$, $p<.001$, $\eta_p^2=.719$). Schwa-insertion after *r* occurs in the eponymous context (47.6), hardly in coda context (0.8) and not at all in onsets (0.0). Equally unsurprising, given the results in section 3.4.8.1, is that there is an interaction between position and age ($F(3,114)=27.01$, $p<.001$, $\eta_p^2=.415$), which shows that in the schwa-insertion context, older speakers have a significantly higher score for schwa-insertion (72.7) than young speakers (22.4), while they are non-distinct in other contexts.

Finally, the index score for the retroflex/bunched approximant shows similar effects for syllable position in Leiden as in the other Netherlandic Dutch accents ($F(1.85,70.16)=202.67$, $p<.001$, $\eta_p^2=.842$, Greenhouse-Geisser corrected). Scores for the two onset contexts are 1.8 and 2.4, respectively, whereas higher scores are found in the schwa-insertion context (46.2) and the coda context (85.2), and they are both significantly different from all other contexts. For this index, too, there is a significant interaction between position and speaker age ($F(1.85,70.16)=20.90$, $p<.001$, $\eta_p^2=.355$, Greenhouse-Geisser corrected). Similar to the situation for consonantality, for many older speakers the schwa-insertion context is similar to the two onset contexts, whereas younger speakers treat the schwa-insertion context more on a par with the coda: the index scores for the schwa-insertion context and coda are 20.3 and 78.7, respectively, for the older speakers, while those for the young speakers are 72.1 and 91.7.

As is the case in Utrecht, the relationship between the use of the retroflex/bunched approximant and the presence or absence of schwa-insertion is illustrated by the interaction between the effect of syllable position and age on these two index scores (and that of consonantality). Whereas older speakers have retroflex/bunched approximants in the word-final and coronal consonant coda contexts, they overwhelmingly realise /r/ in the schwa-insertion context with a consonantal *r* (uvular trills and approximants, or alveolar taps) and with schwa-insertion. Younger speakers, on the other hand, treat the coda and schwa-insertion contexts alike, and have more vocalic variants (mostly the retroflex/bunched approximant) in both (generally without schwa-insertion).

3.4.8.3 Onsets

Table 3-53 presents an overview of the variants used in onsets in Leiden. The situation in onsets in Leiden is similar to that in Utrecht: in both cities, there is a majority of around 80% uvular *r* realisations. Within this category, fricative realisations are more common in Leiden, whereas uvular approximant *r* is more frequent in Utrecht. Another difference is the somewhat higher number of retroflex/bunched approximants in onsets in Leiden. While this may seem to conform to expectations, as this is a stereotypical *r*-realisation in Leiden (see chapter 2), it is impossible to draw any conclusions from the 20 onset tokens found here. While use of the retroflex/bunched approximant in onsets may be a salient and oft-imitated feature of Leiden speech, there is a dearth of systematic research into its prevalence, and it is unclear in what way it is bound up with more vernacular, non-standard speech forms, or with social class (Wortel 2002). The *HEMA* data target urban-accented Standard Dutch, rather than a non-standard city vernacular, and it may be more common in the latter. That said, a small-scale study by Borger et al. (2012) which specifically examines this variant in vernacular Leiden Dutch finds effects of age that suggest its use may be disappearing. While there are too few tokens here for any meaningful statistics, the urban accent data are consistent with this study: 15 of the 20 retroflex/bunched approximants in onsets occur with older speakers.

Table 3-53 Token frequencies of *r* variants in word-initial (*n*=632) and intervocalic (*n*=384) onsets. No. of speakers: 42.

variant	*word onset*		*intervocalic*	
	n	%	*n*	%
uvular trill	242	38.3	131	34.1
uvular fricative trill	57	9.0	18	4.7
uvular fricative	87	13.8	62	16.1
uvular approximant	114	18.0	102	26.6
voiced alveolar trill	12	1.9	6	1.6
alveolar tap	74	11.7	44	11.5
voiced alveolar fricative	5	0.8		
alveolar approximant	13	2.1	12	3.1
retroflex/bunched approximant	11	1.7	9	2.3
r-elision	17	2.7		
total	632	100	384	100

3.4.8.4 Codas

The majority of /r/ realisations in coda position are approximants and vowels. In Leiden, the retroflex/bunched approximant makes up well over 80% of all coda /r/ realisations. Uvular fricatives and central vowels are much less frequent in this context than in the otherwise comparable Utrecht variety.

Some Leiden speakers (6 out of 42) do not distinguish the schwa-insertion context from the coda context when it comes to *r*: the retroflex/bunched approximant is the categorically employed realisation, without schwa insertions taking place. These are invariably younger speakers. For most Leiden speakers, however, retroflex/bunched approximants and other vocalic variants are optional realisations of /r/ in this context, and they alternate between these (without schwa-insertion) and consonantal uvular or alveolar variants (trills, approximants, taps) *with* schwa-insertion.

Table 3-54 Token frequencies of Leiden *r*-variants in coda (*n*=751) and schwa-insertion context (*n*=317). No. of speakers: 42.

descriptive label	*coda*		*schwa-ins*	
	n	%	*n*	%
uvular trill	7	0.9	51	16.1
uvular fricative trill	1	0.1	5	1.6
uvular fricative	16	2.1	16	5.0
uvular approximant	3	0.4	37	11.7
voiced alveolar trill	16	2.1	9	2.8
alveolar tap	2	0.3	48	15.1
voiced alveolar fricative	1	0.1		
alveolar approximant	8	1.1	9	2.8
partially devoiced alveolar trill	2	0.3		
voiceless alveolar trill	1	0.1		
alveolar trill/tap w/frication	9	1.2		
voiceless tap	13	1.7		
voiceless alveolar fricative	1	0.1		
retroflex/bunched approximant	631	84.0	142	44.8
palatal glide	3	0.4		
schwa	14	1.9		
mid front vowel	1	0.1		
r-elision with cons retraction	3	0.4		
r-elision	19	2.5		
total	751	100	317	100

3.4.9 The Hague

The distribution of *r* variants in The Hague has a striking level of uniformity: the number of different variants used is smaller here than in any of the other cities in the corpus. Also, the differences between speakers are smaller than anywhere else. All speakers have exclusively or almost exclusively uvular variants in onset positions, and either exclusively retroflex/bunched approximants and similar vocalic variants in coda, or a large majority of these plus a minority of uvular consonantal variants.

Table 3-55 Token frequency and number of speakers of *r*-variants in The Hague. All contexts (*N*=1878), all The Hague speakers (*N*=36).

descriptive label	token frequency		number of speakers	
	n	%	*n*	%
uvular trill	434	23.1	35	97.2
uvular fricative trill	31	1.7	14	38.9
uvular fricative	203	10.8	33	91.7
uvular approximant	419	22.3	35	97.2
alveolar approximant	1	0.1	1	2.8
voiced alveolar trill	1	0.1	1	2.8
voiceless tap	1	0.1	1	2.8
retroflex/bunched approximant	658	35.0	35	97.2
palatal glide	11	0.6	7	19.4
schwa	40	2.1	20	55.6
mid front vowel	7	0.4	5	13.9
low vowel	12	0.6	7	19.4
r-elision with cons retraction	4	0.2	4	11.1
r-elision	56	3.0	25	69.4

3.4.9.1 *Social factors*

The index for place of articulation is uniformly high in The Hague, reflecting the many uvular realisations. However, there are significant differences between younger and older speakers, as well as between men and women, even though the differences are small. Since there are almost no alveolar realisations in The Hague, the variants pulling the index down are the vocalic and approximant ones, which are weighted as 50 in the index. Scores are lower for younger speakers ($F(1,32)=19.93$, $p<.001$, $\eta_p^2=.384$) and for women ($F(1,32)=20.11$, $p<.001$, $\eta_p^2=.386$). In other words, in The Hague, younger speakers and women use fewer uvular variants, not relative to alveolar variants (these are virtually absent), but relative to approximant and vocalic ones. There is no significant interaction between sex and age. The index scores for the four social groups are in Table 3-56.

Table 3-56 Index scores for place of articulation in The Hague (sex and age).

	men	women	all
young	79.2	75.2	77.4
old	89.1	79.1	82.9
all	82.7	77.3	79.8

Consonantality shows no significant effects in The Hague for sex and age. However, use of the retroflex/bunched approximant does: effects for both age ($F(1,32)=17.58$, $p<.001$, $\eta_p^2=.355$) and sex ($F(1,32)=16.81$, $p<.001$, $\eta_p^2=.344$) are significant; the relevant scores are in Table 3-57.

Table 3-57 Index scores for retroflex/bunched approximant in The Hague (sex and age).

	men	women	all
young	37.1	47.9	42.0
old	13.3	33.3	25.8
all	28.7	40.2	34.8

Finally, the index score for schwa-insertion also shows significant effects for sex and age; older speakers are more likely to realise the schwa-insertion items with schwa than younger speakers ($F(1,32)=5.65$, $p=.024$, $\eta_p^2=.150$) and men have more schwa-insertion than women ($F(1,32)=14.43$, $p=.001$, $\eta_p^2=.311$). The scores for each social group are in Table 3-58.

Table 3-58 Index scores for schwa-insertion in The Hague (sex and age).

	men	women	all
young	55.7	11.1	35.6
old	91.7	37.1	57.6
all	68.4	24.8	45.4

3.4.9.2 Index scores: the effects of syllable position

The index for place of articulation shows an effect of syllable position ($F(1.28,40.8)=151.12$, $p<.001$, $\eta_p^2=.825$, Greenhouse-Geisser corrected), as well as significant interactions of position with age ($F(1.28,40.8)=6.54$, $p=.009$, $\eta_p^2=.170$, Greenhouse-Geisser corrected) and sex ($F(1.28,40.8)=11.68$, $p=.001$, $\eta_p^2=.267$, Greenhouse-Geisser corrected). The two onset contexts (word onset: 99.8, intervocalic: 99.6) are significantly different from the two coda contexts (schwa-insertion context: 74.4, coda: 57.0), i.e., there are more back variants in the onset context vis-à-vis the coda contexts. The interactions show that these positional effects are stronger for women than for men and much stronger for younger than for older speakers. While the index scores for the two onset contexts are close to 100 in all cases – reflecting all back (uvular) variants – those for the schwa-insertion and coda context are 86.8 and 61.3 respectively for men, but 62.1 and 52.8 for women; and while they are 82.8 and 62.8 for older speakers, they are 66.1 and 51.3 for younger speakers. In other words, for men the schwa-insertion context is much closer to their onset contexts in terms of place of articulation, while for women it patterns with the coda context (and the schwa-insertion context has even fewer back variants than the word-final coda). In addition, while there is no difference between younger and older speakers in the two onset contexts, younger speakers have significantly lower scores in the two coda contexts.

There are also positional effects for the consonantality index ($F(1.86,59.59)=134.16$, $p<.001$, $\eta_p^2=.807$), as well as interactions of syllable position with age ($F(1.86,59.59)=3.49$, $p=.040$, $\eta_p^2=.098$) and with sex ($F(1.86,59.59)=9.44$, $p<.001$, $\eta_p^2=.228$), and these are in similar directions to those for place of articulation. That is, the two onset contexts are significantly different from the two coda contexts, which are also significantly different from one another. The scores in the onset contexts are high (word onsets: 87.3, intervocalic: 83.9), indicating more consonantal variants; those in the schwa-insertion context (54.1) and coda context

(36.5) are lower. These positional effects are stronger for women than for men, and stronger for young speakers than for older speakers. The much lower scores for women and young speakers in the schwa-insertion and coda contexts suggest a much higher incidence of vocalic variants, including the retroflex/bunched approximant.

The index scores for schwa-insertion complement the picture emerging from the previous two scores. While the positional effects per se are not very interesting (there is of course a main effect of position: $F(3,96)=56.19$, $p<.001$, $\eta_p^2=.637$), the interactions with age and sex point in the same direction as those for place of articulation and consonantality. The age effect ($F(3,96)=5.69$, $p=.001$, $\eta_p^2=.151$) and the sex effect ($F(3,96)=14.40$, $p<.001$, $\eta_p^2=.310$) show more schwa-insertion for men than for women, and more for older speakers than for the younger ones.

Finally, the index score for the retroflex/bunched approximant also shows a significant effect of syllable position ($F(1.34,42.86)=112.44$, $p<.001$, $\eta_p^2=.778$), as well as significant interactions of position with age ($F(1.34,42.86)=10.71$, $p=.001$, $\eta_p^2=.251$) and sex ($F(1.34,42.86)=12.33$, $p<.001$, $\eta_p^2=.278$). As in the other Dutch cities, the onset contexts pattern together with scores close to zero, while scores are higher for the schwa-insertion context (48.7) and the coda context (70.2). The interactions show that these effects are stronger for women (specifically, the schwa-insertion context is more distinct from the onset contexts than for men), and for young speakers (with simply higher scores in both the schwa-insertion and word-final coda context, while those in the onset contexts are uniformly low).

The positional effects (and their interactions with social factors) for all these index scores point to the same pattern which is visible in the The Hague data: speakers overwhelmingly use uvular *r* variants in onsets (both word-initial and intervocalic), while in codas they use a mix of uvular consonantal variants and more vocalic ones, especially the retroflex/bunched approximant. The degree to which they use these vocalic variants, and the degree to which they generalise this to the schwa-insertion context, is largely determined by the factors of sex and age. The following section examines these patterns in more detail, as the individual variants used in the four syllable contexts are discussed.

Table 3-59 Token frequencies of *r* variants in word-initial (n=562) and intervocalic (n=352) onsets in The Hague. No. of speakers: 36.

descriptive label	*word onset*		*intervocalic*	
	n	%	n	%
uvular trill	274	48.8	123	34.9
uvular fricative trill	17	3.0	4	1.1
uvular fricative	104	18.5	61	17.3
uvular approximant	139	24.7	162	46.0
voiced alveolar trill	1	0.2		
retroflex/bunched approximant			2	0.6
r-elision	27	4.8		
total	562	100	352	100

3.4.9.3 Onsets

The onset variants used in The Hague are in Table 3-59. Only 3.3% (30 tokens) of the realisations in onsets are other than consonantal uvular *r* variants, and the voiced uvular trill and uvular approximant together make up over 75% of all onset /r/ realisations. In fact, even 27 out of the 30 other realisations could be classed as uvular: these concern instances of coalescence between /x/ and /r/ in the items *schrift* /sxrɪft/ as [sχɪft] and *gras* /ɣrɑs/ as [χɑs] (see Sebregts 2004a). The remaining three non-uvular *r*-tokens are a single alveolar trill and two retroflex/bunched approximants.

3.4.9.4 Codas

A little more variation than in onsets is found in codas in The Hague; however, the retroflex/bunched approximant alone makes up just under 75% of the coda realisations of /r/ in The Hague.

Table 3-60 Token frequencies of *r* variants in coda (*n*=677) and schwa-insertion (*n*=287) contexts. No. of speakers: 36.

variant	*coda*		*schwa-ins*	
	n	%	*n*	%
uvular trill	19	2.8	18	6.3
uvular fricative trill	8	1.2	2	0.7
uvular fricative	19	2.8	19	6.6
uvular approximant	28	4.1	90	31.4
alveolar approximant	1	0.1		
voiceless tap	1	0.1		
retroflex/bunched approximant	500	73.9	156	54.4
palatal glide	11	1.6		
schwa	38	5.6	2	0.7
mid front vowel	7	1.0		
low vowel	12	1.8		
r-elision with cons retraction	4	0.6		
r-elision	29	4.3		
total	677	100	287	100

An interesting observation from a sociolinguistic point of view is that one of the stereotypical vernacular coda realisations of /r/ in The Hague, the low central vowel [ɐ], only occurs in a small minority of cases (1.8%). This may either indicate that this variant is *purely* stereotypical in the sense of the accent's popular image, but in fact not found all that much in current-day The Hague speech, or it simply confirms that the variety tapped into in the urban accent corpus is closer to Standard Dutch as spoken in The Hague, rather than the broad urban vernacular with which this variant is associated.

Finally, in the schwa-insertion context there are two discernable patterns: 50% of the speakers treat the schwa-insertion context as identical to other coda contexts, and have overwhelmingly retroflex/bunched approximants and no schwa insertion, while the other half of the speakers in The Hague have schwa-insertion and the same *r*-variants as they have in onset/intervocalic contexts (i.e. uvular approximants and trills).

3.4.10 Nijmegen

As in The Hague, the general patterning of *r* in Nijmegen Dutch is fairly consistent between speakers, although there is far more intra-speaker variation. For most speakers, uvular variants predominate in onsets, with uvular approximants much more frequent than trills and fricatives. Uvular approximants and fricatives are also frequent in coda positions, but there they alternate with vocalic variants, often in the speech of one and the same speaker. Elision of segmental *r* also occurs in significant numbers in coda position in Nijmegen, more so than in any other urban accent.

Alveolar variants are extremely rare: they account for no more than 20 out of the 2080 tokens (0.96%), and are attributable to four speakers. None of these speakers use alveolar variants exclusively; the speaker with the highest number of apico-alveolar realisations, an older male, produced them for 10 of his 53 *r* tokens (18.9%), against 40 uvular realisations (75.5%).

Table 3-61 Token frequency and number of speakers of *r*-variants in Nijmegen. All contexts (*N*=2080), all Nijmegen speakers (*N*=41).

descriptive label	*token frequency*		*number of speakers*	
	n	%	*n*	%
uvular trill	244	11.7	33	80.5
uvular fricative trill	192	9.2	35	85.4
uvular fricative	210	10.1	37	90.2
uvular approximant	984	47.3	41	100.0
voiced alveolar trill	4	0.2	2	4.9
alveolar tap	9	0.4	3	7.3
voiced alveolar fricative	1	0.0	1	2.4
alveolar approximant	4	0.2	2	4.9
alveolar trill/tap w/frication	2	0.1	1	2.4
retroflex/bunched approximant	154	7.4	27	65.9
palatal glide	14	0.7	8	19.5
schwa	132	6.3	32	78.0
mid front vowel	9	0.4	5	12.2
low vowel	49	2.4	21	51.2
r-elision with cons retraction	16	0.8	10	24.4
r-elision	56	2.7	21	51.2

3.4.10.1 Index scores: social factors

There are no significant sex or age differences for place of articulation in Nijmegen. Both men and women, and both younger and older speakers, have overwhelmingly back (uvular) realisations. Consonantality shows an effect for sex ($F(1,37)=8.58$, $p=.006$, $\eta_p^2=.188$), with female speakers using more consonantal variants (index score 69.4) than men (62.1). See Table 3-62.

Table 3-62 Index scores for consonantality in Nijmegen (sex and age groups).

	men	women	all
young	61.0	69.1	65.3
old	62.9	69.7	66.6
all	62.1	69.4	66.0

The retroflex/bunched approximant is not quite as widespread in Nijmegen as in the other urban accents in the Netherlands, which shows in the low index scores, ranging from 3.5 (older men) to 10.1 (young women). While the pattern is similar to that in the other accents, the scores are too low to show any significant effects. Conversely, the index scores for schwa-insertion are uniformly *high* across all groups; here too, there are no significant effects of sex and age of the speaker.

3.4.10.2 Index scores: the effects of syllable position

There is a significant effect of syllable position on place of articulation in Nijmegen ($F(1.54,56.85)=110.43$, $p<.001$, $\eta_p^2=.749$, Greenhouse-Geisser corrected). While scores are uniformly high in the two onset contexts (both 98.8) and the schwa-insertion context (96.3), the score for the coda context is significantly lower (73.4). A significant interaction between position and age ($F(1.54,56.85)=3.85$, $p=.037$, $\eta_p^2=.094$, Greenhouse-Geisser corrected) shows that this effect is larger with young speakers than with older speakers. That is, while young speakers and older speakers both have high scores (close to 100) for the onset and schwa-insertion contexts, young speakers have a lower score in the coda (68.9) than older speakers (77.8). There is also a main effect of position on the index score for consonantality ($F(1.48,54.91)=97.77$, $p<.001$, $\eta_p^2=.725$). All syllable positions are significantly different from all others, with consonantality scores decreasing from word-initial (82.5) via intervocalic (75.6) and schwa-insertion (71.1) to coda position (43.9). The index scores for schwa-insertion show the expected effects of position ($F(3,111)=1210.43$, $p<.001$, $\eta_p^2=.970$): it is very frequent in the schwa-insertion position (92.4), and infrequent in the coda position (0.7) (and absent from the onset positions). Finally, the index score for the retroflex/bunched approximant shows an effect of syllable position ($F(1.20,44.48)=30.24$, $p<.001$, $\eta_p^2=.450$, Greenhouse-Geisser corrected), with only coda position significantly different from all others. In all positions but the coda, the score is zero or close to zero, while in codas it is 19.9, reflecting the fact that the retroflex/bunched approximant is almost exclusive to the coda (non-schwa-insertion) context in Nijmegen; what is also noteable is that it is not a very frequent variant at all, unlike in the other Dutch cities in the corpus.

3.4.10.3 Onsets

Onset position in Nijmegen (Table 3-63) shows less variation than in most cities, with the exception of The Hague. Speakers vary between uvular trills, fricatives and approximants in onset positions, with approximants by far the most frequent among them.

3.4.10.4 Codas

The coda context shows more variation than the onset context in Nijmegen, as illustrated by Table 3-64. Consonantal uvular variants, as well as a number of different approximant and vocalic variants are all represented in considerable numbers. The question then, as always, is if this variation is brought on by different *speakers* with a relatively consistent use of one or several similar variants, or by different contexts favouring different variants – with all or most speakers showing the same kind of patterned variation. This will be explored in more detail in the following two chapters.

In short, the most striking pattern in the Nijmegen data is clearly not related to place of articulation, but to manner. The great majority of speakers (73%) vary between consonantal (i.e., fricative and trilled) and approximant/vocalic realisations of /r/ in coda positions, instead of using one or the other. There is no speaker who exclusively uses fricative realisations of /r/ in coda position – as is the case with many of the Belgian Dutch speakers.

Table 3-63 Token frequencies of *r* variants in word-initial (*n*=629) and intervocalic (*n*=393) onsets. No. of speakers: N=41.

variant	*word onset*		*intervocalic*	
	n	%	*n*	%
uvular trill	120	19.1	70	17.8
uvular fricative trill	101	16.1	22	5.6
uvular fricative	80	12.7	15	3.8
uvular approximant	319	50.7	281	71.5
voiced alveolar trill	3	0.4		
voiced alveolar tap	2	0.3	3	0.8
voiced alveolar fricative	1	0.2		
alveolar approximant	2	0.3	1	0.3
retroflex/bunched approximant			1	0.3
r-elision	1	0.2		
total	629	100	393	100

Table 3-64 Token frequencies of coda (*n*=744) and schwa-insertion (*n*=314) *r*-variants. No. of speakers: 41.

descriptive label	*coda*		*schwa-ins*	
	n	%	*n*	%
uvular trill	11	1.5	43	13.7
uvular fricative trill	58	7.8	11	3.5
uvular fricative	108	14.5	7	2.2
uvular approximant	148	19.9	236	75.2
voiced alveolar trill			1	0.3
alveolar tap	1	0.1	3	1.0
alveolar approximant	1	0.1		
alveolar trill/tap w/frication	2	0.3		
retroflex/bunched approximant	146	19.6	7	2.2
palatal glide	13	1.7	1	0.3
schwa	129	17.3	3	1.0
mid front vowel	9	1.2		
low vowel	47	6.3	2	0.6
r-elision with cons retraction	16	2.2		
r-elision	55	7.4		
total	744	100	314	100

3.5 Conclusion

This purpose of this chapter was to describe the patterns of *r*-variation found in modern-day colloquial urban Standard Dutch, filling the most prominent gap in our knowledge of Dutch *r*-variation. These patterns were described using a newly-assembled database of *r* tokens from over 400 speakers in 10 speech communities, the *HEMA* corpus or urban accent corpus. Analysis of the urban accent data shows an intricate interaction of factors in all dimensions of language variation. Part of the variation seems to be change in progress: apparent changes are taking place, in the Netherlands (towards the retroflex/bunched approximant in The Hague, Rotterdam, and Leiden) as well as in Flanders (towards devoicing and frication in Antwerp). In Amsterdam, gender differences were shown to be an additional influence in shaping the variation. Furthermore, speaker-internal variation was found to be high. Much of it may be controlled by the linguistic context (certainly in the case of onset vs. coda), in other cases it seemed as if speakers had entirely different variants at their disposal for the realisation of /r/ in what were essentially the same contexts.

Explaining the variation, then, involves a view from several linguistic disciplines. The task is daunting, not least because so many different kinds of variation appear intertwined; describing the inter-dialectal variation seems a logical first step, but many phenomena seem to cut across dialects, while intra-dialectal variation is high, which makes labelling a particular variety as 'having a certain *r* pattern' virtually impossible.

What this overview of the variation does certainly offer, instead of easy explanations as to the why and how of *r*-variation, is a basis to explore the questions posed in Chapter 1, such as what unites the various realisations of /r/, and how they are interrelated. These questions are the topic of the following two chapters, which therefore take a somewhat different viewpoint: instead of taking the ten urban accents as the primitives and describing *r*-variation between and within them as this chapter has done, they concentrate on the variants themselves. Chapters 4 and 5 examine, respectively, the consonantal and the more vocalic *r* variants in terms of their phonetic characteristics, as well as their distribution over contexts, with a view to explaining the latter through the former.

4 *r*-variation: trills, taps and fricatives

The aim of this and the following chapter is to show how the various realisations of /r/ are related to each other, and specifically how the more complex variants are related to the more reduced ones (see section 1.3.3). The argument is that particular variants are expected to occur in certain phonetic environments, by way of general constraints on articulation and aerodynamics. Such predictions based on phonetic theory will be tested against the urban accent data. These two chapters thus establish the phonetic links between the various *r*-sounds in Dutch, and the contexts that condition their occurrence and relative frequency. A further assumption is that an important locus of new variants is that they result from gestural reduction, which is modelled using representations familiar from Articulatory Phonology. The new variants that arise as reductive innovations in turn become production targets themselves, as a consequence of the link between perception and production as modelled in Exemplar approaches such as that of Pierrehumbert (2001). The rise and distribution of some Dutch *r*-variants, however, will prove more difficult (or even impossible) to analyse as *reductive* innovations, and an alternative analysis (still in terms of their phonetic properties) is proposed.

While the main source of evidence for discovering the origins of (sets of) *r*-variants in Dutch will come from the juxtaposition of the distribution of these variants with established phonetic biases driving sound change, additional historical linguistic evidence is adduced where available. The major place variation between alveolar and uvular variants of *r* will be discussed first, in section 4.1. Variation in manner is the topic of the remaining sections, with the current chapter focussing on the consonantal variants, trills and fricatives (4.2) and taps (4.3). Approximant and vocalic variants are the topic of Chapter 5.

4.1 Alveolar and uvular *r* in Dutch

It is generally assumed that Modern Dutch *r* was inherited from its West-Germanic ancestors in the form of a coronal consonant (Schönfeld 1970; Weijnen 1991; Van Reenen 1994). What is meant here by ‘Dutch’ is not Standard Dutch, in which alveolar [r] was indeed the only accepted realisation (in the prescriptive sense) until well into the 20th century (Verstraeten and Van de Velde 2001), but the collection of Low Franconian dialects that diverged from their Germanic neighbours to come to be collectively known as Dutch. What is meant by “originally” is that coronal variants are thought to have historically preceded dorsal ones. Under such a view, uvular [ʀ] in Dutch is an innovative form, although it may not be very recent (whereas its acceptance in Standard Dutch is). There has been some controversy over the question whether the origins of uvular *r* lie completely outside the Dutch language area proper, or whether there has also been an indigenous development of uvular *r*. Since establishing the *origin* of *r*-variants is a crucial task within the framework of this thesis (which attempts to explain the current presence and distribution of *r* variants through their likely diachronic origins), this question is the first to be taken up. The current section will briefly review the distribution of alveolar and uvular *r* in Dutch, a first analysis of which was given in Chapters 2 and 3, before examining the available evidence on the origins of uvular *r* in Dutch. Since the conclusion from that review is that a purely external origin for uvular *r* in Dutch is unlikely, the focus will then turn to questions of the spreading and current distribution of uvular *r* in the Dutch urban accents, before returning to the question of its (internal) origins.

4.1.1 The geographical distribution of alveolar and uvular *r* in Dutch

The data from the two large dialect corpora discussed in Chapter 2, *RND* and *GTRP*, showed that the geographical distribution of uvular vs. alveolar *r* in Dutch dialects displays two patterns: first, uvular *r* in Dutch is a feature of southern and south-eastern dialects; and secondly, uvular *r* is characteristic of the speech of many cities and larger towns, also outside the southern area in which it is general. This picture was argued to be an oversimplification, since it did not show any dialect-internal variation (nor intra-speaker variation, of course), due to the design of the studies on which it was based. The urban dialect data presented in Chapter 3 have shown that the amount of intra-dialectal variation regarding place of articulation is indeed high in many of the dialects. The exceptions are Nijmegen and The Hague, which are – *almost* – homogeneous in terms of (uvular) place of articulation, alveolar variants accounting for only 0.9% and 0.1% of all realisations of /r/ in these dialects, respectively. Even in Bruges and Antwerp, however, where *r* is largely alveolar, uvular variants make up 7.2% and 9.9% of all realisations.

The urban dialect data also made it clear that the amount of intra-speaker variability regarding major place of articulation is in fact very low. Most speakers (84.3%) are entirely consistent when it comes to place of articulation, that is, as far as their *consonantal* realisations of /r/ are concerned; the approximant and vocalic variants that occur exclusively in codas (and almost exclusively in the Netherlands) also exhibit some variation along the front-back dimension, but they cannot be straightforwardly compared to the consonantal variants. For the purposes of examining the distribution of alveolar vs. uvular place of articulation, therefore, the discussion will be limited to the four main consonantal allophones (trill, tap, fricative and approximant) of alveolar and uvular *r* (split into 13 variants as in Table 4-1). See section 3.2.1 and Chapter 5 for arguments for grouping the alveolar and uvular approximants with the consonantal variants.

Table 4-1 Consonantal allophones of alveolar and uvular *r*.

consonantal alveolar variants	*consonantal uvular variants*
voiced alveolar trill	uvular trill
partially devoiced alveolar trill	
voiceless alveolar trill	uvular fricative trill
voiceless alveolar tap/trill w/frication	
voiced (post)alveolar fricative	uvular fricative
voiceless (post)alveolar fricative	
voiced alveolar tap	
voiceless alveolar tap	
alveolar approximant	uvular approximant

Table 4-2 shows the numbers of speakers that realise consonantal *r* either exclusively as alveolar, uvular, or vary between the two places of articulation ('mixing') for each of the cities in the urban accent corpus. Speakers were put in the 'mixing' category if they used both alveolar and uvular realisations, even if there was only a single token in either of the two categories. Although clearly most speakers are consistent with respect to the place of articulation of their (consonantal) realisations of *r*, 15.7% of all speakers in the corpus display variation between the two main places of articulation in at least a single token as compared to the others.

Table 4-2 Number of speakers by place of articulation of consonantal *r*. Calculated over all speakers (*N*=408).

city	*consonantal r*					
	alveolar		*uvular*		*mixing*	
	n	%	*n*	%	*n*	%
Antwerp	35	85.4	2	4.9	4	9.8
Brugge	39	90.7	3	7.0	1	2.3
Ghent	7	16.7	24	57.1	11	26.2
Hasselt	13	32.5	23	57.5	4	10.0
Amsterdam	24	60.0	8	20.0	8	20.0
Rotterdam	19	44.2	16	37.2	8	18.6
Utrecht	6	15.0	25	62.5	9	22.5
Leiden	3	7.1	26	61.9	13	31.0
The Hague	0	0.0	34	94.4	2	5.6
Nijmegen	0	0.0	37	90.2	4	9.8
total	146	35.8	198	48.5	64	15.7

The table mostly confirms what was evident from Chapter 3: that place of articulation (in this case, limited to the alveolar and uvular consonantal variants) is highly dependent on the city accent. On one end of the scale are Antwerp and Bruges with mostly alveolar-*r* speakers, on the other Nijmegen and The Hague with mostly uvular-*r* speakers. None of the accents are entirely homogeneous with respect to place of articulation, however; even in The Hague, which is closest to such a situation, there are speakers with an occasional alveolar *r* realisation.

At first glance, it appears very difficult to find a pattern in the geographical distribution of speakers that vary between alveolar and uvular consonantal variants of *r*. It is, for instance, *not* the case that the largest number of 'mixing' speakers are found in those cities where there are also roughly equal numbers of (exclusively) alveolar and uvular *r* speakers: Hasselt and, especially, Rotterdam are the cities where the numbers of alveolar and uvular *r* speakers are most balanced, but their numbers of mixing speakers are not especially high. Conversely, the highest numbers of mixing speakers are found in Leiden and Ghent, where there are in fact obvious trends towards one of the two places of articulation (uvular in both cases). In these cities, the mixing speakers outnumber the exclusively alveolar *r*-speaking minority. However, it is true that those city accents where the trend towards one of the places of articulation is highest, the numbers of mixing speakers are lowest (though perhaps trivially so).

There are of course other possible explanations for the differing numbers of mixing speakers. A large number of mixing speakers could, for instance, be due to there being a change in progress in a particular urban accent, while a smaller number suggests a more stable situation. However, there were no age effects for place of articulation found in Leiden or Ghent, where the numbers of mixing speakers are highest (see the data in Chapter 3, section 3.4), which makes the idea that a high number of mixing speakers reflects an unstable situation due to a change in progress less plausible. On the other hand, there are significant effects of age for place of articulation in Hasselt, with younger speakers producing more uvular realisation than older speakers. While this may indeed indicate a change in progress, it does not seem related to the number of mixing speakers, which in Hasselt is rather low.

Most importantly, however, the urban accent data are perhaps not sufficient to be able to provide a full answer to this question. The situation is complicated, for instance, by the different sociolinguistic status of place of articulation of *r* in the Netherlands as compared to Flanders: whereas alveolar and uvular *r* have both been considered acceptable in Netherlandic Standard Dutch since the early 20th century, the wholesale acceptability of uvular *r* in Belgian Standard Dutch is of a much more recent date (Van de Velde 1996:126). This makes the question of whether the varying numbers of mixing speakers are a sociolinguistic phenomenon connected to notions of standardness hard to answer, as speakers may vary as to what they consider to be prestige vs. non-prestige variants, or dialectal vs. standard forms. For speakers in the Netherlands, conversely, it is questionable if there even is such a notion regarding alveolar vs. uvular *r*.

There are, therefore, very few conclusions to be drawn from the data on speakers who vary between alveolar and uvular place of articulation. The data suggest that higher numbers of such mixing speakers are *not* an indication of change in progress, and that other factors, such as differing notions of standardness across the accents (perhaps correlated with social class of the speakers, or other factors not included in the design of the urban accent corpus) are needed to explain their geographical distribution.

4.1.2 The linguistic distribution of alveolar and uvular *r* in Dutch

A separate issue related to the intra-speaker variation between alveolar and uvular place of articulation of *r* is the question whether the alveolar and uvular variants are randomly distributed in the speech of the mixing speakers, or if there is an influence of the immediate (preceding or following) segmental context. To this end, place of articulation among mixing speakers was analysed with a series of generalised linear mixed-effects models using the lme4 package (Bates and Maechler 2009) in R (R Development Core Team 2005), version 2.13.1. The response variable was the occurrence of a uvular *r* in an onset, with both speaker and item included as random effects. The only fixed effect included in the final model is that of preceding context. Adding the effect of place of articulation of the following vowel did not significantly improve the fit ($\chi^2(2)=23.65$, $p=.161$). A summary of the model is in Table 4-3.

Table 4-3 Summary of a linear mixed-effects regression predicting the likelihood of a uvular variant in onset position for mixing speakers (AIC=1216). The intercept corresponds to a word-initial labial consonant+*r* cluster. Number of observations = 1600.

Random effects	*Variance*	*Std deviation*	*N*	
Speaker	9.975	3.16	64	
Item	0.067	0.26	14	
Fixed effects	*Estimate*	*Std error*	*z*	*p*
(Intercept)	0.646	0.55	1.17	.242
Preceding context: coronal C	0.664	0.46	1.44	.151
Preceding context: dorsal C	0.369	0.43	0.85	.396
Preceding context: V	0.505	0.41	1.23	.218
Preceding context: #	1.094	0.47	2.35	.019*

What the model shows is that the preceding context has an effect on the place of articulation of *r* among mixing speakers, although it is very small: in absolute word-initial position (#: *riem*, *rok*) uvular variants are found significantly more often ($p=.019$) than in the context of a preceding labial, in which there is a preference (relatively speaking) for alveolar variants. Other pairwise comparisons, however, do not show significant differences. A similar pattern is observed in the coda context. Here too, a model was fitted that predicts the likelihood of a uvular *r* among mixing speakers, with speaker and item included as random effects, and the following context as a fixed effect. A summary of this model is in Table 4-4.

This model includes a random slope for following context within speaker, because it led to a significant improvement in the model fit ($\chi^2(2)=35.45$, $p<.001$). There are no significant main effects of following context (and adding vowel place did not improve the model), which shows that the effect of the following context is subject to individual variation only. In other words, there is no discernable pattern within the coda context to mixing speakers' alveolar vs. uvular realisations with respect to the immediate segmental context. In sum, mixing speakers' use of uvular and alveolar variants of *r* is not significantly influenced by the segmental context, except for the place of articulation of the preceding consonant (or lack thereof) in an onset.

Table 4-4 Summary of a linear mixed-effects regression predicting the likelihood of a uvular variant in coda position for mixing speakers (AIC=802). The intercept corresponds to a word-final *r*+dorsal consonant cluster. Number of observations = 1063.

Random effects	*Variance*	*Std Deviation*	*N*	
speaker	24.521	4.95	64	
-- following context: coronal c	9.644	3.11		
-- following context: labial c	1.620	1.27		
-- following context: #	5.058	2.25		
item	0.317	0.56	14	
Fixed Effects	*Estimate*	*Std Error*	*z*	*p*
(intercept)	-0.086	0.81	-0.11	.915
following context: coronal c	1.299	0.75	1.73	.084
following context: labial c	0.937	0.68	1.38	.169
following context: #	0.845	0.69	1.23	.219

These results are only partly in line with those of Van Reenen's (1994) *GTRP* corpus study (see Chapter 2). Specifically, Van Reenen found more effects of the preceding context on *r*-onsets: as in the results from the urban accent corpus, clusters of /r/ with a preceding labial consonant preferred alveolar *r*, while word-initial singleton /r/ preferred uvular *r* in his study. However, in contrast to the results above, /kr-/ clusters also strongly preferred uvular *r* in the *GTRP* data. Overall, however, the studies converge on finding effects of the preceding context in *r*-onsets on the choice between alveolar and uvular *r*, while finding no effects of the voicing value of the preceding consonant, nor of the place of articulation of the following vowel.

In sum, the immediately preceding phonetic context exerts at least some influence on the selection of alveolar vs. uvular *r* for those speakers who vary between the two places of articulation. However, due to the complex interaction of internal and external factors such as prestige and standard/dialect interference, it is impossible to gauge here what exactly determines the selection process. The focus from Section 4.2 onward will be on the realisational variation in manner, rather than place of articulation of *r*, and the analyses there will use the notions of "alveolar *r* speakers" and "uvular *r* speakers" – these groups include those speakers that realise consonantal *r* *predominantly* as either uvular or alveolar, respectively. The remainder of this section, however, will be devoted to the question of the *origin* of uvular *r* in Dutch. It will first consider the hypothesis that uvular *r* was an innovation from outside the Dutch language area, before examining the possible origins of uvular *r* as a development from an apical alveolar *r*.

4.1.3 Uvular *r* in Germanic as a French import: *Trautmann's hypothesis*

The origin of uvular *r* in the Germanic languages is traditionally assumed to lie outside those languages, being a "fashion" imported from French by members of the cultural and political elite in several northern European countries. Known as *Trautmann's hypothesis* after the Neogrammarian scholar, this account of the source of uvular *r* is also adopted by Trudgill (1974) and, specifically for Dutch, Van Haeringen (1962). The story generally runs as follows. In the early to mid 17th century, a group of upper class Parisian women called *Les Précieuses* innovated uvular *r* as one of many cultivated linguistic affectations, *r* in French having been apical up to that time. Consequently, this articulation gained in prestige, and spread to other members of higher circles, in Paris and other French towns, and later to speakers from the other social circles in these towns. From that point on, it started to spread in two distinct ways. It spread areally, throughout France, into French-speaking Switzerland and Belgium, and into non-French-speaking areas such as south-western Germany. A second spreading route was socially, from higher social circles in France to those in other countries such as Germany, the Netherlands and Denmark – all countries very much under French cultural influence at the time. This type of spreading did not proceed gradually from a geographical point of view, but rather jumped from city to city: uvular *r* thus appeared in Cologne, Berlin, The Hague and Copenhagen well before it reached the surrounding countryside by gradual spreading. Each of these cities in turn became a new centre from which uvular *r* started to spread, both to other social groups in the city and to the surrounding area. The origin of uvular *r* in the Germanic languages, including Dutch, is thus said to lie in the cultural influence that French, a Romance language, had in the 17th and 18th centuries.

This account of the origins and spreading mechanisms is certainly attractive, as it may partly explain the complicated distribution of uvular *r* in Western Europe, connected as it is to notions of prestige and "educated speech" in different ways in different places. In more recent work, however, Trautmann's hypothesis has come under attack as two of its main premises were questioned: first, the plausibility of the absolute origin within the circles of the *Précieuses* (Wollock 1982); and secondly, the assumption that Paris was the one and only source of uvular *r* in Europe (Runge 1974; Wollock 1982; Van Reenen 1994).

The *Précieuses* circle being the origin of uvular *r* in France has been questioned mainly because Trautmann's sole basis for assuming uvular *r* originated with them is the use of the term "parler gras" to describe the speech of a group of such ladies in Chapelle's *Relation d'un Voyage en France* (from 1656, cited in Wollock 1982). Trautmann (1880) unequivocally interprets this phrase as referring to uvular *r*, but, as Wollock (1982) shows citing a number of other sources, the term may have stood for any number of sounds, including [l], [w], [j]/[ʒ] and *r*-deletion. [l], in fact, is cited by most sources as the *Précieuses*' most likely substitution for [r] at the time (e.g. Howell 1986).[17] Wollock shows that Trautmann was far too easily convinced by scanty evidence, especially as many of the sources Wollock cites were available in Trautmann's time. Runge (1974:7-9) argues how the "vehement opposition" to uvular *r* shared by Trautmann and many of his contemporaries in Germany (such as Visscher), which they saw as a foreign threat to the correct, historical Germanic pronunciation of the language, may have coloured their interpretation of the facts. Trautmann's other writings on German *r* confirm this

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[17] Wollock (1982:202) notes that [l] is also a common substitution of apical [r] in children's speech. Cf. Van der Linde (2001).

view, as he refers to the rise of uvular *r* and the concomitant decline of apical *r* as “ein beklagenswerter Verlust für unsere Sprache” (Trautmann 1884:299).

Although the identification of uvular *r* with the *Précieuses* may be seen as jumping to conclusions, Wollock (1982) also cites a large amount of evidence for the general thrust of the story: that a uvular *r* pronunciation gained prestige in upper class speech in France, and consequently spread to French-influenced (and French-speaking) higher circles in other European cities. There is, however, no need to trace these developments back to a small closed circle of socialites. In French, uvular *r* was probably not uncommon at the time of the *Précieuses*, as a regional pronunciation (possibly both in the Provence and the north of France), and as an idiosyncrasy – although in all probability considered a speech defect at the time (Straka 1965). However, it was not until the 19th century, when uvular *r* had become the dominant variant in Standard French, that it began spreading along the ‘social route’. In addition, there is considerable evidence for the claim that uvular *r* arose independently in German around the same time, or even before, it started spreading in France. Runge (1974) mentions several examples, some of which actually brought forward by Trautmann himself, of references to dorsal *r* in pre-1800 literature: the 1672 comedy *Die drei ärgsten Erznarren* by Christian Weise, and later grammar books by Adelung (1777) and Von Kempelen (1791). All of these refer to dorsal pronunciations as “schnarren” (‘to rattle’, sometimes ‘to snore’), and view it as a speech defect rather than an affectation, contradicting the French influence hypothesis. And if Moulton’s (1952) reading of the mystic Böhme is correct, uvular *r* in (Silesian) German may in fact predate the *Précieuses* by a century.[18]

These German data, Wollock (1982) argues, are not at all exceptional: uvular *r* is actually a common independent innovation in many languages that have apical trilled [r]. He mentions as examples Spanish, Russian, Italian, and dialects of English (Northumbria and Carleton, Leicestershire) and Yiddish. Engstrand, Frid and Lindblom (2007) add Czech and Estonian, and also argue for an independent development of dorsal *r* in various languages of Europe. All things considered, it seems clear that Trautmann’s hypothesis is certainly not the full story of the origin and spread of uvular *r* in the Germanic languages, and it should therefore also be considered with caution when approaching the question of how uvular *r* originated in Dutch.

4.1.4 The origin of uvular *r* in Dutch

Van Haeringen (1962) follows Trautmann’s hypothesis completely in his explanation of the origins of uvular *r* in Dutch. For him, uvular *r* was a conscious appropriation of a salient speech feature by those wishing to associate themselves with the then

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[18] Runge (1974) in fact argues for a much earlier dorsal articulation of *r*, claiming that early Proto-Germanic (PGmc) */r/ was velar/uvular. The ancestral apical *r* of the Germanic languages is said by Runge to derive from the rhotacisation of PGmc */z/, with which */r/ subsequently collapses. The more commonly held view is that both PGmc */r/ and */z/ were alveolar, which accounts more straightforwardly for their later merger. Cf. also Denton (2003).

prestigious French culture. These speakers were said to be mostly found in higher social circles in The Hague at the time. From there, the "fashion" spread to other cities (Rotterdam, Delft, Leiden), and to other social groups in The Hague. Amsterdam is said to have resisted the change because of its status as a cultural centre in its own right, not needing the prestige associated with French. However, the spread of dorsal *r* to the cities and towns along the IJssel river in the east of the country (leap-frogging Utrecht) seems a lot harder to explain under the "French influence" hypothesis. The across-the-board use of dorsal *r* in Limburg (including rural areas) probably warrants a different explanation altogether; Van Haeringen speculates that Maastricht may have been the starting point there, but maintains that this too is evidence for a French influence, although possibly via another route than the cities in the west.

Van Reenen (1994:58) considers Trautmann's hypothesis only part of the explanation for the origins of uvular *r* in Dutch. He claims a non-prestigious [ʀ] spread from Germany into the south-eastern dialects (well over 400 years ago, if Damsteegt (1969) correctly interprets 17th century writers De Heuijter and Montanus), advancing slowly north and west from there. In addition, the prestigious uvular *r* was introduced by the upper class in The Hague, around 1700 at the earliest, and spread to other important cities from there (as well as to other social groups in those cities later). If the evidence presented above is correct, and uvular *r* in German arose independently from that of French, the south-eastern Dutch uvular *r* will not be the result of a French influence. This would explain why uvular *r* in the south and south-east of the Netherlands, and the east of Belgium, is not connected to a particular social class or indeed to city speech. Rather, it is a feature of related dialects on both sides of the Dutch/German border.

There is, of course, a third logical possibility: that, much like in German, uvular *r* in Dutch was a local development, arising independently from those in Germany and France. This possibility is examined by Van Bezooijen (2003), who finds evidence for such a claim in Montanus' 1635 *Spreeckonst*, an early description of the pronunciation of Dutch, which describes *r* as a coronal trill, before explicitly referring to the fact that there are other pronunciations possible in Dutch – such as the *kraekletteren*, "creaky letters", used "often by many people", which remind Montanus of the sound of ravens and crows. Van Bezooijen (2003:84) concludes that uvular *r* may well have a long internal tradition in Dutch.

Indeed, there is no a priori reason to assume that the *origin* of uvular *r* in Dutch is entirely exogenous, even if its rapid *spread* in the Netherlands from the early 18th century onward may well find its explanation in an influence from French. It is important, however, to keep the two (origin and spread of a sound change) apart, as well as the arguments from phonetic and phonological evidence from those from historical and sociolinguistic sources. There is a wealth of evidence of spontaneous innovations of uvular *r* from languages in which *r* is (mainly) an apical consonant (see the following section for an overview). On the basis of this cross-linguistic tendency, the mere fact that a coronal (apical) consonantal *r* exists in Dutch dialects predicts that uvular *r* will, from time to time, arise spontaneously in acquisition. It is then a complex of sociolinguistic and phonetic factors that may explain whether such an innovation is regarded as a speech defect, goes completely unnoticed, or in fact gains some prestige within a speech community, and is consequently promoted and spreads. In cases where it either goes unnoticed or becomes prestigious, uvular *r* will be transmitted during first language acquisition, and will start to co-vary within the phonological system. Simulations of the sociolinguistic spreading of sound changes have shown that even a single speaker with the innovative feature in a speech community can be enough for a change to take hold (Baker 2008). It remains to be discussed, however, exactly *why* uvular *r* should spontaneously appear in languages with apical *r* in the first place, and how it can persist into adulthood in the speech of the innovating speakers. Mostly, this seems to rest on the articulatory difficulty associated with apico-alveolar trilled [r], and the perceptual similarity between the voiced uvular trill [ʀ] and the voiced apico-alveolar trill [r]. These two points will be discussed in the following two sections.

4.1.5 The articulatory complexity of apical trills

Trills can be regarded as *difficult* sounds from a number of points of view. They are articulatorily complex: trills require a large amount of precision, as a critical positioning of the articulators is necessary for trilling to occur. Furthermore, apico-alveolar trills need a specific degree of tongue body stiffness. A second complicating factor is in the aerodynamics of trills, on which much more below in relation to fricative variants of *r*. The aerodynamic requirements for trilling and simultaneous voicing define a narrowly constrained space in which trills can be successfully executed (e.g. Solé 2002).

The complexity of trills is evidenced in accounts of acquisition and L2 learning. Along with sibilants, apical trills are the last sounds mastered during acquisition (McGowan 1992:218-219; Vihman 1996). They are also not present at the babbling stage, whereas (the much less common, and hardly ‘simple’) bilabial and (ingressive) uvular trills are (Vihman 1996). For second language learners, trills pose a problem, and even native speakers of languages with apical trills may never be able to “roll their [r]s” (Żygis 2004). Languages in which children are reported to have problems with the acquisition of apical trilled *r* include Czech (Šimáčková 2002), Slovenian (Kocjančič 2004), Russian (Żygis 2004) and Polish (Patrycja Strycharczuk p.c.), Portuguese, Italian (references in Schiller 1998) and Spanish (Diaz-Campos 2008), as well as Swedish (Rūķe-Draviņa 1965:67), Norwegian (Simonsen 2002), and Estonian (Vihman 2002). It is this complexity associated with apical trills that is taken as the basis for the discussion of the many other, “reduced” *r* variants to follow in later sections of this chapter. The relevant point here is that, apart from other substitutions, spontaneous innovations of uvular *r* by individual speakers during language acquisition have been found for *all* of these languages.

The substitution of uvular [ʀ] for apical [r] by individual speakers has in fact long been noted in the literature, although often only anecdotally so. Weijnen (1941) relates from his own experience: although both his parents were apical-*r* speakers, and tried to teach him the apical articulation, he acquired uvular [ʀ]. For Norwegian, Torp (2001:77fn6) cites Larsen’s (1926) comment that “at least about one person in each parish [...] quite spontaneously, without hearing anybody else doing it, uses uvular R, although he knows that his environment considers it an error" (Torp's translation).

Despite the fact that both language acquisition and dialect studies have noted the replacement of apical trills by uvular ones, there is no evidence from experimental phonetic studies that uvular trills are actually easier or simpler in terms of gestural configuration or aerodynamics.[19] Instead of being simpler, it could therefore also be the case that this articulation is simply stumbled upon during language acquisition, and is able to persist into adulthood since, unlike other attested child language substitutions such as [n] or [j], it does not create problems for the system of contrasts. In fact, an explanation along these lines was attempted as far back as 1791, by Von Kempelen:

> since children often cannot conceive of where to produce this difficult consonant, they try various positions of the tongue. Finding one by means of which a similar trembling is produced, they stay with it; and happy even once to have found a "schnarring" sound and to be understood by others, they concern themselves no further about whether there is another *r* or not. (cited in Wollock 1982:217-218)

Although Von Kempelen could not back up his claims by means of language acquisition research to today's standards, this account is not at all implausible. Chapter 5 discusses the variation in articulatory configurations for the Netherlandic Dutch retroflex/bunched approximant, in which highly dissimilar articulations are seen to lead to perceptually similar results. A similar case is that of the innovation of labio-dental *r* in British English (Scobbie 2004; Knight et al. 2007). What is crucial in these accounts is that the different articulations involved are perceptually sufficiently similar for the innovating variant to be acceptable as an instance of the intended category, while they are sufficiently different for the possibility of maintaining a contrast, for instance sociolinguistically. The following section will discuss the degree of similarity among apical and uvular trills.

4.1.6 Acoustic similarity between apical and uvular trills

The most obvious acoustic similarity between apical and uvular trills is that both consist of pulse patterns: vowel-like periods with formant structure interrupted by periods of silence. The trill frequencies are reported to be very similar, between 25 and 33 Hz (Ladefoged et al. 1977; Lindau 1985; Verhoeven 1994; Ladefoged and Maddieson 1996). The trills in the urban accent data are in accordance with these findings, alveolar trills having a trill frequency of 29.7 Hz, with uvular trills at 30.4 Hz (see section 3.2.1.10 and Tops 2009 for more extensive discussion). In addition, there is evidence that other, non-trilled, dorsal *r*-articulations show similarity to other, non-trilled alveolar ones. Engstrand, Frid and Lindblom (2007) show how

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[19] Kostakis (2007) hypothesises that uvular trills have a better trade-off between ease of production and ease of perception: due to the smaller mass of the articulator (uvula vs. tongue tip), uvular trills need a shorter duration to achieve the same number of contacts. Note, however, that the average difference in contacts and duration between uvular and alveolar trills is small (see following section).

relatively front (velar) dorsal approximant *r*s are acoustically similar to alveolar ones (F2 and, especially, F3).

On the other hand, there is also substantial evidence that the acoustic results of the two articulations are usually different enough for them to be perceptually distinguishable. The formant structure of the two trills is not particularly similar, for instance, with uvular trills displaying a much higher third formant. This difference is likely to cue the different place of articulation. More obviously even, despite the many cases of spontaneous innovations of uvular [ʀ], it is still considered a speech defect in many languages in which apical [r] is the norm. In Italian, for example, the term *erre moscia* 'limp/lifeless r' is used to describe any *r* variant that is not an apical trill or tap, including uvular trills (Romano 2013). In fact, uvular *r*, found especially with middle class speakers from the north of Italy, is often a source of ridicule, as a *Google* search of "erre moscia" will testify.[20] Still, the highly similar trill pattern seems to be enough for innovating language learners to persevere with a uvular articulation once it is acquired. This is a situation in fact very similar to that of the innovative labiodental *r* in Southern British English and its sufficiently strong similarity to the labialised lingual approximant standard.

In conclusion, the relationship between alveolar and uvular trills is somewhat different from those between other variants discussed in this chapter and the next. While the latter will be analysed mainly as cases of lenition, or reductive innovations of variants based on other, more constricted variants, there seems little evidence for characterising the former in this way. While there have been attempts to analyse the development from apical to uvular trills as more articulatorily gradual than is generally assumed (Morin 2013), the data presented above do not support a weakening analysis, at least not in the sense of articulatory reduction. It is more likely that uvular trills are a product of their perceptual similarity to apical trills and the articulatory complexity of the latter (see 4.2). Uvular trills arise during acquisition, including in languages where it is a marginal or stigmatised phenomenon, while a direct articulatory relationship is absent. The distributional patterns of uvular and alveolar *r* in urban Dutch among mixing speakers also show no signs of uvular trills being weaker in any way: there are hardly any significant effects of syllable position (or any other factors), and the one that is significant finds uvular trills more often in the typically strong absolute word-initial position.

This allows us to start assembling a diagram such as that in Figure 1-6 by Magnuson, but describing specifically the relationships between *r*-variants in Dutch. In addition to noting the family *resemblance* between apical and uvular trills, it turns out to be possible to characterise their *relationship* as perceptual, and the *origin* of the uvular rhotics as lying in acquisition. This is expressed in Figure 4-1, which not only notes a resemblance, but also makes the nature of the link between the variants explicit. The dashed line between the variants (the alveolar trill on the left and the uvular trill on the right) indicates the *indirect* relationship between the two: the latter is not a direct reduction variant of the former. The relationship is in fact not

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[20] This is especially the case with public figures with uvular or other non-apical *r*, such as the writer Umberto Eco, former industrialist Gianni Agnelli (both born in or near Turin), or politician Silvio Berlusconi (Milan) (Christian Uffmann p.c.).

articulatory, but perceptual (based on the trilling pattern), and arises in acquisition, not as a casual speech process (as most other variants are argued to below). The arrow indicates *directionality*; it therefore predicts that uvular *r* will spontaneously arise as a variant in varieties where an alveolar trill is a major variant of *r*, but not vice versa.

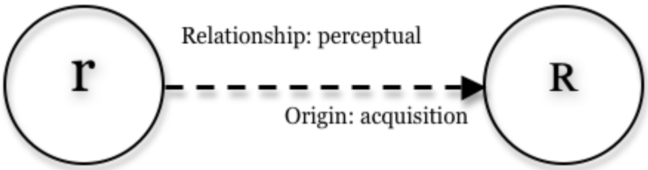

Figure 4-1 The relationship between alveolar trills and uvular trills is perceptual in nature, and arises in acquisition.

This diagram should be seen against the background of the similar ones from Lindau (1985) and Magnuson (2007) (Figures 1-2 and 1-5), and is primarily an expository device detailing diachronic relationships. It is not meant to be a representation of speaker knowledge.

4.2 Trills and fricatives

The data in chapter 3 demonstrate that trills, and sonorant (i.e. non-fricative) trills in particular, are a minority realisation of /r/ in (urban) Dutch, despite their status as the main, canonical, variants in the literature (Cohen et al. 1961; Van den Berg 1974). Among the uvular (consonantal) variants, trills are still relatively frequent: 30.5% of all uvular consonantal *r*-tokens in the data are sonorant trills, and 14.8% are fricative trills. The relative frequency of alveolar trills is much lower: voiced sonorant trills account for 11.5% of all alveolar consonantal *r*-tokens, and 15.7% are (partially) voiceless and/or fricative trills. In this respect, the Dutch *r* data from urban accents appear to be in line with the results from studies on Standard Dutch reported in Chapter 2 (Vieregge and Broeders 1993; Van de Velde 1996), and the claim in Mees and Collins (1982) that trills are a minority realisation of /r/ in spoken Dutch.

Despite the relative minority position of trills, however, the phonetics of trilled *r* (both alveolar and uvular) are in fact instrumental in explaining the origin and the patterning of many of the other, now more frequent, *r*-variants. Specifically, it is precisely the complexity of the trill articulation that is at the heart of the diachronic development of these other variants. Lenition forms, or reductions, of the sonorant trill in casual speech processes may manifest themselves as fricatives, taps, and approximants for various phonetic reasons, and synchronically come to alternate with the more complex forms, which may or may not lead to socially relevant variation. This is not to claim that there is an underlying or ‘hyperform’ trill from which all other variants are synchronically derived, but the phonetic relationships between trilled *r*-phones and the currently more frequent realisations of Dutch *r* explain much of the nature and distribution of those other non-trilled allophones. In this chapter, it is the properties of trilled [r] and [ʀ] that will be shown to explain the origin of the more reduced *r*-sounds. These properties include articulatory, aerodynamic, and perceptual factors.

First, both trills require a large amount of *precision* on the part of the articulators, in order to satisfy the conditions under which trilling is able to occur. For the coronal trill, the tongue tip has to be positioned near or just touching the passive articulator; in addition, the tongue muscles need to be sufficiently relaxed for the tip to be able to vibrate. Although it is the passive articulator (i.e. the uvula) that vibrates in uvular trills, critical positioning and conflicting demands of tensing and laxness are equally important. A second important factor concerns the *aerodynamics* of trilled sounds: specifically, the difference in air pressure behind and in front of the lingual constriction needs to be within a narrow range for the Bernoulli effect to arise. Third, the *perceptual* characteristics of trilled sounds also account for their behaviour in certain contexts. The salient vibratory pattern characteristic of trills can be compromised if simultaneous frication is present.

These phonetic factors are discussed below, in connection with the patterning of *r*-variants in Dutch. Essentially, they form the grounding for *r*'s variability. It should be kept in mind, however, that while there are viable phonetic explanations for the *r*-variants that appear in different contexts, there are clear differences *within* these broadly defined contexts, as well as between dialects, and between speakers of a single dialect as to which variants of *r* appear and in what relative numbers, as is clear from the data in Chapter 3. That is, the relative numbers of particular variants differ from speaker to speaker and from urban accent to urban accent, and social factors are at the heart of these differences. In other words, the appearance of a particular variant in a particular context cannot be said to be only the (automatic) effect of context; other factors, mainly of a sociolinguistic nature, also play their role in explaining the incidence of *r*-variants in Dutch. Some of these were discussed in Chapter 3, and others are discussed in the relevant sections below. This line of argumentation, from phonetic origins to the distribution of variants to external factors, will be followed in all cases to be discussed.

4.2.1 The phonetic properties of trilled *r*

The production aspects of coronal and uvular trills are extensively described in the phonetic literature, such as Catford (1977), Laver (1994), Ladefoged and Maddieson (1996), and Barry (1997). McGowan (1992) describes a model of the mechanics of tongue-tip vibration. All these sources describe trills as involving the vibration of either the tongue tip or the uvula (or, for bilabial trills, the lips, but these will not be an issue here), caused principally by aerodynamic forces. This is in opposition to taps and flaps, which are active muscular movements of the tongue. A trill is not a simple series of taps individually controlled by the tongue muscles (Recasens 1991), but rather the automatic effect of a specific tongue configuration in conjunction with aerodynamic conditions initiating the Bernoulli effect: "[t]he conditions for initiating tongue-tip trilling involve muscle contraction of the tongue to assume the position, shape, and elasticity requirements, and a sufficient pressure difference across the lingual constriction. Once trilling is initiated, tongue-tip vibration is maintained as a self-sustaining vibratory system" (Solé 2002:656). As several authors note, this mechanism is much like vocal cord vibration, also brought on by the Bernouilli effect: air pressure differences between the opposing sides of a constriction trigger the repeated opening and closure of that constriction.

Specifically, tongue-tip trills involve bringing the tongue-tip "into complete closure with the alveolar ridge (or very nearly so), often in a slightly cupped aspect. Contact pressure is relatively light, and oral pressure builds rapidly to the point of forcing its way through the closure. A high speed jet of air escapes through the gap, and a combination of elastic muscle forces and the sucking action of the Bernoulli Effect in the air-jet bring the tongue surface very quickly back into renewed contact. The cycle is then repeated for as long as the stricture and the air supply are maintained" (Laver 1994:219)

For the uvular trill, the sides of the tongue dorsum are lifted, keeping the central part low. This forms a longitudinal groove in which the uvula vibrates under much the same circumstances as described above for the coronal trill. Trill duration and frequency are relatively stable across the two different trill types. 2-3 contacts characterise coronal as well as uvular trills (Lindau 1985; Ladefoged and Maddieson 1996; Tops 2009). During the closure phase, there is no or weak formant energy. During the open (release) phases, a vowel-like formant structure shows up on the spectrogram. Both the alveolar and the uvular trill in Dutch are usually said to exhibit a 'neutral' spectral structure, much like schwa (Kaiser 1928; Verhoeven 1994), and this is also true for the urban accent data. The spectral properties of the open phase may however also resemble that of a following vowel; in this case, the trill is superimposed upon the vowel, as it were, as in the spectrogram of *rok* in Figure 4-2 (repeated from Chapter 3, Fig 3-11).

Ladefoged and Maddieson (1996) find that the closed and open phases of apical trills are on average 25 ms each – so there is one cycle every 50 ms, and 20 cycles per second, or a trill frequency of 20 Hz. Lindau's (1985) average trill frequency of 25 Hz, for which she measured apical trills from Spanish, Standard Swedish, and a variety of Niger-Congo languages, are closer to the results from Dutch. For instance, Tops' (2009) measurements of 56 alveolar trills from speakers in 5 locations in Flanders show an average trill frequency of 29.7 Hz. While Ladefoged et al. (1977) found longer open phases (in other words, a lower trill frequency) for uvular trills than for alveolar trills, most other studies find the opposite: Lindau (1985) reports a higher trill frequency for uvulars (around 30 Hz for her Southern Swedish speakers, compared to the 25 Hz for alveolars, which she explains by reference to the smaller mass of the uvula vis-à-vis the tongue tip. Tops (2009)'s results closely resemble Lindau's, her Belgian Dutch uvular trills having an average trill frequency of 30.4 Hz. Verhoeven (1994), however, found an average of 26 Hz for the uvular trills of (his single speaker of) Limburg Dutch. This is still within the range of Tops's results: one of the speakers in her corpus has an average trill frequency of 24.3 Hz (the full range is 24.3 – 34.4). Tops (2009:110) concludes that the conflicting results of these studies, paired with her own results from Dutch which show no significant difference in frequency, indicate that there is no consistent difference in these respects between the two trills.

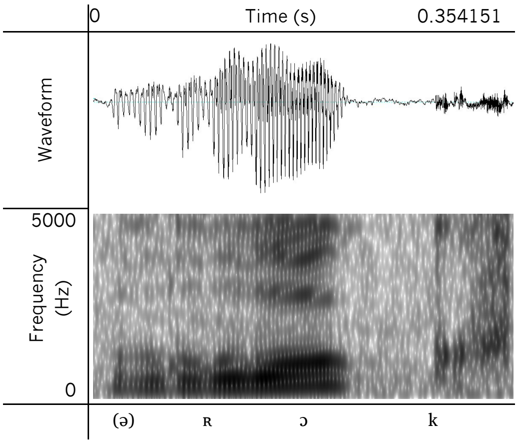

Figure 4-2 Waveform and spectrogram of a voiced uvular trill in the item *rok* /rɔk/, speaker RO29v79. The formant structure of the /ɔ/ is already largely present in the trill phase.

4.2.2 The distribution of trills in urban accents of Dutch

The properties of trills established in the previous sections may already lead to a number of predictions as to where trilled variants of *r* are to be expected to occur most for phonetic reasons. The circumstances most favourable for trilling are likely to be those that allow the relatively slow and precise movements of the tongue necessary for trilling to occur: trills should be more frequent in onsets, relative to codas; they should be more frequent in utterance-initial positions; and they should be more frequent in the context of speech sounds that do not involve gestures antagonistic to those for the trill (e.g. central and low vowels, relative to high front vowels). Sections 4.2.3 and 4.2.4 discuss the articulation and aerodynamics of trill production in more detail, explaining particularly how trill failure may give rise to other variants appearing in certain contexts. This section examines the distribution of trills in the urban accent data, to gauge whether it matches the phonetically-based predictions.

4.2.2.1 Alveolar r

Table 4-5, which shows the absolute and relative numbers of alveolar trills in the data (across all accents) repeats part of Table 3-9 from Chapter 3, but the totals and percentages now refer to all *consonantal alveolar* variants only.

Table 4-5 Token frequency of alveolar trills relative to all alveolar variants in word-initial onsets (*n*=2610), intervocalic onsets (*n*=1617), schwa-insertion context (*n*=1282) and coda (*n*=2362). No. of speakers: 210 (all speakers with alveolar variants).

descriptive label	*word onset*		*intervocalic*		*ə-insertion*		*coda*	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*
vd alveolar trill	424	16.2	108	6.7	175	13.7	199	8.4
partially devcd alv trill	0	0	0	0	4	0.3	114	4.8
vl alveolar trill	0	0	0	0	16	1.2	173	7.3
vl alv trill/tap w/ frictn	0	0	1	0.1	12	0.9	916	38.8
total trills	424	16.2	109	6.7	207	16.1	1402	59.3

Table 4-5 illustrates once more that voiced trills are more frequent in word-initial onsets than intervocalically or in codas (where the schwa-insertion context in fact patterns with onsets; see Chapter 6 for more detail). Voiceless and fricative trills, on the other hand, are largely confined to the coda context. In order to gauge what determines the occurrence of trills among other alveolar variants, a linear mixed-effects model was fitted to the data from predominantly alveolar *r* speakers, i.e. speakers with a majority of alveolar variants in the two onset contexts (henceforth, "alveolar *r* speakers"). Within the onset context, the effects of both the segmental environment (place of articulation of a preceding consonant, place and height of the following vowel) and social factors were considered for inclusion in the model. The eventual model is summarised in Table 4-6.

Table 4-6 Summary of a linear mixed-effects regression predicting the likelihood of a trill in onset position for alveolar *r* speakers. The intercept corresponds to a coronal consonant+*r* cluster before a back vowel for a male speaker. Number of observations = 4114.

Random effects	*Variance*	*Std Deviation*	*N*	
speaker	1.562	1.25	169	
item	0.064	0.25	14	
Fixed Effects	*Estimate*	*Std Error*	*z*	*p*
(intercept)	-2.821	0.36	-7.75	.000***
Preceding context: dorsal C	-0.730	0.33	-2.21	.027*
Preceding context: labial C	0.619	0.44	1.41	.160
Preceding context: V	-0.888	0.32	-2.76	.006**
Preceding context: #	2.047	0.33	6.18	.000***
Vowel place: central	1.358	0.39	3.49	.000***
Vowel place: front	-0.509	0.23	-2.26	.024*
Sex: female	0.673	0.23	2.92	.003**

Adding the effect of vowel height, city, or age of the speaker did not improve the fit of the model, nor did the addition of random slopes within speakers. What the model shows is that there are significant effects of the preceding context and the following vowel on the occurrence of trills among alveolar *r* speakers. Trills are more likely in absolute word-initial position and after a labial consonant, and less likely in intervocalic positions, and after coronal and dorsal consonants. Furthermore, trills are more likely in the context of a central vowel, and less likely in the context of front and back vowels. Finally, there is a significant social factor: female speakers are more likely to realise trills than men.

The linguistic factors in the model are all in line with what would be predicted on the basis of the phonetics. Trills being more frequent in the absolute word-initial position is expected based on the more favourable aerodynamic circumstances for this context. Recall from the descriptions of the trill variants in Chapter 3 that most onset trills are in fact preceded by a brief vocalic element, which will aid the production of a trill. Trills are also more common in the context of central vowels (vis-à-vis front and back vowels), which is expected given the tight articulatory constraints on trill production: both the gestures for front and back vowels are antagonistic to the ideal position for the apical trill (cf. Recasens 1999:81-85). The contexts where trills are less frequent are intervocalically, after dorsal consonants, and before front vowels. Trills are less likely in these contexts for a number of phonetically-motivated reasons, which are discussed in subsequent sections of this chapter; these address the other alveolar variants, fricatives, taps and approximants, explaining why they are more likely to occur there to the detriment of trills. Specifically, taps are found most frequently in intervocalic contexts, and fricatives in the context of high and front vowels – exactly those contexts where trill production is more likely to fail.

The model also shows an effect of sex of the speaker, with more alveolar trill realisations among women than men. This may reflect a greater adherence to norms such as those of standardness (Labov 1972a; Trudgill 1974), perhaps brought on by the task, although the effect is very small, and other age effects (such as those related to consonantality, as discussed in Chapter 3) are insufficient to provide support for this hypothesis.

While the occurrence of trill realisations in onsets is influenced by a number of linguistic and social factors, the model in fact also shows that part of the variance is explained as “random” between-speaker variation. A look at speaker level reveals that there are in fact alveolar *r* speakers who never produce trills, as well as some for whom over 50% of *r* tokens are trills.

Figure 4-3 shows the percentage of trills relative to other alveolar realisations in onsets, per speaker.[21] Speakers are ordered by their number of trill realisations, in ascending order from left to right. The graph shows that around 20% of the 169 predominantly alveolar *r* speakers never produce trills in the onset context, while the two speakers on the right produce trills for up to half of their inset tokens. To some extent, then, the use of trills is speaker-dependent in a way that is not associated with the social factors that are identified in the current study.

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[21] The bars show alveolar variants only. Shorter bars indicate that speakers also use other than alveolar variants in these contexts, despite being predominantly alveolar *r* speakers.

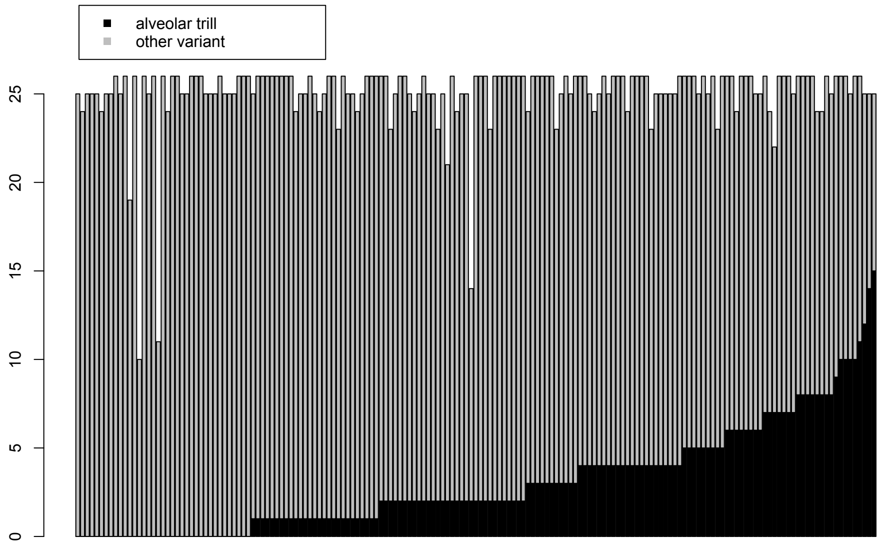

Figure 4-3 Number of trills (black) per speaker, relative to all other alveolar variants in onset items (n=26). All alveolar *r* speakers (n=169), all onset tokens (n=4114).

Table 4-7 Summary of a linear mixed-effects regression predicting the likelihood of a trill in coda position for alveolar *r* speakers. The intercept corresponds to an *r*+coronal consonant cluster for an Antwerp speaker. Number of observations = 4362.

Random effects	*Variance*	*Std Deviation*	*N*
speaker	1.843	1.36	169
-- following context: dorsal C	5.418	2.33	
-- following context: labial C	5.143	2.27	
-- following context: #	1.949	1.40	
item	0.609	0.78	14

Fixed Effects	*Estimate*	*Std Error*	*z*	*p*
(intercept)	0.618	0.43	1.45	.148
following context: dorsal C	-3.181	0.71	-4.46	.000***
following context: labial C	-1.850	0.70	-2.65	.008**
following context: #	1.086	0.52	2.10	.036*
City: Bruges	-0.676	0.33	-2.04	.042*
City: Ghent	-0.229	0.50	-0.46	.644
City: Hasselt	-0.367	0.44	-0.83	.407
City: Amsterdam	-2.905	0.38	-7.72	.000***
City: Rotterdam	-5.292	0.48	-10.99	.000***
City: Leiden	-3.791	0.68	-5.58	.000***
City: Utrecht	-3.487	0.65	-5.36	.000***

In codas, trills are more likely to be partially or completely voiceless, and include many that end in non-trilled frication. Statistical analysis shows that there are many factors that determine the relative frequency of trills in codas. Table 4-7 shows the results from a linear mixed-effects model fitted to the data from alveolar *r* speakers. Within the coda, the effects of the segmental environment (place of articulation of a following consonant, place and height of the preceding vowel) as well as social factors were considered for inclusion in the model. Only factors that significantly improved the model fit were ultimately included. A random slope for speaker was included as it led to a significant improvement in the model fit ($\chi^2(9)=181.13$, $p<.001$). This means that the effect of the following consonantal context varies with individual speakers.

There is a main effect of following context: absolute word-final position favours trilled variants, whereas clusters of /r/ with labial and, especially, dorsal consonants disfavour them. Included here are all trilled variants, not only the voiced sonorant ones. This means that the trill/tap with following homorganic frication is included, which is the majority realisation for many alveolar *r* speakers, mostly those in Flanders. The disfavouring of trills in *r*+labial/dorsal consonant position reflects the patterning of this position as an intervocalic context (in which taps are much more frequent than trills).

The effect of city shows that trills in codas are much more frequent in the Belgian Dutch accents (slightly less so in Bruges than in the other cities), compared to the Netherlandic ones. Trills in codas are least frequent in Rotterdam, which is significantly different from all other accents in the corpus in this respect. Note that alveolar trills in codas are in fact entirely absent from the data for The Hague and Nijmegen. Table 4-8 and Table 4-9 show the *p*-values of pairwise comparisons between the segmental contexts and urban accents, respectively.

Table 4-8 *p*-values of pairwise comparisons of following context on the incidence of trills among alveolar *r* variants in codas with alveolar *r* speakers.

#	Cor C	Lab C	Dor C
#	.036	.000	.000
	Cor C	.008	.000
		Lab C	.105
			Dor C

Table 4-9 *p*-values of pairwise comparisons of speech communities on the incidence of trills among alveolar variants in codas with alveolar *r* speakers.

Ant	Gnt	Has	Bru	Ams	Utr	Ldn	Rot
Ant	.644	.407	.042	.000	.000	.000	.000
	Gnt	.810	.363	.000	.000	.000	.000
		Has	.478	.000	.000	.000	.000
			Bru	.000	.000	.000	.000
				Ams	.384	.203	.000
					Utr	.727	.014
						Ldn	.048
							Rot

4.2.2.2 Uvular r

In relation to the articulatory variation she finds in realisations of uvular *r* in Southern Swedish and French, Lindau (1985) states that “once the /r/ sound is established as uvular, it often weakens, and trills freely vary with fricatives and approximants”. While the latter is certainly confirmed by the Dutch urban accents data, as uvular trills alternate with fricatives and approximants in the speech of most uvular *r* speakers, it is also clear that it is not the complete story. The variation is 'free' in the sense that uvular trills, fricatives and approximants are all acceptable realisations of /r/ in Dutch, and functionally the same (much like many other realisations), but they are not 'free' in the sense that either the intra-speaker or inter-speaker variation is random. Instead, the distribution of the uvular consonantal variants (trill – fricative – approximant, where the uvular approximant can be classified as a consonantal variant on the basis of the weakness of its formant structure, see Chapter 3) is sensitive to the segmental context and the accent of the speaker, as well as showing variation on the individual speaker level.

The absolute and relative numbers of uvular trills (as compared to other uvular variants) are in Table 4-10.

Table 4-10 Token frequency of uvular trills relative to all consonantal uvular variants in word-initial onsets (*n*=3681), intervocalic onsets (*n*=2285), schwa-insertion context (*n*=1393) and coda (*n*=1889). No. of speakers: 262 (all speakers with uvular variants).

descriptive label	*word onset*		*intervocalic*		*ə-insertion*		*coda*	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*
uvular trill	1425	38.7	849	37.2	374	26.8	162	8.6
uvular fricative trill	445	12.1	117	5.1	144	10.3	661	35.0
total trills	1870	50.8	966	42.3	518	37.2	823	43.6

Especially looking at the total numbers, the distribution of uvular trills over contexts seems less skewed than that of alveolar trills: there are relatively high numbers of trills relative to other uvular variants in all contexts, with the largest differences appearing in the relative contribution of voiced sonorant trills (more in the two onset contexts than in codas) vs. voiceless fricative trills (esp word-final codas). A series of linear mixed-effects models was run to determine the potential effects of linguistic context, as well as accent and social factors, on the distribution of trills, relative to other uvular variants. The effect of speaker and item were once again treated as random, while fixed effects were added if and when they improved the fit of the model. The final model for the onset context is summarised in Table 4-11. The relevant data are the onset *r* tokens from all predominantly uvular *r* speakers, which is defined as speakers who have a majority of uvular realisations in their onset tokens (henceforth, "uvular *r* speakers").

The final model includes the effects of preceding context and city accent, as well as a random slope for preceding context within speaker, motivated by a significant improvement in model fit ($\chi^2(14)=74.692$, $p<.001$). This indicates that while there is a main effect of preceding context, the effect varies with individual speakers.

Two main effects of preceding context remain after inclusion of the random slope. First, the intervocalic context conditions fewer uvular trills than most word-initial onset contexts. It is significantly different from the context of a preceding coronal consonant+*r* cluster, as is visible in the table, as well as from word-initial singleton *r* and the labial consonant+*r* context. These differences mainly concern the fricative trills, as is evident from the means in Table 4-10. Secondly, the word-initial singleton *r* context contains the largest number of trill realisations, and is significantly different in this respect from the intervocalic context as well as that of a dorsal consonant+*r* cluster. An overview of all pairwise significant differences is in Table 4-12.

Table 4-11 Summary of a linear mixed-effects regression predicting the likelihood of a trill in onset position for predominantly uvular *r* speakers. The intercept corresponds to a coronal consonant+*r* cluster for an Antwerp speaker. Number of observations = 5815.

Random effects	*Variance*	*Std Deviation*	*N*	
speaker	3.692	1.92	238	
-- preceding context: dorsal C	0.605	0.78		
-- preceding context: labial C	0.840	0.92		
-- preceding context: V	1.163	1.08		
-- preceding context: #	0.608	0.78		
item	0.062	0.25	14	
Fixed Effects	*Estimate*	*Std Error*	*z*	*p*
(intercept)	-0.790	0.92	-0.86	.390
preceding context: dorsal C	-0.432	0.26	-1.68	.093
preceding context: labial C	0.232	0.34	0.68	.500
preceding context: V	-0.751	0.24	-3.12	.002**
preceding context: #	0.290	0.28	1.02	.306
City: Bruges	1.509	1.30	1.16	.245
City: Ghent	0.578	0.94	0.61	.540
City: Hasselt	1.403	0.96	1.47	.142
City: Amsterdam	0.236	1.04	0.23	.820
City: Rotterdam	1.869	0.98	1.92	.056
City: Leiden	1.377	0.94	1.46	.144
City: Utrecht	0.633	0.94	0.67	.502
City: The Hague	1.344	0.94	1.43	.152
City: Nijmegen	0.123	0.93	0.13	.890

Table 4-12 *p*-values of pairwise comparisons of preceding context on the incidence of trills among uvular *r* variants with uvular *r* speakers.

V	Dor C	Cor C	Lab C	#
V	.139	.002	.001	.000
	Dor C	.093	.039	.006
		Cor C	.500	.306
			Lab C	.869
				#

The effect of city is also present in the model because it improves its fit; although there are no significant differences visible in Table 4-11, i.e. relative to the intercept representing an Antwerp speaker, there are a number of significant differences between city accents in a pairwise comparison (see Table 4-13): here, Rotterdam and Nijmegen are on opposite ends of the scale, with most trills in Rotterdam, and fewest in Nijmegen. Rotterdam is significantly different in this respect from Utrecht, Ghent, Amsterdam and Nijmegen, while Nijmegen is different from Leiden, Hasselt, and The Hague, in addition to Rotterdam.

The data from uvular *r* speakers in the various urban accents show that the presence or absence of trilled realisations of uvular *r* depends partly on the segmental context *r* is in, while it is also partly accent-dependent. This shows, as it did with alveolar trills, that while the patterning of trills conforms to predictions made on the basis of phonetics, i.e. how favourable the circumstances for trilling are, these reflect tendencies rather than absolutes, and will work out differently in different accents.

Table 4-13 *p*-values of pairwise comparisons of speech communities on the incidence of trills among uvular variants with uvular *r* speakers.

Ant	Nmg	Ams	Gnt	Utr	Bru	Hag	Ldn	Has	Rot
Ant	.890	.820	.540	.502	.245	.152	.144	.142	.056
	Nmg	.848	.255	.196	.156	.002	.002	.003	.000
		Ams	.570	.508	.237	.063	.057	.061	.012
			Gnt	.896	.346	.062	.056	.067	.008
				Utr	.374	.079	.071	.083	.011
					Bru	.867	.893	.916	.724
						Hag	.937	.894	.275
							Ldn	.953	.311
								Has	.364
									Rot

The effect of individual speaker variation is best illustrated again by the chart in Figure 4-4, which shows, for each uvular *r* speaker, the number of trills as a percentage of their uvular *r* tokens in onsets. As with trills among alveolar *r* speakers, there is considerable variation between speakers. However, the chart, when compared to that in Figure 4-3, also shows some important differences between alveolar and uvular trills. While there is a considerable number of alveolar *r* speakers who never realise /r/ as a trill, there is only a small number of uvular *r* speakers without at least some trills. Similarly, while alveolar *r* speakers were seen to produce at most some 50% of their /r/ realisations as trills, there are some uvular *r* speakers who consistently produce trills. Many speakers, of course, are between the two extremes, and alternate trilled realisations of uvular *r* with non-trilled ones in all possible proportions.

The extent to which trilling is context-dependent is a major difference between alveolar and uvular trills: whereas there are very clear patterns as to which prosodic and segmental contexts favour and disfavour trilled [r], for trilled [ʀ] this is much less the case. While preceding context, place of the following vowel, and speaker sex are all significant predictors determining the occurrence of trilled alveolar realisations, for uvular trills the only significant contextual difference is that between word-initial and intervocalic onsets, where word initial dorsal fricative-*r* clusters pattern with the latter, and even this varies strongly per speaker. There are larger effects for some of the city accents, and as Figure 4-4 illustrates, trilling is mostly an individual speaker trait.

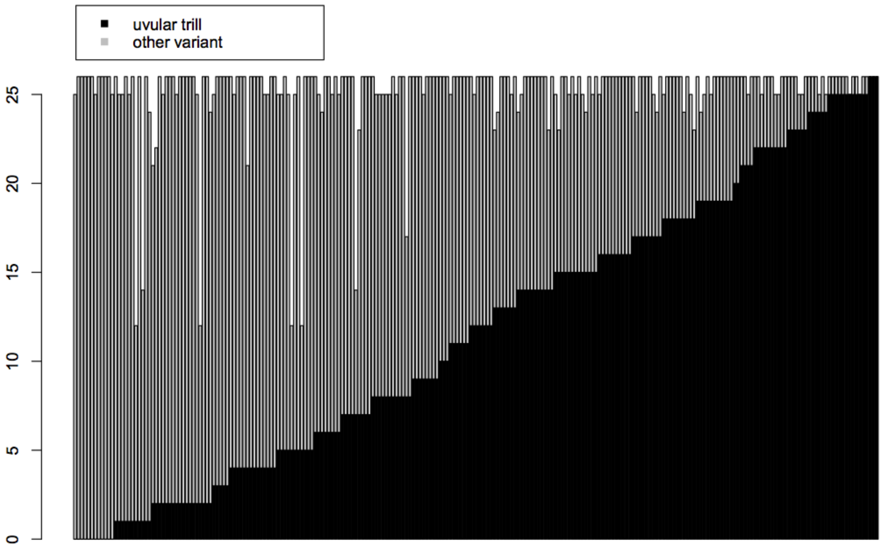

Figure 4-4 Number of trills (black) per speaker, relative to all other uvular variants in onset items (*n*=26). All uvular r speakers (*n*=238), all onset tokens (*n*=5815).

The fact that there is an effect of accent on the occurrence of uvular trills opens up the possibility of testing the first part of Lindau's (1985) statement quoted above, viz. "once the /r/ sound is *established* as uvular" [italics KS]. If the term 'is established' is taken to mean 'has become the main variant', then the urban accents are an ideal testing ground for this claim. That is, Lindau seems to predict that when and where uvular *r* is a relatively recent innovation, and/or is in a minority position vis-à-vis alveolar *r* variants, the weakening of trilled uvular *r* is arrested. In other words, the highest number of trilled uvular *r* (relative to other uvular variants) should be found in those accents where alveolar *r* is dominant. Comparing the patterning of accents in Table 4-13 with the figures in Table 4-14, which illustrates the relative numbers of uvular *r* speakers (rather than tokens) per accent, suggests that the hypothesis may receive some support: Nijmegen, where uvular *r* is general, has the lowest number of trills, whereas Rotterdam, which has roughly equal numbers of uvular and alveolar *r* speakers, has the highest. The high score of Leiden, with its many mixing speakers, may also find its explanation here. There are, however, too many problematic cases. The low scores of Antwerp and Amsterdam, particularly, where uvular *r* speakers are a small minority, are surprising, as the relative number of trills would be expected to be higher. Also unexpected from this point of view is The Hague, where uvular variants in onsets are as general as in Nijmegen, patterning with Rotterdam instead.

It may be that this is taking Lindau's remark too literally, and that "establishing" uvular *r* need only be done on an individual level. This makes sense, from the diachronic point of view: as soon as there are "native speakers", as it were, of a uvular *r* accent, we would expect the usual casual speech processes to apply, and for new language learners the full gamut of uvular *r* variation becomes available as input. For speech communities with 25%, or even just 10%, of uvular *r* speakers, the feedback received from realising *r* as a 'weakened' uvular variant would be positive enough for the variant to survive. In that sense, it is simply too late to test Lindau's claim: uvular variants are "established" in all urban accents in the data.

Table 4-14 Uvular *r* speakers as % of total number of speakers per city dialect, ranked top-bottom by relative number of uvular trills to all uvular variants.

City	*% speakers with categorically uvular r*	*% speakers with predominantly uvular r*
Rotterdam	37.2	44.2
Hasselt	57.5	62.5
Brugge	7.0	7.0
Leiden	61.9	83.3
Utrecht	62.5	82.5
The Hague	94.4	100.0
Ghent	57.1	73.8
Amsterdam	20.0	27.5
Antwerp	4.9	9.8
Nijmegen	90.2	100.0

In order to test Lindau's hypothesis, we would rather have to look at uvular *r* speakers in a speech community that is (almost) homogenously alveolar-*r*-speaking, to find out whether their uvular realisations display less variation, and have a higher incidence of successful trills. A case study would be the Italian speakers Romano (2013) mentions as having uvular trills in an area where such a realisation is considered a "pronunciation defect" or an "affectation". In sum, the use of trilled vs. non-trilled variants of uvular *r* seems to be a highly individual trait, not linked to socially conditioned variation, and only to a minor extent to phonological context, whereas that of trilled alveolar *r* variants is both more limited in general, and much more strongly context-dependent. These differences are most likely connected to the different patterns of reduction, i.e. the different variants that appear when either alveolar or uvular trilled *r* is disfavoured.

Turning from onsets to codas, there are much more pronounced differences between the urban accents in the relative frequency of uvular trills, as the linear mixed-effects model summarised in Table 4-15 shows.

Uvular trills in codas are most frequent in Hasselt and Ghent, and least frequent in Rotterdam and The Hague, with various overlapping subsets in-between (see Table 4-16 for the *p*-values of pairwise comparisons between the urban accents). Differences between the various segmental contexts are small, and significant only in the case of *r*+coronal consonant clustes vis-à-vis all others. Uvular trills are less frequent in the former context. Relevant *p*-values for pairwise comparisons are in Table 4-17. The incidence of uvular trills in codas strongly resembles that of alveolar trills in the same position: they are more frequent in the Flemish cities than in the Dutch ones, where The Hague and Rotterdam especially have very few of them. In these cities, uvular r speakers appear to restrict trilled uvular r to onset positions, and realise /r/ in codas either as non-trilled fricatives, or – more usually – not as uvular consonantal variants at all (instead, opting for vocalic realisations).

Table 4-15 Summary of a linear mixed-effects regression predicting the likelihood of a trill in coda position for predominantly uvular *r* speakers. The intercept corresponds to an *r*+coronal consonant cluster for an Antwerp speaker. Number of observations = 6054.

Random effects	*Variance*	*Std Deviation*	*N*	
speaker	3.379	1.84	238	
-- following context: dorsal C	6.390	2.53		
-- following context: labial C	7.859	2.80		
-- following context: #	0.722	0.85		
item	0.021	0.15	14	
Fixed Effects	*Estimate*	*Std Error*	*z*	*p*
(intercept)	-2.258	0.88	-2.57	.010*
following context: dorsal C	0.760	0.27	2.80	.005**
following context: labial C	0.608	0.29	2.10	.036*
following context: #	0.717	0.16	4.40	.000***
City: Bruges	1.719	1.29	1.34	.182
City: Ghent	2.094	0.92	2.27	.023*
City: Hasselt	2.114	0.93	2.26	.024*
City: Amsterdam	-0.138	1.04	-0.13	.894
City: Rotterdam	-3.450	1.07	-3.22	.001**
City: Leiden	-2.908	0.97	-2.99	.003**
City: Utrecht	-1.433	0.94	-1.53	.126
City: The Hague	-3.132	0.98	-3.18	.001**
City: Nijmegen	-1.339	0.93	-1.45	.148

The incidence of uvular trills in codas strongly resembles that of alveolar trills in the same position: they are more frequent in the Flemish cities than in the Dutch ones, where The Hague and Rotterdam especially have very few of them. In these cities, uvular *r* speakers appear to restrict trilled uvular *r* to onset positions, and realise /r/ in codas either as non-trilled fricatives, or – more usually – not as uvular consonantal variants at all (instead, opting for vocalic realisations).

Table 4-16 *p*-values of pairwise comparisons of speech communities on the incidence of trills among uvular variants in codas with uvular *r* speakers.

Has	Gnt	Bru	Ant	Ams	Nmg	Utr	Ldn	Hag	Rot
Has	.973	.769	.024	.001	.000	.000	.000	.000	.000
	Gnt	.825	.023	.000	.000	.000	.000	.000	.000
		Bru	.182	.177	.022	.044	.002	.001	.010
			Ant	.894	.148	.126	.003	.001	.001
				Ams	.068	.042	.000	.000	.000
					Nmg	.873	.457	.001	.003
						Utr	.210	.005	.004
							Ldn	.146	.921
								Hag	.540
									Rot

Table 4-17 *p*-values of of pairwise comparisons of following context on the incidence of trills among uvular *r* variants in codas with uvular *r* speakers.

Dor C	#	Lab C	Cor C
Dor C	.951	.421	.005
	#	.543	.000
		Lab C	.036
			Cor C

The segmental contexts show a larger difference between alveolar and uvular trills in codas: whereas uvular trills are less frequent in the context of a following coronal consonant, alveolar trills are actually less favoured before dorsal and labial ones (i.e. in the schwa-insertion context). This is likely a local contextual effect (of place of articulation). The following sections discuss the phonetic properties of trills that affect their successful realisation, and that are crucial in explaining the origin of the reduced *r* variants (specifically the fricative and tap realisations) that appear where trills do not.

4.2.3 The aerodynamics of trills

Similarly to its role in explaining processes of devoicing or gestural weakening with voiced obstruents (Ohala 1983a; Żygis 2008), the *aerodynamics* of trill production are crucial in explaining the processes that affect trills. Since the successful execution of a trill hinges on a combination of a high degree of precision in articulator positioning and stiffness and aerodynamic factors, the slightest failure in achieving those precise conditions will lead to a non-trilled speech sound. These phonetic facts form the basis of *r*'s cross-linguistic variability, and the beginnings of an answer to the extreme variation found with Dutch *r*. However, even when a trill is initially produced, the aerodynamic circumstances may be such that devoicing and consequent fricativisation occur. Solé (1998; 1999; 2002) conducted a number of experiments in which oropharyngeal pressure (the air pressure behind the oral constriction for the trill) was systematically varied, to examine its effects on coronal trill production. The behaviour of trills under varying aerodynamic conditions accounts for some observed patterning of trills (cross-linguistically): specifically, the universal preference for voiced trills, the alternation between trills and fricatives, and trill devoicing (as well as the lack of nasal trills, which will not be discussed here).

The main difference between voiced and voiceless trills lies in the nature and rate of airflow: in voiceless trills, airflow is substantial and continuous, and slightly turbulent because of impedance at the glottis, but in voiced trills the airflow has periodic vibrations produced by vocal fold vibration, which makes for a lower volume velocity, and consequently a lower pressure in the oral cavity. Air also flows faster through the oral cavity in voiceless trills, creating turbulence. This is in line with the differences found between voiced and voiceless fricatives. Voiceless trills are inherently fricative: during the release phases of the trill, turbulent air flows out, creating audible noise (see also Verhoeven 1994). They also show a higher rate of vibration, and are longer than voiced trills (again patterning like voiceless and voiced fricatives in this respect).

Solé's (1998 et seq.) main experiment was the venting of oropharyngeal pressure during trill production. That is, a catheter was placed behind the oral constriction, and air pressure building up behind it was lowered by opening it (and thus allowing air to escape). If the pressure falls below a certain threshold, tongue-tip vibration cannot be maintained, and the trill fails. The result is an apical post-alveolar fricative. It was shown that voiced trills are extinguished easily: small catheters causing only a slight pressure drop (2.5 – 3.5 cm H_2O) were enough to end vibration. The fricative that results may furthermore devoice. Voiceless trills are more robust, needing a bigger pressure drop before they fail (5 cm H_2O). The result is simply a voiceless fricative. Restoring pressure after trilling has ceased does not restore trilling. Voiced trills, therefore, allow only a small range of variation in oropharyngeal pressure: it needs to be low enough for voicing (high pressure impairs the transglottal flow needed for voicing), and high enough for trilling. Solé estimates the range for successful voiced trills to be between 5.4 and 4 cm H_2O (see Figure 4-5). Small variations lead to devoicing and/or an end to trilling. This is akin to the difficulty of maintaining simultaneous voicing and frication (Ohala 1983a), but more strongly so.

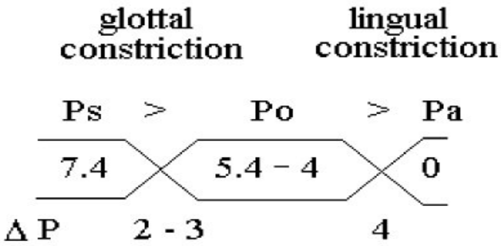

Figure 4-5 Oropharyngeal pressure (Po) and trill production. Ps represents subglottal pressure, Pa atmospheric pressure, and ΔP the minimum pressure difference across the two constrictions required for voicing (glottal constriction) and trilling (lingual constriction).[ii]

[ii] Reprinted from *Journal of Phonetics*, 30(4), Solé, M.-J., Resonance in an exemplar-based lexicon: The emergence of social identity and phonology, 655-688, Copyright (2002), with permission from Elsevier.

Finally, Solé found coarticulatory effects: vowel context turned out to be of influence on trill production. Trills in an [i] context showed a higher oropharyngeal pressure than those in an [a] context, probably due to the barrier formed by the high tongue body position for [i]. Trills in the [i] context failed more often than those in the [a] context, which is probably due to the conflicting predorsum gestures. The predorsum lowers for the trill (which creates space for the vertical movements of the tongue-tip, while raises for high vocoids [i,y,j] (see also McGowan 1992; Barry 1997; Recasens and Pallarés 1999). Cross-linguistically, this leads to changes in sequences of trill + palatal segments: Solé mentions depalatalisation occurring in in Belorussian, Slovak, Serbo-croatian, Macedonian. Alternatively, trilling may be lost and palatality preserved (which results in a tap or fricative): Żygis (2004) reports this for Polish and Russian. Non-trilled variants of palatal trills are also found in Toda (Spajic et al. 1996). All this evidence converges into the prediction that trills are less likely in a high vowel context.

Manner of articulation of preceding consonants also influence the likelihood of trill production, as Lewis (2004) shows in his experiments with four Spanish speakers. The incidence of successful trills in a C#*r*-context rises with degree of stricture in the preceding consonant. The smallest number of trills was reported following [s] (65%), the highest numbers following [l] and [n] (90% and 97.5% respectively). Contexts where *r* was not preceded by a consonant, that is post-pausal and post-vocalic contexts, fell in-between (75% and 84% respectively). Lewis attributes the post-consonantal effects to degree of stricture: the higher the degree of oral stricture of the preceding consonant (n >> l >> s), the higher the incidence of successful trills. The relatively high number of successful trills after vowels and in post-pausal context, although the degree of stricture is lowest there, is attributed to the fact that there are relatively few articulatory demands in these contexts, and speakers are able to properly position the tongue to create favourable circumstances for trill production (cf. Recasens 1991). The presence or absence of voicing in trills was shown to also be largely context-dependent: the highest percentage of voiceless trills was found following [s] and in post-pausal (i.e. utterance-initial) context.

Coarticulation with other segments may also lead to total assimilation to trills, such as in Catalan, where [s,z,ʃ,ʒ] followed by [r] result in [r] (Solé 2002:685). An explanation is that coronal fricatives may lose the ability to create turbulence when followed by the complex [r], which needs time for positioning. Note that, interestingly, Dutch speakers may actually *create* [sr] sequences. Many speakers simplify the /sxr/ cluster to [sr] (Sebregts 2004a).

In summary, the aerodynamic requirements for initiating and sustaining voiced trills allow for a small range of variation. Variations that are too large lead to devoicing and/or cessation of trilling, and the resulting sound is a fricative. Voiceless trills allow for more variation, but they are of course inherently fricative. Contexts in which trilling is disfavoured are preceding and following high vocoids, preceding voiceless obstruents, and utterance-final position, in which subglottal pressure is lowered. Utterance-initial position may also favour voiceless trills (though not necessarily trill failure). Further on in this chapter, these predictions from phonetic theory will be tested against the urban accent data: are trills indeed more frequent in word-initial contexts, and are (trilled or non-trilled) fricatives more frequent in the context of high vowels, voiceless obstruents and word-finally? If so, then a substantial part of the explanation of Dutch *r*-variation can come from general articulatory and aerodynamic constraints, placed within a theory of gradual sound change. First, however, the discussion will turn to the question of why, if voiced trills are apparently such difficult sounds from articulatory and aerodynamic points of view, there is such a strong preference for voiced trills cross-linguistically.

4.2.4 Trills, voicing, and frication

There is a universal preference for trill phonemes to be voiced. From the UPSID database of (at the time) 317 languages, Maddieson (1984) lists 130 voiced trill phonemes, and only 3 voiceless ones (1.5%).[22] Other sonorant classes score higher in this respect: 3.17% of nasals, approximants and other liquids are voiceless. Solé (2002:680) explains this preference by referring to the perceptual properties of voiceless trills. From an articulatory point of view, voiceless trills would be expected to be preferred, as (tongue-tip) vibration is more easily sustained during voicelessness, and in fact the mechanisms of voicing and trilling have conflicting demands (see below). However, since voiceless trills are inherently fricative, they are poorly differentiated auditorily from true fricatives. Thus, the cross-linguistic preference for voiced trills is the outcome of a conflict between articulatory and acoustic/auditory factors, where the latter most often wins out.

The relationship between voiceless trills and fricatives at the same place of articulation is clearly reflected in the Dutch alveolar *r* variants presented in chapter 3, which show gradient similarities when comparing auditory impressions, as well as their waveforms and spectrograms. Moving from a voiced to a partially devoiced to a voiceless trill, on to a voiceless trill with homorganic frication, and finally to an alveolar non-trilled fricative, the differences between each pair of variants is minimal, whereas that between the endpoints of this continuum (the voiced trill and the non-trilled fricative) is large enough to warrant separate IPA symbols. The similarity is even greater in the case of uvular trills (cf. the potential merger of [x] and [ʀ] in The Hague and Leiden, to be discussed in chapter 6). This again shows that the 'family resemblances' of Lindau (1985) are more than just that: the variants transcribed by her and other researchers have a substantial interpretation in being the endpoints of continua along which *r*-sounds vary, before they become recognisable (and transcribable) as separate segments in linguists' analyses.

The preference for voicing in trills across languages does not mean that devoicing of trills is not reported for those languages. Apart from the (few) languages that have voiceless trill phonemes (contrasting, as for instance in Sedang, with other trills), trill devoicing may occur allophonically in languages where the trill is usually said to be voiced: it is reported for Brazilian Portuguese, Farsi (Ladefoged and Maddieson 1996:237), American Spanish (Lipski 1994; Bradley 2004), Czech (Šimáčková 2001), Brussels French (Baetens-Beardsmore 1971), Russian (Padgett 2002), Thai, Khmer (Guion and Wayland 2004), and Gräsö Swedish (Helgason 1999). In urban accents of Dutch, trills are in fact often voiceless (usually so in coda positions), as Table 4-18 shows for alveolar trills.

Voicelessness in trills is strongly related to fricativisation, as Solé (1998; 2002) shows experimentally, and is confirmed by the variant continuum in Dutch. This suggests a possible origin of the (trilled) fricative variants of *r* in Dutch.

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[22] The voiceless ones are found in Maasai, Nivkh and Sedang. For the latter two languages, UPSID also lists a voiced alveolar trill.

Table 4-18: voiced vs. voiceless trilled alveolar /r/ realisations

Alveolar trills in urban Dutch	*n*	%
Total number of trills	2291	100.0
Of which voiced	1055	46.0
Partially devoiced	116	5.1
Voiceless	1120	48.9

Fricatives and trills alternate historically and synchronically in many languages. Bhat (1974:91-92) mentions a number of cases where historical *r* has become fricative in word-final position. He mentions that another environment that induces spirantisation in liquids is a front vowel, which is also confirmed by Solé's (2002) experimental results. The results from his extensive survey of languages when it comes to trill-fricative alternations are as follows. *r* is reported to be voiceless and/or fricative finally in Kunimaipa, Albanian, Eastern Armenian, Mantjitjara, Somali, Kunjen, Hopi, Mbe, Farsi, and Modern Turkish. Following front vowels or palatalising contexts induce fricativisation of *r* in Albanian, Carib, Tswana, Basque, Polish, and Czech. *r* devoices and/or fricativises word-initially in Sa'ban, Albanian, Pame, Somali, and Sinhalese. Apical trills with co-occurring friction (as variants of what is generally considered a voiced trill phoneme) are furthermore reported in Toda (Spajic et al. 1996), and Spanish (Blecua Falgueras 2001). Solé's experiments replicated this alternation, by showing what may cause trill loss and fricativisation: small variations in pressure differences and articulator imprecision.

Recasens (2002) examines a number of historical processes, including rhotacism of [z], i.e. the changing of an alveolar fricative into a tap, [ɾ]. He suggests it is favoured by apicality of the changing fricative, and may be the result of articulatory undershoot with subsequent friction loss (for which Solé 1992 presents evidence from a perceptual experiment). An example is found in the Southern Spanish forms of *mismo*, *desde* as [ˈmiɾ.mo], [ˈdɛɾ.de]. The opposite change also occurs: 16th century French developed *chaise* out of *chaire* (from Latin *cathedra*), for instance. In fact, though not discussed by Recasens, who focuses on Romance, Dutch too has a small number of alternations between present and past tense verb forms with /r/ and /z/, respectively (*verliezen~verloren* "to lose", *bevriezen~bevroren*, "to freeze"), the result of a once productive rhoticization rule in West Germanic (Booij 2002).

Recasens suggests that rhotacism and its opposing change are therefore not weakening or strengthening changes, but arise out of perceptual confusion between two very similar phones. This is illustrated by the examples of Occitan (which had both rhotacism and *r*-fricativisation at one stage) and areas of France where the alveolar fricative is [ɾ]-like and the rhotic is [z]-like (2002:342; see also Bloch 1927). However, Recasens also acknowledges the role of aerodynamic factors in trill fricativisation, which means a change from a trill to a fricative can be characterised as weakening, since it would involve less precision on the part of the speaker, i.e. less active control of the tongue, though not a lesser degree of tongue displacement, indicating less articulatory effort.

When both trilling and voicing are absent from rhotics in Romance, the resulting sound is a voiceless post-alveolar fricative. It is not, however, identical to the post-alveolar fricative in English *ship* ([ʃ]); this is clear from x-ray data referred to by Recasens, which show the difference between such a (laminal) fricative, and an apical one. It is most likely the apical alveolar or post-alveolar fricative that is also used as a realisation of /r/ in Dutch, especially in Belgian Dutch varieties (transcribed as [ɹ̝] in Chapter 3).

Non-trilled fricative realisations of what are considered to be trill phonemes are reported in a number of languages, such as Toda (Spajic et al. 1996), Italian (Ladefoged and Maddieson 1996), Polish and Czech (Šimáčková 2001). Czech is the only language reported to have a laminal (fricative) trill (in opposition with a sonorant apical one). The most extensively described language in which /r/ is often realised as a fricative is Spanish (Malmberg 1965; Lipski 1994; Penny 2000; Blecua Falgueras 2001; Bradley 2004). In many dialects of Spanish, but mostly in South America, both /r/ and /ɾ/ are often realised as "assibilated", which refers to palatal and/or retroflex fricative realisations. These may be voiced or voiceless – in IPA terms: [ʃ ʒ ʂ ʐ]. Fricative *r* or ɾ with a more fronted articulation is also reported for some varieties. This includes dental, alveolar and post-alveolar variants, that may be trilled or non-trilled, voiced or voiceless, variously transcribed as [ř ɹ̝ ž ɹ̝̊ ɾ̥]. Lipski (1994) contains an overview of the realisations of /ɾ/ and /r/ in American Spanish, which shows that variation is widespread, partly sociolinguistically controlled, and partly dependent on regional dialect. Devoicing and assibilation is most frequent domain-finally (where the domain in question may be the syllable, the word or the phrase), but an unconditioned fricative trill realisation of /r/ is also frequently reported.[23] Penny (2000) shows that the same phenomena are attested in European Spanish, especially in Navarra Castilian. In fact, the alternation between trilling and apical (alveolar or post-alveolar) friction is attested in a number of Spanish dialects.

4.2.5 Trill complexity and cross-linguistic frequency

Despite their articulatory complexity demonstrated above, trills – apical trills, at least – are rather frequent cross-linguistically. 76% of the languages in Maddieson (1984) have an *r*-sound, and 47.5% of these are reported to be trills, mostly dental/alveolar (99.1%). This means that 36.4% of the languages in the UPSID at the time have a trill, compared to 34.3% with one or more voiced fricatives, 66.9% with a voiced stop, 80.9% with a glide, 81.3% with a lateral, and 96.8% with a nasal stop. In sum, trills are not infrequent, but less frequent than some other classes. The frequency of trills being similar to that of voiced fricatives makes sense since some of the reasons for their complexity, and therefore their relative dispreference, are the same, as argued in

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[23] Lipski (1994) presents a range of other /r/ realisations in American Spanish apart from fricatives, suggesting that the situation in Spanish is at least as complex as that of Dutch in, of course, a much larger geographical area. Allophones of /r/ described by Lipski include trills, taps, fricatives, and approximants at dental, alveolar, retroflex, and uvular places of articulation, as well as neutralisation of /r/ and /l/ and *r*-elision.

this chapter (cf. also Żygis 2004, who discusses voiced palatalised trills, a yet more problematic and far less common class of sounds).

A possible reason for the relatively high distributional frequency of trills despite their complex articulatory nature is their auditory salience. The vibratory pattern is highly specific to *r*, and an average trill frequency of 20-30 Hz is easily perceived by listeners (Zwicker and Feldtkeller 1967) (Note that the trill frequency of the vocal folds, in contrast, is too high for humans to be able to hear individual cycles.) However, it may also be the case that the reported trills for many of the languages in Maddieson (1984) are not realised as such by all speakers at all times, as Ladefoged et al. (1977) and Lindau (1985) seem to suggest. The UPSID is primarily a database of phonological contrasts, and – although usually based on phonetic fieldwork – may not always reflect the phonetic realities of everyday usage. In fact, for the well-described languages of Europe this suspicion is borne out. German, for instance, is described as having a uvular trill, whereas there is abundant evidence that this is a marginal realisation of German *r*, and approximant and fricative realisations are more common (Schiller and Mooshammer 1995; 2000). Likewise, the descriptions of Spanish mentioned above are not reflected in the simple characterisation of Spanish in the UPSID as having a trill and a tap phoneme (cf. Simpson 1999 for more elaborate criticism of the UPSID as linguistic data). In short, the high cross-linguistic frequency of trill phonemes as reported in UPSID may not in fact be at odds with the low frequency of "actual trills" mentioned by Ladefoged et al. (1977), as long as the term "trill phoneme" in the sense of the UPSID is taken to mean a phoneme that is *potentially* realised as a trill, for which the number of actual trill realisations may be quite low.

4.2.6 Fricative *r* in Dutch

Some previous accounts of *r* in Dutch have noted that it is in fact frequently realised as a fricative, especially in the case of velar or uvular *r* (Mees and Collins 1982; 1994). Mees and Collins also state that a weak fricative realisation for alveolar *r* is a possible articulation of both onset and word-final *r*, but this observation is not as general as that of the possibly fricative nature of uvular *r*. Van den Berg (1974) refers to a "mediopalatal" fricative for Dutch. It may be the case that this refers to the apical post-alveolar fricative [ɹ̝]. Weijnen (1991) mentions dialects in the south of the Netherlands, where (alveolar) trilled *r* is said to be accompanied by (dental) frication. This occurs in onsets as well as in coda position, and may at some point in history have led to decomposition of original [r] into [rs] in the latter position in particular lexical items. Weijnen suggests this may also have been the origin of a number of otherwise unexplained verbs in West-Flemish that have <rs> or <rz> where Standard Dutch has <r> (e.g. *claersen*, *verdiersen*).

4.2.7 Fricative realisations of *r* in the urban dialects

The facts about trilled [r]'s susceptibility to devoicing and its link to fricativisation presented above lead to a number of predictions as to where fricative realisations are to be preferably expected in the data. First, there are word-final codas: the aerodynamic circumstances in utterance-final [r], particularly the decrease in subglottal pressure, are unfavourable for trills, and hence favourable for fricatives. Since all items in our data are separate utterances, all word-final codas are also utterance-final. Secondly, the turbulent airflow necessary for voiceless obstruents is antagonistic to the laminar flow for voiced trills. Devoicing and subsequent fricativisation in clusters of [r] and voiceless obstruents is therefore expected, especially for uvular *r*, as the constriction further back in the mouth is more strongly antagonistic to voicing. The data contain several of these items, both in onsets and codas (*trein, strik, kruk; kers, kaars, bord, paard, worst*). Finally, trilled alveolar [r] is disfavoured preceding and following high vowels, and especially preceding the high front vowel [i]. The data contain the items *riem* and *beroep*, with /r/ preceding [i] and [u] respectively, as well as *sturen* and *bureau*, where it follows stressed and unstressed [y].

The urban accent data show that these predictions hold true for the realisation of *r* in Dutch. The sections immediately below describe the contexts in which fricative variants of *r* occur in the data. Section 4.2.7.1 looks at the distribution of alveolar fricative variants, while 4.2.7.2 focuses on uvular fricative *r*.

4.2.7.1 Alveolar fricative r

The distribution of alveolar trills in the urban accent data is in Table 4-19 below. The percentages refer to all alveolar variants.

Table 4-19 Token frequency of alveolar fricatives relative to all alveolar variants in word-initial onsets (*n*=2610), intervocalic onsets (*n*=1617), schwa-insertion context (*n*=1282), and coda (*n*=2362). No. of speakers: 210 (all speakers with alveolar variants).

descriptive label	*word onset*		*intervocalic*		*ə-insertion*		*coda*	
	n	%	*n*	%	*n*	%	*n*	%
vl alv trill/tap w/ frictn	0	0	1	0.1	12	0.9	916	38.8
vd (post)alv fricative	105	4.0	63	3.9	9	0.7	22	0.9
vl (post)alv fricative	1	0.0	0	0	0	0	127	5.4
totals	106	4.1	64	4.0	21	1.6	1065	45.1

It is obvious from the table that fricative alveolar *r* variants are overwhelmingly a coda phenomenon, as predicted: word-final codas (of which many contain voiceless obstruents) are particularly unfavourable to trills, and favourable to voiceless fricative realisations of *r* (as well as vocalic realisations; see Chapter 5). By far the most frequent fricative coda variant is in fact the devoiced trill or tap followed by homorganic frication, strongly suggesting its relationship to the sonorant trill. However, it is the distribution of (largely voiced) fricative variants in onsets that reveals the perhaps more interesting pattern, showing influences from the linguistic context (prosodic and segmental), as well as those of city accent and individual-level variation.

To examine the factors underlying the variation in fricative *r* realisations in onsets, a series of linear mixed-effects models was fitted to the data from the predominantly alveolar *r* speakers as defined in the previous sections. The effects of speaker and item were treated as random, and the response variable was the use of a fricative variant of *r*. The effects of preceding and following context, city accent, and the social factors of sex and age were progressively added to the model, but only included in the final model if they improved the overall model fit. The eventual model included preceding context, vowel height, and city accent, as well as a random slope for preceding context within speaker. A summary of the model is in Table 4-20.

Table 4-20 Summary of a linear mixed-effects regression predicting the likelihood of a fricative in onset position for alveolar *r* speakers. The intercept corresponds to a coronal consonant+*r* cluster followed by a high vowel for an Antwerp speaker. Number of observations = 4114.

Random effects	*Variance*	*Std Deviation*	*N*	
speaker	10.050	3.17	169	
-- preceding context: dorsal C	65.423	8.09		
-- preceding context: labial C	67.26	8.20		
-- preceding context: V	6.433	2.54		
-- preceding context: #	10.562	3.25		
item	0.000	0.00	14	
Fixed Effects	*Estimate*	*Std Error*	*z*	*p*
(intercept)	-6.904	0.94	-7.32	.000***
preceding context: dorsal C	-6.087	3.34	-1.82	.069
preceding context: labial C	-3.321	3.24	-1.02	.306
preceding context: V	3.406	0.86	3.96	.000***
preceding context: #	4.431	0.90	4.93	.000***
Vowel height: low	-1.803	0.43	-4.21	.000***
Vowel height: mid	-0.895	0.22	-4.13	.000***
City: Bruges	-0.082	0.48	-0.17	.865
City: Ghent	2.229	0.55	4.04	.000***
City: Hasselt	2.182	0.50	4.35	.000***
City: Amsterdam	-0.427	0.55	-0.78	.437
City: Rotterdam	-1.608	0.81	-1.99	.047*
City: Leiden	-0.059	0.89	-0.07	.948
City: Utrecht	-0.173	0.87	-0.20	.842

Neither inclusion of vowel place, nor the social factors of sex and age, improved the fit of the model. The model contains a random slope for preceding context within speaker, as this improved the model fit ($\chi^2(14)=29.414$, $p=.009$). This indicates that the effect of preceding context varies with individual speakers. An examination of random effects revealed that there are individual speakers who produce a high number of fricatives in the labial and dorsal context, while most speakers do not. For all factors with more than one level (preceding context, vowel height, and city), the model was refitted to different intercept levels in order to obtain the significance values for pairwise comparisons. An overview of all *p*-values is in Table 4-21 to Table 4-23.

The preceding context remains as a main effect, despite the individual variation. Most fricatives are found with word-initial singleton *r* onsets (*riem, rok*), and these are significantly different from all other contexts. Note, however, that trills were also found to be most frequent in word-initial context, so the high number of fricatives is not necessarily to the detriment of trills. Intervocalic onsets are also significantly different from all other contexts, and condition the second largest number of fricatives. The smallest number of alveolar fricatives is found in C*r*-clusters. In this context, in fact, neither trills nor fricatives are very frequent: in C*r*-onsets *r* is overwhelmingly realised as a tap (see section 8 of this chapter).

Table 4-21 p-values of pairwise comparisons of preceding context on the incidence of fricatives among alveolar *r* variants with alveolar *r* speakers.

Dor C	Lab C	Cor C	V	#
Dor C	.020	.069	.004	.001
	Lab C	.306	.033	.014
		Cor C	.000	.000
			V	.000
				#

Table 4-22 p-values of pairwise comparisons of vowel height on the incidence of fricatives among alveolar variants with alveolar *r* speakers.

Low	Mid	High
Low	.036	.000
	Mid	.000
		High

The effect of vowel height is highly significant, though not very large; fricatives are found most in the context of a high vowel, and least when *r* is in a syllable with a low vowel. This ranking (low>mid>high) conforms to what is predicted on articulatory grounds, as the tongue configuration for high vowels is most, and that for low vowels least, antagonistic to the gestural configuration necessary for tongue tip trilling (Solé 2002).

Table 4-23 p-values of pairwise comparisons of speech communities on the incidence of fricatives among alveolar variants with alveolar *r* speakers.

Gnt	Has	Ant	Ldn	Bru	Utr	Ams	Rot
Gnt	.941	.000	.014	.000	.009	.000	.000
	Has	.000	.013	.000	.008	.000	.000
		Ant	.948	.866	.842	.437	.047
			Ldn	.979	.921	.692	.160
				Bru	.916	.528	.059
					Utr	.779	.186
						Ams	.165
							Rot

Finally, the statistical model shows an effect of speech community, or accent. Ghent and Hasselt show significantly larger numbers of alveolar fricatives in onsets than the other urban accents, which largely pattern together. This shows that, while the phonetic factors go in the predicted directions, there is no blanket effect of the linguistic environment, and numbers and distribution of fricative alveolar *r* is able to vary between speakers and speech communities.

The bar chart in Figure 4-7 further illustrates the patterns identified by the statistical model. It shows both that fricative realisations are favoured by word-initial onset *r*, and disfavoured by Cr- onsets, with intervocalic contexts in the middle; within these contexts, the effects of vowel height are also very clear: *riem* conditions more fricatives than *rok*, and *beroep* and *sturen* show the highest number among the intervocalic contexts. Note that there is no residual random effect of item in the model, which means that the between-item differences are explained by the predictors that are in the model, i.e. preceding context and vowel height.

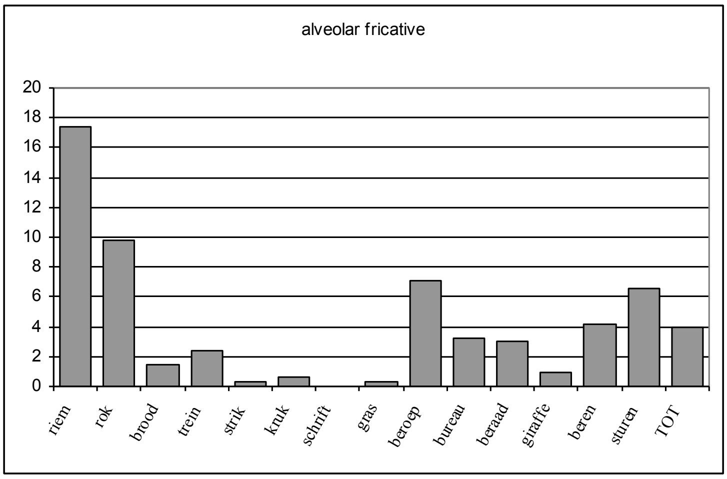

Figure 4-7 Percentage of alveolar fricatives (y-axis) per item (x-axis), relative to other alveolar variants. All alveolar *r* speakers (n=169).

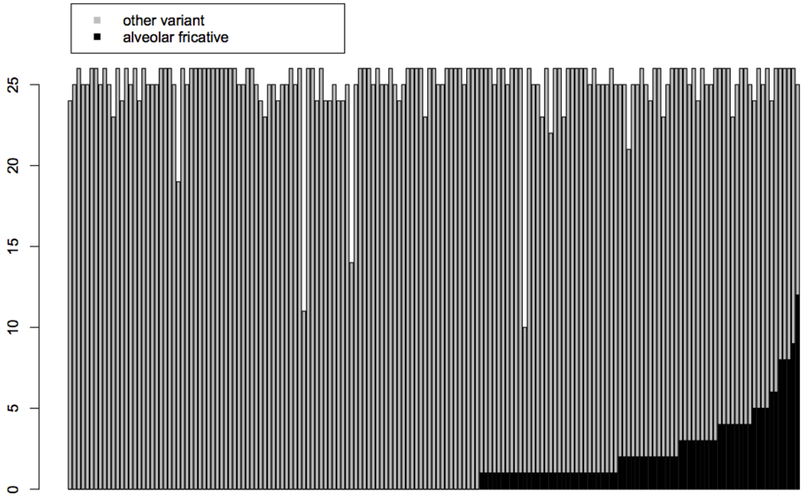

Figure 4-6 Number of fricatives (black) per speaker, relative to all other alveolar variants in onset items (*n*=26). All alveolar *r* speakers (n=169), all onset tokens (*n*=4114).

Finally, Figure 4-6 shows how strongly fricative realisations depend on the individual speaker: a majority of alveolar *r* speakers have no fricative realisations of *r* at all, with only a small number of speakers realising more than 1/3 of their *r* tokens as fricatives.

The situation in codas shows no significant effect of the vowel context, but there are strong effects of the following consonant, as well as of city accent, and there is a small effect of age. Table 4-24 presents a linear mixed-effects model predicting the likelihood of a fricative alveolar variant. It includes all factors with a significant main effect, as well as a random slope for following context within speaker, as this significantly improved the model fit ($\chi^2(9)=67.81$, $p<.001$).

Table 4-24 Summary of a linear mixed-effects regression predicting the likelihood of a fricative in coda position for predominantly alveolar *r* speakers. The intercept corresponds to an *r*+coronal consonant cluster for a younger Antwerp speaker. Number of observations = 4362.

Random effects	*Variance*	*Std Deviation*	*N*	
speaker	2.168	1.47	169	
-- following context: dorsal C	59.258	7.70		
-- following context: labial C	51.707	7.19		
-- following context: #	2.344	1.53		
item	1.535	1.24	14	
Fixed Effects	*Estimate*	*Std Error*	*z*	*p*
(intercept)	-0.215	0.64	-0.34	.737
following context: dorsal C	-9.073	2.22	-4.09	.000***
following context: labial C	-10.901	2.63	-4.15	.000***
following context: #	3.109	0.81	3.84	.000***
City: Bruges	-2.140	0.38	-5.58	.000***
City: Ghent	0.049	0.56	0.09	.931
City: Hasselt	0.195	0.50	0.39	.697
City: Amsterdam	-4.158	0.46	-9.13	.000***
City: Rotterdam	-7.568	0.86	-8.77	.000***
City: Leiden	-6.109	1.04	-5.85	.000***
City: Utrecht	-3.751	0.76	-4.94	.000***
age: older	-0.611	0.29	-2.10	.036*

There is a main effect of following context, although the effect varies with the speaker, as indicated by the inclusion of a random slope for this predictor. Fricatives are much less frequent in the schwa-insertion contexts (tautosyllabically before dorsal and labial consonants), and most frequent in absolute word-final position. This is entirely in line with the predictions of what the aerodynamically most favourable positions for trilling are. That is, fricatives appear most in the contexts that phonetically least favour trills. A summary of the significant differences between contexts is in Table 4-25.

Table 4-25 *p*-values of pairwise comparisons of following context on the incidence of fricatives among alveolar *r* variants in coda with alveolar *r* speakers.

#	Cor C	Dor C	Lab C
#	.000	.000	.000
	Cor C	.000	.000
		Dor C	.574
			Lab C

That there are differences among the city accents and between age groups, however, shows that the contextual differences are not absolute or automatic. Table 4-26 shows that Rotterdam and Leiden pattern together at one end of the scale (with very few coda fricatives), and so do Utrecht, Amsterdam and Leiden. Hasselt, Ghent and Antwerp cluster together at the other end, with many instances of fricative *r* in codas. Bruges, in the middle, is significantly different from all other accents, including its fellow Belgian Dutch ones.

Table 4-26 *p*-values of pairwise comparisons of preceding context on the incidence of fricatives among alveolar *r* variants in codas with alveolar *r* speakers.

Has	Gnt	Ant	Bru	Utr	Ams	Ldn	Rot
Has	.823	.697	.000	.000	.000	.000	.000
	Gnt	.931	.000	.000	.000	.000	.000
		Ant	.000	.000	.000	.000	.000
			Bru	.040	.000	.000	.000
				Utr	.607	.055	.000
					Ams	.067	.000
						Ldn	.257
							Rot

The position of Bruges here reflects the difference between its accent and that of Antwerp, specifically, discussed in Chapter 3, section 3.4.2.4: the tables there showed that Bruges has more trilled and voiced variants in coda, while Antwerp has more voiceless and fricative ones. Also discussed there was the age effect relevant to Antwerp only, older speakers having more trilled, and fewer fricative, variants. It turns out here that there is in fact a small main effect of age across all accents when it comes to alveolar fricative *r*. Older speakers have fewer fricatives, which suggests a change in progress towards fricativisation. This would support the idea that fricativisation (as well as lenition to approximants, cf. Chapter 5) is a progressive development.

4.2.7.2 Uvular fricative r

Table 4-27 shows the distribution of uvular fricatives and fricative trills in the urban accent data. The numbers refer to the relative frequencies of these variants compared to all uvular variants in the respective syllable contexts.

Table 4-27 Token frequency of uvular fricatives and uvular fricative trills relative to all uvular variants in word-initial onsets (*n*=3681), intervocalic onsets (*n*=2285), schwa-insertion context (*n*=1393) and coda (*n*=1889). No. of speakers: 262 (all speakers with uvular variants).

descriptive label	*word onset*		*intervocalic*		*ə-insertion*		*coda*	
	n	%	*n*	%	*n*	%	*n*	%
uvular fricative trill	445	12.1	117	5.1	144	10.3	661	35.0
uvular fricative	463	12.6	227	9.9	172	12.3	762	40.3
totals	908	24.7	344	15.1	316	22.7	1423	75.3

While the distribution of alveolar fricatives in onsets is largely determined by linguistic contextual factors, in addition to speech community and individual variation, that of uvular fricatives – relative to other uvular variants – is mostly accounted for by external (social) factors. As before, a linear mixed-effects model was fitted to the data, the response variable here being the occurrence of a uvular fricative variant of *r* in an onset with predominantly uvular *r* speakers. Speaker and item were included as random effects, and other linguistic and social factors were included only when they significantly improved the model. The eventual model, summarised in Table 4-28, includes vowel place (the front-back dimension) as its only linguistic predictor, while it also includes all of the social ones: speech community (city accent), sex and age.

Table 4-28 Summary of a linear mixed-effects regression predicting the likelihood of a fricative in onset position for predominantly uvular *r* speakers. The intercept corresponds to an *r* followed by a back vowel for a young male Antwerp speaker. Number of observations = 5815.

Random effects	*Variance*	*Std Deviation*	*N*	
speaker	1.284	1.13	238	
item	0.293	0.54	14	
Fixed Effects	*Estimate*	*Std Error*	*z*	*p*
(intercept)	-3.541	0.80	-4.43	.000***
Vowel place: central	-0.045	0.62	-0.07	.942
Vowel place: front	0.616	0.31	1.98	.048*
City: Bruges	2.184	1.07	2.05	.041*
City: Ghent	2.141	0.81	2.66	.008**
City: Hasselt	2.105	0.81	2.59	.009**
City: Amsterdam	-0.068	0.90	-0.08	.940
City: Rotterdam	0.854	0.83	1.03	.305
City: Leiden	2.083	0.80	2.60	.009**
City: Utrecht	0.288	0.81	0.35	.724
City: The Hague	1.506	0.80	1.88	.060
City: Nijmegen	1.722	0.80	2.15	.031*
Sex: female	0.571	0.17	3.29	.001**
Age: older	-0.898	0.18	-5.13	.000***

The inclusion of vowel height and preceding context did not improve the fit of the model, and these factors were therefore omitted. Random slopes within speaker or item likewise did not improve the fit. The model shows that the use of fricative variants of *r* in Dutch is correlated with vowel place, speech community, sex and age. Since both vowel place and city are factors with more than two levels, the interpretation of their effects needs a full overview of significant differences, and these are in Table 4-29 and Table 4-30 below. Sex and age have only two levels (male~female and young~older), and their effects can therefore be read off the model summary.

Female speakers realise uvular *r* more often as a fricative than male speakers, and younger speakers have more fricatives than older speakers. Both effects suggest a possible change in progress. A change towards more fricative realisations could indicate a general weakening of uvular variants, but only if similar (but opposite) effects are found with the more complex trill realisation. The previous section showed that this is not the case in the urban accent data, and it is therefore too early to tell whether such a change is taking place.

The significant differences between urban accents are in Table 4-29. These show that, by and large, the Belgian cities Bruges, Ghent and Hasselt pattern with the Dutch cities Leiden, Nijmegen and The Hague in having the highest proportions of uvular fricatives, while Amsterdam, Antwerp, Utrecht and Rotterdam form a subset of speech communities in which uvular fricatives are relatively rarer. There is some overlap, such that Rotterdam and The Hague, at the boundaries of these subsets, show non-significant differences with most other accents. These subsets seem to correspond to the numbers of uvular *r* speakers in the various urban accents, with larger relative frequencies of uvular fricative *r* in those cities where there are larger numbers of uvular *r* speakers, However, there are again some exceptions that break this pattern: Bruges, with its very low number of uvular *r* speakers but relatively high frequency of fricative *r* and Utrecht, with its high number of uvular *r* speakers but low frequency of uvular fricatives, are in the “wrong” subsets.

Table 4-29 *p*-values of pairwise comparisons of speech communities on the incidence of fricatives among uvular variants in onsets with uvular *r* speakers.

Bru	Gnt	Has	Ldn	Nmg	Hag	Rot	Utr	Ant	Ams
Bru	.956	.920	.895	.545	.378	.097	.015	.041	.010
	Gnt	.916	.851	.031	.043	.001	.724	.008	.000
		Has	.945	.239	.060	.305	.000	.010	.000
			Ldn	.222	.060	.305	.000	.010	.010
				Nmg	.466	.019	.000	.031	.001
					Hag	.084	.000	.060	.060
						Rot	.155	.305	.305
							Utr	.724	.509
								Ant	.940
									Ams

The single predictive factor that shows a main effect of linguistic context is the place of articulation of the following vowel, where front and back vowels are significantly different from each other (but neither are significantly different from central vowels). The *p*-values that illustrate these results are in Table 4-30.

Table 4-30 *p*-values of pairwise comparisons of vowel place on the incidence of fricatives among uvular variants in onsets with uvular *r* speakers.

back	central	front
back	.942	.048
	central	.283
		front

That there are more uvular fricative realisations of *r* in the context of front vowels is striking: while this would be an expected result with alveolar *r*, the link between fricativisation and front vowels is expected to be weaker with consonants that have a more back place of articulation. On the other hand, the backing of the entire tongue body that is required for the articulation of a uvular trill is likely to be antagonistic to the configuration for front vowels, perhaps similarly to the way in which the tongue body lowering required for alveolar trills is to high (and front) vowels.

While the model shows no effects of the preceding context, it is instructive for a full understanding of linguistic effects on uvular fricative *r* to examine its distribution over the individual items, as in Figure 4-8, which shows the random intercept for items, with higher log-odds scores further to the right on the x-axis. It is clear that uvular fricative *r* occurs most with the item *kruk*, in which it follows a dorsal stop. There is no general effect of a preceding dorsal consonant, presumably because the numbers of fricative *r* in the items *schrift* and *gras* are relatively low. However, note that in these items, *r* is preceded by a fricative traditionally transcribed as velar /x/, whose place of articulation may in fact vary on a continuum of post-palatal to uvular (Harst et al. 2007), and what is often found in these cases is a uvular fricative realisation of the *entire* /xr/ cluster (i.e., as [χ]). Because it is not always possible, however, to separate such a cluster into what corresponds to the velar fricative and what corresponds to /r/, these were usually transcribed as cases of *r*-elision in the onset and left out of the analysis here. Goeman and Van de Velde (2001) show that in Dutch dialects, it is relatively rare for the fricative and *r* to have the same place of articulation (specifically, for both of them to be uvular). In the *HEMA* data, it is a phenomenon most associated with the Leiden and The Hague accents, with 17 and 27 tokens, respectively, of *r*-elision in word onsets (see Sebregts 2004a for discussion of the phonetics of such cases of cluster simplification).

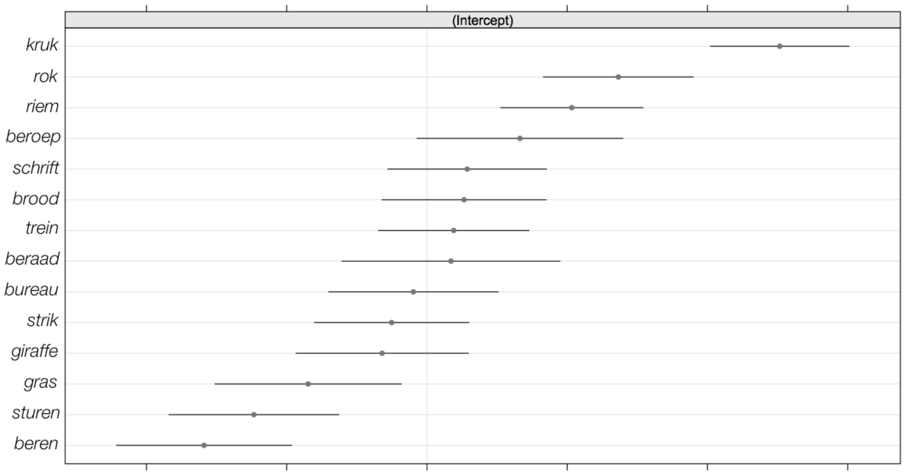

Figure 4-8 Distribution of uvular fricative variants in onsets: intercepts of individual items. Calculated over all uvular *r* tokens in onsets (*n*=5815).

Finally, Figure 4-9 shows the distribution of uvular fricative *r* over individual speakers. In contrast to alveolar fricative *r*, most uvular *r* speakers have at least some fricative tokens, though similarly to the situation with alveolar fricatives, only very few speakers have very many of them (although for a single speaker they are almost general).

In conclusion, trilled and non-trilled fricative realisations of *r* are relatively frequent among uvular *r* speakers, with wide-ranging differences between the urban accents, as well as smaller ones between men and women, younger and older speakers, and individuals. Uvular fricative *r* appears far less restricted to particular syllabic or segmental contexts, and there is some evidence in Dutch that fricative realisations are an automatic consequence of there being uvular *r* speakers.

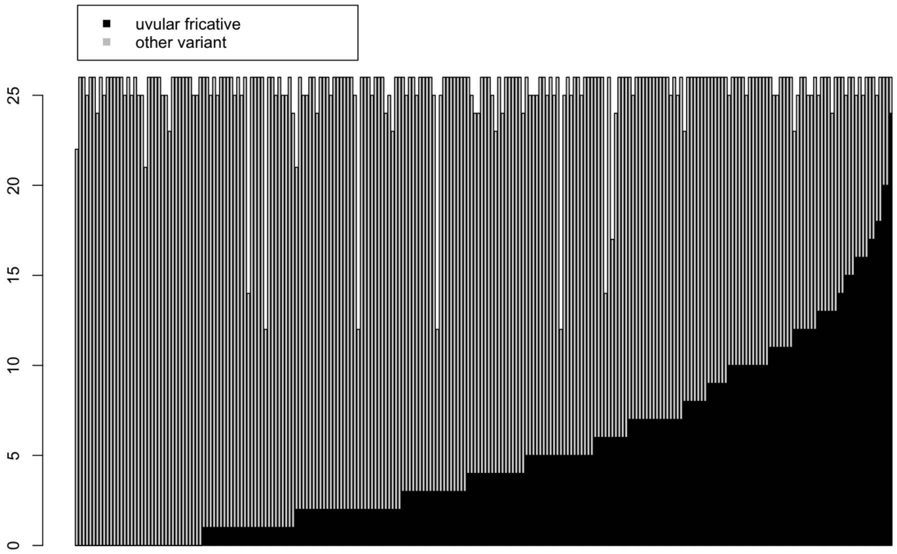

Figure 4-9 Number of fricatives (black) per speaker, relative to all other uvular variants in onset items (*N*=26). All uvular *r* speakers (*N*=238), all onset tokens (*n*=5815).

The situation in codas mirrors that of the alveolar fricative variants: uvular fricative *r* is more frequent in the Belgian Dutch accents than in the Netherlandic Dutch ones. Table 4-31 presents a summary of a linear mixed-effects model in which the response variable is the occurrence of a uvular variant in coda, among predominantly uvular *r* speakers. Included in the model are the following context and city accent, as they significantly improved the model, as well as a random slope for context within speaker, as this significantly improved the model fit ($\chi^2(9)=242.85$, $p<.001$).

The model shows the strong effect of city accent, with all of the Netherlandic Dutch accents showing significantly lower scores than the intercept. Antwerp, Ghent and Bruges, on the other hand, have significantly higher scores. There are also (smaller) differences between the Dutch cities: while Leiden, The Hague, Amsterdam and Rotterdam are not significantly different from each other in this respect, Utrecht and Nijmegen are (the latter is in fact significantly different from all other accents, occupying a middle ground between the Flemish and Dutch cities). A full overview of the *p*-values of pairwise comparisons between cities is in Table 4-32.

Table 4-31 Summary of a linear mixed-effects regression predicting the likelihood of a fricative in coda position for predominantly uvular *r* speakers. The intercept corresponds to an *r*+coronal consonant cluster for an Antwerp speaker. Number of observations = 6054.

Random effects	*Variance*	*Std Deviation*	*N*	
speaker	3.758	1.94	238	
-- following C: dorsal	8.730	2.95		
-- following C: labial	9.151	3.03		
-- following C: #	2.067	1.44		
item	0.217	0.47	14	
Fixed Effects	*Estimate*	*Std Error*	*z*	*p*
(intercept)	0.574	0.86	0.67	.503
following C: dorsal	-1.817	0.50	-3.67	.000***
following C: labial	-2.720	0.51	-5.39	.000***
following C: #	0.852	0.35	2.46	.014*
City: Bruges	2.607	1.32	1.97	.049*
City: Ghent	2.877	0.89	3.23	.001**
City: Hasselt	1.519	0.90	1.69	.091
City: Amsterdam	-4.676	1.02	-4.59	.000***
City: Rotterdam	-6.172	1.05	-5.87	.000***
City: Leiden	-4.838	0.89	-5.42	.000***
City: Utrecht	-3.970	0.88	-4.49	.000***
City: The Hague	-5.130	0.90	-5.72	.000***
City: Nijmegen	-3.040	0.86	-3.52	.000***

Table 4-32 *p*-values of pairwise comparisons of speech communities on the incidence of fricatives among uvular variants in codas with uvular *r* speakers.

Gnt	Bru	Has	Ant	Nmg	Utr	Ldn	Hag	Ams	Rot
Gnt	.804	.006	.001	.000	.000	.000	.000	.000	.000
	Bru	.319	.049	.000	.000	.000	.000	.000	.000
		Has	.091	.000	.000	.000	.000	.000	.000
			Ant	.000	.000	.000	.000	.000	.000
				Nmg	.023	.000	.000	.012	.000
					Utr	.064	.015	.296	.002
						Ldn	.554	.815	.071
							Hag	.514	.160
								Ams	.091
									Rot

There is also an effect of following consonant: there are fewer fricatives in the schwa-insertion context (where the following consonants are dorsal and labial, with no significant difference between them) than in the coda contexts of *r* preceding a coronal consonant or word-final *r*. That (trilled and non-trilled) fricative variants are most frequent in the latter context is again expected from the aerodynamic circumstances, if we assume a diachronic development from trills. The relevant *p*-values indicating differences between the various consonantal contexts are in Table 4-33.

Table 4-33 *p*-values of pairwise comparisons of following context on the incidence of fricatives among uvular variants in codas with uvular *r* speakers.

#	Cor C	Dor C	Lab C
#	.014	.000	.000
	Cor C	.000	.000
		Dor C	.096
			Lab C

In conclusion, the relationship between trills and fricatives, and the origin of fricative variants of *r*, can to a large extent be characterised as being aerodynamic in nature. Trills are by definition unstable articulations, for which the aerodynamic circumstances move in a narrow margin. Small perturbations, as are likely in casual speech, can easily lead to trill failure and yield frication (either accompanying trilling or taking its place). While this frication and trill failure may occur online synchronically, it is not likely that all or even many of the fricative tokens in the data are synchronically failed trills. It is more likely that for many speakers, the fricative portion is simply a component of their realisation of /r/ in particular contexts (this is especially the case with the strongly fricated coda-*r* in the Belgian Dutch accents). Studies have shown that the syllabic and segmental contexts that are most conducive to trill frication include codas (airflow is low) and high vowel contexts (articulatory conflict).

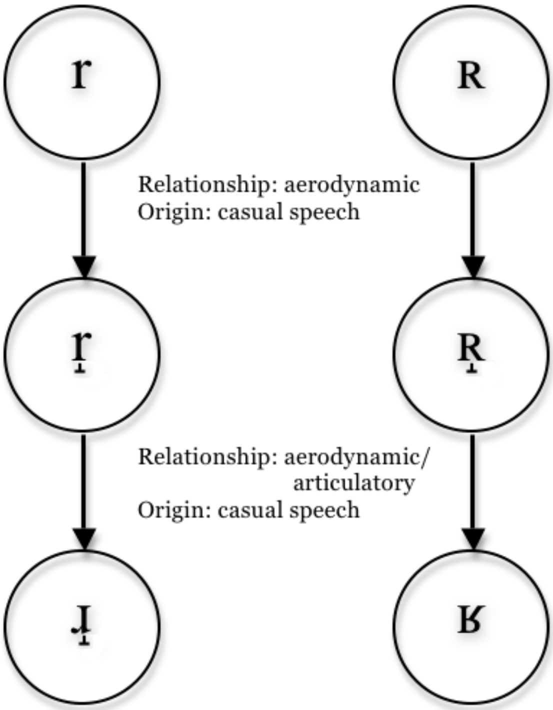

Figure 4-10 The relationship between trills, fricative trills, and fricatives.

The data in this chapter show that fricative variants of Dutch *r* are indeed significantly more frequent in these contexts.

Figure 4-10 shows the relationship between the variants discussed in this section, and adds to the full picture of *r* variant relationships. Unlike those in Figure 4-1, which showed the relationship between alveolar and uvular trills, the lines connecting the variants in Figure 4-10 are solid, reflecting their *direct* relationship rooted in aerodynamics and articulatory reduction. The diachronic origin of the fricative variants is in *casual speech processes*. The arrows indicate directionality, as the fricative variants in Dutch are more likely to have developed from trills, rather than vice versa. The evidence for this presented in this chapter has come from the synchronic distribution, in terms of token frequencies, of trills and fricative variants of *r*: the latter occur precisely where trill failure due to aerodynamic circumstances is most likely. There is no similar account as to why trills should be likely to arise from fricative variants in precisely the environment where they are more frequent, although the possibility of such a sound change cannot be ruled out, as it forms part of the widely adhered-to account of the origin of apical *r* in West Germanic (from */z/), as discussed at the start of this chapter.

4.3 Taps

In contrast to fricative realisations of *r*, there is considerable evidence that the occurrence of taps as variants of *r* is not relatable to any failure of implementing or sustaining trills. First, many instances of a single momentary contact between the articulators simply *are* (very short) trills. In other words, from an articulatory point of view these ‘taps’ (single-contact trills) are indeed successful trills. Secondly, ‘true’ taps involve a completely different articulatory plan from trills. Nevertheless, even those taps that are distinguishable in terms of their articulation from single-contact trills are auditorily/perceptually extremely similar to them. It is presumably this perceptual similarity and the articulatory simplicity vis-à-vis trills which has lead to taps having been viewed as lenition forms of trills despite the lack of a direct articulatory relationship. These points will be elaborated on in this section. The discussion will focus on *coronal* taps (and their relationship to coronal trills), the status of uvular taps being highly problematic, for the following reason. Unlike the situation with alveolar taps, it is unclear whether there are in fact two distinct articulatory targets for what could acoustically be classed as uvular taps and trills. Single-contact uvular trills occur in natural speech (and in our data), but whether an actual targeted tap articulation is viable is highly questionable, due to the size of the active articulator (the tongue dorsum). Note that there is no known instance of uvular taps contrasting with uvular trills in any language, which is also in contrast to the situation with alveolar taps and trills (e.g. Spanish (Macpherson 1975), Catalan (Hualde 1992:373), Basque, Kurdish, Huave (Maddieson 1984)).[24] It is most likely

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[24] In Iberian Portuguese, the uvular trill contrasts with an alveolar tap. Historically, the opposition was one of an alveolar trill and tap. The trill became uvular relatively recently (about a century ago), and is realised as a uvular fricative in the Lisbon area and most Brazilian

that any instance of a single-contact uvular *r* is a relatively short uvular trill, rather than a distinct articulation, and these instances in the data were therefore classed as trills. The remainder of this chapter will therefore describe the articulatory and acoustic properties of alveolar taps, and their distribution in the Dutch urban accent data.

4.3.1 Taps versus trills

The articulatory differences between taps, trills, and ordinary stops are well-described in the phonetic literature (e.g. Catford 1977; Laver 1994). The main difference between coronal trills and taps is that instead of a static positioning of the tongue tip in combination with aerodynamics (trills), there is a single rapid dynamic articulation in taps.[25,26] Therefore, a trill cannot be seen as a succession of taps, nor is a tap identical to a single-contact trill. However, note that taps and single-contact trills never contrastively occur in the world's languages, although it is likely that they occur as two different phenomena in the speech of individuals (Laver 1994:224-225).

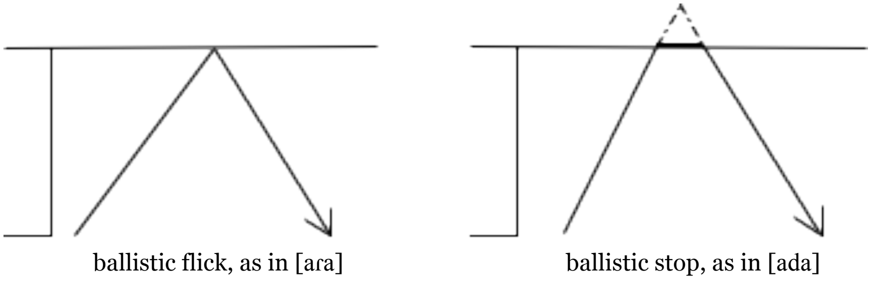

Figure 4-11 The articulatory difference between taps ("ballistic flick") and stops (from Catford 1977).

The difference between tapped stops and regular plosives has been claimed to be simply speed (Ladefoged 1975:147). Catford (1977), however, states that both the momentary nature of taps (as opposed to the prolongable nature of most other sounds) and the different target (which for plosive stops can be said to be *beyond* the surface of the passive articulator) distinguish taps from ordinary plosives. This is

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Portuguese dialects. The alveolar trill-tap distinction survives in some Iberian Portuguese dialects, as well as in African Portuguese (Mateus and d'Andrade 2000).

[25] Taps can also be allophones of other, non-rhotic, sounds, such as, in American English, intervocalic /t/ in *ladder*, *latter*, *city*. There are phonetic differences between the two, apparent in x-ray footage (Ladefoged and Maddieson 1996): for an American English speaker producing a tap-/t/ there is anticipation during the preceding vowel in the form of retraction and raising of the tongue. The tongue is then moved forward to make the contact and returns to the floor of the mouth. For a Spanish speaker producing a tap-/r/, there is no such anticipation, but a quick upward and downward movement of only the tongue-tip.

[26] Some authors, such as Ladefoged and Maddieson (1996:230), make a distinction between taps (for which the tongue moves directly towards the passive articulator) and flaps (for which the tongue moves tangentially towards a surface, striking it in passing). This contrast is not made here.

illustrated in Figure 4-11 (note that Catford's term for taps is 'flicks'). The momentary, dynamic nature of taps is also illustrated by their consistent intervocalic occurrence: apart from the lexically intervocalic contexts, most other contexts in which taps appear are usually augmented such that they become intervocalic. This includes both the familiar coda schwa-insertion cases (*harp*, *kerk*, *berg*, *arm*), which are realised with a schwa-like vocoid after *r* (see chapter 6 for more discussion and some qualification of this characterisation), as well as the non-intervocalic onsets (*riem*, *rok*, *brood*, *trein*, *strik*, *kruk*, *schrift*, *gras*). In the latter set, a short schwa-like vocoid precedes the tap in most cases. Since the very essence of the tap is its momentary nature, as Catford (1977) observes, this should not be surprising. In both the coda schwa-insertion context and the word-initial onset context, the presence of the vocalic element ensures the most salient feature of the tap, i.e. the brief closure, to be perceptible. Figure 4-12 shows the appearance of the vocoid in the Cr context.

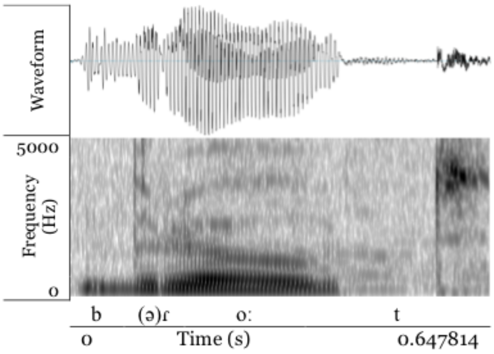

Figure 4-12 Voiced alveolar tap in *brood*, speaker AM01v40 (an older Amsterdam speaker). There is a vocoid portion of 36 ms long visible between the burst of the [b] and the closure for the tap.

This vocoid insertion before or after a tap [ɾ] is not specific to Dutch. In fact, the appearance of a svarabhakti vowel between voiceless consonants and (tapped or trilled) alveolar *r* in German was noted by Trautmann (1884:292-299) well over a century ago. Furthermore, Helgason (1999) presents data from Eastern Swedish, in which *grönt* 'green' is realised as [gəʀᴇːnt], and Kocjančič (2004:3) describes the *r* of Standard Slovenian as consisting of "a vocoid (schwa) and a tap" Outside of the Germanic languages, *r* in Czech (Machač 2009) and Greek (Baltazani and Nicolaidis 2013) have been shown to involve the same articulatory characteristic. One language for which the phenomenon of vowel epenthesis surrounding tap-*r* has been extensively studied is Spanish: descriptions go back to Lenz (1892-1893), and by 1965 Malmberg called it a well-known phenomenon (1965:31), mentioning examples such as *pronto, fresco* (as [pəˈronto], [fəˈresko]) from Argentinian Spanish. Blecua Falgueras (2001) finds the "elemento esvarabático" in the majority of realisations of Spanish tap-*r*. Her phonetic study shows that the tap found in this context has the same phonetic properties as taps between two full vowels, and concludes that, even though the vocoid element is shorter than any full vowel (32 ms on average in her data), this means that taps are always intervocalic. Another way of looking at this phenomenon is viewing the vocoid element as an inherent ingredient of the alveolar tap (for more detail see the discussion of schwa-insertion in Chapter 6).

A further difference between taps and trills is that the predorsum lowering associated with trills is not found with taps (Recasens and Pallarés 1999). Trills also show more postdorsum retraction than taps. Both predorsum lowering and postdorsum retraction make room for the vertical movements of the tongue-tip. The tongue body is also more tightly constrained for the trill. The combination of these factors lead to the trill being much less susceptible to coarticulation with neighbouring vowels (Recasens and Pallarés 1999; Recasens 1991). Instead, the trill itself exerts a relatively large influence on preceding vowels, also because of the tongue body configuration. Taps coarticulate quite freely, which suggests there is little articulatory control. Positioning is not as crucial as for the trill. Conversely, taps do not exert much influence on neighbouring vowels. Varying oropharyngeal pressure as described above in the experiments by Solé for trills (leading to cessation of trilling) showed no effect on tap production (the only effect of venting air pressure on taps was a greater amplitude during closure). The robustness of taps in the face of varying pressure conditions reflects the different mechanism needed: muscular action instead of aerodynamic force. In sum, the tap has a less complex articulation and is more robust in the face of small variations.

While Recasens and Pallarés (1999) emphasise the coarticulatory differences between trills and taps to argue that taps are not single-contact trills and trills not repeated taps, there are, however, also similarities between trills and taps, both articulatorily and perceptually. The primary articulatory similarity between taps and trills is found in the closure phase, which has a similar duration for the single contact of the tap and the multiple contacts of trills (around 20 ms). As with trills, the closure phase of a tap may be voiceless (Ladefoged and Maddieson 1996:231). This identity in closure phase duration and possible laryngeal modifications leads to taps and trills being perceptually similar, especially so in situations where there is no Spanish/Catalan-type contrast *r ~ ɾ*, and the trill may be realised by a single contact, as in Dutch.

The less complex nature and greater robustness of the tap in combination with the perceptual similarity make the tap [ɾ] a good candidate for becoming a historical lenition form of the trill [r]. This is in fact the case. Bhat (1974) shows that trills alternate in allophonic relationships with taps and flaps cross-linguistically: trills are often word-initial and post-consonantal, taps and flaps occur in intervocalic contexts. Trills are found in slow, emphatic speech and in stressed contexts, taps and flaps in unstressed positions, non-emphatic or fast speech. Inouye (1995) analyses a number of trill/tap alternations as lenitions, and so doesRecasens (2002:346) for cases of the replacement of a trill by a tap historically in many Romance dialects. From a distributional standpoint, a lenition analysis is certainly warranted, as taps are seen to occur mainly in non-prominent contexts (pre-consonantal, word or sentence-final, intervocalic). In contrast, the alveolar trill shows up in “strong” contexts: word-initially, and word-internally after consonants. Note that even in Spanish, which has a phonemic contrast between taps and trills, [r] and [ɾ] are in fact usually neutralised, and only contrast in intervocalic position, where the perceptual distinction is maximal (Inouye 1995). The following section looks at the distribution of alveolar taps in the urban accent data, to review whether they indeed most appear in the contexts predicted from the phonetic and historical studies cited here.

4.3.2 Taps in the urban accent data

Section 4.2.4 showed that the workings of aerodynamic forces clearly favoured certain contexts over others for the occurrence of fricative variants. If taps are indeed lenition variants of *r* (vis-à-vis trills), the 'non-prominent' contexts referred to by Recasens (2002), i.e. intervocalic, pre-consonantal, and word-final, should favour the occurrence of taps. In fact, what the data show is that in onsets, taps are favoured over all other alveolar consonantal variants in almost *all* prevocalic contexts in Dutch by alveolar-*r* speakers. More than 50% of all alveolar onset tokens are taps. An overview of the distribution of taps across the four major syllabic contexts is in Table 4-34.

The table shows that voiced alveolar taps are the most frequent alveolar variants in all onset contexts, as well as in the schwa-insertion context (which, when schwa-insertion takes place, creates a phonetic onset as well). The only context where voiced taps are disfavoured is that of the true coda. Voiceless taps, on the other hand, are absent or rare in those contexts where voiced taps are found, but they are more frequent than voiced taps in codas. This illustrates the general tendency towards devoicing also found with fricative variants.

Table 4-34 Token frequency of alveolar taps relative to all alveolar variants in word-initial onsets (*n*=2610), intervocalic onsets (*n*=1617), schwa-insertion context (*n*=1282), and coda (*n*=2362). No. of speakers: 210 (all speakers with alveolar variants).

descriptive label	*word onset*		*intervocalic*		*ə-insertion*		*coda*	
	n	%	*n*	%	*n*	%	*n*	%
voiced alveolar tap	1876	51.0	1226	53.7	969	69.6	283	15.0
voiceless alveolar tap	0	0.0	0	0.0	21	1.5	368	19.5
totals	1876	51.0	1226	53.7	990	71.1	651	34.5

There are, however, differences between contexts *within* the onset condition. The distribution of taps within this context was assessed via a linear mixed-effects regression model, with speaker and item included as random effects. Other effects were conservatively included only if they significantly improved the model fit; the final model is in Table 4-35, and includes preceding context, vowel place, as well as age of the speaker as significant predictors. The model includes a random slope for preceding context within speaker, as this improved the fit of the model ($\chi^2(14)=42.174$, $p<.001$). This indicates that the effect of preceding context, which as a main effect shows more taps with C*r*- clusters than in intervocalic positions, and yet fewer in word-initial positions, varies with individual speakers.

Table 4-35 Summary of a linear mixed-effects regression predicting the likelihood of a tap in onset position for predominantly alveolar *r* speakers. The intercept corresponds to a coronal consonant+*r* cluster followed by a back vowel for a young speaker. Number of observations = 4114.

Random effects	*Variance*	*Std Deviation*	*N*	
speaker	1.514	1.23	169	
-- preceding context: dorsal C	0.429	0.66		
-- preceding context: labial C	1.090	1.04		
-- preceding context: V	0.283	0.53		
-- preceding context: #	1.703	1.30		
item	0.000	0.00	14	
Fixed Effects	*Estimate*	*Std Error*	*z*	*p*
(intercept)	1.945	0.20	9.77	.000***
preceding context: dorsal C	0.375	0.17	2.26	.024*
preceding context: labial C	-0.360	0.22	-1.65	.100
preceding context: V	-0.437	0.15	-2.92	.004**
preceding context: #	-2.221	0.19	-12.01	.000***
Vowel place: central	-0.075	0.20	-0.38	.707
Vowel place: front	0.262	0.09	2.77	.006**
Age: older	-0.533	0.16	-3.42	.001***

There are a number of significant main effects on the use of taps in onsets by alveolar *r* speakers, though the effects are generally small (and the overall frequency of taps is very high). First of all, there is an effect of the preceding context.

Table 4-36 *p*-values of pairwise comparisons of preceding context on the incidence of taps among alveolar variants in onsets with alveolar *r* speakers.

Dor C	Cor C	Lab C	V	#
Dor C	.024	.000	.000	.000
	Cor C	.100	.004	.000
		Lab C	.576	.000
			V	.000
				#

Table 4-36 above shows the *p*-values of pairwise comparisons between the preceding contexts in terms of their effect on the incidence of taps in onsets. There are significantly fewer taps in the absolute word-initial context, a fairly large effect, and significantly more in the context of preceding dorsal consonants. Differences between the other contexts are small, although that between preceding coronal consonants and the intervocalic context (V) is also significant. In light of the discussion above, the lower incidence of taps in the absolute word-initial position is not surprising, and it is typically the position in which trills and fricatives are most frequent. Taps being less frequent in intervocalic positions than in C*r* onsets is perhaps less expected, but, as the next chapter will show, intervocalic positions do favour the alveolar approximant, an even more strongly lenited variant.

Apart from the effect of preceding context, there is an effect of vowel place (Table 4-37), with more taps in the context of front vowels than in the context of back vowels, and central vowels in-between (although only the front~back difference is significant, not the front~central and central~back differences). This is unsurprising since trills, especially (as well as approximants, cf. Chapter 5), are significantly less frequent with front vowels; possible aerodynamic reasons for this were discussed in section 4.2.3, and additional articulatory reasons in 4.3.1: given the large amount of coarticulation between vowels and trills, the gestures for front vowels are likely antagonistic to those for the trill, prohibiting successful trill realisations in this context. Taps, on the other hand, require little articulatory control and freely appear here. In other words, it is not the case that front vowels particularly attract taps; it is that they repel trills, and taps are simply the "default" alveolar consonantal realisation (they are by far the most frequent in all contexts).

Table 4-37 p-values of pairwise comparisons of vowel place on the incidence of taps in onsets with alveolar *r* speakers.

front	back	central
front	.006	.098
	back	.707
		central

Finally, there is an effect of age on the use of alveolar taps: older speakers use fewer taps than young speakers. This may indicate that there is a change in progress towards more taps, although – as will become clear in the discussion of approximants in the following chapter – this happens not just to the detriment of trills.

In conclusion, the predominance of taps in onsets makes any assumption that they are synchronically actually short (single-contact) trills less probable. If so, one would expect more variation with trills with two or three contacts, especially since the number of contacts are not under active control from the speaker. It is, in other words, not likely that there is an invariant trill target for all alveolar onset *r*, that is consequently not met due to articulatory or aerodynamic constraints. Nevertheless, since taps alternate freely with other manners of articulation in onsets, including trills (almost all speakers do variably use trills), it is demonstrably not the case that the tap is the single *r*-target either. This points towards an analysis in which both trills and taps, as well as fricatives and approximants, are available to all speakers who use alveolar variants in onsets. That is, they are all part of the pool of variants speakers have at their disposal in production and perception, as their corresponding exemplars are stored.

In coda positions, the difference between taps and trills is blurred because of the fricativisation found in both. As the label indicates, both trills and taps are included in the variant "alveolar trill or tap with homorganic frication" (see the description for this variant in Chapter 3, section 3.2.1.4). The frication portion in fact often makes it impossible, in cases where there is only one lingual contact, to determine which of the two is present. Nonetheless, there are also clear cases of voiced and voiceless alveolar taps in codas, as Table 4-34 shows. In the schwa-insertion context, taps are in fact particularly frequent when schwa is inserted. In cases without schwa insertion, taps are disfavoured (see Chapter 6, tables 6.3 and 6.4, where this is discussed in more detail). The schwa-insertion context in these cases, in other words, behaves like other coda contexts, and fricatives and approximants appear instead.

To determine the effects of linguistic and social factors on the appearance of taps in codas, a series of linear mixed-effects models was run in which the response variable was the occurrence of an alveolar tap variant in coda, among predominantly alveolar *r* speakers. Included in the final model are all significant main effects, following context, accent, and sex, as well as a random slope for context within speaker, as this too significantly improved the model fit ($\chi^2(9)=214.0$, $p<.001$).

Table 4-38 Summary of a linear mixed-effects regression predicting the likelihood of a tap in coda position for predominantly alveolar *r* speakers. The intercept corresponds to an *r*+coronal consonant cluster for a male Antwerp speaker. Number of observations = 4362.

Random effects	*Variance*	*Std Deviation*	*N*	
speaker	0.762	0.87	169	
-- following C: dorsal	2.235	1.49		
-- following C: labial	3.665	1.91		
-- following C: #	3.984	2.00		
item	0.403	0.63	14	
Fixed Effects	*Estimate*	*Std Error*	*z*	*p*
(intercept)	-1.477	0.36	-4.10	.000***
following C: dorsal	3.296	0.56	5.87	.000***
following C: labial	2.936	0.57	5.16	.000***
following C: #	-1.486	0.45	-3.27	.001**
City: Bruges	1.281	0.26	4.89	.000***
City: Ghent	0.266	0.40	0.67	.501
City: Hasselt	0.829	0.35	2.40	.016*
City: Amsterdam	0.183	0.29	0.63	.527
City: Rotterdam	-1.654	0.37	-4.51	.000***
City: Leiden	-1.102	0.55	-1.99	.046*
City: Utrecht	0.144	0.49	0.30	.768
sex: female	-0.503	0.19	-2.71	.007**

Table 4-38 shows that there are differences in the occurrence of alveolar taps between different following contexts, with more taps before labial and dorsal consonants (the schwa-insertion contexts), as expected on the basis of the figures in Table 4-34. In addition, there are significantly fewer taps in absolute word-final position, which is predicted from their phonetic characteristics. The *p*-values of pairwise comparisons between the following contexts are in Table 4-39.

Table 4-39 *p*-values of pairwise comparisons of following context on the incidence of taps in codas with alveolar *r* speakers.

Dor C	Lab C	Cor C	#
Dor C	.583	.000	.000
	Lab C	.000	.000
		Cor C	.001
			#

Differences between cities are small, but some are significant: it appears that in Bruges and Hasselt, in particular, taps in codas are more frequent than elsewhere; in Leiden and Rotterdam they are significantly less frequent. It is interesting to note that Antwerp patterns largely with a middle group that also includes Amsterdam and

Utrecht, rather than with the other Flemish cities, even though at a more macro-level it most closely resembles Bruges in its patterning of *r*-variants. However, as sections 4.2.2.1 and 4.2.7.1 showed, trills and especially fricatives are much more frequent in codas in Antwerp than in Bruges. This is also in line with the higher number of fricative and voiceless realisations in Antwerp discussed in section 3.4.2.4. Results of pairwise comparisons between cities are in Table 4-40.

Table 4-40 p-values of pairwise comparisons of speech communities on the incidence of taps among alveolar variants in codas with alveolar *r* speakers.

Bru	Has	Gnt	Ams	Utr	Ant	Ldn	Rot
Bru	.179	.009	.000	.018	.000	.000	.000
	Has	.210	.072	.196	.016	.001	.000
		Gnt	.839	.828	.501	.028	.000
			Ams	.937	.527	.022	.000
				Utr	.768	.070	.001
					Ant	.046	.000
						Ldn	.361
							Rot

In conclusion, taps are particularly frequent in the schwa-insertion context, where (when schwa-insertion indeed takes place) they are intervocalic, which, given their phonetic makeup, is their natural environment. Taps are also very frequent in word-initial onsets, especially in C*r* clusters. Here, a phonetically intervocalic environment is created as well, by the insertion of a brief vocalic element before the closure of the tap. Another way of looking at this process would be to say that the vocoid is in fact part of the tap, forming a “diphthong” in the sense of Andersen (1972:36). Finally, in pure coda positions, and especially in absolute word-final position, the tap is relatively infrequent.

This distribution of alveolar taps is in accordance with an analysis in which they are not synchronically lenited forms, i.e. failed trills or even successful trills with a single contact (as was argued above on the basis of their articulatorily different character), but in which they are the outcome of a lenition development, under a broader view of what constitutes lenition. Diachronically speaking, alveolar taps are lenition forms of *r*; synchronically, they vary freely with other, related variants. The tap is the dominant onset realisation for alveolar *r* speakers. It is therefore not confined to weak positions, although it is certainly less frequent in some typically strong ones, such as absolute word-initial position. The relationship between the alveolar trill and the alveolar tap is illustrated in Figure 4-13.

The relationship here is articulatory only in the sense that the trill and the tap share both their articulators, not in the sense that the latter is a directly lenited (i.e. reduced) form of the former. However, the tap is more robust (there is less influence form air pressure differences), and requires less articulatory control; it is therefore a good candidate for being a lenition form of the trill, with its origin in casual speech, although they are in a different kind of relationship from that between the trill and the fricative. The shorter, simpler tap is a “reduced” articulation from a historical point of view, though not in terms of direct articulatory reduction. The indirect relationship is indicated by the dashed line between them. The arrow indicates the directionality, for which the case here is less strong, however, than for the other variants discussed in this chapter. Since taps are so frequent, it is harder to find synchronic distributional evidence for their proposed origin, and a reverse directionality (of trills originating as stylistic variants of taps in strong positions) is not implausible. Finally, the relationship between the two is also perceptual, in that they are very similar, and often hard to distinguish (even by trained linguists).

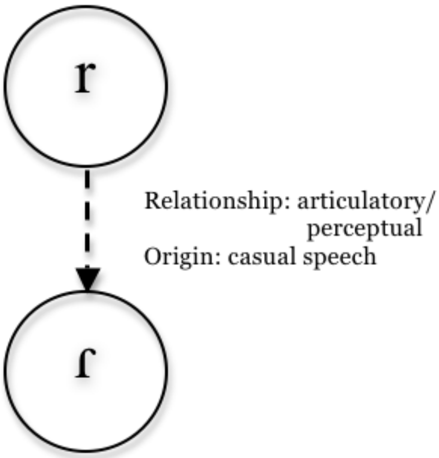

Figure 4-13 The relationship between alveolar trills and taps.

4.4 Conclusion

Figure 4-14 shows the relationships and inferred origins between the variants discussed in this chapter, combining the partial diagrams from the individual sections. The data presented in this chapter have shown that the distribution of the consonantal *r*-variants (trills, taps, and fricatives) is far from random. To a large extent, the distribution is predictable on the basis of the phonetic/phonological properties and context. The non-trilled variants occur most in positions where they are expected to arise as variants of failed or incomplete trill articulations in casual speech forms, as a consequence of general phonetic processes related to articulatory and aerodynamic circumstances. The trills (alveolar and uvular) themselves are particularly frequent in positions where the circumstances for their successful execution are most favourable.

Specifically, fricative and tap realisations occur most in those positions where trilled articulations are less likely. Word-finally, trills are predicted to have their lowest “success rate”, as the aerodynamic circumstances for maintaining trilling are poor. For alveolar trills, this is also the case in onsets in the context of high vowels. The result of trill failure in these positions is invariably a fricative of some kind. Similarly, intervocalic positions, especially post-tonic ones, are more likely to induce shortening of trills to a single-contact trill, or their replacement by a tap.

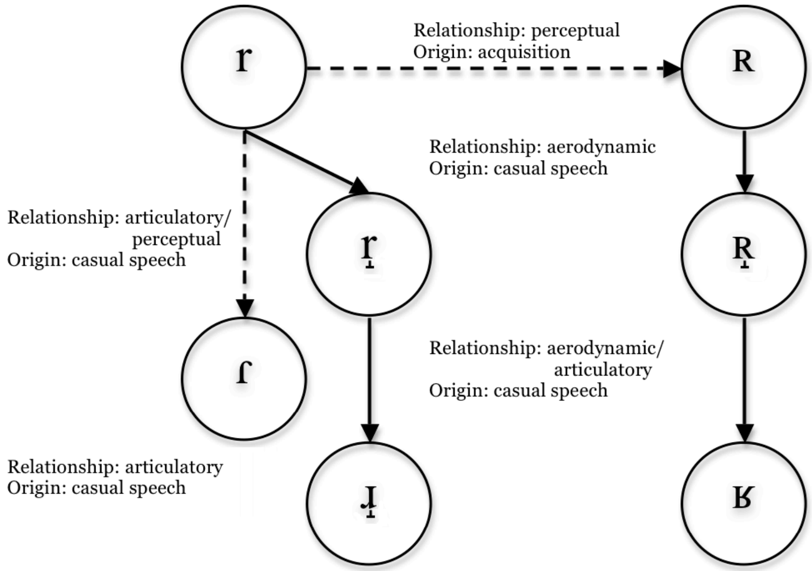

Figure 4-14 Relationships between the consonantal variants of Dutch *r*.

This account of the distribution of trills, taps, and fricatives characterises the relationships between these variants, in the sense discussed in Chapter 1. That is, it assumes an asymmetrical “family” relationship between trills on one hand, and the non-trilled variants that are predicted to emerge initially as reduced, or lenited, variants of these trills on the other. However, it is not the case that trills are impossible in, and therefore absent from, the positions in which more taps and fricatives are found. It is also not the case that the effects of context and phonetic circumstances are the same for all speakers. The variation found in the urban accent data is quantitative rather than qualitative in a number of ways. *More* tokens with a certain variant are found in certain contexts, but they are never exclusive. Similarly, certain variants are found more with certain speakers, even if in general they reflect the same trend. In fact, the variation found with *r* variants in Dutch is only partly explained via linguistic, contextual factors: speaker age, sex and accent (speech community) were also shown to be significant predictors in many cases presented here. This shows not only that the phonetic pressures identified here are never *automatic* – however “natural” phonetically, they do not have to happen –, but also that the phonetic variation, while sometimes fine-grained and minimal, is available to speakers as a source of sociolinguistic functionality.

The picture that emerges has several phonological implications. A description of Dutch *r*-variation is impossible from the view of a deterministic categorical grammar. Very few variants are confined to certain contexts, and no contexts are restricted to a particular variant. Characterising the variation as largely random phonetic fluctuation, on the other hand, also does not do justice to the patterns revealed in the analyses above, as there is clearly a complex interplay of linguistic and extra-linguistic factors that determines the use of *r* variants.

The aim of this chapter was to connect two sources of evidence – data on particular *r* variants from descriptive and experimental phonetics, and data on the distribution of *r* variants in Dutch urban accents – to explore the idea that most, if not all, variants can be analysed diachronically as lenition forms of trilled *r*. These lenited variants arise in casual speech processes and acquisition, and – as new exemplars – they consequently become available to speakers as new production targets. They are then part of the pool of variants speakers have at their disposal, each with their own distribution. As argued in Chapter 1, such a view is consistent with a theory of the interface in terms of exemplar dynamics, in which speakers by virtue of storage have access to statistical distributions of variants over contexts – linguistic and otherwise.

An exemplarist “phonetic grammar” is probabilistic, not deterministic; however, it is important not to take too naïve a view of how such a grammar would work. Even a cursory look at the division of alveolar and uvular variants in any city is enough to illustrate this. The most obvious case is that of Rotterdam (see section 3.4.6.3 and Table 4-2 above). In onsets, the numbers of alveolar and uvular variants are almost equal (51.9% alveolar, 47.3% uvular). If Rotterdam, even as an abstraction, is considered a single, closed speech community, then, under a naïve view that does not consider other factors, the expectation would be for individual speakers from Rotterdam to emulate this variation, and produce roughly equal numbers of alveolar and uvular *r*. This is, however, not the case, as in fact 44.2% of Rotterdam speakers realise onset *r* exclusively as alveolar, while 37.2% have exclusively uvular variants in this position. While 18.6% indeed mix alveolar and uvular variants, they also do not do this in roughly equal proportions. This shows that, instead of naïve probability matching, i.e. speakers matching their exemplars in production to those available in the speech community, there are other constraints that play a role. One such constraint may be the presence of entrenched motor routines (Zanone and Kelso 1992:419; Pierrehumbert 2001). The motor patterns that speakers have learned to use and reuse that are associated with particular exemplar clouds may override the formation of new links between articulation and perception for closely associated exemplars. Of course, also determining the actual productions of speakers are social factors. Since exemplars are conceptualised as labelled tokens, they include both perceptual and social-indexical information. Speakers will, rather than simply copy patterns found in the entire speech community, match the distribution of tokens associated with (*indexed* for) their perceived target social class, gender, age group, etc. In the example of place of articulation variation in Rotterdam, it is also likely that there are social factors at play, although these would have to be some that the *HEMA* corpus methodology was not able to incorporate. Social class is a possible factor, although there is no evidence that place of articulation among consonantal variants (alveolar vs. uvular) carries any social meaning as such. If it does, it is certainly not something that is above the level of consciousness for speakers of Dutch. There are yet other candidates for explaining the variation. Perhaps it is linked to geography; Rotterdam is a port city, with a wide river dividing the southern suburbs from the city centre and its surrounding neighbourhoods. These are, however, speculations at this point; the data certainly invite further study.

The following chapter continues the exploration of patterns of *r*-variation in the urban accents, focussing on the approximant and vocalic variants of Dutch *r*.

5 *r*-variation: approximants and vowels

This chapter deals with approximant and vocalic variants of *r*, examining their phonetic make-up and how they are related to each other and to other, more constricted types of *r*, as well as their distribution in urban accented Dutch. As with most *r*-sounds studied in the previous chapter, the relationships between *r*-variants are analysed largely in terms of arising out of casual speech processes. As with the fricatives and taps, lenition (interpreted as articulatory reduction) is shown to play a major role in the development of the current patterns of variation. However, problems in the approach to lenition as articulatory reduction only also surface when looking at approximant variants of *r*. Particularly, the retroflex/bunched approximant is an articulatorily highly complex *r* variant, which makes it less likely to have arisen as a case of articulatory reduction during casual speech. Its distribution, however, is highly similar to that of two other sets of variants argued here to be such reduction variants, viz. both the purely vocalic variants (vowels), also discussed in this chapter, and voiceless, strongly fricative variants of Dutch *r*, which were discussed in the pervious chapter. Rather than being a simple case of articulatory reduction, it appears that a reinterpretation of the cues associated with coda-*r* along perceptual parameters accounts for the presence of the retroflex/bunched approximant, and explains the relationship between this and other *r*-variants.

As in the previous chapter, the phonetic features of the relevant variants are discussed first, followed by their distribution over the urban dialect data. Any distributional asymmetries are then compared to predictions made by the phonetic analysis. In the case of the retroflex/bunched approximant, the discussion of its phonetic features includes a study of its articulatory properties, the subject of only speculative discussion until the current study. This is based on a small corpus of new ultrasound data, recorded in collaboration with James M. Scobbie at the Clinical Audiology, Speech and Language Research Centre (CASL), Queen Margaret University in Edinburgh, UK.[27] The chapter is divided into 3 major sections: section 5.1 focuses on the “consonantal approximant” realisations (see Chapter 3, sections 3.2.1.9 and 3.2.1.13 for their definition and 5.1.3 below for more detail), while sections 5.2 and 5.3 deal with the retroflex/bunched approximant and other vocalic variants, respectively. The “zero” or elision variants are discussed in Section 5.4; section 5.5 concludes.

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[27] Queen Margaret University College at the time of recording (November 2004).

5.1 Approximant *r*-variants

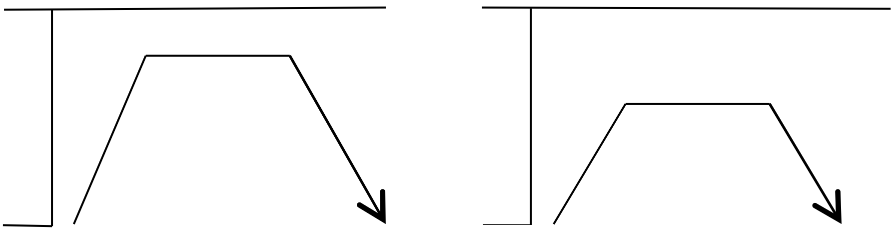
In the UPSID database, 28 languages are reported to have an approximant *r*, accounting for 9.9% of all rhotic phonemes in the database (1984). This makes them neither rare nor especially frequent in relation to other rhotics. While the UPSID's representation of these as approximants of course runs into the same conceptual problems as noted with the trill phonemes in Chapter 4 (see 4.2.5), i.e. representing the abstract units of languages in terms of invariant phonetic properties, it is in fact well-known that in the Germanic languages, approximant realisations of /r/ are relatively common, even in the standard varieties of these languages. For instance, many varieties of English, such as General American English (GAE) and Southern British English (SBE), have an approximant as their most frequent realisation of /r/ (Ladefoged and Maddieson 1996), as do Standard German (Wiese 2000) and Danish (Basbøll 2005). Approximant *r*-sounds can have a variety of places of articulation, as these languages show: they range from post-alveolar (SBE) to retroflex or mid-palatal (GAE) to uvular (German) to uvulo-pharyngeal (Danish). In several other languages, approximants are common realisations of *r*, even if they are not usually transcribed as such. Some examples are Swedish (Bruce and Engstrand 2006), and non-Germanic languages such as Spanish (Blecua Falgueras 2001; Colantoni 2006), Greek (Müller 2010; Nicolaidis and Baltazani 2011), and Polish (Jaworksi and Gillian 2011).

As was shown in Chapter 3, approximant realisations of *r* are common in Dutch as well. This is especially true of the Netherlandic Dutch dialects, and especially so in codas. A special case of approximant-*r* in Dutch is the variant that has been referred to provisionally as the retroflex/bunched approximant, popularly known as *Gooise r* in the Netherlands (cf. Chapter 2, fn.3), and transcribed in Chapter 3 as [ɹ]. It is special for two reasons: first, it is especially frequent (comprising over 55% of all *r*-realisations in codas in Netherlandic Dutch); secondly, its articulation has been the source of some debate in the decade preceding this study. Its articulatory properties will be more closely examined in section 5.2, which presents the results of an ultrasound study of this variant. Other variants identified in Chapter 3 and discussed here are an alveolar, a palatal and a uvular approximant.

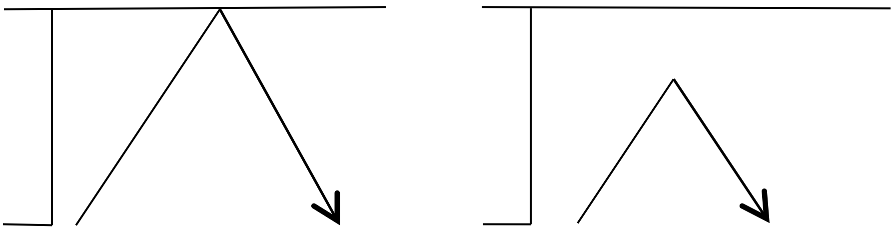
5.1.1 Approximants as lenition variants of *r*

The first important step is to examine whether, like fricative and tap variants, approximant and vocalic realisations of *r* are non-arbitrarily related to more constricted, consonantal variants along phonetic (articulatory and/or auditory-acoustic) parameters.

A change of more constricted consonants into approximants and/or vocalic segments is, contrary to the fricativisation examined in the previous chapter, rather uncontroversially a case of lenition (Bauer 1988; 2008; Lavoie 2001:36; Kirchner 2001; 2004; Gurevich 2011). The many approximant and vocalic variants of *r* encountered in the urban accent *r* data should therefore be analysable as such fairly straightforwardly. There are, however, a few problems with such an account. First, the contexts in which approximants appear are not unequivocally the usual reduction targets: they occur in no small number in ‘strong’ positions (onsets) as well. Secondly, as mentioned above, the most frequent approximant variant, the retroflex/bunched approximant cannot be straightforwardly analysed as a reduced variant. Its articulation, as section 5.2 will show, is in fact more complex that that of some of the consonantal variants used in onsets, and does not differ from those variants in degree only; on the other hand, in terms of its distribution it patterns with the more obviously reduced, i.e. vocalic, variants. Both points will be discussed below, leading to the conclusion that – despite first appearances – the approximant realisations (including the retroflex/bunched approximant, as well as all vocalic *r*-realisations) can indeed be viewed as forms diachronically originating from more constricted types of *r*. The point made is that the phonological term *lenition* can be applied to these variants in general, while the more phonetically precise term *reduction* can only be applied to the inception of the sound changes that led to these variants, not their subsequent development (cf. Chapter 1, section 1.3.2.2).



a. fricative b. approximant



c. tap d. semi-vowel

Figure 5-1 Articulation types (from Catford 1977).

Returning to Catford’s (1977:134) diagrams of articulation types (see Figure 4-10 in section 4.3.1), the case of the difference between fricatives on the one hand and approximants on the other is most easily visualised as a reduction of the degree of stricture, as in Figure 5-1. That is, the tongue (tip or body) gesture is essentially the same for fricative and approximant *r*s in terms of direction, but not in magnitude. The relationship between uvular untrilled fricatives and uvular approximants is likely to be of this nature: the difference between these variants is gradient, as the process of labelling them in the urban accent data demonstrated. Instances of weakly fricated uvular *r* tokens form a grey area between clear fricatives and approximants. A similar relation holds between the tap and certain of what Catford terms “semi-vowels” (glides). If the short ballistic gesture of the tap is decreased in magnitude, the result will be a ‘ballistic approximant’ of sorts. Given the transitory nature of, specifically, most of the alveolar approximants in the urban accent data, it can be assumed that these are indeed of this articulation type, and are, at least as far as their diachronic origin is concerned, essentially lenited taps.

5.1.2 Weakening to approximants and vocalisation in Articulatory Phonology

Lenition resulting in approximants or vowels is modelled in Articulatory Phonology as a decrease in the constriction degree (CD) parameter of the articulatory representation (see the general introduction to Articulatory Phonology representations in Chapter 1). That is, the magnitude of the gesture in question is reduced, while all other aspects of the articulatory plan – most crucially, its constriction location – remain the same. A visualisation of this is provided in Figure 5-2 and Figure 5-3: the difference between two realisations of *beren*, as found in the data (one with alveolar tap [ɾ], one with alveolar approximant [ɹ]) is modelled as involving the same gestures, in the same constellation, but with a tongue-tip constriction degree (TTCD) <clo> (closed) for the tap, and a TTCD <mid> for the approximant. Likewise, the lenition path from a uvular trill or fricative in *boer* to an approximant and from there to a central or back vowel is modelled as a gradual decrease in constriction degree of the tongue body (TBCD) from <trill> or <critical> for the trill and fricative, respectively, via <mid> to <wide> for the approximant and vowel.

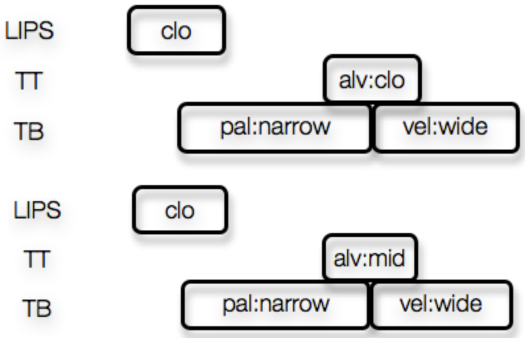


Figure 5-2 Articulatory representations of *beren*, for realisations with an alveolar tap (top) and an alveolar approximant *r* (bottom). TT=tongue tip, TB=tongue body.

While these representations are able to reflect the progressive lenition of trills/taps to approximants and vowels, they do not in themselves explain, any more than phonological accounts in terms of feature loss, where lenition comes from or why it takes place. Pierrehumbert (2001) presents a proposal along the lines of gradual diachronic lenition under the influence of a “lenition bias” inherent in speakers. During speech production under normal circumstances, each utterance is produced to match as closely as possible the relevant exemplars as they are perceived, but slightly lenited (i.e. with a slightly reduced gesture). As these slightly lenited productions enter the set of exemplars of both the speaker and the listener, they shift the distribution of exemplars ever so slightly in the direction of more lenited realisations. Assuming that a lenition bias forms part of any speaker's speech performance, then over time more and more lenited realisations of a category will become its central values. Even more so than in the case of spirantisation, this shows the reductive character of casual speech processes as they take hold diachronically. It does, of course, not mean that this gradual lenition is unmonitored, or unlimited. Perceptual biases and systemic pressures such as contrast preservation undoubtedly play a role in constraining such changes (acknowledged by Pierrehumbert 2001:147; see Sóskuthy 2013 for a model that incorporates such systemic pressures).

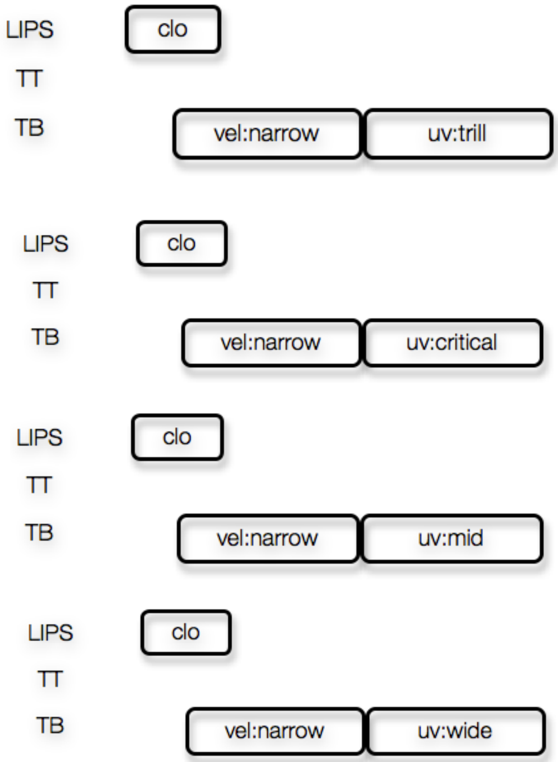


Figure 5-3 Articulatory representations of *boer*, for realisations with a uvular trill, uvular fricative, uvular approximant, and low back vowel.

Later in this chapter the retroflex/bunched approximant will be shown to need a different analysis with respect to the process that gave rise to it; consequently, its current articulatory representation differs from those above. Specifically, as indicated above, the retroflex/bunched approximant cannot be analysed as differing only in constriction degree from other variants; instead, it differs in constriction location, degree, and even in the number of relevant constriction parameters. In other words, it should be analysed as a separate allophonic configuration, rather than a lenited variant of a separate allophone. Before addressing these issues, however, the following section examines the distribution of approximant variants in the urban dialect data.

5.1.3 Approximants in the urban dialect data

Four approximant variants were distinguished in the data (see Chapter 3), according to their main place of articulation: alveolar, uvular and two mostly palatal approximants (the retroflex/bunched approximant and palatal glide. As Table 5-1, which repeats some information from Table 3-9, shows, approximants occur in both onset (pre- and intervocalic) and coda positions in the urban accent data.

Table 5-1 Token frequency of approximants in word-initial onsets (n=6334), intervocalic onsets (*n*=3922), schwa-insertion context (*n*=3199) and coda (*n*=7551). No. of speakers: 408.

descriptive label	*word onset*		*intervocalic*		*ə-insertion*		*coda*	
	n	%	*n*	%	*n*	%	*n*	%
alveolar approximant	204	3.2	219	5.6	76	2.4	160	2.1
uvular approximant	1318	20.8	1092	27.8	703	22.0	304	4.0
retr/bunched approx	19	0.3	19	0.5	502	15.7	2399	31.8
palatal approximant	0	0	0	0	9	0.3	132	1.7
totals	1541	24.3	1330	33.9	1290	40.3	2995	39.7

The patterning of approximants is asymmetrical: the alveolar approximant and the uvular approximant occur in both contexts, but they are most frequent in intervocalic onsets and least frequent in word-final codas, whereas the two palatal approximants [ɻ] and [j] occur largely in the two coda contexts, especially word-final codas. That is, based on their contextual distribution, there seem to be two sets of approximant *r* variants. Also, while the alveolar and uvular approximants occur in all varieties in the data, the retroflex/bunched and palatal approximants are almost completely confined to Netherlandic Dutch, accounting to a large extent for the very different frequencies of approximant variants in the Netherlands and Flanders.

Table 5-2 illustrates these distributional asymmetries of the two sets of variants – alveolar and uvular approximant on the one hand, and the two palatal approximants on the other. Note that the retroflex/bunched and palatal approximants are almost absent from the Belgian Dutch data. From these tables, the general pattern that emerges is clear: alveolar and uvular approximants occur in all contexts, but prefer onsets, whereas the palatal approximants are almost exclusively coda variants, and almost exclusive to the Netherlands.

Table 5-2 Token frequency of approximant *r*-variants (all contexts, all speakers) in Antwerp (*n*=2109), Bruges (*n*=2151), Ghent (*n*=2205), Hasselt (*n*=2101), Amsterdam (*n*=2071), Rotterdam (*n*=2243), Utrecht (*n*=2083), Leiden (*n*=2084), The Hague (*n*=1878), and Nijmegen (*n*=2080).

	alveolar app		*uvular app*		*retr/bunched*		*palatal glide*	
	n	%	*n*	%	*n*	%	*n*	%
Antwerp	161	7.6	90	2.4	0	0.0	0	0.0
Bruges	91	4.2	32	1.5	0	0.0	0	0.0
Ghent	9	0.4	409	18.5	1	0.0	2	0.1
Hasselt	38	1.8	296	14.1	0	0.0	0	0.0
Amsterdam	159	7.7	207	10.0	375	18.1	0	0.0
Rotterdam	93	4.1	198	8.8	533	23.8	106	4.7
Leiden	42	2.0	256	12.3	793	38.1	3	0.1
Utrecht	61	2.9	526	25.3	425	20.4	5	0.2
The Hague	1	0.1	419	22.3	658	35.0	11	0.6
Nijmegen	4	0.2	984	47.3	154	7.4	14	0.7

The distribution of the two sets of approximants in Table 5-1 is not surprising considering their phonetic properties. As was shown in Chapter 3 when discussing the phonetics of the Dutch *r* variants, the alveolar and uvular approximants show more *consonantal* characteristics, whereas the palatal approximants are more *vocalic*. This is in fact evident from the inspection of spectrograms, examples of which are repeated below.

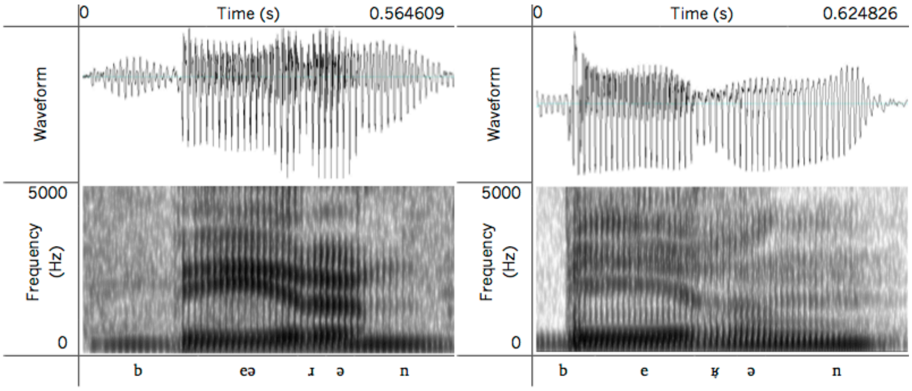


Figure 5-4 Alveolar approximant in *beren* (left). Token from speaker AM07m861. Uvular approximant in *beren* (right). Token from speaker NI02m84.

The alveolar and uvular approximants manifest themselves acoustically as a weakening of all formants relative to the surrounding vocalic context, either very briefly as with the alveolar approximant, or for a longer period as the uvular approximant (Figure 5-4). The formants do not really shift, except towards the vowel target following *r*. These *r* variants in fact closely resemble other *r* variants: the alveolar approximant looks like an alveolar tap in being a brief interruption of the vowel movements, except that there is no actual closure; the uvular approximant resembles a uvular fricative in duration and amplitude, except that no noise is generated.

The other two approximant variants show a very different spectral pattern. Figure 5-5 shows strong formant structures, creating diphthongs out of the vowel-*r* sequence, [uɻ] in *boer* and [aj] in *schaar*. In both cases the F2 is relatively high and F1 low, as would be expected from a palatal approximant. The difference between the two is the relatively low F3 that is visible with the retroflex/bunched approximant but not with the palatal glide, where the F3 for the [j] remains roughly at the same height it is during [u]. In any case, the two palatal approximants show very vowel-like structures, as opposed to the consonantal shapes of the alveolar and uvular approximants.

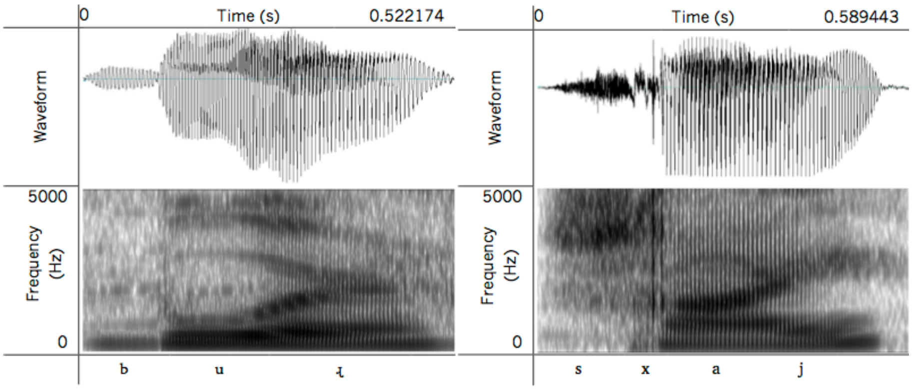


Figure 5-5 Retroflex/bunched approximant in *boer* (left). Token from speaker RO32v78. Palatal glide in *schaar* (right). Token from speaker RO01v55.

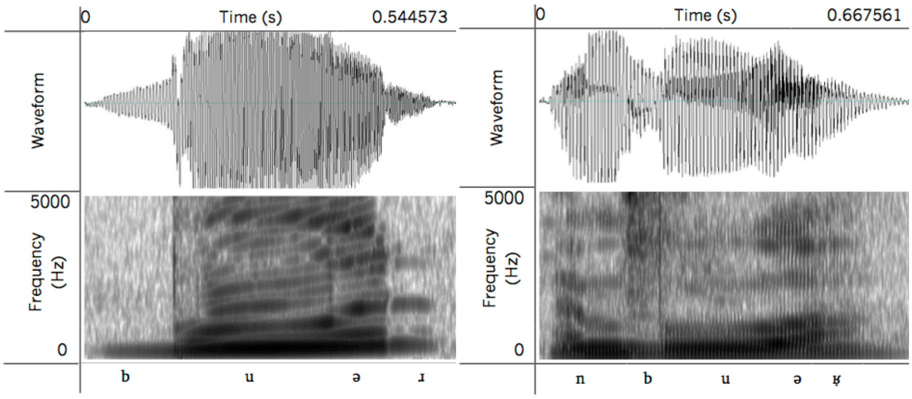


Figure 5-6 Alveolar approximant in *boer* (left). Token from speaker AM16v87. Uvular approximant in *boer* (right). Token from speaker NI38m42.

That the consonantal character of the alveolar and uvular approximants vis-à-vis the palatal ones is not simply a result of their different syllable position – in the examples above, intervocalic [ɹ] and [ʀ] in *beren* contrast with syllable-final [ɻ] and [j] in *boer*, of course – is obvious when the consonantal variants are considered in syllable-final environments, where they also occur.

Figure 5-6 shows the alveolar and uvular approximants in syllable-final *boer*. Again, there is a visible weakening of formants. The vowel before the alveolar approximant centralises towards the end, and this central vowel quality (visible as evenly spaced formants) is retained throughout the *r*, yielding something like [buəɹ]. With the uvular approximant, both F1 and F2 rise somewhat toward the end of the vowel (also heard as centralisation), and all formants grow weaker as the approximant sets in. (The item *boer* is preceded by the indefinite article *een*, realised as a syllabic nasal [n̩] in the token on the right in Figure 5-6).

On the basis, therefore, of both the phonetic character and the distributional asymmetries found with these variants, a distinction between the two sets of approximants is warranted. The uvular and alveolar approximants can be considered weakened forms of more constricted *r* types (taps, trills, and fricatives), differing from these in degree of constriction only, as in Catford's descriptions (Figure 5-1) and the gestural scores in Figure 5-2 and Figure 5-3. The uvular and alveolar approximants occur in the same contexts as (voiced) taps, trills and fricatives, and resemble them acoustically. The retroflex/bunched approximant and the palatal glide, however, occur almost exclusively in codas, just like the vocalic variants to be discussed later. Acoustically, too, they resemble these vowel types: they exhibit prominent, vowel-like formants. Therefore, the two vocalic approximants will be discussed separately (in section 5.2) from the consonantal approximants (alveolar and uvular, this section), as well as from the pure vowel-like variants (in section 5.3). In view of their highly skewed distributions, the discussion of the consonantal approximants will be limited to onsets, that of the vocalic approximants to codas.

5.1.4 Alveolar approximant *r* in the urban accent data

The distribution of the alveolar approximant-*r* within onset contexts was examined using a series of linear mixed-effects models that were fitted to the data set of predominantly alveolar *r* speakers. The effects of speaker and item were treated as random, and fixed effects were added to the model conservatively whenever they significantly improved the model's fit. The fixed effects considered were the preceding context (word-initial, intervocalic, or a labial, coronal or dorsal consonant), the place of articulation of the stressed vowel (front, central, back), vowel height (high, mid, low), as well as the social factors of speaker age and sex, and speech community. A summary of the final model is in Table 5-3.

The model includes the linguistic contextual predictors of preceding context and place of articulation of the vowel, all social factors, as well as a random slope within speaker for vowel place (significant improvement over a model without random slopes: $\chi^2(5)=37.48$, $p<.001$). This is one of two possible models for these data, as inclusion of a random slope for preceding context within speaker also yields a significant improvement over a model without random slopes ($\chi^2(14)=29.41$, $p=.009$). A model with both random slopes, however, did not converge. The model with only a random slope for preceding context is presented here, as this straightforwardly shows that while the effect of the preceding context varies within speakers, there is still a main effect for the intervocalic context. Inclusion of a random slope within speaker for vowel place in fact removed any main effects of this factor, indicating a large amount of variation between speakers in this respect. The difference in fit between the two models with one random slope was not significant.

Table 5-3 Summary of a linear mixed-effects regression predicting the likelihood of an approximant in onset position for predominantly alveolar *r* speakers. The intercept corresponds to a coronal consonant+*r* cluster in a back vowel context for a young male Antwerp speaker. Number of observations = 4114.

Random effects	*Variance*	*Std Deviation*	*N*	
speaker	4.320	2.08	169	
-- preceding context: dorsal C	0.816	0.90		
-- preceding context: labial C	1.262	1.12		
-- preceding context: V	1.579	1.26		
-- preceding context: #	3.781	1.94		
item	0.041	0.20	4114	
Fixed Effects	*Estimate*	*Std Error*	*z*	*p*
(intercept)	-3.567	0.47	-7.54	.000***
preceding context: dorsal C	0.242	0.32	0.76	.449
preceding context: labial C	-0.288	0.48	-0.60	.547
preceding context: V	1.475	0.32	4.60	.000***
preceding context: #	0.069	0.41	0.17	.866
Vowel place: central	-1.291	0.44	-2.96	.003**
Vowel place: front	-0.341	0.19	-1.76	.079
City: Bruges	-0.400	0.37	-1.09	.275
City: Ghent	-1.883	0.76	-2.48	.013*
City: Hasselt	-0.452	0.49	-0.93	.354
City: Amsterdam	0.269	0.38	0.71	.481
City: Rotterdam	0.075	0.41	0.18	.856
City: Leiden	0.465	0.63	0.74	.459
City: Utrecht	0.645	0.58	1.11	.267
Sex: female	-0.814	0.25	-3.25	.001**
Age: older	0.707	0.26	2.76	.006**

The model shows a main effect of preceding context on the appearance of alveolar approximants in onsets: significantly more approximants are found in the intervocalic context than elsewhere ($p<.001$). Differences between the other contexts are not significant; the relevant *p*-values are in Table 5-4. So while alveolar approximants are certainly not limited to weak positions, they are more frequent in the classical lenition context of intervocalic position.

Table 5-4 p-values of pairwise comparisons of preceding context on the incidence of approximants among alveolar *r* variants in onsets with alveolar *r* speakers.

V	Dor C	#	Cor C	Lab C
V	.000	.000	.000	.000
	Dor C	.639	.449	.235
		#	.866	.432
			Cor C	.547
				Lab C

There is also an effect of the following vowel: alveolar approximants are more frequent before central vowels than before front and back vowels, while the differences between the latter two are not significant (see Table 5-5). The items in which the following vowel is central are a further subset of the intervocalic items, viz. those in which *r* is in the onset of a post-tonic syllable (*beren*, *sturen*). Again, this conforms to what is generally regarded as a lenition context, or weak position (cf. Honeybone 2012).

Table 5-5 p-values of pairwise comparisons of following vocalic context on the incidence of approximants among alveolar *r* variants in onsets with alveolar *r* speakers.

Back	Front	Central
Back	.079	.003
	Front	.033
		Central

All of the potential social factors also show significant effects. Those of city, or urban accent, are relatively limited: they show that there are fewer alveolar approximants in Ghent than elsewhere, which is not a significant difference when compared to Hasselt and Bruges, but it is compared to all others; there are no further significant differences in the frequency of alveolar approximants between cities (*p*-values in Table 5-6). Furthermore, there are effects of sex and age: approximants are more frequent with older speakers, and with men. This is the only lenited variant found more with older than with younger speakers. It is difficult to speculate on what might be behind this, and it is beyond the purview of this chapter (which aims to establish the link between the phonetic characteristics of variants and their distribution). However, two possible explanations present themselves. First, there may be a change in progress toward more consonantal variants, although limited to onsets and among alveolar *r* speakers only. This would be an illustration of how leniting changes do not progress unmonitored, but can be constrained by social factors. Alternatively, there might be a more stable age-graded pattern, with a higher proportion of approximant realisations being indexical of age. It would require a separate, more in-depth study of these speakers to determine which of these explanations holds. That alveolar approximants are found more with men than women mirrors the effect of sex found with alveolar trills (see Chapter 4), which are more frequent with female speakers.

Table 5-6 *p*-values of pairwise comparisons of speech communities on the incidence of approximants among alveolar variants in onsets with alveolar *r* speakers.

Gnt	Has	Bru	Ant	Rot	Ams	Ldn	Utr
Gnt	.083	.052	.013	.012	.005	.011	.004
	Has	.916	.354	.316	.150	.193	.097
		Bru	.275	.252	.081	.172	.074
			Ant	.856	.481	.459	.267
				Rot	.650	.554	.350
					Ams	.758	.524
						Ldn	.817
							Utr

In conclusion, there is converging evidence to analyse alveolar approximant *r* as a lenited tap *r*. Phonetically, the approximant shares with the tap its relatively short duration, weakening of all formants, and lack of strong formant transitions, while the main difference is the absence of a closure in the approximant. In terms of its phonological distribution, the approximant appears most frequently in the typical lenition context of intervocalic position, especially when post-tonic.

5.1.5 Uvular approximant *r* in the urban accent data: onsets

The distribution of uvular approximant *r* tokens in the onset was examined using a series of linear mixed-effects models fitted to the subset of predominantly uvular *r* speakers in the urban accent data. The effects of speaker and item were treated as random, and fixed effects were added to the model conservatively whenever they significantly improved the model's fit. The fixed effects that form part of the final model are speech community and speaker sex. A summary is in Table 5-7.

Table 5-7 Summary of a linear mixed-effects regression predicting the likelihood of an approximant in onset position for predominantly uvular *r* speakers. The intercept corresponds to a male Antwerp speaker. Number of observations = 5815.

Random effects	*Variance*	*Std Deviation*	*N*	
speaker	2.215	1.49	238	
item	0.425	0.65	5815	
Fixed Effects	*Estimate*	*Std Error*	*z*	*p*
(intercept)	0.906	0.82	1.10	.270
City: Bruges	-1.382	1.21	-1.14	.253
City: Ghent	-0.796	0.86	-0.93	.353
City: Hasselt	-1.737	0.87	-1.99	.046*
City: Amsterdam	0.064	0.94	0.07	.946
City: Rotterdam	-1.465	0.89	-1.64	.101
City: Leiden	-1.743	0.85	-2.04	.041*
City: Utrecht	-0.550	0.86	-0.64	.521
City: The Hague	-1.312	0.85	-1.54	.124
City: Nijmegen	0.321	0.85	0.38	.705
Sex: female	-1.073	0.21	-5.11	.000***

Uvular approximants are most frequent in Nijmegen, and least so in Leiden. This difference is significant, as are the differences between cities in many other pairwise comparisons. Table 5-8 gives an overview of the *p*-values involved. A crude distinction in the data can be made between Leiden, Hasselt, Bruges, Rotterdam and The Hague, with relatively fewer uvular approximants, and Nijmegen, Amsterdam, Antwerp, Utrecht, and Ghent, with relatively more (although differences between cities in the middle of the table are often not significant). Nijmegen also simply has the highest absolute number of uvular approximant tokens (see Table 5-2), and they make up 47.3% of all *r*-tokens in the Nijmegen data. Another significant factor is sex of the speaker: uvular approximant tokens are significantly more frequent among male speakers (p<.001). This is the opposite effect of that found for uvular fricative *r* in onsets, which is more frequent with female speakers.

Table 5-8 *p*-values of pairwise comparisons of speech communities on the incidence of approximants among uvular variants in onsets with uvular *r* speakers.

Ldn	Has	Bru	Rot	Hag	Gnt	Utr	Ant	Ams	Nmg
Ldn	.905	.755	.492	.243	.018	.002	.041	.001	.000
	Has	.800	.588	.346	.042	.007	.046	.003	.000
		Bru	.982	.872	.502	.337	.253	.141	.062
			Rot	.777	.189	.055	.101	.015	.000
				Hag	.214	.049	.124	.014	.000
					Gnt	.490	.353	.119	.003
						Utr	.521	.279	.023
							Ant	.946	.705
								Ams	.661
									Nmg

The uvular approximants behave to some extent as lenited forms of uvular fricative *r*. Their distribution over the four syllable contexts is the mirror image of that of fricatives: the latter are found most frequently in coda (non-schwa-insertion) positions, the former in all others. Acoustically, the two strongly resemble each other, to the point of possible overlap between the two categories. In the two onset contexts, uvular approximants are particularly frequent, making up almost 25% of all tokens, with some notable differences between cities (in Nijmegen, they account for almost 60% of all onset *r* tokens). This suggests that uvular approximant *r* is a relatively stable realisation of /r/, and might be the natural endpoint of progressive lenition of uvular *r* through trill and fricative phases. On the other hand, uvular trills and fricatives are also not particularly infrequent, and there is little evidence of a current change in progress. At present, the best argument for any prediction that uvular approximant *r* will eventually win out in onsets comes from other languages that have or have had extensive *r*-variation: in Danish, Modern Parisian French, and Standard German, the most frequent realisation of /r/ (at least in onsets) is a uvular approximant or weak fricative (Grønnum 1998; Little 2012; Wiese 2001b).

In sum, it is apparent that intervocalic position favours the occurrence of both the alveolar and uvular approximants. Within word-initial onsets, words with a velar fricative-*r* cluster pattern with intervocalic contexts in favouring approximant *r*. Both of these 'consonantal' approximants are analysed here as related to particular more constricted variants of *r*. The alveolar approximant is related to the alveolar tap: it resembles it in terms of its transitory nature (which sets it strongly apart from the other, vocalic, approximants) and differs from it mainly in degree of stricture (approximation versus closure). The uvular approximant is similarly related to the uvular untrilled fricative, which it resembles in its spectral structure (specifically, the weakening of all formants) and differs from in the absence of high-frequency energy (i.e. frication noise). In other words, both approximants are variants that show gestural reduction vis-à-vis other, also frequent, more constricted variants of *r*. Their distribution over syllabic and segmental contexts is in line with this analysis (intervocalic position being a prime location for such reduction), although they are frequent across the board (except in absolute word-final position), and the uvular approximant may be becoming more general. Figure 5-7 depicts these relationships, interpreted in terms of the origin of the approximants in diachrony. The solid lines represent the relationship as being direct (i.e. based on articulatory reduction) in nature, and the arrows indicate directionality.

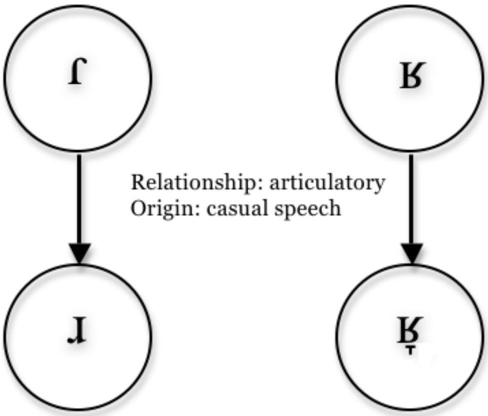


Figure 5-7 The relationships between the alveolar tap and alveolar approximant, and the uvular fricative and uvular approximant.

5.2 The retroflex/bunched approximant and the palatal glide

A number of studies have noted the larger degree of variation in /r/ realisations found in coda positions. All of the consonantal variants of *r* that occur in onsets also occur in codas, but there are a number of vocalic variants that occur in coda positions only (Van den Berg 1974; Van Reenen 1994). Damsteegt (1969) and Van den Berg (1974) explicitly link these variants to the consonantal ones, stating that they are reductions of the trills that occur in onsets. Damsteegt (1969:10), for instance, claims that both alveolar and uvular *r* are often subject to reduction to such a degree that only a certain colouring of the preceding vowel is left. Note that vocalisation in coda position also applies to /l/ for many speakers of Netherlandic Dutch: /l/ can appear as a [w]-like glide in these cases (Van Reenen 1986). This section is devoted to these vocalic variants of *r*. They lack even the limited consonantal constriction of the alveolar and uvular approximants described in the previous section, and their character is more like that of glides and vowels.

The retroflex/bunched approximant, or *Gooise r* (see Chapter 2, fn.3), is currently the most widely used *r*-variant in codas in the Netherlandic Dutch accents, while it is almost absent from Belgian Dutch, as Table 5-9 shows. The table also includes figures for the palatal glide, or [j]-like, variant of *r* in Dutch, which appears to be mostly a Rotterdam variant. A linear mixed-effects model was fitted to the data from speakers from the Netherlands only within the coda context. The response variable was the occurrence of the retroflex/bunched approximant. As before, speaker and item were included as random factors; the syllabic and segmental context, as well as the social factors of age and sex, were considered for inclusion as fixed factors. Only factors that significantly improved the model are a part of the eventual model, which is summarised in Table 5-10.

Table 5-9 Retroflex/bunched and palatal approximants in codas.

City	*Retroflex/bunched*		*Palatal glide*	
	n	%	*n*	%
Amsterdam	349	42.5	0	0.0
Rotterdam	490	55.1	107	12.2
Utrecht	434	52.6	6	0.7
Leiden	699	84.4	4	0.5
The Hague	562	75.0	13	1.7
Nijmegen	183	22.2	13	1.6
All Netherlandic Dutch	2717	55.1	143	2.9
Antwerp	0	0.0	0	0.0
Brugge	0	0.0	0	0.0
Hasselt	0	0.0	0	0.0
Gent	1	0.1	2	0.2
All Belgian Dutch	1	0.03	2	0.1
All dialects	2718	32.5	145	1.7

Table 5-10 Summary of a linear mixed-effects regression predicting the likelihood of a retroflex/bunched approximant in coda position for Netherlandic Dutch speakers (*n*=242). The intercept corresponds to an *r*+labial consonant cluster for a younger male Amsterdam speaker. Number of observations = 6067.

Random effects	*Variance*	*Std Deviation*	*N*	
speaker	4.155	2.04	242	
item	0.099	0.31	14	
Fixed Effects	*Estimate*	*Std Error*	*z*	*p*
(intercept)	-2.443	0.48	-5.12	.000***
following context: dorsal C	-0.193	0.35	-0.56	.578
following context: coronal C	2.785	0.29	9.49	.000***
following context: #	2.241	0.29	7.65	.000***
City: Rotterdam	1.022	0.48	2.15	.032*
City: Leiden	3.137	0.48	6.48	.000***
City: Utrecht	0.719	0.48	1.49	.136
City: The Hague	2.919	0.51	5.77	.000***
City: Nijmegen	-1.738	0.50	-3.49	.000***
Sex: female	0.953	0.28	3.38	.001***
Age: older	-1.874	0.28	-6.62	.000***

The model shows an effect of following context, with significantly more retroflex/bunched approximant tokens in absolute word-final position and in *r*+coronal consonant context than in the schwa-insertion contexts of *r*+labial and *r*+dorsal consonant. This is of course related to schwa-insertion itself: when this takes place, the accompanying realisation of /r/ is usually not a retroflex/bunched approximant, but an alveolar tap or uvular approximant (see Chapter 4 and section 6.2). The relevant *p*-values for pairwise comparisons of the contexts are in Table 5-11.

Table 5-11 *p*-values of pairwise comparisons of following context on the incidence of retroflex/bunched approximants in codas with alveolar *r* speakers.

Dor C	Lab C	#	Cor C
Dor C	.578	.000	.000
	Lab C	.000	.000
		#	.013
			Cor C

Table 5-12 *p*-values of pairwise comparisons of speech communities on the incidence of retroflex/bunched approximants in codas with alveolar *r* speakers.

Nmg	Ams	Utr	Rot	Hag	Ldn
Nmg	.000	.000	.000	.000	.000
	Ams	.136	.032	.000	.000
		Utr	.516	.000	.000
			Rot	.000	.000
				Hag	.662
					Ldn

There is also an effect of city accent (Table 5-12): the retroflex/bunched approximant is most frequent in Leiden and The Hague, followed by Rotterdam. In the accents under consideration, it is least frequent in Nijmegen. This suggests that the retroflex/bunched approximant is still mostly a *Randstad* phenomenon (see Chapter 2), although it has been shown to be spreading to areas outside it (Van Bezooijen et al. 2002). Of course, Nijmegen is the only non-Randstad city in the urban accent corpus, so it is impossible to generalise from it.

Finally, there are effects of both sex and age: the retroflex/bunched approximant is more frequent with younger speakers and with women (echoing the ANOVA results of the index score reported in section 3.3.3.3). Both of these observations have been made before, although mostly based on anecdotal evidence (Stroop 1997) or small-scale studies (Van Bezooijen 2005). These data clearly support the suggestion of a change in progress, led by young women.

5.2.1 The origin of the retroflex/bunched approximant in Dutch

Although the retroflex/bunched approximant has been shown to be strongly on the rise in Netherlandic Standard Dutch (Voortman 1994; Van de Velde 1996; Van Bezooijen et al. 2002), it has not been described in great detail in the literature. A possible early reference can be found in Kloeke (1938), who mentions an approximant realisation for *r* in Rotterdam and Leiden speech.[28] He represents this orthographically as *è* after long vowels, and *j* after short vowels, as in '*hoo-è*' for *hoor* 'hear' and '*zwajt*' for *zwart* 'black'. This would suggest that the phonetic

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[28] "Deze aristocratische *r* heeft een ordinaire partner, die mij voornamelijk uit Leiden en Rotterdam bekend is. Bij het voortbrengen van deze klank ontbreekt het eigenlijk kenmerkende van de r, n.l. het ratelen. In de Auslaut wordt (te Leiden althans) de tongpunt sterk teruggetrokken en dan een soort van korte è geproduceerd: hoo-è (=hoor). Na korte vocaal herinnert het geluid aan een j: zwajt (=zwart)." (Kloeke 1938:33fn)

characteristics of the variants Kloeke describes are those of the palatal glide, discussed in this section, and the mid-front vowel to be discussed in section 5.3 below (transcribed as [ɛ] in Chapter 3). Both variants in fact are most frequent in Rotterdam, where Kloeke situates his approximant, though not particularly in Leiden. It may also be the case, given the fact that Kloeke subsumes [ɛ]-like and [j]-like sounds in the first place, that he refers more generally to front (palatal) approximant and vocalic *r* realisations, in which case the retroflex/bunched approximant should also be included. The tentative characterisations Kloeke gives of the auditory impression made by the variants strengthens this notion: “a sort of very short *è*”, “the sound recalls a *j*”. Also, Kloeke specifically mentions the retraction of the tongue-tip for the production of the *è* variety, which supports the assumption that he is referring to a retroflex-like articulation. Judging from the urban dialect data, in fact, the front approximant and vocalic variants cannot be seen independently from each other. All (Netherlandic) speakers who use palatal glide or mid-front vowel realisations also use retroflex/bunched approximants (though the reverse is not true), and alternate between them within coda contexts – and sometimes within two realisations of the same word. This again seems testament to the reductive phonetic relationship between these variants: only speakers with approximant variants use the even more open vocalic variants.

Interestingly, Kloeke (1938) refers to the palatal realisations of *r* as the “common partner” of (“aristocratic”) uvular [ʀ]. In fact, the approximant variants are mentioned only as a footnote (both literally and figuratively) to his discussion of the spread of uvular *r* in western Netherlandic Dutch. Kloeke, following Trautmann’s hypothesis (see Chapter 4), describes uvular *r* as a prestige variant, and speculates that the palatal realisations are unsuccessful attempts by lower middle class speakers to imitate this prestige variant.[29] Viewing the front approximant variants as arising out of misarticulated attempts at imitation, of course, goes directly against the articulatory reduction view of the introduction of new variants. While it is certain that there are other ways in which new forms may enter the language, as the account of uvular *r* shows, the retroflex/bunched approximant in fact fits into the general schema of progressive lenition that runs from trills to taps and fricatives to approximants and vowels, contrary to first impressions. The origin of the vocalic approximants can therefore be analysed as an internal change, and does not need the speculative account advanced by Kloeke (1938). As is clear from the data above, however, the spread and current distribution of the retroflex/bunched approximant among speakers of Dutch involve external factors, much like Kloeke argued over 75 years ago. However, the direction in terms of prestige in which the spreading is argued to have taken place is likely different from Kloeke’s ideas on the matter

In his description of the sounds of Dutch, more than three decades later, Van den Berg (1974) also associates the vocalic approximant variants of Dutch *r* with uvular *r* speakers. In his discussion of *r*-variants in Dutch, there is initially no place for reduced variants, but he discusses them briefly in the final chapter of his book. There, he makes an uncharacteristically normative statement, rejecting a “strongly

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[29] “De klank zou dan kunnen worden opgevat als een mislukte poging der kleine burgerij om de ‘gebrouwde’ *r* na te bootsen.” (1938:33fn)

reduced uvular /r/, preceded by a transitional j, as in [vo:jr] for [vo:r]" [*voor* 'for'] (1974:114). In all probability, this refers to the same approximant realisation: the palatal element is there, and the fact that this involves dorsal activity will have led Van den Berg to the conclusion that this is a reduced version of dorsal (uvular) *r*. He thus places the origin of the palatal variants with uvular *r* speakers.

The association of palatal/retroflex and uvular *r* sounds is particularly interesting, since a look at other languages shows that it is in fact more common for alveolar *r* and retroflex sounds to be related historically. The historical development of retroflex consonants in Norwegian, for instance, is via *r*-consonant clusters, where *r* was an apical alveolar (Kristoffersen 2000). Note also the retroflex realisation of *r* in many English varieties, where more constricted apical variants are assumed to have predated the current approximant ones (Lass 1997:287; McMahon 2000:268). In the Dutch urban dialect data, however, retroflex/bunched approximant *r* is used both by speakers who have alveolar *r* in onsets and by those with uvular *r*.

Table 5-13 Retroflex/bunched approximant in coda: frequency by place of articulation of speakers' onset variants. NLD speakers only (*n*=242).

[ɹ] in coda	*Place of articulation onset*					
	alveolar (n=53)		*mixing (n=38)*		*uvular (n=151)*	
	n	%	*n*	%	*n*	%
Some [ɹ] in coda	46	87.0	35	91.2	138	91.1
Majority of [ɹ] in coda	20	37.0	20	52.9	92	60.6
Categorical [ɹ] in coda	2	3.7	0	0.0	20	12.9

Table 5-13 above shows that, in fact, the percentage of uvular *r* speakers (that is, speakers with *exclusively* uvular *r* in onsets) who realise /r/ as a retroflex/bunched approximant in codas is higher than that of the alveolar *r* speakers. While the relative numbers of speakers with at least some approximant coda *r* are roughly equal (around 90%), differences appear when the numbers of speakers are considered with a *majority* of retroflex/bunched *r* in coda. While 37% of alveolar *r* speakers realise the majority of their coda-*r* as a retroflex/bunched approximant, this runs up to over 60% for uvular *r* speakers. Moreover, of the 22 speakers with categorical retroflex/bunched approximants in coda, 20 are uvular *r* speakers. These distributional facts seem to suggest that the retroflex/bunched approximant is more intimately tied up with uvular *r*-variants than with alveolar ones. It is then the question whether the approximant fits into the general scheme of *r*-weakening, and if so, how it is related to the more consonantal variants. To be able to answer these questions, we need to establish the articulatory characteristics of the approximant: is it indeed retroflex, bunched or are both articulations possible? And if the latter is the case, are the two approximant articulations related to the more consonantal variants speakers employ?

5.2.2 The articulatory properties of retroflex/bunched *r*

Retroflex/bunched approximant *r* was only described in acoustic terms in Chapter 3, since, up to the present, its articulatory properties have been the subject of some controversy. Cohen et al. characterise it as dorsal, back and non-rounded (1961:39). Mees and Collins seem to agree, stating that it is "a type of pre-velar approximant with the back of the tongue bunched and the root retracted, giving rise to pseudo-retroflex resonance" (1982:10). They suggest using the IPA symbol for a retroflex approximant [ɻ], although it is not a true retroflex, as "the tongue tip is not curled back or even raised." Stroop (1998) unequivocally calls this variant a 'retroflex', while Gussenhoven (1992) transcribes it as [ɹ] – an alveolar approximant.

Note that the precise articulatory quality of this variant is important for the analysis of approximant variants as gestural weakening to hold. Calling the approximant in some way a reduced variant of some other, more constricted type of *r* sound, implies that it would resemble this more constricted *r*-sound in at least some of its phonetic characteristics. As the retroflex/bunched approximant is used in codas both by uvular as well as alveolar *r* speakers, it might also be the case that the 'retroflex/bunched approximant' label subsumes two different articulations, related to those used in the onset. A small-scale articulatory study using ultrasound imaging was set up to ascertain the articulatory properties of this *r* variant, the design and results of which are described in Scobbie and Sebregts (2010), and in the remainder of this section.

5.2.2.1 Design of the ultrasound study

Ultrasound Tongue Imaging (UTI), a rapidly developing method of linguistic data collection (Stone 1997; Gick 2002; Scobbie et al. 2008; Wrench and Scobbie 2011), has a number of advantages over other articulatory imaging methods, such as electro-magnetic articulatography (EMA), X-ray, and Magnetic Resonance Imaging (MRI). First, it is practical, as it is non-invasive, safe, and easy to use. Moreover, it provides dynamic, real-time images that are relatively easy to interpret. At the time of recording, there was a limited maximal frame rate of 25 per second, which would make it unsuitable for studying very fast articulations and processes such as coarticulation. However, this problem is less of an issue when studying approximant *r*, which has relatively slow-moving gestures. More recently, UTI at much faster frame rates (up to 100 Hz) has opened up possibilities for wider application of the technique.

In order to examine the precise articulatory characteristics of the retroflex/bunched approximant, ultrasound data were collected from a total of 10 native speakers of Standard Dutch, all at that time living in Edinburgh, where recording took place. They were post-screened down to 5 retroflex/bunched approximant *r* speakers; the other speakers all had consonantal uvular or alveolar coda *r*. The speakers in the sample were all female and in their twenties to thirties. They were given a picture naming task, with 7 *r*-items in coda contexts, 5 items with *r* in onset for comparison, and 11 *r*-less distracter items. Two of the distracter items formed a minimal pair with an item containing coda *r*, and three formed near-minimal pairs. The full list of items is in Table 5-14. The subjects were seated in an ordinary desk chair, approximately four feet away from the computer monitor on which the pictures were shown. An ultrasound probe was placed on the lower jaw, just behind the chin. By fixing the probe to a helmet worn by the subjects, it was held stable relative to movements of the head. The ultrasound scanner used was a Merlin 1101 medical scanner. Tongue surface images were thus recorded on video at a 25 Hz frame rate, and captured and analysed using the *Articulate Assistant* software package, developed at Queen Margaret University (Articulate Instruments 2010). The number of repetitions of the task was three for speakers U1, U2 and U3; four for speaker U4; and two for speaker U5.

Table 5-14 Ultrasound *r*-items.

onset r		*coda r*		*distracter items*	
riem	/rim/	*mier*	/mir/	*boek*	/buk/
brood	/brod/	*boer*	/bur/	*koe*	/ku/
trein	/trɛin/	*schaar*	/sxar/	*sla*	/sla/
kruk	/krʏk/	*bord*	/bɔrd/	*bot*	/bɔt/
draad	/drad/	*paard*	/pard/	*kat*	/kɑt/
		kers	/kɛrs/	*mes*	/mɛs/
		kaars	/kars/	*kaas*	/kas/
				huis	/hœys/
				vis	/vɪs/
				vlag	/vlɑɣ/
				bal	/bɑl/

5.2.2.2 *Results*

Four of the five speakers with approximant *r* in coda used uvular *r* realisations in onset contexts, one had alveolar *r* in onset. Three speakers used retroflex or bunched approximants in coda categorically, one speaker alternated a bunched approximant with uvular trills, and one speaker alternated retroflex approximants with alveolar approximants and fricatives.

Table 5-15 Five approximant *r* speakers.

Speaker	*Onset-r*	*Coda-r*
U1	uvular (trill)	retroflex approximant
U2	uvular (fricative/approximant)	bunched palatal approximant
U3	uvular (trill/approximant)	bunched palatal approximant
U4	alveolar (tap/fricative/approximant)	(post-)alveolar approximant/retroflex approximant/post-alveolar fricative
U5	uvular (trill/approximant)	bunched palatal approximant/uvular fricative trill

A first qualitative analysis of the articulatory characteristics of the retroflex/bunched approximants used shows that both retroflex apical and bunched dorsal are possible articulations for coda approximant *r* in Dutch. Two speakers out of five employed apical articulations (with varying degrees of retroflexion), while the other three had bunched lamino-dorsal constrictions in the palatal region. These results are summarised in Table 5-15. Sample tracings of the tongue surface (*splines*) during the production of *boer* /bur/ ‘farmer’ for four subjects are in Figure 5-8. (The image quality of the fifth speaker, U5, was considerably less than that of the other four speakers, and therefore not used for further analysis.)

Figure 5-8 shows the tongue shapes traced on 12 different frames during the articulation of the vowel and *r*. The tongue root is on the left, tip on the right. The dome-like shape of high, back [u] is clearly visible for all four speakers, as is the maximal *r* target. This target is a tip-up configuration for U1 and U4 (with more retroflexion for U1), and a bunched, tip-down configuration for U2 and U3 (with a more clearly lowered pre-dorsum, or “saddle-shaped” tongue body, for U3). Both the retroflex and the bunched articulation were accompanied by a pharyngeal constriction, visible on the very left edge of the images.

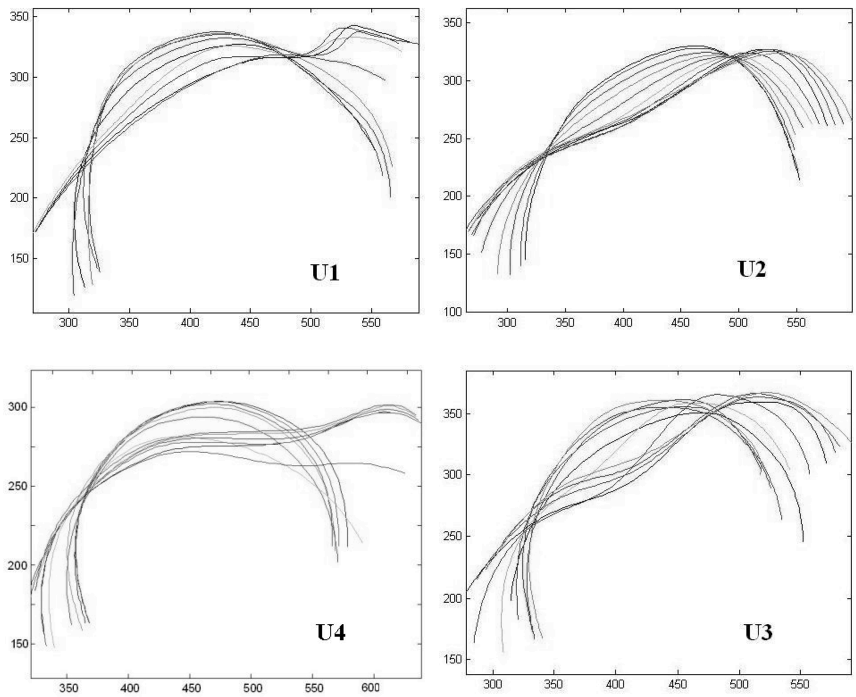

Figure 5-8 Splines of the tongue surface during the production of *boer*. Tongue tip is on the right. The numbers on the axes are arbitrary.

The configurations in Figure 5-8 closely resemble those familiar from instrumental investigations of American English *r* (Delattre 1965, using x-ray; Guenther et al. 1999; Zhang et al. 2003; Tiede et al. 2004, using MRI). These show the same kind of articulatory positions for *r*, and the same amount of variation. Despite the articulatory variation, these American English approximant *r*s are unified by their very similar acoustics: all have a very low third formant (F3). This is precisely what led Lindau (1985) and Ladefoged and Maddieson (1996) to the hypothesis that in fact this low F3 is the target for American English *r*, and the precise articulatory mechanism is irrelevant as long as it produces the desired acoustic effect. Figure 5-9 and Figure 5-10 show that a low F3 is also the acoustic target for the Dutch approximant, and that in Dutch, too, the highly similar acoustics are what unites the retroflex and bunched approximants.

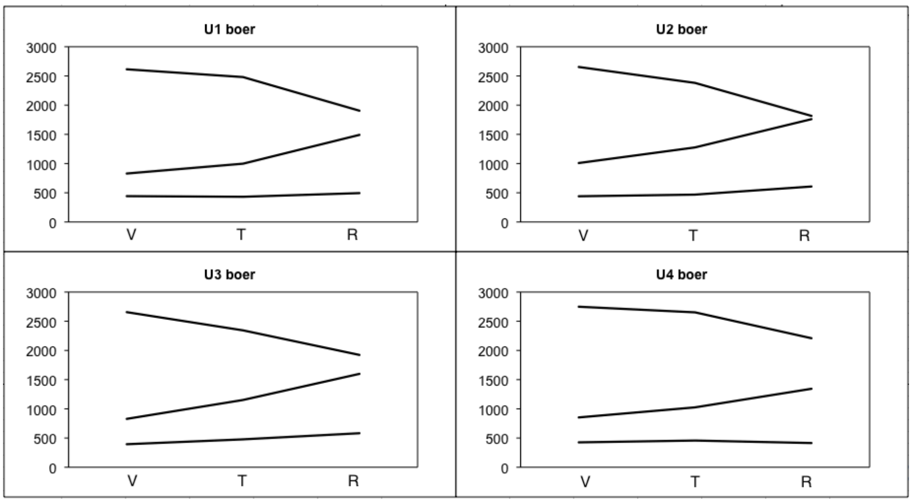

Figure 5-9 Formant movements from vowel (V) via transition (T) to rhotic (R) in *boer* (averaged over three repetitions). F3, F2, F1 (top to bottom), y-axis scale in Hz.

In Figure 5-9, which shows the movements of the first three formants throughout the vowel+*r* portion of the item *boer* /bur/ for four speakers in the ultrasound corpus, it is evident that all speakers have a common auditory/acoustic target for *r*, i.e. a low F3 or, more precisely, a close approximation between F2 and F3. For speaker U2, in fact, F2 and F3 almost conflate. Studies of English *r* have shown that it is the approximation of F2 and F3, rather than low F3 per se, that leads to the percept of rhoticity (Villafaña Dalcher et al. 2008; Heselwood and Plug 2011). Speakers U1 and U4 reach this target with an articulatory configuration that includes a raised tongue tip (with a degree of retroflexion), while speakers U2 and U3 have a bunched tongue dorsum with the tongue tip down (and lightly pressed inward). It is clear therefore that this is an example of acoustic identity paired with articulatory disparity. Figure 5-10 shows a similar pattern for most speakers, but speaker U4 deviates from it: her formant values in the centre of the rhotic are much closer to those of a central vowel (i.e. schwa-like), whereas her articulation is quite similar to that of speaker U1. The main articulatory difference is a temporally shorter apical gesture for speaker U4, vis-à-vis U1, which is also somewhat delayed. There is, in other words, a case here of acoustic disparity despite articulatory similarity. Interestingly, U4's delayed apical gesture sometimes only reaches its maximum after voicing for the preceding vowel has ceased, and therefore remains without acoustic effect. Possible implications of this are discussed in 5.2.2.3.

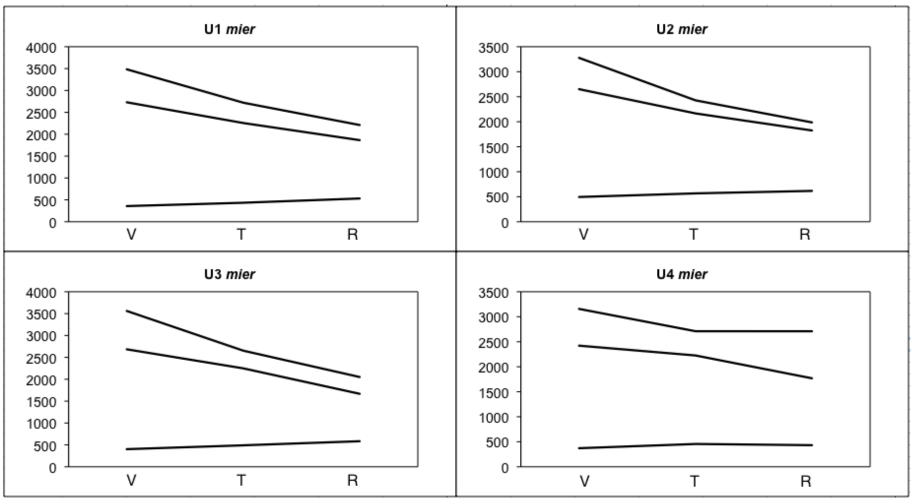

Figure 5-10 Formant movements from vowel (V) via transition (T) to rhotic (R) in *mier*. F3, F2, F1 (top to bottom), y-axis scale in Hz.

These examples from the ultrasound data show that the choice of the “retroflex/bunched” label to denote the place of articulation for this variant does not merely reflect uncertainty as to its precise realisation of /r/ prior to investigation with ultrasound, but also that it in fact concerns a single perceptual variant with two wholly different articulatory configurations. The ultrasound data also make clear that there are links between the retroflex/bunched approximant and more vocalic coda variants of Dutch *r*, such as the central vowel. With only very slight modification of the timing of this articulatory pattern, the characteristic low F3 (or F2/F3 conflation) is not achieved, and a more evenly spaced formant pattern, associated with a schwa-like vowel, results instead.

Finally, the ultrasound data show that it is very difficult to link the onset and coda variants of these speakers, or to predict one from the other. While speaker U4 has apical realisations of *r* in onsets *and* apical *r* in codas, and speakers U2 and U3 have uvular *r* in onsets and a bunched *r* in codas, it is by no means the case that these patterns provide any predictive power for other speakers, of whom there are no articulatory data. The most obvious counterexample to an analysis generalising from these speakers is speaker U1, who combines uvular *r* in onsets with apical retroflex *r* in codas. The articulatory configurations she employs for her two main allophones have virtually contradictory gestures. The fourth logical possibility, speakers with alveolar onset *r* and a bunched approximant in coda, also exists (Strycharczuk and Sebregts 2014). More generally, even with speakers U2, U3 and U4, it is not at all obvious that their coda approximant realisations are straightforwardly related to their onset variants, in terms of either gestures or features. It is very difficult, for example, to see the bunched approximant as the coda pendant of a uvular onset allophone, and the relationship between them is much more complex than simply more vocalic vs. more consonantal interpretations of a single set of gestures. Instead, the bunched *r* in coda can be argued to involve more complex constrictions than the uvular *r* in onsets. Further implications of these and other results from the ultrasound data are discussed in the following section.

5.2.2.3 Implications

Articulatory analysis shows that for speaker U4, who has alveolar onset *r*, the tongue-tip in codas is further advanced, approaching the (post-) alveolar region instead of the palate. In addition, her vowel-to-*r* transitions are more rapid, and she has a very short rhotic target phase. In combination with the variable vocalisation and more consonantal realisations found with this speaker, this suggests that she is a more generally alveolar *r* speaker, with only slightly retracted/more retroflex articulations syllable-finally. That is, for this speaker the onset and coda variants are on a continuum of more-to-less vocalic alveolar realisations. In contrast to the other speakers in the study, if there is an acoustic target of low F3 for her, it is only variably met.

For U1, the other speaker with a retroflex articulation, the low F3 target is categorically met. Furthermore, her onset and coda variants are obviously not part of a continuum, being uvular trill and retroflex approximant, respectively. If intermediate articulations are possible at all, they were never produced during the data collection task. Interestingly, for the three bunched speakers, the onset and coda variants also seem to be categorically distinct. That is, no intermediate articulations between the uvular variants employed at onset and the bunched articulation at coda are found, and there is a complete dichotomy between the high F3 of the onset variants and the low F3 of the coda. The non-categorical speaker, U5, alternates between bunched approximants and uvular fricative trills in coda, but likewise produces no intermediate forms. While the number of contexts in this study was limited, and it only involved isolated words, the categorical nature of the two allophones was confirmed in a follow-up study (Strycharczuk and Sebregts 2014), which looked specifically for possible intermediate articulations, in the "fake geminate" context of coda-onset *r* (e.g. *paar reizen*, "a few trips"), but found none.

What these differences between (alveolar) speaker U4 and the other (uvular) speakers suggest is that for her there is a stronger articulatory connection between consonantal alveolar variants of *r* and the retroflex approximant. That there is also a strong acoustic connection between the two becomes clear when we examine some spectrograms of more consonantal *r* variants from other speakers who do not have the retroflex approximant. Figure 5-11 shows the presence of F3-lowering with consonantal apical *r*-variants (a voiced trill and a voiceless tap) from speakers from Amsterdam and Bruges, respectively (from the urban accent corpus). This shows how the acoustic effect is not only shared by the retroflex and bunched approximants, but also by several apical *r*-variants of a more constricted nature.

These similarities support the idea that the retroflex approximant may indeed have originated as a reduced variant of other apical *r* variants after all. In that case it is a close cousin of the alveolar approximant, except that it has slower tongue

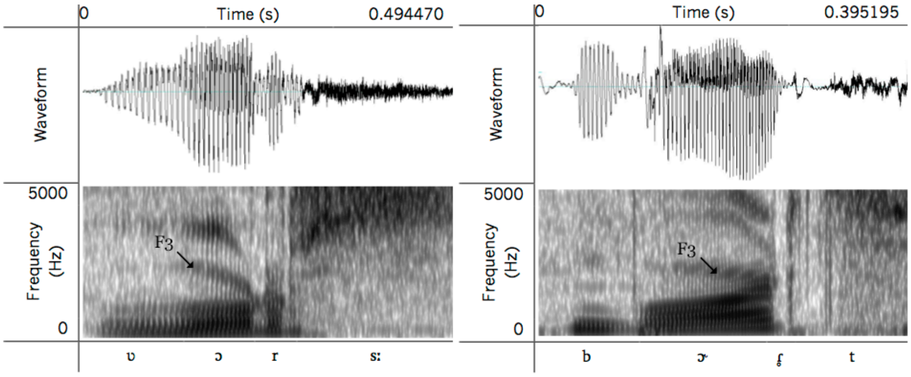

Figure 5-11 Alveolar trilled *r* with low F3 in *worst* (left). Token from speaker Br42m38. Voiceless tap with low F3 in *bord* (right). Token from speaker Am13v71.

gestures, leading to a more vocalic acoustic signature. This suggestion finds its strongest support from the apical coda gesture from U1, which may be so delayed as to come after the offset of voicing, therefore having no acoustic effect. U1's retroflex approximant in coda appears to show exactly the incipient stage of change, being a genuinely reduced variant of her onset allophone. On the contrary, the retroflex approximant found with the speaker with a more categorical onset-coda allophony, U1, is not synchronically analysable as reduced (or even related to her onset uvular *r* variants). She seems to be a speaker for whom the coda acoustics, low F3 or F2/F3 conflation, is the primary target for coda *r*. Her coda approximant is a categorical allophone, as opposed to one gradiently related to the onset one, and presumably finds representation at the phonological rather than the phonetic level. Finally, the bunched configuration found with U2 and U3 should in turn be viewed as an innovative articulation on the basis of its perceptual similarity to the retroflex. Synchronically, the complex gestural configuration of neither the retroflex nor the bunched variant is of course "reduced" in any way, vis-à-vis more constricted variants of *r*, illustrating the disconnect between the origin of the variant and its current status.

5.2.3 The origin of the retroflex/bunched approximant revisited

In the previous section it was argued that the retroflex approximant realisation of Dutch *r* can be considered a reduced, i.e. more vocalic, variant of other alveolar *r* allophones, at least in terms of its origin. The bunched articulation in turn is an innovation caused by perceptual factors: speakers acquiring coda *r* will have arrived at a different articulatory configuration producing the same acoustic results (obscuring the articulatory difference, and in fact making it irrelevant). The alternative hypothesis, that the retroflex/bunched approximant developed as a variant of *r* for *uvular r* speakers first, seems less likely from a perceptuo-articulatory viewpoint. While the retroflex/bunched approximant is in fact more frequent for speakers with uvular *r* in onsets than it is for alveolar onset-*r* speakers in the urban accent data, the phonetic properties point toward apical variants as the source for retroflex (and, consequently, bunched palatal) approximant *r*.

Cross-linguistic comparison lends additional support to the connection between retroflex and other apical variants. Note that (as far as can be ascertained on the basis of the literature) no other language seems to have developed a pattern of uvular and retroflex/bunched consonants in alternation. Retroflex realisations invariably crop up where apical (post)alveolar *r* does, as in English and Norwegian. Weakened or vocalised variants of uvular *r* sounds, on the other hand, are of a different character: they are low central or back vowels, as in German. Similarly, in Danish the present-day reflex of historic coda *r* is the lowering and/or retraction of a preceding vowel. Danish onset *r* is uvulo-pharyngeal (Basbøll 2005).

In fact, the only case with any resemblance to the Dutch uvular onset/retroflex coda pattern would seem to be the one described by Torp (2001) for certain southern dialects of Norwegian (and Göta Swedish). The situation in these Norwegian dialects is as follows. Standard and northern varieties have apical *r* in onsets, and historical coda-*r* preceding a coronal consonant is realised as a retroflex consonant – the situation also familiar from Swedish. Many southern (predominantly urban) dialects, on the other hand, have uvular *r* in onsets, and in coda. Torp describes how the two developments (retroflexion and uvular *r*) are spreading, but never into the same area. That is, those dialects in which retroflexion is on the rise show resistance to uvular *r* spreading into that dialect, and vice versa. This leads Torp to hypothesize that the two developments are in fact incompatible.

However, to his surprise, Torp also found speakers with both innovations in their systems, i.e. uvular onset *r* and retroflexion of historical coda -*r*C clusters. This pattern is observed in younger speakers in an area on Norway's south coast. Retroflexion and uvular *r*, then, do seem to be compatible within one linguistic system, which indicates we should perhaps be looking for a phonetic relationship of some kind between the two after all. There is, however, good reason to proceed cautiously and not too quickly link them.

The southern area in which Torp finds the pattern is, crucially, much like the (western) Dutch one in terms of there being a dialect contact situation. Judging from the dialect maps Torp presents, the area where both dorsal *r* and retroflexes are attested forms the borderland between the gradually enlarging dorsal *r* area and the larger East-Norwegian area with apical *r* and retroflexes. It is therefore highly preferable to analyse this case as one of two historically independent developments spreading into the same area, where both are taken up by new learner-speakers – clearly without regard for their historical origins in two "mutually excluding" (2001:81) rhotic systems. Under this analysis, the resulting system is far less surprising than when (universal) featural identity is deemed necessary for the association of two sounds with a single functional unit. The only prerequisites for the emergence of such a pattern is that it is learnable and that there are sufficient exemplars of both allophones present. Since the pattern splits the two variants over syllabic positions (onset vs. coda), it seems eminently learnable. Moreover, since this is a borderland area between the regions where both variants are attested, there should be enough exemplars of both available for the new pattern to be able to arise.

Torp in fact appeals to a dialect contact situation in explaining the occurrence of both dorsal *r* and retroflexes in Oslo middle-class speech, attributing this to the large Danish community in Oslo during the political union between Denmark and Norway. For the southern coastal area, however, he assumes direct borrowing from (prestigious) Oslo speech of the retroflexes, instead of relating the pattern to the availability of both forms in the area itself. He does adduce some very interesting additional evidence, however: the southern dialects with the dorsal-*r*-plus-retroflexes pattern exhibit one other *r*-related phenomenon: coda vocalisation. Torp cites the following examples:

(5.1) Retroflexes in dorsal *r* area in Norwegian

tårn	[tɔːən]	→	[tɔɳ]	‘tower’
kors	[kɔəs]	→	[kɔʂ]	‘cross’

These data show that there was no diachronic change in this area from uvular consonantal [ʀ] in coda to a situation where segmental *r* is replaced by retroflexion of the following consonant, but rather from a vocalised *r*-as-schwa-offglide to retroflexion. As Torp (2001:82) notes, “this is *phonetically* a much less conspicuous difference.” His hypothesis is therefore revised to “no dialect will get both dorsal /r/ and retroflexes, unless it also has *r*-vocalisation”.

Inconspicuous as the change from vocalised *r* to retroflexion may be, however, the Norwegian situation gives no reason to assume that retroflexion may have *originated* with dorsal *r* speakers. It is, rather, evidence against such a hypothesis. Except for this area on the ‘linguistic frontline’ of the two innovations, the Norwegian *r* patterns largely concur with the view that retroflexes are associated with apical *r*: the south-western dialects of Norwegian have dorsal *r* in all positions and no retroflexes, eastern ones have apical *r* and retroflexes, and the only dialect to synchronically combine dorsal *r* and retroflexes never had dorsal *r* in the retroflexing environment. It therefore seems most reasonable to argue that the retroflex/bunched approximants in Dutch originate from weakening of apical variants, but that the bunched variants arise due to being acoustically similar to the retroflex approximant, in having the characteristic pattern of F2/F3 near-conflation. Synchronically, of course, there need no longer be a link between the coda approximant and more constricted apical variants. Most obviously, there will be no such link for speakers such as U1 from the ultrasound corpus, who combines a coda retroflex approximant with an onset uvular trill in her pattern of *r*-allophony; however, such a link may in fact exist for speaker U4, whose onset and coda variants resemble each other much more closely, and are more likely to be in the kind of relationship assumed between onset and coda variants in standard Articulatory Phonology.

The complexity of the relationship between the retroflex/bunched approximant and the more constricted variants it synchronically alternates with makes it hard to account for in any phonological framework, whether feature-based (as in most generative frameworks) or gesture-based (as in Articulatory Phonology). Chapter 6, section 6.2.4 discusses a more promising approach, one where highly abstract features are assigned bottom-up. The representation in Figure 5-12 is the one relevant to the diachronic approach taken here, and is considerably simpler in light of the discussion above: the retroflex/bunched approximant originates from more constricted apical variants, here represented by the (consonantal) alveolar approximant. What the image does not depict is the route via which the variant has also spread throughout the speech communities: aided by social prestige, and being acquired by speakers who do not also produce the more constricted variants that once gave rise to it.

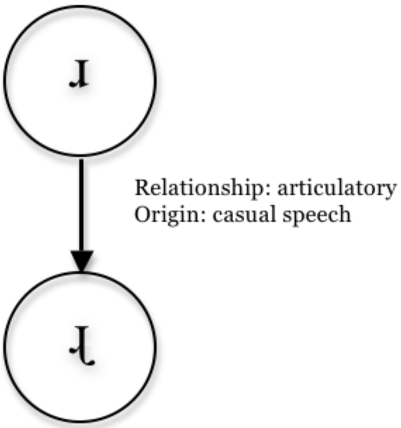

Figure 5-12 The diachronic relationship between the apico-alveolar approximant and the retroflex/bunched approximant.

5.3 Other vocalic variants of *r* in the Dutch dialect data

The other variants of Dutch *r* that were termed ‘vocalic’ in Chapter 3 were described there as a mid front vowel transcribed [ɛ], schwa [ə], and a low vowel [ɐ]. Their distribution among the urban dialects is in Table 5-16.

All of these variants occur exclusively in coda positions (true coda and schwa-insertion context). It is clear from Table 5-16 that vocalic realisations of /r/ are mainly a feature of the Netherlandic dialects. This again unites the two approximant variants dealt with in the previous section and the vocalic variants discussed here. In all of these cases, the realisation of /r/ takes on the character of a vocalic off-glide, or the second part of a vowel diphthong. In the case of the /-ər/-final words (*suiker*, *emmer*), the final syllable rhyme may even have a monophthongal quality: *emmer* /ɛmər/ is realised as [ɛmə] or [ɛmɐ]. An example of the latter is in Figure 5-13.

Table 5-16 Vocalic *r* variants in urban accents of Dutch (% of all coda *r* tokens, *n*=10750)

City	*All vocalic*		*Mid front ɛ*		*Schwa ə*		*Low ɐ*	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Amsterdam	6	0.6	0	0.0	6	0.6	0	0.0
Rotterdam	123	10.8	31	2.7	90	7.9	2	0.2
Utrecht	68	6.5	6	0.6	57	5.4	5	0.5
Leiden	15	1.4	1	0.1	14	1.3	0	0.0
The Hague	59	6.0	7	0.7	40	4.1	12	1.2
Nijmegen	190	18.0	9	0.9	132	12.5	49	4.6
Antwerp	4	0.4	0	0.0	4	0.4	0	0.0
Bruges	3	0.3	0	0.0	3	0.3	0	0.0
Ghent	3	0.3	0	0.0	3	0.3	0	0.0
Hasselt	0	0.0	0	0.0	0	0.0	0	0.0
All	471	4.4	55	0.5	351	3.3	68	0.6

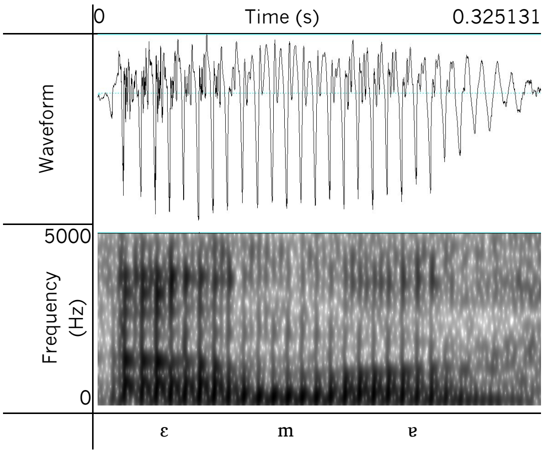

Figure 5-13 Vowel coalescence: schwa with low vowel *r* from a young male speaker from Nijmegen (NI03m84).

This realisation, where the tongue body gestures for the vowel and the rhotic overlap so strongly, and those of *r* are so strongly reduced that the result is an open central vowel, has obvious similarities to the most common realisation of /r/ in Standard German in similar contexts, such as *Wetter* [ʋɛtɐ] (Ulbrich 1972:111). This, then, would seem to be one of the 'logical conclusions' of the progressive leniting changes of *r*: it is realised as a true vowel, without consonantal constriction or the complex gestural configuration of the retroflex/bunched approximant. It would stand to reason that these vowel realisations are especially frequent among younger speakers, if it is indeed the case that the current distribution reflects ongoing change in progress in urban Standard Dutch. However, as the remainder of this section will show, this is not the case. There are a number of possible reasons for this, which are discussed below.

Table 5-17 presents the summary of a linear mixed-effects model predicting the occurrence of a vowel variant of *r* in the coda. It was fitted to the data from all speakers, except those from Hasselt, where vowel variants do not occur. As before, fixed effects were included if they significantly improved the model. The factors included in the final model are the place of articulation of the following consonant, the height and place of articulation of the preceding vowel, city accent, and speaker age. Also included is a random slope for preceding vowel height, as this significantly improved the model fit ($\chi^2(5)=16$, $p=.006$). This indicates that the effect of vowel height varies between speakers.

Table 5-17 Summary of a linear mixed-effects regression predicting the likelihood of a vowel variant in coda position for all speakers in all cities except Hasselt, where vocalic variants do not occur. The intercept corresponds to an *r*+coronal consonant cluster in a high back vowel context for a younger Antwerp speaker. Number of observations = 9936.

Random effects	*Variance*	*Std Deviation*	*N*	
speaker	2.232	1.49	368	
-- preceding vowel: low	2.415	1.55		
-- preceding vowel: mid	0.310	0.57		
item	0.101	0.32	14	
Fixed Effects	*Estimate*	*Std Error*	*z*	*p*
(intercept)	-5.761	0.93	-6.17	.000***
following context: dorsal C	-3.795	0.63	-6.06	.000***
following context: labial C	-2.070	0.67	-3.08	.002**
following context: #	0.142	0.34	0.42	.675
preceding vowel: low	-2.789	0.70	-3.99	.000***
preceding vowel: mid	-1.931	0.56	-3.46	.001***
preceding vowel: central	-0.700	0.54	-1.30	.195
preceding vowel: front	1.132	0.41	2.75	.006**
City: Bruges	-0.260	1.16	-0.22	.823
City: Ghent	-0.016	1.09	-0.02	.988
City: Amsterdam	0.445	1.00	0.44	.658
City: Rotterdam	4.272	0.82	5.20	.000***
City: Leiden	1.604	0.88	1.82	.068
City: Utrecht	3.438	0.83	4.13	.000***
City: The Hague	3.356	0.84	4.00	.000***
City: Nijmegen	5.193	0.82	6.35	.000***
Age: older	0.592	0.25	2.38	.017*

The effects of city (speech community) reflect the relative numbers of vowel variants in Table 5-16: there are significantly more vowel realisations of /r/ in Nijmegen and Rotterdam than elsewhere, Utrecht and The Hague are next in the table, and in the other cities the numbers are very low, differences between them not significant. The *p*-values for differences among city accents are in Table 5-18.

The model shows a large number of significant effects for segmental context. First, there is the effect of following consonant (or absence thereof), which shows not so much a segmental effect as a syllabic one: there are significantly fewer vowel realisations of /r/ before final dorsal and labial consonants – this is the schwa-insertion context. Of course, in those cases where schwa-insertion takes place, /r/

itself is not realised as a vowel (or if it were, it would merge with the inserted vowel). There are no differences within the two syllabic contexts: differences between following labial and dorsal consonants are not significant, nor are those between a following coronal consonant and absolute word-final position (*p*-values for pairwise comparisons are in Table 5-19).

Table 5-18 *p*-values of pairwise comparisons of speech communities on the incidence of vowel variants of *r* in codas.

Nmg	Rot	Utr	Hag	Ldn	Ams	Ant	Gnt	Bru
Nmg	.010	.000	.000	.000	.000	.000	.000	.000
	Rot	.031	.021	.000	.000	.000	.000	.000
		Utr	.844	.000	.000	.000	.000	.000
			Hag	.001	.000	.000	.000	.000
				Ldn	.125	.068	.060	.051
					Ams	.658	.641	.511
						Ant	.988	.823
							Gnt	.832
								Bru

Table 5-19 *p*-values of pairwise comparisons of following context on the incidence of vowel variants of *r* in codas.

Dor C	Lab C	#	Cor C
Dor C	.084	.000	.000
	Lab C	.005	.002
		#	.675
			Cor C

True effects of segmental context are found with the preceding vowel: vowel variants of *r* are significantly more frequent after high vowels and after front vowels. Mid vowels are in-between low and high, whereas the difference between central and back vowels is not significant. The relevant *p*-values for pairwise comparisons are found in Table 5-20 and Table 5-21.

Table 5-20 *p*-values of pairwise comparisons of preceding vowel context (height) on the incidence of vowel variants of *r* in codas.

Low V	Mid V	High V
Low V	.015	.000
	Mid V	.001
		High V

Table 5-21 *p*-values of pairwise comparisons of preceding vowel context (front/back) on the incidence of vowel variants of *r* in codas.

Central V	Back V	Front V
Central V	.195	.000
	Back V	.006
		Front V

There may be several reasons why high and front vowels are more conducive to vowel variants of *r*. First, Dutch high and mid vowels (as opposed to low vowels) acquire an offglide before *r* also when a consonantal *r* is present (Cohen et al. 1961; Koopmans-van Beinum 1969; 't Hart 1969). The nature of this offglide is often said to be schwa-like, or centralising, and sometimes to lead to neutralisation between pre-*r* tense and lax vowels (Van der Torre 2003:167; cf. Botma et al. 2012 for a re-evaluation of similar claims about pre-/l/ vowels). The vowel variants of *r* may then simply be these offglides, while there is no segmental exponent of *r* present. Secondly, the tongue gestures involved in high and front vowels may be more antagonistic to those for specific *r* variants than those involved in low and back vowels. Hall and Hamann (2010) show that in a wide variety of languages, sequences of /ir/ and /jr/ are avoided, and offer an explanation in terms of incompatible articulatory gestures. Included in the avoidance strategies are instances of /r/ being deleted or changing into "some other sound" (2010:1842). Under such a view, the appearance of more vowel-*r* tokens in the high and front vowel contexts may be taken as part of such cross-linguistically common avoidance strategies (see also Recasens and Pallarés 1999 for an examination of coarticulatory effects of vowels and, specifically, alveolar taps). While these tendencies may indeed contribute to their asymmetrical distribution, vowel variants of *r* are not *confined* to front and high vowel contexts: they also occur after low and back vowels, so they still fit into the more general pattern of progressively lenited forms of *r*.

An effect that is more problematic for the progressive lenition account is that of age: vowel variants are more frequent among older speakers than younger speakers. While it is likely that this simply forms part of the larger picture of more convergence towards the retroflex/bunched approximant among younger speakers, for a better picture we need to consider what other, more constricted variants these vowel variants may have as their origins.

Table 5-22 Onset variants of speakers with [ɛ,ə,ɐ] realisations of /r/.

speakers using vowel variant	*place of articulation of onset variants*		
	alveolar	*mixing*	*uvular*
[ɛ] (*n*=30)	23.3	13.3	63.3
[ə] (*n*=122)	19.7	14.8	65.6
[ɐ] (*n*=33)	6.1	0.0	93.9
any vowel variant (n=185)	17.8	11.9	70.2
all speakers (N=408)	36.3	15.0	48.8

A first step is to examine more closely those speakers who use vowel variants in codas. Table 5-22 breaks this set of speakers down by place of articulation of their onset variants. The relative numbers of alveolar, uvular, and mixing speakers in all of the data are given for reference.

Vowel variants are used more by uvular *r* speakers, i.e. those speakers with exclusively uvular variants in onsets, relative to alveolar *r* and mixing speakers. While uvular *r* speakers make up 48.8% of all speakers in the corpus (bottom row), they make up over 70% of the group of speakers that use these three vocalic variants (one row up in the table). Conversely, alveolar *r* speakers are underrepresented in the group of speakers using vocalic variants. This supports Schiller's (1998) claim that there is much more room for vocalisation of back (dorsal) variants of *r* than there is for front variants, due to the ‘crowding’ of the dental/alveolar/post-alveolar area, where many linguistically significant contrasts are made. Because many changes in stricture of apical *r* variants would result in “phonemic conflicts”, the opportunity for weakening is considerably smaller than for dorsal variants. Schiller takes this to have contributed to the rise of uvular *r* in German.

However, while uvular *r speakers* may be overrepresented in the pool of vowel *r* tokens, the expected reduced realisation of uvular *r* variants, [ɐ], is not very frequent at all amongst the vocalic *r* tokens: only 33 speakers ever realise /r/ as [ɐ], and do so in only 66 cases in total (Table 5-16). That [ɐ] is the expected outcome of reduction of uvular *r* is evidenced by the realisation of vocalised *r* in Standard German (Wiese 2000) and Danish (Basbøll 2005), where dorsal *r* has been dominant for quite some time. In Dutch, however, this particular vocalic *r* reflex is a small minority, and – in the urban dialect data, at least – mainly a feature of Nijmegen speech. Note that Nijmegen is overwhelmingly uvular *r*-speaking (in terms of onset variants), and also geographically close to the German border. This suggests it is part of a continuum of dialects on either side of that border (cf. Humbert 1996, who describes the vocalisation of /r/ in Groningen dialects of Dutch (much further north than Nijmegen, but also relatively close to the German border), or at least a common development of their allophonic pattern. Importantly here, *if* low [ɐ] is used as a realisation of /r/ in the urban dialect data, it is overwhelmingly by uvular *r* speakers, as Table 5-22 shows.

The same picture cannot be drawn for the front vowel variant of *r*, [ɛ]. It is not the case that this variant is used mainly by alveolar *r* speakers, as a vocalised version of more consonantal front *r* variants. Although, out of all speakers who use vowel variants, the relative number of alveolar *r*-speakers is highest among those speakers who variably realise /r/ as [ɛ], they are still in the minority compared to uvular *r*-speakers. In fact, use of [ɛ] seems to depend, rather than on the place of articulation of the main consonantal variants a speaker employs, on the *manner* of articulation of the other variants a speaker uses. That is, [ɛ] is only used by those speakers who mostly use other vocalic variants, such as the palatal approximants. By contrast, [ɐ] is used to a considerable extent by speakers who use other back (uvular) variants; in other words, the use of [ɐ] *does* depend on place of articulation. Figures that show this are in Table 5-23 below.

Table 5-23 Other variants used in coda by speakers with [ɛ][ə][ɐ].

	ɛ *(n=569)*		ə *(n=2569)*		ɐ *(n=574)*	
alveolar cons	2.8		8.1		1.2	
uvular cons	10.2		21.4		34.5	
palatal glide	13.9	76.5	5.6	58.5	3.0	47.2
retr/bunch appr	44.8		48.5		27.5	
other vocalic	17.8		4.4		16.7	
non-segmental	10.5		12.0		17.1	

Speakers using [ɛ] mainly use other vocalic variants in addition to [ɛ] in coda positions (76.5%); the palatal glide is a notably frequent realisation for this group of speakers compared to the average numbers in which this variant appears in the data. Speakers using [ɐ], on the other hand, use other vocalic variants in less than half of the cases, whereas uvular consonantal variants are overrepresented here. Finally, speakers using [ə] in coda position pattern rather like the average speaker (at least, those from the Netherlands), in the relative numbers in which they use other variants in coda positions. Note, however, that more than 1 in 4 speakers in the corpus has [ə] realisations among their *r*-tokens, which means that patterning more like average speakers is trivial, as they *are* average speakers.

The front vowel variant of *r* appears mostly with speakers who also have many other vocalic *r* tokens, including a relatively high number of palatal glides. To a lesser extent this is also true for schwa realisations of *r*, although the palatal glide is less frequent here, and the retroflex/bunched approximant forms a much larger proportion of the vocalic *r* tokens. Finally, the low vowel is most frequent with speakers who also have consonantal uvular variants in coda.

These figures suggest that at least to some extent the vowel variants pattern with other, more constricted variants of *r* that correspond to their respective places of articulation. It seems obvious that the low vowel originates in the lenition of uvular variants, as it does historically in German. Schwa and front vowel *r*, on the other hand, are more likely to be reductions of other approximants, i.e. the retroflex/bunched and the palatal approximant. Their acoustic signatures are in accordance with this view (see Chapter 3, and section 5.2 above): the defining characteristics of these approximants, F2/F3 conflation and a high F2, respectively, correspond to specific tongue body gestures. When these are reduced, as for speaker U4 in the ultrasound study, the resulting vowel-like articulations indeed come to resemble central and front vowels (see Figure 5-5).

While these vowel variants may be the logical endpoint (or one step before the endpoint, if *r*-deletion is considered as such) of a path of progressive lenition, then the strong position of the retroflex/bunched approximant, and its spread and increasing frequency with younger speakers, appears to have halted the diachronic lenition process. This shows that while the progressive lenition analysis goes some way in explaining the origin and current distribution of *r*-variants, it is by no means deterministic in its own right, and other factors (here: the social desirability of the retroflex/bunched approximant) are always able to intervene, as it does here. Importantly, the general trend is still visible in the linguistic distribution of the variation, while the external factors that disturb it are correlated with the social groups in the model of the data.

Figure 5-14 shows the relationships between the approximant and vowel variants discussed in this section. The solid lines indicate the *direct* articulatory relationship; the arrows indicate directionality.

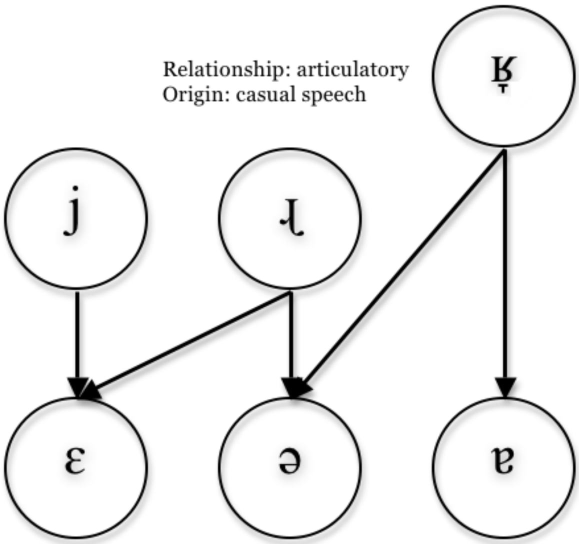

Figure 5-14 The relationship between uvular, retroflex, palatal approximants and low, central, front vowels.

5.4 The ‘zero’ variants: *r*-deletion

The final set of variants to be discussed is that of the ‘zero’ variants. In Chapter 3, these were labelled “*r*-elision” (indicating the absence of segmental *r* either perceptually or visible in the acoustic signal) and “*r*-elision with retraction of the following consonant” (indicating the absence of segmental *r* in combination with retraction, usually palatalisation, of a following (coronal) consonant. In the traditional view of lenition as changes to a speech sound “on its way to zero” (Vennemann in Hyman 1975) this is the logical endpoint of a diachronic weakening process. In the analysis of *r* variants as lenition forms that originate in casual speech these ‘variants’ occupy a similar position, and it is therefore that we can formulate some predictions as to where they should be found most. Section 5.4.1 contains these predictions, and also discusses the surprisingly few studies on *r*-deletion in Dutch. Section 5.4.2 presents an analysis of the ‘zero’ variants of *r* in urban accents of Dutch.

5.4.1 Accounts of coda *r*-deletion in Dutch

Diachronically, *r*-deletion in dialects of Dutch appears to be rather common; De Schutter and Taeldeman (1993; 1994), in their extensive two-part survey of the phenomenon, cite many word forms from a variety of dialects (although the focus is on Flemish ones), for which the cognate form in the standard language contains r, but which are *r*-less in the dialect forms. De Schutter and Taeldeman (1994) claim that r-deletion is not found in Standard Dutch, however. This is contested by Van de Velde's (1996) study of radio presenters' speech, who transcribes a number of 'zero' tokens of *r*. In a series of articles, Cucchiarini and Van den Heuvel (1995; 1999; 1998; Van den Heuvel and Cucchiarini 2001) claim *r*-deletion is an optional rule in connected speech in Standard Dutch, while noting, with Booij (1995:126), that it may be a gradient, instead of a categorical process. Their studies attempt to show this instrumentally. The contexts in which *r*-deletion is "acceptable" according to Cucchiarini and Van den Heuvel are in (5.2).

(5.2) Cucchiarini & Van den Heuvel (1995): *r*-deletion contexts

a. After schwa, except in word-final position

Rotterdam	[rɔtəˈdɑm]	(place name)
vaders	[ˈvadəs]	'fathers'

b. After unstressed, short vowels

parkeren	[pɑˈkerə]	'to park'
portier	[pɔˈtir]	'doorman'

c. After long vowels, but only in conjunction with lengthening and diphthongisation towards [ə]

noorden	[ˈnoədə]	'north'
paars	[paəs]	'purple'

The schwa in (5.1)c is not a remnant of *r*, according to Cucchiarini and Van den Heuvel, since this '*r*-colouring' of a preceding vowel also occurs when *r* is present in the form of a full consonant (*noorden* [ˈnoədə] 'north'). Schwa, then, is not a variant of *r* in their view in these forms. However, weakening of *r* to schwa does take place after a stressed, short vowel, where deletion is unacceptable, according to the authors:

(5.3)	*Harlingen*	[ˈhɑəlɪŋə]	(place name)
	worst	[ʋɔəst]	'sausage'

It is not immediately clear if the different status that Cucchiarini and Van den Heuvel give to schwa in these forms is warranted, as complete deletion after short vowels is possible for at least some speakers, and might even be relatively general in Rotterdam, for instance (Wim Zonneveld p.c.).

The examples and transcriptions above are the authors', and based on their intuitions rather than actual collected data. In Cucchiarini and Van den Heuvel (1998; 1999) and Van den Heuvel and Cucciarini (2001), they test these intuitions on a database of speech recorded by an automatic train timetable inquiry system. Results from a continuous speech recognizer (Strik et al. 1997) deciding on presence or absence of *r* suggest that *r*-deletion is frequent after schwa: *r* was deleted in 66.3% of all instances of /-ər/. Deletion is less frequent after full vowels: 21.5 % after short and 16.6% after long vowels. Human transcribers of a subset of the same data scored a little more conservatively: they considered *r* absent in 34% of all possible cases after schwa, and between 6-13% after full vowels. Nonetheless, this is a number of *r*-deletions considerably higher than the 1.7% found in the *HEMA* corpus (see Chapter 3, section 3.3).

Reasons for this difference may be found in the methodologies of the two studies. Cucchiarini and Van den Heuvel (Cucchiarini and Heuvel 1998) used a forced recognition task for their automatic speech recognizer, and the human subjects were also forced into a binary choice of presence vs. absence of *r*. This leaves no room to take gradient weakening (perhaps to the point of near-deletion) into account (something which they acknowledge themselves, see 1999:4). The question of when exactly *r* is considered 'deleted' is glossed over: is this the case as soon as there is no portion in the signal present that can be easily separated from the preceding vowel (i.e. a segment)? As Plug and Ogden (2003) note, the separation of a vowel and a following *r* is difficult when *r* is realised as an approximant. On the other hand, *r* in the current urban accent data was also categorised into discretely labelled variants, so it should run into the same problems. An important difference, however, may be that in this case, there were two human transcribers who carefully inspected spectrograms for evidence of the presence of *r*, something which neither the speech recogniser nor the listeners in Cucchiarini and Van den Heuvel's studies were able to do. In addition, in the urban accent data, *r* may be present as a vowel, as vowel colouring only, or as a change in the following consonant. There are several reasons for including these realisations as instances of *r*. First, while Cucchiarini and Van den Heuvel are correct when they state that vowel colouring (including a schwa offglide) can also be present with a segmental *r*, this does not mean that a vocalic offglide cannot constitute *r* when other features are absent. Furthermore, while the schwa offglide is often present with *r*, the other vowel variants, such as the low vowel [ɐ], is not. This indicates that these vowels should be seen as variants of *r* itself. More importantly, whether the vowel offglides or vowel colouring are seen as constituting *r* itself or not, their very presence shows that these tokens *contain* /r/, in the abstract (phonological) sense, as they are what sets these forms off from *r*-less ones. Similarly, as Plug (2001) and Plug and Ogden (2003) show, retraction or palatalisation of a following coronal consonant in fact constitutes the presence of /r/, as it can disambiguate forms such as *bod* [bɔt] 'offer' and *bord* [bɔʈ] 'plate'. In other words, it seems that the definition of deletion that Cucchiarini and Van den Heuvel use (as severe segmental weakening) is simply very different from that of 'elision' or 'zero' employed here (complete absence of evidence of *r*). Differences in the rates of *r*-deletion between the two studies, then, are due to a combination of methodological differences (the nature and task of the transcribers) and the definition of the topic of interest.

On the basis of both these earlier studies and a more general idea of where these most lenited forms of *r*, the 'zero' variants are most likely to appear, we can formulate the following predictions: there should be more 'zero' variants after schwa than after full vowels; there should be more 'zero' variants in those contexts where the vowel variants (the next-to-most lenited variants) are also most found; and there should be more 'zero' variants with retraction in the context of final coronal obstruents.

5.4.2 Coda-*r* deletion in the HEMA corpus

The table below shows the number of tokens labelled as not containing any segmental *r* variant. This includes tokens where some alteration of the following consonant may signal the presence of *r* (the middle columns in the table), as well as tokens where no trace of *r* is present at all (the rightmost columns). Note that tokens where *r* is realised as some diphthongisation of the preceding vowel were recorded as containing a segmental, vocalic variant – described in the previous section. However, cases of *r*-deletion with concomitant vowel lengthening are included in the category described here as this was not taken into account.

Table 5-24 Non-segmental coda *r* in the urban accent data.

city	*all non-segmental r*		*r-elision & retraction of consonant*		*r-elision*	
	n	*%*	*n*	*%*	*n*	*%*
Antwerp	4	0.5	0	0.0	4	0.5
Bruges	4	0.5	0	0.0	4	0.5
Ghent	2	0.2	0	0.0	2	0.2
Hasselt	2	0.2	0	0.0	2	0.2
Amsterdam	33	4.0	13	1.6	20	2.4
Rotterdam	72	8.1	6	0.7	66	7.4
Utrecht	79	9.6	26	3.2	53	6.4
Leiden	22	2.7	3	0.4	19	2.3
The Hague	33	4.4	4	0.5	29	3.9
Nijmegen	82	10.1	17	2.1	65	7.9
total	330	4.0	69	0.8	261	3.1

What is most immediately obvious from Table 5-24 is that *r*-elision is much more widespread in the Netherlands than in the Flemish accents. Within the Netherlands, it is most frequent in Nijmegen, Utrecht and Rotterdam. Retraction of a following consonant in combination with *r*-elision is found most in Utrecht. To gauge the significance of these differences, and of the relative contributions of the linguistic context and social factors, a linear mixed-effects model was run predicting the occurrence of one of the 'zero' variants. Factors were once again included conservatively in the model and left in only if they significantly improved the model fit. Only the data from the Netherlandic accents were included, since the numbers for the Flemish ones were too small for the model to converge. Likewise, the lexical items with labial and dorsal consonants following *r* were left out of the model, since there were no deletions found in these contexts. A summary of the resulting model is in Table 5-25.

There is no effect of vowel context, which goes against the predictions based on Cucchiarini and Van den Heuvel (1995) and Van den Heuvel and Cucchiarini (2001). There is, however, an effect of the following (consonantal) context: *r*-elision is more frequent before coronal consonants than in absolute word-final position (and elsewhere, as deletion before labials and dorsals does not occur in the data).

Table 5-25 Summary of a linear mixed-effects regression predicting the likelihood of a 'zero variant in coda position for all NLD speakers. The intercept corresponds to an *r*+coronal consonant cluster for a younger male Amsterdam speaker. Number of observations = 4470.

Random effects	*Variance*	*Std Deviation*	*N*	
speaker	2.052	1.43	242	
-- following context: #	1.792	1.34		
item	1.590	1.26	10	
Fixed Effects	*Estimate*	*Std Error*	*z*	*p*
(intercept)	-4.099	0.70	-5.89	.000***
following context: #	-2.194	0.85	-2.59	.010**
City: Rotterdam	1.375	0.45	3.05	.002**
City: Leiden	-0.010	0.50	-0.02	.984
City: Utrecht	1.418	0.46	3.11	.002**
City: The Hague	0.628	0.49	1.28	.200
City: Nijmegen	1.428	0.45	3.15	.002**
Sex: female	-0.787	0.25	-3.12	.002**
Age: older	0.708	0.26	2.77	.006**

Contrary to the weak effects of segmental context, the geographical and social factors in the model show more robust patterns: *r*-elision is indeed more frequent in Nijmegen, Rotterdam and Utrecht than elsewhere in the Netherlands (and it is largely absent from the Belgian Dutch accents). An overview of the significant differences between cities is in Table 5-26.

Finally, both sex and age show significant main effects: *r*-elision is more frequent with older speakers, and with men. This is perhaps the most interesting outcome of the analysis of 'zero' variants of *r*, as it suggests that, in urban accents of Standard Dutch at least, loss of *r* in codas is not on the increase. Changes in progress (toward speech forms that are not stigmatised) are most usually associated with young female speakers (Labov 1994; Milroy et al. 1994), and a case of this phenomenon is described above in section 5.2), so it is more probable that the trend is away from these "most lenited" forms, and the progressive lenition in this sense is halted. This is of course most likely related to the strong shift toward the retroflex/bunched approximant in codas for Netherlandic Dutch speakers, which *does* show effects in the expected direction. The popularity of this coda variant appears to be 'eating up' the other more lenited forms, such as the vowel variants and 'zero'.

Table 5-26 *p*-values of pairwise comparisons of speech communities on the incidence of 'zero' variants in codas.

Ams	Ldn	Hag	Rot	Utr	Nmg
Ams	.984	.200	.002	.002	.002
	Ldn	.188	.002	.002	.001
		Hag	.084	.071	.066
			Rot	.913	.893
				Utr	.980
					Nmg

A more in-depth study of *r*-elision would require data of a very different kind than those in the urban accent corpus: variation in speech rate, as well as style and register would have to be included in the design. Since the data in the *HEMA* corpus do not include these, and, though in a casual setting, are of a relatively formal nature (given the speech tasks), it has only been possible to touch upon the subject briefly and sketch the patterns in the data.

5.5 Conclusion

This chapter has discussed the approximant and vocalic variants of *r* in Dutch. It is clear that many of these variants lend themselves rather straightforwardly to a 'lenition' analysis. The consonantal approximants can most easily be traced back to more constricted variants along articulatory parameters. The alveolar approximant is closely related to the alveolar tap, and differs from it only in the magnitude of the apical gesture. The uvular approximant has a similar relationship to the uvular fricative, from which it differs only in the magnitude of the dorsal backing gesture.

The retroflex/bunched approximant is of a more complex nature, compared to the other variants discussed in this chapter. There does not seem to be a straightforward articulatory link between this variant and the more consonantal ones. In fact, the retroflex bunched approximant seems to be more complex articulatorily than most consonantal variants it alternates with. This would seem to preclude an analysis of its origin being from articulatory weakening. However, a phonetic basis for its origin that is not incongruous with a lenition analysis is apparent when the perceptual-acoustic properties of the variant are considered. It appears that the defining characteristic of the retroflex/bunched approximant, the near-conflation of F2 and F3, is also found in other, more constricted, *r* variants, including the alveolar trill. A progressive weakening (from trill to tap to approximant) may have involved the retention of this perceptual feature, which was then latched onto by later generations of speakers as a new, perceptually-based, coda-*r* target.

Among the vowel variants of *r*, the low vowel is most intimately bound up with uvular variants, both in terms of its phonetic characteristics (it is essentially an even more open dorsal approximant). The front vowel variant of *r* (transcribed here as [ɛ]) is not as straightforwardly related to more constricted front variants of *r*, but rather to other vocalic variants – specifically the retroflex/bunched approximant and the palatal glide. Finally, a schwa realisation of Dutch *r* is fairly frequent, and naturally involves the least amount of tongue displacement, which also means it may be a weakened variant of a number of other *r*-variants. Specifically, it is a likely outcome of a reduction of the gestures of the retroflex/bunched approximant: in such cases, the low F3/high F2 target is not met, and the result is a vocalic realisation with fairly evenly spaced formant structure.

The approximant and vocalic variants of *r* described in this chapter are thus all plausible outcomes of weakening processes, both online (through the constraints of casual speech), and by extension diachronically. Their distribution over contexts in the Dutch urban accent data is in line with such a view: while the more "consonantal" approximants are found in both the traditional lenition contexts, such as intervocalically, as well as in stronger positions (they occur in all positions in which the more constricted consonantal types of *r* also occur), the more vocalic variants occur exclusively with coda-*r*.

Finally, a brief look at 'zero' variants of *r*, or *r*-elision, showed that it is not a particularly frequent phenomenon in the urban accent data, although that may be due to the particular register and speech style. It patterns to some extent with other strongly lenited forms of *r*, such as the vowel variants. Most importantly, this "logical endpoint" of lenition is not a feature of younger speakers, and does not seem to show signs of being a change in progress. In the Netherlandic accents, it is the retroflex/bunched approximant instead that is not only by far the most frequent realisation in codas already, but also seems to have time on its side.

6 Implications for phonology

While Dutch *r* has had its share of attention from phonologists, their accounts have not usually focused on the realisational variation associated with /r/. What phonologists have studied most extensively are the ways in which the phoneme /r/ affects surrounding speech sounds, as well as processes of *r*-deletion in various dialects of Dutch. In these studies, the phonetic variability found with *r* is usually ignored completely. The choice to do so is likely due to one or both of the following assumptions:

1. the realisation of /r/ in the particular variety described is assumed to be stable, or
2. the realisational variation is thought to be irrelevant to the phonological system and the processes at hand.

The data presented in the previous chapters show that, while (1) often seems implicit in the descriptions, only (2) can reasonably be considered a viable option in particular cases, although this would have to be argued or shown by the analyst, not assumed. As noted in the introduction, if any attention has been given to /r/'s realisational variation in phonological studies, it has been centred on positional allophony. This then leads to descriptions of Dutch *r*-variation not unlike that of Wiese's (2000) account of German *r*-allophony, crudely dividing Dutch *r* into two variants, e.g. onset [r] vs. coda [j] (as in Van der Torre 2003:176). While the previous chapters have shown that the prosodic and segmental environment indeed is an important factor determining the realisation of /r/, they have also argued strongly that the impact of *r*-variation on the knowledge speakers must have of the sound structure of their language extends well beyond allophonic knowledge.

The point here is that, while much of the realisational variability described in the previous chapters may be at the level of phonetics, and therefore dismissed in some phonological theories as irrelevant, much of the fine phonetic detail regarding *r* is in fact under speaker control: it varies among accents, age groups, sexes and individual speakers, and therefore needs to be part of a full account of speakers' knowledge of the language. Since speakers obviously interact, as speakers and listeners, knowledge of the variation itself should in fact be part of such an account. In addition, the explanation of current *r* patterns hinges on the phonetic characteristics of particular *r* variants and how, diachronically, they could have given rise to other variants. For these reasons, it is not a trivial question to ask, whenever a phonologist gives an account of a process that applies to *r*, or for which it is a conditioning factor, *which r*? And if the answer were indeed *all* or *any*, this would be important evidence for the status of the process as highly abstract, i.e. "phonological" in the strict sense (as categorical) of the term. On the other hand, if there are differences in how *r* undergoes or conditions a process related to its realisation, the process may need to be analysed differently, as “phonetic”, i.e. potentially gradient.

This chapter will describe the position of *r* in the consonant system of Dutch, and its phonotactics (6.1) before discussing the matter of its phonological representation (in terms of features or otherwise), with particular reference to its realisational variation (6.2). We will then take a look at a process in which *r* has been said to be involved as a *category*, /r/, without regard for its phonetic realisation, and confront this view with the urban accent variation data. Section 6.3 considers the process of schwa-insertion in -*r*C clusters, focussing on whether the realisational variation of *r* has an influence on the process applying (or applying in a certain manner), which itself bears on the question of whether it is phonological or phonetic. Section 6.4 concludes.

6.1 Phonotactics of Dutch /r/

Table 6-1 shows the consonant system of Standard Dutch (from Booij 1995).

Table 6-1 The consonants of Dutch.

	Bilabial	*Labio-dental*	*Alveolar*	*Palatal*	*Velar*	*Glottal*
Plosives	p,b		t,d		k,g	
Fricatives		f,v	s,z		x,ɣ	h
Nasals	m		n		ŋ	
Liquids			l,r			
Glides		ʋ		j		

Dutch has two liquids, a lateral and a rhotic (this is true for all varieties of Dutch, not just Standard Dutch). Both show realisational variability to some extent. The reason /r/ is often classed as alveolar, or coronal, may have something to do with its phonological behaviour, though constraints or processes in which the place of articulation of *r* is crucial are few (or maybe even non-existent; see below). The most likely reasons for /r/’s consistent classification as a coronal liquid despite its surface variation are simplicity of the description (making /r/ the counterpart of /l/ in as many features as possible) and linguistic tradition.

The distributional properties of /r/ in Standard Dutch are described extensively in the literature; see, for instance, Cohen et al. (1961), Zonneveld and Trommelen (1980), Trommelen (1984), and Van der Torre (2003:145-148). The overview below is based on these sources.

First, /r/ appears freely in singleton onsets. This holds for word-initial and word-internal, pre- and post-tonic onsets.

(6.1)	*riem*	/rim/		‘belt’
	koraal	/kɔ.ˈral/		‘coral’
	herrie	/ˈhɛ.ri/		‘noise’

In onset clusters, /r/ is free to appear after all non-sibilant obstruents.[30] This is true word-initially as well as word-internally. Dutch has a limited number of three-consonant onset clusters; these are always word-initial, and invariably of the form s-obstruent-liquid. When the liquid is /r/, the second element can be /p,t,k/ or /x/. The fact that the consonant /l/ can appear freely in the same position (except for initial /tl-/ combinations) forms the main phonotactic evidence that the liquids form a natural class.

(6.2)	*praat*	/prat/		‘talk’
	brood	/brod/	[brot]	‘bread’
	fris	/frɪs/		‘fresh’
	vrij	/vrɛi/		‘free’
	trein	/trɛin/		‘train’
	draad	/drad/	[drat]	‘thread’
	kruk	/krʏk/		‘stool’
	chroom	/xrom/		‘chrome’
	gras	/ɣrɑs/		‘grass
	cobra	/ko.bra/		‘cobra’
	Afrika	/ˈa.fri.ka/		‘Africa’
	patroon	/pa.ˈtron/		‘pattern’
(6.3)	*spraak*	/sprak/		‘speech’
	strik	/strɪk/		‘bowtie’
	scriptie	/ˈskrɪpsi/		‘thesis’
	schrift	/sxrɪft/		‘notebook’

In absolute syllable-final position, /r/ is free to occur both word-internally and word-finally.

(6.4)	*peer*	/per/	‘pear’
	boer	/bur/	‘farmer’
	schaar	/sxar/	‘scissors’
	harnas	/ˈhɑr.nɑs/	‘suit of armour’
	vernis	/vɛr.ˈnɪs/	‘varnish’

In word-final clusters, /r/ can occur before the full set of obstruents, bearing in mind that Dutch obstruents are always phonetically voiceless in word-final position: [p,t,k,f,s,x]. In addition, /r/ can occur before the labial and coronal nasals

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[30] The only initial /sr-/ clusters are found in the loanwords *Sri Lanka* and *Sranan*. /r/ does not occur after sonorants in initial clusters for most speakers; the cluster spelled *wr-* in *wrijven* ‘to rub’ and *wreed* ‘cruel’, a potential sonorant-/r/ cluster, is generally pronounced [vr-] (Mees and Collins 1982:9, Booij 1995:62).

/m,n/, but not before the other sonorants, /ŋ, l, j, ʋ/.[31] Again, these phonotactic restrictions are shared by both liquids.

(6.5)	*harp*	/hɑrp/		‘harp’
	korf	/kɔrf/		‘basket’
	bord	/bɔrd/	[bɔrt]	‘plate’
	kers	/kɛrs/		‘cherry’
	kerk	/kɛrk/		‘church’
	erg	/ɛrɣ/	[ɛrx]	‘severe’
	arm	/ɑrm/		‘arm’
	kern	/kɛrn/		‘nucleus’

Coda clusters with three or four elements may contain /r/ as their first element. The final consonant in such clusters is always a coronal.

(6.6)	*worst*	/ʋɔrst/	‘sausage’
	markt	/mɑrkt/	‘market’
	schurft	/sxʏrft/	‘scabies’
	arts	/ɑrts/	‘physician’
	herfst	/hɛrfst/	‘autumn’
	Ernst	/ɛrnst/	‘seriousness’

There are two more distributional characteristics of /r/ in Dutch to be remarked on briefly: it does not occur after the ‘true’ diphthongs of Dutch, /ɛi,ɑu,œy/ within the syllable (Cohen et al. 1961), which is its most striking phonotactic difference with /l/, which does occur after the diphthongs (*pijl* /pɛil/ ‘arrow’, *Paul* /pɑul/ (proper name), *vuil* /vœyl/ ‘dirt’). Finally, the sequence /-rər-/ is absent from Dutch.[32] All in all, the phonotactics of Dutch *r* show behaviour cross-linguistically typical of sonorants in general, and liquids in particular (cf. Botma 2011).

6.2 Representations of /r/

6.2.1 Full specification in Generative Phonology

Most phonological studies of Dutch that involve *r* are within a standard *SPE*-type Generative Phonology framework (Chomsky and Halle 1968) or its descendants, and

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[31] Mirroring the situation with *wr*- onsets (fn. 30), the final cluster –*rw* is realised by many speakers as [-rf] or [-rəw]: the only lexical item containing this cluster word-finally is *murw* [mʏrf, mʏrəw] ‘tender’

[32] Except in the loan *topscorer*, although this has an alternative form *topscoorder*, in which the cluster is broken up. Also absent is the sequence /-ləl-/, while /-rəl/ occurs freely: *kerel* /ˈkerəl/ ‘bloke’, and /-lər/ is frequent in (pseudo-)polymorphemic words, as there are two [-ər] suffixes in Dutch: *speler* /ˈspelər/ ‘player’, *vuiler* /vœylər/‘dirtier’.

they do not take realisational variation into account. Almost all these studies employ traditional *SPE* features, and propose very similar full specifications for the phoneme /r/, including [+sonorant] and [+coronal], as well as negative specifications of [-nasal] and [-lateral] to set /r/ off from the other sonorants (e.g. Brink 1970; Booij 1995; Trommelen and Zonneveld 1989). Most also add [+continuant] and [+voice]. A typical specification is in (6.7).

(6.7) *SPE*-type features for /r/, full specification (Booij 1995):
[+cons,+son,+appr,+cont,+voice,-nas,-lat,-asp, COR]

In other words, /r/ is phonologically specified as a coronal liquid. However, based on the observations in previous chapters (and previous literature), /r/ seems to be the only phoneme for which almost all relevant features that are positively specified underlyingly can have opposite values in the phonetic (surface) realisation, as /r/ can be realised as a vowel [-cons], as a voiceless [-voice] obstruent [-son, -appr], and have a uvular place of articulation [-COR]. It seems that, apart from [-lateral], necessary to set /r/ off from /l/, only the [+continuant] specification cannot be reversed, although even that hinges on the (not entirely uncontroversial) definition of taps and trills as [+continuant] segments. Interestingly, the exact featural make-up of /r/ in fact does not play a role in standard generative analyses of phonological processes concerning it.[33] This is somewhat surprising, as the most frequently discussed process induced by the presence of *r*, *r*-colouring of preceding vowels, would appear to be assimilatory in nature, inviting a spreading analysis in such frameworks. The process will not play a role in the context of this dissertation, as the *HEMA* data do not provide all the relevant contexts (particularly, the contrasting contexts of the same vowels before other consonants), but the basic facts are as follows. In most varieties of Dutch, vowels are both quantitatively and qualitatively affected by the presence of a following /r/ in the same word (for an overview of the phonetic effects, see Koopmans-van Beinum 1969; 't Hart 1969; for a phonological analysis, Zonneveld and Trommelen 1980). The tense mid vowels /e,ø,o/ in particular are affected, and the realisation of /r/ does not seem to be of influence. If that is because the "colouring" process is one of purely phonological feature spreading, this would be a strong argument for a single, abstract representation of Dutch /r/, divorced from its phonetic exponents. If there is any phonetic reason behind the process (even if only historically), the expectation would be for there to be differences between speakers with different *r*-realisations, or what phonetic features might possibly be shared among the *r*-variants in question.

Most standard phonological accounts of Dutch *r* at least mention the phonetic variability of surface realisations of /r/, even though these are not assumed to play a role in its phonological behaviour. Both Van den Berg (1974) and Booij (1995) make this assumption explicit: Van den Berg calls the different realisations of /r/

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[33] One exception is Brink's (1970) analysis of the phonological consequences of –*nis* suffixation, where /r/'s coronality is crucial in resisting schwa-insertion before the suffix. This process is not productive, however, and its specifics are not relevant here.

"extraphonological variants of a single phoneme" (1974:42), and Booij, after listing "an alveolar roll [r], an alveolar flap [ɾ],a uvular roll [ʀ], a uvular fricative [χ], [...] a uvular approximant [ʁ], [and] a palatal approximant similar to [j]" as the surface variants of /r/, claims: "we do not need a phonological feature for uvular [ʀ] because it is an allophone of the alveolar [r] [sic]" (1995:12). However, he does state that uvular [ʀ] can be characterised using features that are not part of his representation in (6.7), namely [+back, -high] (these are place features under the Dorsal node). These, however, are not part of the underlying phonological specification, which is assumed to have (privative) Coronal as its only place feature.

The feature bundle in (6.7), or others like it, is not able to capture the surface variation of Dutch r, nor is intended to. If the features are assumed to have phonetic content, they characterise only the coronal trills, taps and approximants. Phonologically, they are more than enough to account for the phonotactic behaviour of /r/, but may run into problems when faced with certain phonological processes, as the following sections will show. Equally problematic is Booij's statement regarding the nature of uvular [ʀ]. That is, for individual speakers, it is demonstrably not an "allophone" of alveolar [r], even if it is interpreted to mean "/r/, specified as alveolar" or something along these lines. Only a minority (of around 15%) of speakers in our corpus have consonantal *r*-allophones at both uvular and alveolar places of articulation, and in those cases they are in almost free distribution, with complex social factors interacting with a very limited distributional allophonic pattern (see section 4.1.2). On the other hand, there are many speakers who realise /r/ exclusively as uvular (or combine uvular realisations with other, vocalic ones), for whom a representation of /r/ as alveolar at any level of abstraction seems far-fetched: there would be no evidence for these speakers to set up representations including coronal or alveolar place, either from the phonetics or from phonological behaviour.

One source of evidence for speakers to set up representations including an alveolar specification if they do not realise /r/ at alveolar place of articulation themselves would be variation: if uvular *r* speakers hear alveolar realisations, they might add a feature specification for this place of articulation to their own representation. This, however, shifts the problem to questions of at what point an "aberrant" realisation leads to an update in the feature specification, and where to draw the line at relevant variation. A single encountered alveolar realisation (or: a single speaker's realisations) will presumably be disregarded, rather than taken as crucial evidence for such an update. Speakers in The Hague and Nijmegen may go some time without encountering alveolar realisations of /r/. More importantly, this line of reasoning would also have to go the other way around: alveolar *r* speakers would also have to include a uvular specification upon hearing the relevant variation. In fact, since *r* is so variable as to include consonants and vowels, fricatives and sonorants, retroflexes and palatals, a large number of concurrent (and even opposing) feature specifications would have to be present for speakers sensitive to this variation. This would bring phonological representations very close to those argued for in Chapter 1: the rich, detailed representations of Exemplar Theory, in which indeed any realisation is potentially stored and able to have an impact on the representation of the entire category. As discussed in Chapter 1, however, the two types of representations serve entirely different purposes, and that of the abstract, feature-based ones in standard Generative Phonology is not to encode large amounts of variation or articulatory detail. The following sections explore these issues further, focussing first on allophony and other intra-speaker variation, and turning to inter-speaker variation later.

6.2.2 Alternatives to full specification: underspecification and Government Phonology

Alternatives to the feature specification above are possible, and for other languages attempts to capture both the phonological behaviour of /r/ and its variable nature in its representation have been proposed. A possibility is underspecification: features are not specified underlyingly, but filled in at later stages of a derivation. This way, the unity of the phoneme can be preserved through a shared set of features at the underlying level, while variation is captured by having different values (or even different features) at the surface level. Wiese's (2000) approach to German *r*, mentioned in Chapter 1, is an example: only [+low, +continuant] are specified underlyingly; other features are added by default rules, or specific ones to derive certain variants. A somewhat different type of proposal employing minimal specification to allow for some variability is found in Broadbent (1991), Backley (1993) and Harris (1994) for English, and Ploch (1993) for Southern German. These are all in a Government Phonology framework, and as such do not use feature-filling operations; instead, the privative features, or elements, in this theory are directly phonetically interpretable. They represent /r/ as consisting of a single vocalic element (either |A| or |@|) in a consonant position. (The elements chosen roughly translate to, respectively, [low] and [sonorant] in traditional features.) The boldest proposal comes from Giegerich (1999:184-97), who analyses /r/ (as well as /ə/), as phonologically empty, or Ø. This absence of specification is then interpreted phonetically as the "default sonorant" for English: [ɹ] in onsets and [ə] in rhymes.

As argued in Chapter 1, the feature approach in general, and that using underspecified representations in particular, works mostly to capture larger allophonic patterns, such as [ʁ]~[ɐ] in German, or [ɹ]~Ø in English. This is also true for the approaches within Government Phonology, and they face additional restrictions: since adding elements or changing their values is impossible, the only way to model variation in featural terms is as decomposition: the onset [tʰ]~coda [ʔ] allophony in London English, for instance, can be modelled as a loss of elements in the coda (Harris 1994). The fully specified onset [tʰ] (containing the elements for 'stop', 'frication/aspiration' and 'coronal', |?,h,R|) then alternates with an impoverished coda [ʔ] (containing only the 'stop' element, |?|).

In addition to handling cases of allophony, segmental decomposition is also how lenition is modelled in Government Phonology: as the loss of elements from the representation, segments becoming consequently less complex over time. This of course opens up a potentially interesting avenue for modelling Dutch *r*-variation, which has been argued throughout this thesis to be largely due to lenition processes (albeit diachronic, not synchronic). However, the restrictive nature of Government

Phonology's element theory makes this approach not very fruitful. This is because consonant complexity (i.e., the number of elements a consonant contains) is seen as inversely proportional to their place on the sonority scale (Harris 1990), which means that stops contain many elements that they can decompose into, but /r/, as shown above, is generally regarded as simplex (or even empty). However, even if the link between segmental complexity and sonority is severed, and /r/ is regarded as elementally complex, as in Van der Torre (2003), the resulting representation can only go so far in modelling *r*-variation as lenition, eventually running into the same problems as the traditional feature approaches: only a subset of the variants can be represented as allophones (Sebregts 2004b). There is no non-arbitrary way of deciding which variants should have their place within phonology, receiving their own slightly impoverished element set, and which are phonetic variants of these prime allophones. Of course, some of the allophonic patterns in the data appear to lend themselves to a phonological treatment; for example, the allophony between uvular onset *r* and bunched/retroflex coda *r* found with many of the Netherlandic speakers in the corpus seems to necessitate separate feature bundles for each allophone, but it is precisely this pattern that can*not* be analysed as one allophone containing a subset of the features of the other (see Chapter 5).

6.2.3 Capturing the unity and variation of *r*

Both the underspecification and element theory representations of /r/ go some way in defining the place of /r/ in the consonant system, and both can handle limited patterns of gross rhotic allophony. They share this with the standard generative features approach. More so than the latter, they are able to handle some degree of inter-speaker variation, as well: if the minimal underlying specification is shared by speakers of a language community, other features are filled in on a speaker-specific (as well as context-specific) basis. This is also how these approaches tackle the issue of the cross-linguistic unity of rhotics, discussed in Chapter 1, section 1.1.1: since the class of rhotics is very diverse in its surface realisations and there is no single phonetic feature they all share, the representation at the underlying level must be minimal.

There are several other attempts at capturing the unity of the rhotic class at the phonological level while allowing for variation. Hall (1997) suggests that *r*-sounds are best represented using a feature without phonetic content, [+rhotic]. This allows for a variety of realisations, while preserving the unity in distribution and behaviour of /r/. However, the problematic aspects of this proposal should also be immediately clear: it is an ad-hoc solution, one that is unnecessary for any phoneme but /r/. It does not serve to constrain the rhotic class (while the variation is wide, there is no reason to assume that *anything*, including [f] and [ʔ], could function as /r/); Importantly, there is also no indication of how the association of this feature to the phonetic exponents of /r/ could be learned (as argued by Gąsiorowski 2006, who labels this solution "desperate" and "an admission of defeat".)

Wiese (2001a) presents a similarly abstract proposal, in which /r/ is not defined by features at all, but is just "a point on the sonority scale, between laterals and glides" (2001a:350). This runs into the same problems as Hall's, except perhaps the last one: the sonority profile of /r/ could be learned on the basis of its phonotactic distribution alone. This comes at considerable theoretical cost, however, as it turns the concept of sonority (e.g. Steriade 1982; Selkirk 1984) on its head: instead of the relative sonority of segments determining their place in phonotactics, it is their distribution that determines their place on the sonority scale. While the idea that, synchronically, what unites the various realisations of /r/ is to be found at the level of its distributional properties and not in any featural make-up tallies with the approach taken in this thesis (further arguing that other explanations are to be found in the diachronic realm), this particular move leads to questions of circularity, leaving the sonority scale as a purely theory-internal construct. There are also more practical issues: fixing /r/ between laterals and glides is problematic in the face of glide and vowel-like rhotics such as [j], [ə] and [ɐ], especially from an acquisition perspective; and it may not even work, as there are languages such as Polish, that have glide-rhotic onset clusters, violating the very universal restrictions that presumably form the basis of Wiese's proposal (Gąsiorowski 2006).

Finally, an attempt to express the unity of rhotics through shared featural representation is Walsh Dickey (1997), although they are not characterised by shared featural content, but shared structure: rhotics are unique in having a branching place node, with room for both a coronal and a dorsal specification underlyingly. There is some phonetic support for such an approach: in an MRI study, Gick et al. (2002) found that American *r* is invariably produced with a coronal as well as a dorsal constriction, despite the articulatory variation (which is similar to that found with the Dutch bunched/retroflex approximant). Other studies have found complex coronal-pharyngeal configurations for English approximant *r* which also seems to resemble those of Dutch approximant *r* reported in Chapter 5 (Delattre and Freeman 1968; Gick and Campbell 2003). In addition, taps and trills in Spanish and Russian have been found to involve both tongue tip and tongue dorsum (Proctor 2011; but cf. Recasens 1987; Recasens and Pallarés 1999, who find less evidence for a dorsal constriction in the tap in Catalan). This is important additional evidence to claims that alveolar trills and taps have a strong link to retroflex and bunched approximants, and it strengthens the scenario sketched in Chapter 5, section 5.2.2.3 for the development of the latter from the former. It also provides potential evidence for a stronger link between coronal and dorsal *r* in general, beyond perceptual links (Engstrand et al. 2007). On the other hand, it is difficult to see how the complex coronal-dorsal configuration can be generalised to all rhotics, as a coronal gesture is likely to be absent from purely uvular or pharyngeal *r* as in French or Danish (Catford 1977; Gick et al. 2006), and from at least some labiodental *r* in English (Scobbie 2004).

In conclusion, it seems inescapable for a representation of /r/ that tries to do justice to both its unified systemic and phonotactic behaviour and its variable nature, i.e. one that tries to account for both at the same time, to run into problems with at least one of the two. But there is not necessarily a contradiction between the need for a highly abstract, underspecified representation at the phonological level and that for a representation of the surface variation and its phonetic detail. In fact, the existence of the latter demands that of the former, as Pierrehumbert (2003a; 2006) has argued, as well as many others within Exemplar Theory approaches (e.g. Beckman et al. 2007; Munson 2010). This point will be explained in the discussion of such approaches in the following section.

6.2.4 Representing variation and phonetic detail: Exemplar models

The basic properties of Exemplar representations were laid out in section 1.3 of Chapter 1: a large amount of detail concerning individual speech tokens is stored in a rich, structured lexicon. This minimally includes a perceptual record, as well as additional information of both linguistic and extra-linguistic (speaker- and speech event-related) properties (see Figure 1-3). Variation, whether categorical or gradient, is not a problem as it is in fact embedded in the representational structure. Representations have words as their primes, not phonemes or features. However, speakers may well set up categories corresponding to those of the phoneme, segment, or feature on the basis of evidence (from phonetic similarity or alternations). This is explicitly suggested by Pierrehumbert, who argues for a "hybrid model" (2002) with various levels of abstraction (2003b), including one that she calls 'phonetic encoding", which deals with the abstraction of units of phoneme size, although they may also be smaller (at the level of categorical allophones, cf. Ladd 2006, who proposes a similar level of representation not necessarily tied to an Exemplar model). In her model, there is also a "phonological grammar" level, abstracted from the detailed lexicon, containing e.g. phonotactic knowledge (as statistical generalisations). This means that while variation and phonetic detail are represented as linguistic knowledge, the idea of a category *r* is still relevant, and the unity of all the different variants that a speaker perceives, stores and uses comes from these abstractions. The abstractions are over word tokens, which are themselves abstractions from speech (Pierrehumbert 2003b:180). The model is not intended, however, to provide an answer to questions such as why different *r*-sounds in various languages function similarly; in fact, this is thought to be outside the remit of phonological theory proper. Such an answer is to be found outside of phonological explanation, in the diachronic realm. Individual speakers do not have to account for the cross-linguistic patterning of various rhotics as part of their linguistic knowledge. For the linguist, answers are to be sought in studies of sound change, such as the development of certain variants from others in particular environments as proposed in this thesis. They can also be found in acquisition studies, or in the history of languages in contact: much of the evidence for the variety of rhotics "functioning" similarly has come from relatively closely related languages (primarily the Germanic, Romance and Slavic languages of Europe), and it is likely that a shared history among these languages accounts to a large degree for the similarity in distribution and behaviour (cf. Simpson 1999:351). On the other hand, the phonetic biases described in Chapters 4 and 5 are argued to be at the root of the development of particular variants, should hold everywhere, and they make more general predictions. For instance, wherever there are alveolar trills, the eventual appearance of alveolar fricative variants, as well as uvular trills, is predicted. Wherever there are taps, the appearance of approximants in casual speech is predicted, etcetera.

In conclusion, the notion of phonological and phonetic representation in Exemplar Theory diverges strongly from that in standard Generative Phonology. Variation and detail are represented, while the unity of a larger category comes from abstraction and generalisation over individual tokens. This larger category may be of phoneme or major allophone size, and is labelled accordingly, but the precise content of the label is not a central concern, as it is for feature theory within Generative Phonology. These differences are the result of different conceptions of what representations are supposed to be of, and what they are supposed to do. In Generative approaches, the focus is on the phonological behaviour of speech sounds within a system of contrasts; and when there are clear cross-linguistic similarities in the behaviour of phonetically similar categories, these are also considered to find their explanation in similarity of representation. Accounting for variation and phonetic detail is not within the purview of phonology. In Exemplar Theory, the focus is on accounting for the detailed variation in speech, as well as on the psycholinguistic modelling of how the Lexicon mediates between phonetics and phonology. Here, it is the cross-linguistic unity of phoneme classes and their larger patterns of behaviour that are thought to be outside of its explanatory scope.

In this thesis, the emphasis is on the surface phonetic variation found with Dutch *r*, focussing on how that variation is related to both linguistic context and geographical and sociolinguistic factors. The basic view underlying the exploration of how this variation came to be (in chapters 4 and 5) has been that of continually updating representations composed of exemplars, augmented with gestural representations familiar from Articulatory Phonology. The data presented in this thesis are not, however, suited to provide insight into what representations at higher levels of abstraction may look like, although they are able to problematise particular previous proposals.

The remainder of this chapter focuses on a phonological process which has *r* as one of its triggers: schwa-insertion in liquid-consonant coda clusters. It will serve to exemplify how sociophonetic data of the kind collected for the urban accent corpus can be used in the analysis of phonological processes, presenting problems for traditional accounts, as well as providing a deeper understanding of them.

6.3 Schwa-insertion/intrusion

In the discussion of the urban accent data in the previous chapters, one of the syllable contexts distinguished between was termed the “schwa-insertion context” (for reasons briefly explained in section 3.1.4). On a number of occasions it was argued that this context behaves less like the coda context it nominally is, and more like an intervocalic onset, at least when insertion of a vocalic element indeed takes place. This section now provides a fuller discussion of the process itself, by looking at the potential effects of the realisation of /r/ on the incidence and the phonetics of schwa-insertion. Any differences in how and how frequently the process operates may shed light on the origins of the process (which, in line with the view on *r*-variation itself adopted in this thesis, is assumed to lie in the phonetics of casual speech) and on its current status. As for the latter, there appear to be two competing views on schwa-insertion in Dutch. The traditional description in most of the literature is that of a categorical phonological rule (6.3.1); alternatively, schwa-insertion can be seen as a phonetic process (6.3.2). The different predictions these two views make are examined in the context of the urban accent data (6.3.3 and onward). This chapter will show that schwa-insertion in *r*C clusters must in essence be phonological, because of the *r*-variants used when it takes place. However, the predictions of the traditional analysis are mostly not borne out, and the phonetic particulars of the process in the various dialects suggest a more complex relationship between the phonetic and phonological aspects at play.

6.3.1 Schwa-insertion: a phonological account

In the phonological literature on schwa-insertion in Dutch coda clusters, the process is described as the appearance of an epenthetic vowel between /r/ and a following non-coronal or nasal consonant in a coda cluster (Trommelen 1984; 1993; Booij 1995). The vowel, whose quality is usually assumed to be schwa-like, breaks up the cluster and possibly creates an additional syllable, reassigning coda-*r* to its onset. Thus, *film* /fɪlm/ ‘film’ comes to rhyme with *Willem* /ʋɪləm/ (proper name), and *zorg* /zɔrɣ/ ’care’ potentially comes to rhyme with *knorrig* /knɔ.rəɣ/ ‘grumpy’: [zɔ.rəx] ~ [knɔ.rəx].

Examples of all relevant contexts are given in (6.8), see Trommelen (1984) for more examples.

(6.8) Schwa-insertion after liquids

a.	*harp*	/hɑrp/	[ˈhɑrəp]	‘harp’
	korf	/kɔrv/	[ˈkɔrəf]	‘basket’
	herfst	/hɛrfst/	[ˈhɛrəfst]	‘autumn’
	kerk	/kɛrk/	[ˈkɛrək]	‘church’
	berg	/bɛrɣ/	[ˈbɛrəx]	‘mountain’
	arm	/ɑrm/	[ˈɑrəm]	‘arm’
	kern	/kɛrn/	[ˈkɛrən]	‘nucleus’
	Charles	/ʃɑrl/	[ˈʃɑrəl]	(proper name)
b.	*alp*	/ɑlp/	[ˈɑləp]	‘alp’
	twaalf	/tʋalf/	[ˈtʋaləf]	‘eleven’
	melk	/mɛlk/	[ˈmɛlək]	‘milk’
	alg	/ɑlɣ/	[ˈɑləx]	‘alga’
	helm	/hɛlm/	[ˈhɛləm]	‘helmet’

As (6.8) shows, the same process occurs with /l/ before the same set of consonants, except /n/ since the sequence /-ln/ does not occur word-finally in Dutch (cf. the Dutch name for the city of Cologne, *Köln* /kœln/ in German, as *Keulen* /kølən/). This likewise creates potential rhymes such as *volg* ‘follow’ ~ *wollig* ‘woolly’, under the assumption that a full extra syllable is created in the process. Finally, according to the traditional description, schwa epenthesis does *not* take place when /l/ or /r/ is followed by a coronal obstruent:

(6.9) No schwa-insertion before coronal obstruents

a.	*kaart*	/kart/	[kart]	*[ˈkarət]	‘card’
	bord	/bɔrd/	[bɔrt]	*[ˈbɔrət]	‘plate’
	vers	/vɛrs/	[vɛrs]	*[ˈvɛrəs]	‘fresh’
b.	*halt*	/hɑlt/	[hɑlt]	*[ˈhɑlət]	‘halt’
	pols	/pɔls/	[pɔls]	*[ˈpɔləs]	‘wrist’
	hals	/hɑlz/	[hɑls]	*[ˈhɑləs]	‘neck’

While Booij (1995:127) hints at the possible optionality of the rule, Trommelen (1993) claims that, “this is only so in the sense that individual speakers either always apply the rule or don’t apply it. Vacillation seems impossible for a single speaker [...]”(1993:175). However, psycholinguistic and sociolinguistic studies show that there is indeed intra-speaker variability that correlates with the second consonant of the cluster, as well as with the rhythmic structure of the utterance context (Kuijpers and van Donselaar 1998; van Donselaar et al. 1999; Kloots et al. 2002; Kloots et al. 2009). The data in this thesis of course also show both inter- and intra-speaker variability in schwa-insertion (see Chapter 3, sections 3 and 4). Even if the process is optional for the individual speaker, however, it might still be phonological (as opposed to phonetic), as long as it applies categorically and discretely whenever it applies. It would then be a “variable rule” in the Labovian sense, which is compatible with a formal phonological account. All phonological accounts treat schwa-insertion as categorical and discrete, although Booij (1995:126) notes that while his description of the process is one of categorical insertion, it “may be of a more gradual nature than these descriptions suggest”.

Schwa-insertion in Dutch is also possible between liquids and a following consonant word-medially, according to Trommelen (1993:176). For most speakers, this is restricted to cases where /r, l/ follow the vowel carrying main stress, and all following syllables have (unstressed) schwa as their nuclear vowel, as in (6.10). In the examples in 0, the syllable following the liquid contains a full vowel (which may or may not be stressed), and schwa-insertion is not possible. The examples under b. in (6.10) and (6.11) are bimorphemic, the latter showing an alternation with their monomorphemic counterparts in (6.8): (*harp ~ harpist*, *alp ~ alpine*). There are no words with a word-medial liquid in the urban accent data, so they will not form part of the discussion to follow in 6.3.3.

(6.10) Word-medial schwa-insertion

a.	*erker*	/ˈɛrkər/	[ˈɛ.rə.kər]	‘bay window’
	varken	/ˈvɑrkə/	[ˈvɑ.rə.kə]	‘pig’
b.	*helper*	/ˈhɛlpər/	[ˈhɛ.lə.pər]	‘helper’
	welke	/ˈʋɛlkə/	[ˈʋɛ.lə.kə]	‘which’

(6.11) No schwa-insertion when full vowel follows /r/ or /l/

a.	*orkaan*	/ɔrˈkan/	[ɔr. ˈkan]	‘hurricane’
			* [ɔ.rə.ˈkan]	
	firma	/ˈfɪrma/	[ˈfɪr.ma]	‘firm’
			* [ˈfɪ.rə.ma]	
b.	*harpist*	/hɑrˈpɪst/	[hɑr.ˈpɪst]	‘harpist’
			* [hɑ.rə.ˈpɪst]	
	alpine	/ɑlˈpinə/	[ɑl.ˈpi.nə]	‘alpine’
			* [ɑ.lə.ˈpi.nə]	

Finally, these phonological accounts make no reference to the quality or realisation of /r/ itself; given the purely phonological analysis operating at the symbolic level, this is not surprising: the phonetics of *r* cannot be of influence, as these are determined at a lower level (that of phonetic interpretation).

In conclusion, in a standard phonological analysis, schwa-insertion has the following characteristics:

1. It is a categorical, or possibly an optional rule for speakers;
2. It concerns the insertion of a full segment at the phonological level;
3. This segment is a central vowel (schwa);
4. There is no insertion in coronal obstruent contexts;
5. The realisation of /r/ is irrelevant to the application of the process.

6.3.2 Schwa-intrusion: a phonetic account

A very different view of Dutch schwa-insertion is found in Hall (2003)’s treatment of the process in an Articulatory Phonology (AP) framework, in which it is essentially non-phonological and does not in fact involve insertion. AP was briefly discussed in Chapter 1, and the gestural representations developed in this framework were used in Chapters 5 as a way of modelling the gradual reduction of production targets for variants of *r*, but without reference to other aspects of the theory. These will be briefly discussed now, in the context of how Hall deals with Dutch schwa-insertion in AP.

As a non-modular theory, AP stays close to the phonetic surface (employing articulatory gestures as both abstract units of representation and physical instantiations thereof). It characterises all processes, from assimilation to deletion and insertion, as instances of partial or total overlap of gestures. In fact, deletion and insertion as they are usually understood, i.e. the complete deletion or insertion of a segment-sized unit, is impossible under the assumptions of AP in its strict (original) version. Instead, deletion is modelled as a case of complete overlap between gestures (obscuring the gestures of what is, in other theories, a segment), and insertion as arising through the partial overlap of certain gestures (and the non-overlap of others).

Schwa-insertion in Dutch, too, then, is a case of overlap of vocalic and consonant gestures. The apparent insertion is really vowel intrusion, arising from the canonical stressed vowel’s articulation overlapping with the transition between the liquid and the closing consonant. The image in Figure 6-1 shows a dynamic AP representation of the gestures in a sequence of a vowel plus a liquid+consonant cluster. The relatively slow vocalic gestures are modelled as the wide-angle slope that starts on the far left, labelled 'V'; the consonant movements are the more acute angles labelled 'R' (liquid) and 'C' (closing consonant), respectively. As the coordination between the consonant gestures involves non-overlap, the vocalic gesture (which may be interpreted as a tongue body gesture on its way back from a vowel target to a neutral position) is able to "intrude" between those of the two consonants, resulting in a schwa-like percept.

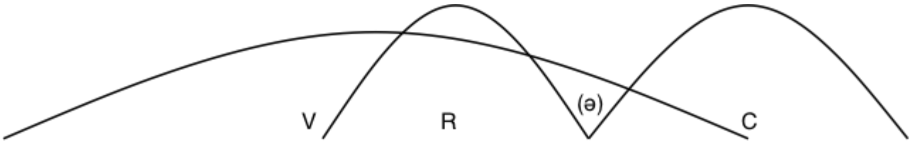

Figure 6-1 Gestural score of vowel intrusion (Hall 2003:43).

In such a non-modular account, where phonetics and phonology are integrated, the work is done by phonetics (specifically, by the timing relationships of gestures – timing being a typical case of what is usually considered phonetic rather than phonological), and there is no need for an abstract rule of insertion (or a constraint set that forces it). The intrusive vowel is not phonologically present (only phonetically), and, crucially, no additional syllable is created by the intrusive vowel in this account. Hall (2003) presents a number of arguments for why Dutch schwa-insertion should in fact *not* be analysed as insertion but as intrusion, most of them hinging on the idea that the intrusive schwa does not form the nucleus of a second syllable. The most important ones are:

- In the experiments of van Donselaar et al. (1999), the total duration of words such as *tulp* is constant, whether an intrusive vowel is present or not (the liquid is considerably shorter in the former case);
- Van Donselaar et al.'s metalinguistic experiments in which subjects were asked to "reverse" words segmentally show that vowel-intrusive *tulp* /tʏlp/ is turned into [plʏt] rather than [pəlʏt];
- The inapplicability of post-schwa [n]-deletion for intrusive schwa (as in *toorn* /torn/) vis-à-vis lexical schwa (as in *toren* /torən/).

Not only is schwa-insertion under the gestural view of Figure 6-1 more accurately characterised as schwa-*intrusion*, it should in fact become *vowel* intrusion, since although the vowel gesture is on its way back to a neutral position (or anticipating a following vocalic gesture) and consequently of a rather central quality, the intrusive vowel will be coloured by the quality of the canonical stressed vowel which it is a reflex of. This colouring should be to a larger extent than that found with canonical schwa (although this is also known to display a relatively large degree of coarticulation with vowels in neighbouring syllables).

Summarising, the phonetic account of schwa-intrusion makes the following predictions:

1. Quantitative variation among speakers, as opposed to categoriality, due to gradient implementation;
2. Gradient implementation (the intrusive vowel is a half-segment, or transition sound), rather than discrete and does not create a separate syllable;
3. The intrusive element is strongly coloured by the stressed canonical vowel, rather than being a schwa;
4. It may leave open the possibility of intrusive vowels in other contexts;
5. There is the possibility of different *r* variants influencing the application of the process.

The two very different treatments of Dutch schwa-insertion/intrusion outlined in 6.3.1 and 6.3.2 are an instance of a "boundary dispute" (as in Myers 2000) between phonetics and phonology. As both sides make clear and mostly contradictory predictions, this boundary dispute can be resolved by examining the type of detailed data presented in this thesis.

6.3.3 Schwa-insertion in the urban accent data

The process of schwa-insertion after *r* will now be examined in the urban accent data to establish if the realisation of /r/ influences the process of schwa-insertion. It is therefore necessary to first determine which *r* variants appear in the schwa-insertion context when schwa-insertion takes place, as well as which variants show up when it does not. A second issue is if there are differences in the rate of application of schwa-insertion depending on the *r* variants used by speakers. Finally, the phonetic detail of the epenthetic/intrusive vowel will be examined to see how this is influenced by different *r* variants. A look at all these aspects may show which of the accounts above of the current status of schwa-insertion is closer to the facts. Given the five predictions at the end of sections 6.3.1 and 6.3.2, the specific questions to be addressed are 1) whether the process is categorical for individual speakers or whether there is quantitative variation, 2) whether the epenthetic vowel creates an additional syllable and is a "full" segment or an intrusive element of shorter duration, 3) whether the epenthetic/intrusive vowel has the quality of a schwa or of the lexical vowel in the same word, 4) whether or not insertion in the contexts of (6.9) is possible, and 5) whether the realisation of /r/ influences these four characteristics.

First, the distribution of the schwa-insertion context items in the data (*harp*, *kerk, arm*, *berg*) will show whether there are differences between accents and/or between individual items in the application of the process. This will demonstrate to what extent schwa-insertion is categorical or variable for speakers, answering question 1. The second question is addressed through an examination of the *r* variants used, as well as a closer look at the quantity of the epenthetic vowel (is it as long as a canonical (lexical) schwa, or even a 'full' vowel?) and its quality (is it indeed schwa, or are properties of the canonical vowel preceding *r* of influence?). Finally, the context in which schwa-insertion is said to take place will also come under reappraisal, as the urban accent data in fact show that schwa-insertion – surprisingly, in view of the usual descriptions in the literature – may in fact occur before coronal obstruents. Although this phenomenon is less widespread, it occurs in almost all urban accents (with the exception of The Hague), and is even relatively frequent in that of Bruges.

The facts from the urban accent data concerning schwa-insertion make it possible to look into the larger issue of the status of schwa-insertion. That is, they provide insight into the question of whether schwa-insertion is indeed a phonological process, or if it is in fact better characterised as a phonetic one of vowel intrusion, arising out of the coordination of the articulatory gestures associated with *r* and the following environment. More importantly for the theme of this thesis, however, is that it will also provide evidence for the possible *origins* of schwa-insertion/intrusion in terms of its phonetics, as well as giving insight into its current status in the degree of phonologisation involved.

Since schwa-insertion before coronal obstruents is specifically associated with the alveolar tap and, to a lesser extent, the alveolar trill realisations of r, it provides crucial evidence for the account of the origin of phonological schwa-insertion before non-coronal obstruents and nasals. Pre-coronal obstruent schwa-insertion has clearly not phonologised (not having spread to realisations of /r/ other than alveolar trills and taps), and seems to operate below the perceptual threshold of linguists describing spoken Dutch. However, it has been described for other languages and is in fact an often observed process in many varieties of Spanish, whose /r/ and /ɾ/ phonemes are canonically realised as apico-alveolar trills and taps, respectively. A discussion of the Spanish facts, providing cross-linguistic evidence for the phonetic naturalness of schwa-insertion in (apical) *r* contexts, therefore concludes section 6.3.

6.3.3.1 The distribution of schwa-insertion

This section presents a broad overview of the urban accent data relevant to schwa-insertion, focussing on the frequency with which it applies in the urban accents. Table 6-2 shows the percentages of schwa-insertion for each of the four schwa-insertion context items in the different accents. The percentages are very similar, though not identical to, the schwa-insertion index scores in Chapter 3 (the index scores were calculated per speaker first, not directly on the total number of tokens in each accent).

Some differences among accents are immediately obvious, such as the low percentage of schwa-insertions in Ghent, as opposed to the other Flemish cities. In the Netherlandic accents, schwa-insertion is found in less than half of the tokens that provide the relevant context in Leiden and The Hague, while it is near-categorical in Nijmegen.

The bottom row of the table, showing the average percentages of schwa-insertion in all of the urban accent data, would suggest that differences in rate of application of the process between the four items are relatively small. However, a closer look at some of the individual accents reveals that this is partly accent-specific: in Ghent, for instance, 42.9% of all tokens of arm have schwa-insertion, while this is true for only 10.8% of those of *harp*. In fact, in the Belgian Dutch accents *arm* is the item with by far the highest number of schwa-insertions, while it has the smallest number in the Netherlandic accents.

Table 6-2 Percentages of schwa-insertion in urban accent data. All schwa-insertion context tokens (*harp*,*kerk*,*arm*,*berg*) (n=3199). No. of speakers: 408.

city	*n*	*total %*	*harp*	*kerk*	*arm*	*berg*
Antwerp	322	95.0	92.5	97.5	92.4	97.5
Bruges	332	83.7	78.3	84.1	91.7	80.7
Ghent	335	20.6	10.8	11.9	42.9	16.7
Hasselt	318	87.4	79.7	83.8	94.9	91.3
Amsterdam	316	79.4	80.0	78.8	78.9	80.0
Rotterdam	343	66.8	68.6	68.6	61.6	68.2
Utrecht	315	84.4	82.1	87.3	86.1	82.3
Leiden	317	49.5	45.6	54.4	48.7	49.4
The Hague	287	43.6	43.7	50.0	41.7	38.9
Nijmegen	314	92.7	92.4	97.5	89.6	91.1
total	3199	70.2	67.2	71.3	72.9	69.4

6.3.3.2 r *variants in the schwa-insertion context*

What Table 6-2 does not tell us is which *r*-variants appear when there is (or when there is no) schwa-insertion. In general, the alveolar and uvular variants that are most common in onsets, especially intervocalic onsets, also appear with greatest frequency in schwa-insertion contexts. That is, alveolar taps and uvular approximants predominate amongst the variants used in schwa-insertion contexts (when schwa is present), although in slightly different relative numbers. Table 6-3 shows the absolute and relative numbers in which r-variants appear in schwa-insertion contexts and intervocalic onset contexts. Factoring out the different contributions made by alveolar vs. uvular variants, the relative numbers of variants within those categories are largely similar.

The next issue is which variants of *r* appear when [ə] fails to show up in these items (Table 6-4). As can perhaps be expected, the Netherlandic and Belgian Dutch accents behave very differently here: whereas in the Netherlandic accents, vocalic variants mainly appear when [ə] is not present in these items, consonantal variants remain dominant in the Belgian Dutch varieties, with the emphasis now shifting to fricative variants. In other words, this reflects the situation in other codas.

The schwa-insertion facts indeed suggest that the presence of schwa entails that *r* occurs in an onset position, whereas in the absence of schwa it is in its canonical coda position. The variants of *r* that occur with schwa-insertion are also found in intervocalic positions, whereas those that occur most without schwa-insertion are those also found in the word-final and pre-coronal obstruent codas.

Table 6-3 *r*-variants in schwa-insertion contexts when [ə] is present. All schwa-insertion context tokens with inserted [ə] (*n*=2266), all speakers with at least a single [ə]-insertion (*n*=352). Comparison with intervocalic onsets. All intervocalic onset tokens (*n*=3922), all speakers (*N*=408).

	ə-insertion context +ə		*intervocalic onsets*	
	n	*%*	*n*	*%*
uvular trill	336	14.8	849	21.6
uvular fricative trill	35	1.5	117	3.0
uvular fricative	56	2.5	227	5.8
uvular approximant	633	27.9	1092	27.8
total uvular variants	1060	46.8	2285	58.3
alveolar fricative	4	0.2	64	1.6
alveolar trill	149	6.6	108	2.8
alveolar tap	965	42.6	1226	31.3
alveolar approximant	69	3.0	219	5.6
total alveolar variants	1187	52.4	1617	41.2
retroflex/bunched app	19	0.8	19	0.5
zero	0	0	1	0.0
total	2266	100	3922	100

Table 6-4 *r*-variants in schwa-insertion contexts when [ə] is not present. All schwa-insertion context tokens without inserted [ə] (*n*=933), all speakers without schwa-insertion in these contexts (*n*=56). Comparison with other codas. All coda tokens (*n*=7551), all speakers (*N*=408).

variant	*ə-insertion context -ə*			*coda*
	n	*%*	*n*	*%*
uvular trill	38	4.1	162	2.1
uvular fricative trill	109	11.7	661	8.8
uvular fricative	116	12.4	762	10.1
uvular approximant	70	7.5	304	4.0
alveolar trills (vd/vl)	58	6.2	1402	18.5
alveolar taps (vd/vl)	25	3.0	651	8.6
alveolar fricatives (vd/vl)	5	0.5	149	2.0
alveolar approximant	7	0.8	160	2.1
retroflex/bunched approx	483	51.8	2399	31.8
other vocalic variants	21	2.6	594	7.9
elision	1	0.1	307	4.1
total	933	100	7551	100

6.3.3.3 *Categoriality of schwa-insertion*

The fact that there is some variation in the application of schwa-insertion between the different items (as is most visible in Ghent in Table 6-2) already shows that there must at least be some variation possible for individual speakers. Indeed, this is what we find in the data, although a relatively large number of speakers (46.4% in the Netherlands, and 47.9% in Flanders) realise [ə] consistently in all 8 tokens they produce of the relevant items. A further 19.2% in the Netherlands and 9.0% in Flanders realise these items consistently without schwa. This leaves 34.3% of the Netherlandic speakers and 43.0% of the Belgian Dutch speakers as variably producing [ə] in these items. In Figure 6-2, these speakers are in the middle two groups: those with up to 50% schwa-insertion, and those with more than 50% but not categorical schwa-insertion.

Of course, the division into Netherlandic and Belgian Dutch accents is too crude to bring out the differences between the individual accents. In Ghent, a third of the speakers is categorically non-schwa-inserting, whereas none of the speakers from Antwerp and Hasselt are. Antwerp and Hasselt are in turn different from each other, in that 83% of the Antwerp speakers realise schwa categorically in the relevant items, while only 51% of the Hasselt speakers do. The Netherlandic accents display similarly divergent patterns: in Amsterdam and Utrecht, 60% of the speakers have categorical schwa-insertion, whereas this holds for only 20% of the speakers from The Hague and Leiden. Leiden is particularly interesting, because it has roughly equal numbers of speakers with no schwa-insertion (32.5%), up to 50% insertions (25%), over 50% but not categorical (22.5%), and categorical schwa-insertion (20%). What is most important here, however, is that in each of the accents there are speakers in the middle groups, with variable schwa-insertion, ranging from 17.1% of speakers in Antwerp to 64.1% in Ghent.

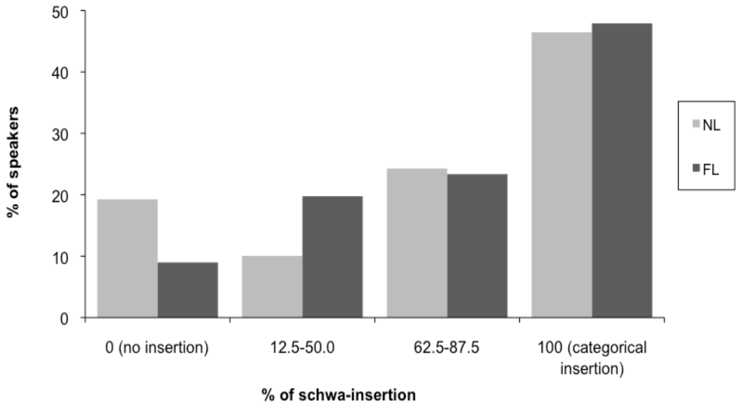

Figure 6-2 % of schwa-insertion for individual speakers. All speakers (*N*=408), all schwa-insertion items (*n*=3199). Number of items = 8.

A summary of the facts presented in this section:

- Around 70% of the tokens in the schwa-insertion context in the data appear with [ə]

- There are large differences between the cities in the corpus: while schwa-insertion is almost general in Antwerp and Nijmegen, it is only found in a minority of tokens in Ghent
- The schwa-insertion context behaves like an intervocalic onset context in terms of the distribution of r variants when [ə] is present.
- When [ə] is absent, Dutch and Flemish speakers realise these items with their most frequent coda variants, the retroflex/bunched approximant and fricative variants, respectively.
- Around 47% of speakers consistently realise [ə] in the schwa-insertion items, whereas 15% consistently do not. The remaining 38% are variable – with large differences between the accents.

In conclusion, schwa-insertion is variable in the urban accents, both at an interspeaker and intra-speaker level, contrary to claims in some of the phonological literature. This confirms the results from Kuijpers and van Donselaar (1998), Kloots et al. (2002) and Kloots et al. (2009), who show that a number of factors (geographical and social background, as well as the segmental and prosodic context) influence the rate of application of schwa-insertion. It was of course also already evident from the results presented in Chapter 3, where statistical analysis of the schwa-insertion index score showed significant effects of city accent and speaker age (with more schwa-insertion among older speakers).

The fact that the *r* variants that appear in the schwa-insertion context depend on the presence or absence of the svarabhakti vowel, shows that for some speakers at least (i.e. those speakers for whom schwa-insertion is optional) part of their variation in /r/ realisations is explained by the optionality of this process (and, by extension, the different contexts *r* is in in words with schwa-insertion vs. those without). Most importantly, it suggests that a phonological analysis of the process, rather than the phonetic one suggested by Hall (2003), is necessary in any modular view of the grammatical architecture. As Warner et al. (2001) show for schwa-insertion after /l/ in Dutch, despite the non-phonological status of epenthetic schwa suggested by Van Donselaar et al. (1999), the presence or absence of schwa determines which variants of the liquid appear. Warner et al. show how the clear/dark *l*-allophony depends crucially on the presence or absence of schwa: clear [l] (which is otherwise found in onsets) appears when schwa is present, dark [ɫ] (which appears in codas) when it is absent. In other words, a coda with schwa-insertion after /l/ behaves as a canonical onset. This situation is of course mirrored by that of /r/ in the urban accent data, as Table 6-3 and Table 6-4 show: the variants of *r* that appear with schwa in these contexts are the same as those that appear intervocalically, whereas those that appear without schwa are those that also appear in the other coda contexts (word-final and coronal obstruent clusters). In other words, the allophony of /r/ depends on the presence or absence of schwa, and schwa needs to be a part of a speaker's phonological plan at some point, something which a gestural realignment analysis in standard Articulatory Phonology cannot accommodate. In AP, the insertion of gestures is prohibited. If the gestures for schwa are there in the phonological representation, *r* will be in an (intervocalic) onset position and should be realised by an onset variant; conversely, if the gestures for schwa are not present (and schwa is an artefact of gestural coordination), coda-*r* variants should appear. And while gestural realignment might be responsible for the presence or absence of schwa, it cannot alter the realisation of /r/ in the process, to the extent of adding gestures.[34]

The question of whether schwa-insertion in -*r*C clusters is phonological or phonetic then seems to have a straightforward answer: the process is phonological. This does not mean, however, that all the predictions from the phonological accounts above are necessarily borne out, as the facts about optionality show. In fact, as the following sections will show, the full picture is more complex, and some of the predictions made by the "phonetic" approach to the process receive support by a closer examination of the phonetics of schwa-insertion. Section 6.3.4 looks at the durational and spectral properties of the inserted/intrusive vowel, to establish whether it concerns a segment-sized unit or a smaller transition sound, and whether it has the properties of a schwa vowel target or is more strongly coloured by its context.

6.3.4 The phonetics of schwa-insertion

6.3.4.1 The duration of epenthetic schwa

What is known from previous literature about the duration of schwa in Dutch largely comes from van Son and Pols (1990), Koopmans-van Beinum (1994) and Van Bergem (1994), who measured duration as well as formant values of *canonical* schwas, i.e. schwa vowels that are thought to be part of the lexical representation, and hence of the phonological plan, either in words such as *het* /ət/ 'the', *er* /ər/ 'there' (van Son and Pols), or in nonsense words specifically designed to elicit schwa in various consonantal environments (Van Bergem). They found that schwa is considerably shorter than other vowels: van Son and Pols found mean values of 52 ms (at normal speech rate) for schwa, while other short vowels were around 80 ms. Koopmans-van Beinum found an average duration of 47 ms for schwa in spontaneous speech, compared to 67 ms for other short vowels of Dutch. Van Bergem reports an average of 76 ms for his 3 speakers, for schwa in a VCəC nonsense words in a lab setting. The only study that has looked in detail at the duration of *epenthetic* schwa is a recent one by Kloots et al. (2012). They examined spontaneous speech from the *VNL* corpus of Standard Dutch (see Chapter 2), and found that epenthetic schwa was on average 44 ms long, while showing considerable social and geographical variation: epenthetic schwa durations range from 34 ms in East Flanders to 53 ms in the Dutch province of Limburg; furthermore, younger speakers and women produce longer schwas than older speakers and men, although Kloots et al. hint at a possible confound with speech rate for these effects. Finally, the "type of /r/" showed no significant effect, although it is unclear how this factor was operationalised, and the discussion suggests

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[34] Warner et al. (2001) propose to augment the theory of Articulatory Phonology by allowing for the insertion of gestures, in order to accommodate the optional schwa and clear/dark *l*-allophony. While this brings the schwa-insertion data into the fold, it sacrifices the parsimonious nature of the Articulatory Phonology gestural approach.

that only the dimension of consonantality played a role here (and that almost all tokens in the study contained consonantal *r* variants).

The *HEMA* corpus of course does not consist of spontaneous speech, being comprised of picture naming and word list reading data. Therefore, somewhat longer canonical schwa durations than those in van Son and Pols (1990) and Koopmans-van Beinum (1994) may be expected. A subcorpus was compiled from the larger urban accent data for these more in-depth analyses of schwa-insertion. Data from four cities were used:

- Bruges – 26 alveolar-*r* speakers
- Nijmegen – 26 uvular-*r* speakers
- Rotterdam – 11 alveolar-*r* speakers, 6 uvular-*r* speakers
- Utrecht – 11 uvular-*r* speakers, 6 alveolar-*r* speakers

In each case, only the word-list data from each of the speakers were used, to ensure a mostly constant speech rate, minimising its effects on schwa duration. The speakers were selected on the basis of having a majority of schwa-insertions in their data in the relevant contexts.

The cities were selected for the subcorpus for the following reasons. Bruges is interesting since it exhibits schwa-insertion in the pre-coronal obstruent context, where it is generally thought to be absent (see section 6.3.5 below), so including data from this community makes a comparison between these two instances of schwa-insertion possible. Bruges is also relatively homogeneous when it comes to *r* variants, so the selection of alveolar speakers is not in any way atypical. Nijmegen is the Netherlandic accent in which schwa-insertion is most frequent, while it is also almost completely uvular-*r* speaking, which should form an interesting point of comparison with the Bruges data. Yet another situation is present in the somewhat smaller samples from Rotterdam and Utrecht, two urban accents with more variation in place of articulation and in the frequency of schwa-insertion. The results from the duration measurements are presented below, starting with those from Bruges. Table 6-5 shows the durations of schwa in the four schwa-insertion items.

Table 6-5 Duration of [ə] in schwa-insertion items in Bruges (ms) (*n*=99). No. of speakers: 26.

item	*n*	*mean*	*min*	*max*	*stdev*
harp	25	34	16	58	12
kerk	24	39	16	66	13
arm	26	34	17	50	10
berg	24	42	22	70	13

It is obvious from Table 6-5 that the mean duration of epenthetic schwa in the relevant contexts is relatively stable across the four items, though longer in the /ɛ/ items compared to the /ɑ/ items. It is also clear that the range of the segment duration is rather large. To interpret these durations, we need to compare them to those of canonical (lexically present) vowels as uttered by the same speakers.

Table 6-6 Duration of short vowels and schwa in Bruges (ms) (n=198). No. of speakers: 26.

vowel	*n*	*mean*	*min*	*max*	*stdev*
full short vowel	49	97	61	148	22
canonical schwa	50	83	48	112	16
epenthetic schwa	99	38	16	70	13

Table 6-6 shows the mean durations of full short vowels, canonical schwa and epenthetic schwa. The full short vowel values were calculated over the items *rok* and *kruk* as uttered by the same Bruges speakers, while the values for canonical schwa were calculated over these same speakers' productions of *beraad* and *sturen*, all from the word list data.

The differences between the canonical vowels and the epenthetic ones are clear: the average length of epenthetic schwa is only half of that of canonical schwa. The ranges for canonical and epenthetic schwa do overlap somewhat, but their distributions are overall quite distinct. Full vowels are even longer, as expected (Koopmans-van Beinum 1994), even though the closing consonant in the items for which this was measured, /k/, conditions the shortest phonetic vowel length in Dutch (Waals 1999:56). To confirm this interpretation, a linear mixed-effects model was run with vowel duration as its dependent variable. Speaker and item were included as random effects, while the fixed effects included were vowel type (epenthetic schwa, canonical schwa, full vowel) and social factors. An overview of the results is in Table 6-7. Significant differences were tested for by Markov Chain Monte Carlo (MCMC) simulations; p-values from these are included in the final column of the table.

Table 6-7 Summary of a linear mixed-effects regression predicting vowel duration in schwa-insertion and control contexts in the Bruges subcorpus. The intercept corresponds to an epenthetic schwa for an older female speaker. Number of observations = 198.

Random effects	*Variance*	*Std Deviation*	*N*	
speaker	30.664	5.54	26	
item	43.798	6.62	8	
Fixed Effects	*Estimate*	*Std Error*	*t*	*p*
(intercept)	40.335	4.24	9.50	.000
vowel: canonical	39.373	6.36	6.19	.000
vowel: full	56.355	6.37	8.85	.000
sex: male	-5.060	3.32	-1.52	.130
age: young	0.044	3.30	0.01	.989

The model shows that there are significant differences in duration between epenthetic schwa (mean: 38 ms) and canonical schwa (83 ms), as well as between epenthetic schwa and full short vowels (97 ms). The difference between canonical schwa and full short vowels is also marginally significant (t=2.31, p=.044)[35]. Social factors are not significant. At the phonetic level, in other words, epenthetic schwa in the Bruges data appears to be 'half a segment'. At first sight, despite the conclusion of section 6.3.3, this would seem to be much more in line with the schwa-intrusion

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[35] Results from refitting the model such that the intercept corresponds with canonical schwa.

account from Hall (2003) presented above than with accounts of wholesale insertion of a phonological segment: if epenthetic schwa were a segment inserted at the phonological level, there is no easy explanation as to why it would have half the length of a lexical schwa. These duration results, however, form only one piece of the puzzle.

Table 6-4 above showed that the *r* variants used in the schwa-insertion context across all the urban accents more closely mirrored those used in the intervocalic onset context than those in the coda contexts, which led to the conclusion that it is most likely that epenthetic schwa indeed creates an additional syllable at the phonological level. In light of the duration results for schwa above, it is important to see whether there are differences between the various accents in this respect, and particularly what the situation is in Bruges. Table 6-8 shows the realisations from the 26 speakers used in the subcorpus above in the intervocalic onset, canonical coda, and schwa-insertion contexts. The percentage for each variant in the schwa-insertion context is underlined, as well as its closest correspondent in either the intervocalic or the coda context.

Table 6-8 *r*-variants in intervocalic onset, coda, and schwa-insertion contexts when [ə] is present (*n*=505) for the speakers in the Bruges subcorpus (No. of speakers: 26).

descriptive label	*intervocalic*		*coda*		*schwa-ins*	
	n	%	*n*	%	*n*	%
vd alveolar trill	11	7.2	42	16.7	21	20.8
vl alveolar trill			10	4.0		
part devoicd alv trill			18	7.2		
vl alv trill/tap w/ frictn			58	23.1		
vl (post)alv fricative			9	3.6		
vd (post)alv fricative	4	2.6				
vl alveolar tap			43	17.1		
vd alveolar tap	126	82.9	64	25.5	79	78.2
alveolar approximant	11	7.2	7	2.8	1	1.0
total	152	100	251	100	102	100

While the vast majority of *r* tokens in the schwa-insertion context are voiced alveolar taps, and the relative numbers are strongly reminiscent of those in intervocalic onsets (the situation in most accents, as Table 6-4 showed), the situation is not quite as clear-cut in Bruges as the overall one: the relatively large number of voiced trills and the low number of approximants parallel the situation in codas more than that in intervocalic onsets. This suggests that, perhaps for a minority of speakers only, Hall's intrusive schwa analysis is indeed along the right lines in Bruges: given that there are speakers whose schwa-insertion context *r* variants are similar to those in the coda, and the duration of the vocalic element is so unlike that of other schwas.

Comparing the Bruges data to those from Nijmegen reveals that the situation in these two accents is markedly different. The durations of short vowels, canonical schwa, and epenthetic schwa in Nijmegen are in Table 6-9.

Table 6-9 Duration of [ə] in in schwa-insertion items in Nijmegen (ms) (*n*=102). No. of speakers: 26.

item	*n*	*mean*	*min*	*max*	*stdev*
harp	25	73	39	156	29
kerk	26	88	45	167	26
arm	26	71	37	129	22
berg	25	105	30	197	36

Epenthetic schwa in Nijmegen turns out to be twice as long as in the Bruges data (and much longer than the values Kloots et al. 2012 report, but that might be an effect of spontaneous vs. read speech); in addition, the differences between the individual items are larger for the Nijmegen speakers, and so are the ranges – with the higher values falling well within the range for stressed short vowels. Table 6-10 shows the average duration of epenthetic schwa in Nijmegen, calculated over all four items, compared to full short vowels and canonical schwa.

Table 6-10 Duration of short vowels and schwa in Nijmegen (ms) (*n*=203). No. of speakers: 26.

vowel	*n*	*mean*	*min*	*max*	*stdev*
full short vowel	50	120	44	185	33
canonical schwa	51	91	54	175	27
epenthetic schwa	102	84	30	197	31

Short vowels and canonical schwa are on average somewhat longer in Nijmegen than in Bruges. But whereas epenthetic schwa is roughly half the length of a canonical schwa in Bruges, in Nijmegen the duration of epenthetic schwa approaches that of canonical schwa; indeed, the difference between the two types of schwa is non-significant, as shown by the results of the linear mixed-effects model in Table 6-11. Like that for Bruges, this model predicts the duration of the relevant vowels with speaker and item as random effects, and vowel type and social factors (sex and age) as fixed effects.

Table 6-11 Summary of a linear mixed-effects regression predicting vowel duration in schwa-insertion and control contexts in the Nijmegen subcorpus. The intercept corresponds to an epenthetic schwa for an older female speaker. Number of observations = 203.

Random effects	*Variance*	*Std Deviation*	*N*	
speaker	343.77	18.54	26	
item	119.11	10.91	8	
Fixed Effects	*Estimate*	*Std Error*	*t*	*p*
(intercept)	91.711	8.50	10.79	.000
vowel: canonical	6.424	10.14	0.63	.527
vowel: full	35.218	10.15	3.47	.001
sex: male	-17.812	7.97	-2.24	.027
age: young	0.248	7.90	0.03	.975

While the differences between epenthetic schwa (84 ms) and full short vowels (120 ms) and between canonical schwa (91 ms) and short vowels ($t=2.46$, $p=.015$)[36] are significant, the difference between epenthetic schwa and canonical schwa is not. In other words, for Nijmegen speakers there is no real difference between the two types of schwa, and epenthetic schwa is a segment like any other. These data, then, seem more amenable to the phonological account of schwa-insertion than the phonetic intrusion one. (The results also show a main effect for sex, with shorter vowel duration for men than for women; this may simply be due to men having a faster speech rate, which has been found for speakers of Netherlandic Dutch (Quené 2008; see also van der Harst 2011:228).)

This conclusion finds additional support from the *r*-variation data. Table 6-12 shows the realisations from the Nijmegen speakers in the subcorpus in the intervocalic onset, coda, and schwa-insertion contexts. The percentages for the variants used in the schwa-insertion context are underlined, along with those for the same variant in the closest corresponding context (either intervocalic or coda). The variants used in the schwa-insertion context and their relative numbers strongly parallel those used in intervocalic onsets, and are markedly different from those in the coda. There is no reason to assume that epenthetic schwa here is really an intrusive element brought about by the co-ordination of gestures, rather than a phonological entity.

Table 6-12 *r*-variants in intervocalic onset, coda, and schwa-insertion contexts when [ə] is present (n=506) for the Nijmegen subcorpus (No. of speakers: 26).

descriptive label	*intervocalic*		*coda*		*schwa-ins*	
	n	*%*	*n*	*%*	*n*	*%*
uvular trill	29	19.0	6	2.4	12	12.0
uvular fricative trill	10	6.5	34	13.4	5	5.0
uvular fricative	3	2.0	59	23.3	1	1.0
uvular approximant	111	72.6	60	23.7	82	82.0
central vowel			29	11.5		
mid-open front vowel			2	0.8		
low vowel			8	3.2		
elision with retraction of c			4	1.6		
elision of r			18	7.1		
total	153	100	253	100	100	100

The comparison of the Bruges and Nijmegen data shows that schwa-insertion in Dutch may not be a unified process across various accents, and that the question of whether it is phonological or phonetic will consequently not have a simple answer. In fact, the Bruges data by themselves suggest that there may be differences between speakers of the same variety in this respect.

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[36] Results from a reparameterised model, with an intercept corresponding to canonical schwa.

Since we have been comparing a Netherlandic Dutch uvular *r* accent with a Belgian Dutch alveolar *r* accent, it is hard to determine what the cause of the difference between the two accents is – whether it is simply a case of geographical variation, or if there is something inherent in the different places of articulation. It is therefore worthwhile to examine other accents from the corpus. The data from Rotterdam and Utrecht provide us with both alveolar and uvular *r* speakers, although the two speaker types are present in different numbers in these two accents. Speakers from these two cities were again selected on the criterion that they had a majority of schwa-insertions in their word-list tokens for the relevant items. Eventually, 17 speakers were included from both urban accents; of the alveolar r speakers from Utrecht, 6 met the criterion, and all were included, as well as 11 uvular *r* speakers (randomly selected from those that met the criterion). To compensate for this uneven distribution, 11 alveolar *r* speakers were selected from Rotterdam, and 6 uvular r speakers, all meeting the criterion of a majority of schwa-insertions.

The results of the duration measurements for Rotterdam and Utrecht turned out to be highly similar; differences between them are non-significant for all vowel types (see model below). Results for the two cities are therefore pooled in Table 6-13.

Table 6-13 Duration of [ə] in schwa-insertion items in Utrecht and Rotterdam (ms) (*n*=132). No. of speakers: 34

item	*n*	*mean*	*min*	*max*	*stdev*
harp	33	67	17	98	21
kerk	33	81	42	130	24
arm	32	72	35	119	20
berg	34	92	17	155	29

The results for the schwa-insertion items from Utrecht and Rotterdam very much echo those from Nijmegen, the mean durations being roughly the same. Comparison of the schwa-insertion items with canonical schwa and short stressed vowels (Table 6-14) reveals a difference, however: the mean duration of canonical schwa is closer to that of full short vowels, whereas in Nijmegen the two schwa vowels had similar durations. In other words, the difference between canonical and epenthetic schwa found in Bruges but not Nijmegen is also present in the Rotterdam and Utrecht data, although the difference between the two is much smaller.

Table 6-14 duration of short vowels and schwa in Utrecht/Rotterdam (ms) (*n*=266). No. of speakers: 34.

vowel	*n*	*mean*	*min*	*max*	*stdev*
full short vowel	66	110	56	153	23
canonical schwa	68	96	44	155	26
epenthetic schwa	132	78	17	155	25

Table 6-15 Summary of a linear mixed-effects regression predicting vowel duration in schwa-insertion and control contexts in the Rotterdam and Utrecht subcorpus. The intercept corresponds to an epenthetic schwa for an older female speaker from Rotterdam. Number of observations = 266.

Random effects	*Variance*	*Std Deviation*	*N*	
speaker	180.08	13.42	34	
item	80.38	8.97	8	
Fixed Effects	*Estimate*	*Std Error*	*t*	*p*
(intercept)	87.799	7.10	12.36	.001
vowel: canonical	17.823	8.19	2.18	.048
vowel: full	31.357	8.20	3.82	.001
City: Utrecht	-4.597	5.36	-0.86	.250
r place: uvular	2.535	5.74	0.44	.652
sex: male	-19.787	5.57	-3.55	.001
age: young	-1.045	5.25	-0.20	.820

Results from a linear mixed-effects model on the same basis as those for Bruges and Nijmegen in fact show how Rotterdam and Utrecht are different from both Bruges and Nijmegen (Table 6-15). First, note that there are no significant differences between the speakers from Utrecht and those from Rotterdam (17 each) here. Importantly, differences between alveolar and uvular speakers (also 17 each) are also not significant for the pooled data ("*r* place" in the table). This shows that the Bruges-Nijmegen differences discussed earlier are not simply reducible to differences in place of articulation of *r*.

Epenthetic schwa in Rotterdam/Utrecht differs from canonical schwa (at the .05 level) and from full short vowels (at the .001 level), but canonical schwa does not differ significantly from short vowels (t=1.43, p=.167)[37]. This seems to be a similar situation to that in Bruges. However, a comparison of the means in Table 6-14 with those from Bruges in Table 6-6 shows that epenthetic schwa in Rotterdam/Utrecht is in fact twice as long as in Bruges, and much closer in length to canonical schwa. That is, epenthetic schwa in Rotterdam/Utrecht is not likely to be a purely phonetic effect (intrusion), but is also not as easily analysable as phonological insertion of a longer schwa "segment" either.

The *r*-variation data, although again not as conclusively as in Nijmegen, strongly suggest nonetheless that the schwa-insertion context behaves as an intervocalic onset, and that the process in Rotterdam and Utrecht must be essentially phonological in nature. As before, in Table 6-16 and Table 6-17 the percentages used for *r* variants used in the schwa-insertion context are underlined, along with those for the same variants in the most closely corresponding contexts.

For both the alveolar and uvular *r* speakers in Rotterdam and Utrecht, the *r* variants in the schwa-insertion context are largely similar to those in the intervocalic context. For alveolar *r* speakers, this means that voiced taps predominate, and trills and approximants appear in smaller numbers. As was the case in Bruges, however, alveolar approximants are underrepresented in the schwa-insertion context compared to the intervocalic onset. Uvular *r* speakers have trills and approximants in

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[37] Results from a reparameterised model, with an intercept corresponding to canonical schwa.

both the schwa-insertion and the intervocalic onset context, and much smaller numbers of fricative variants.

Table 6-16 *r*-variants in intervocalic onset, coda, and schwa-insertion contexts when [ə] is present (*n*=366) for the Rotterdam/Utrecht subcorpus, alveolar speakers (No. of speakers: 17).

descriptive label	*intervocalic*		*coda*		*schwa-ins*	
	n	%	*n*	%	*n*	%
vd alveolar trill	7	6.9	3	1.8	6	9.1
vl alveolar trill			3	1.8		
part devoicd alv trill			3	1.8		
vl alv trill/tap w/ frictn			7	4.2		
vd (post)alv fricative	1	1.0	2	1.2		
vl alveolar tap			14	8.5		
vd alveolar tap	70	69.3	2	1.2	54	81.8
alveolar approximant	23	22.8	10	6.1	6	9.1
palatal approximant			15	9.1		
retr/bunched approximant			71	43.0		
central vowel			12	7.3		
mid-open front vowel			3	1.8		
elision with retraction of c			4	2.4		
elision of r			6	3.6		
total	101	100	165	100	66	100

Table 6-17 *r*-variants in intervocalic onset, coda, and schwa-insertion contexts when [ə] is present (*n*=336) for the Rotterdam/Utrecht subcorpus, uvular speakers (No. of speakers: 17).

descriptive label	*intervocalic*		*coda*		*schwa-ins*	
	n	%	*n*	%	*n*	%
uvular trill	54	52.9	8	4.7	27	42.2
uvular fricative trill	2	2.0	4	2.4	2	3.1
uvular fricative	2	2.0	8	4.7	1	1.6
uvular approximant	43	42.1	10	5.9	33	51.6
retr/bunched approximant	1	1.0	100	58.8		
central vowel			14	8.2		
low vowel			1	0.6		
elision with retraction of c			3	1.8		
elision of r			13	7.7		
total	102	100	170	100	64	100

6.3.4.2 *The duration of epenthetic schwa: analysis*

It is hard to interpret the results from the previous section within a framework where epenthesis has to be either phonological or phonetic. In the case of Bruges, it may be argued that for some speakers, the (extremely short) schwa vowel there is not phonologically present (but instead, an artefact of gestural alignment), although for many other speakers the schwa-insertion context seems to behave as an intervocalic onset, suggesting that it is indeed a case of phonological insertion, despite the half-segment duration. Explaining the latter in a standard modular framework is not an easy task. If there is simply insertion at the phonological level, there is no real reason why it would be interpreted differently from other schwas (since, in such models, phonetic interpretation should be blind to the provenance of phonological material). Conversely, Hall's Articulatory Phonology analysis can account for the duration data, but cannot accommodate the patterns of *r*-allophony.

What is of course possible is that epenthetic schwa and lexical schwa are simply two different phonological objects for those speakers who treat the schwa-insertion context as an intervocalic context but whose schwas are half-long. In Nijmegen, on the other hand, epenthetic schwa is best analysed as a full inserted phonological element, as it is as long as canonical schwa. In this accent, there is no reason to assume that they are different phonological objects. Finally, the Utrecht/Rotterdam data are as straightforwardly phonological as those from Nijmegen, but show the same complexity in the duration data as those from Bruges. While the data mostly show that the process is phonological in nature, rather than being the result of articulatory coordination, the phonetic detail suggests that there is also a in fact a more complicated pattern to be observed here, in which the respective epenthetic schwas of Bruges, Utrecht/Rotterdam, and Nijmegen are gradiently more 'segment-like', and present problems for the phonology-phonetics interface. Predictions from the existing phonological accounts about invariance and the nature of the epenthetic segment are simply not borne out.

In an Exemplar model where lexical items are sets of stored tokens, gestural representations can be viewed as the production templates associated with these tokens. This was assumed in Chapters 4 and 5, as part of a theory of the origin of *r* variants (though without assuming the conceptual principles of AP as part of that theory). This would mean that each lexical item consists of not only a set of perceptual tokens, but also a concomitant set of production targets. Thus, both forms with and without schwas in the schwa-insertion items are lexically present for a single item, perceptually as well as for production purposes. The mechanisms of gestural reduction and realignment can then still be seen to operate on the productional surface level, but the presence or absence of schwa is determined at the level of lexical access (that is, in exemplar selection for production), as is the allophone of /r/ that is part of the representation.

This returns the discussion to one of the central tenets of usage-based phonology: that the patterns found in a language originate in language use, and consequently become part of the lexical representation. The gestural representation proposed below (Figure 6-3) for the Bruges data incorporates the *origins* of schwa-insertion: these lie in the gestural realignment of the tongue-tip gesture for consonantal alveolar r ([r] or [ɾ]) and those of a following consonant. If the resulting vocalic element between the two consonants is perceived by listeners, it will become part of the lexical representation, and the production target for words containing these *r*-consonant clusters may come to include 'epenthetic' schwa.

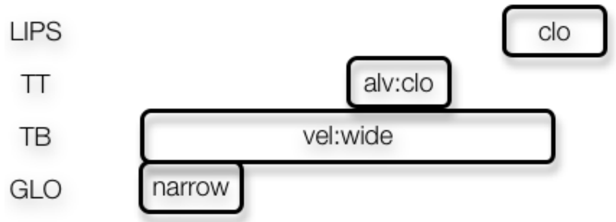

Figure 6-3 Gestural score of *harp* with alveolar tap and intrusive vowel (Bruges).

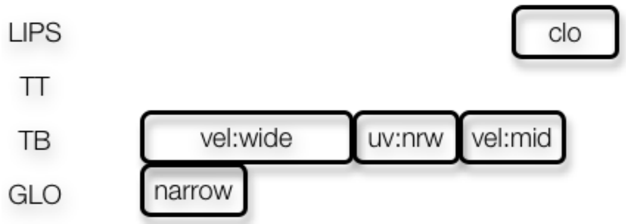

Figure 6-4 Gestural score of *harp* with uvular approximant and phonologically present schwa (Nijmegen).

The durational properties of epenthetic schwa seem to depend on how close the link to the phonetic process still is: for the Bruges speakers, *r* is consonantal and alveolar; for some of these speakers, then, the attested (very short) schwa may simply be the result of gestural coordination, even though the longest schwas in Bruges are well within the range of canonical schwa. Note also that the shortest schwas in Bruges are as long as the vocalic portion (the open phases) of trills (see Chapter 4 and Tops 2009:40-41): some of the "epenthetic vowels" in Bruges may simply be the open phases of single-contact trills. For the Nijmegen speakers, on the other hand, the link between the phonetic process and the presence of schwa seems to be absent entirely, and the difference in length of epenthetic and canonical schwa is non-significant: epenthetic schwa is essentially like any other (schwa) vowel. There is also no articulatory link between *r* and the epenthetic vowel here: the uvular approximant realisation of *r* does not have an inherent vocalic transition phase in the way that alveolar taps and trills do. The difference between the Bruges and Nijmegen accents in this respect is seen by comparing Figure 6-3 and Figure 6-4. Whereas in Bruges, there is only one vocalic (tongue body, TB) gesture, which intrudes between the two consonantal coda ones, there is a separate second vocalic gesture in Nijmegen for epenthetic schwa, as part of the phonological plan. This is presumably also the representation for the uvular *r* speakers in Utrecht and Rotterdam, although the phasing will be slightly different, leading to shorter schwas there.

6.3.4.3 The spectral properties of epenthetic schwa

The epenthetic or intrusive vowel under discussion has been termed 'schwa' throughout this chapter (and in fact, throughout this thesis when identifying the 'schwa-insertion context'), and transcribed as [ə]. However, the schwa-like nature of the epenthetic vowel should not be taken for granted. Especially if the gestural realignment analysis is correct in assuming that the perceived vowel is simply the result of the separation between *r* and the following consonant, the quality of the lexical vowel would be expected to be reflected in that of the 'epenthetic schwa', as it would in fact be a residual vocalic gesture intruding between two consonantal ones. In a dynamic gestural score analysis as that of Hall (2003) (see also Gafos 1999; 2002), the intrusive vowel is modelled as being in the "release to offset" phase when it appears between non-overlapping consonants, as in Figure 6-1. The representation there incorporates the dynamism of articulatory gestures, displaying them as they enfold in time from onset to target to offset ("landmarks" in Gafos's (2002) terms) as they enfold in time. This implies that the intrusive vowel (ə) should carry some of the features associated with the canonical vowel (V) preceding the liquid (R).

Since, on the basis of the duration analysis, at least a subset of the Bruges data seem to agree with the gestural realignment view, they are expected to display the largest degree of vowel-to-vowel coarticulation, i.e. the intrusive vowels are predicted to be relatively similar qualitatively to the lexical vowels in the items. For each of the four items, *harp*, *kerk*, *arm*, *berg*, the first two formants of both the canonical vowel /ɑ/ or /ɛ/ and the epenthetic vowel were measured using PRAAT. Measurements were made at the vowels' midpoints. Data from all 26 speakers in the schwa-insertion subcorpus were used, which means that measurements from both men and women are included. The primary interest is in the relationship between vowels within the same word, and using F1 subtracted from F2 for the horizontal dimension takes away at least some of the vocal tract size variation. The results of the vowel measurements are in Figure 6-5, which plots the means in a two-dimensional vowel space.

What the vowel chart shows is that for all four words, the first formant of the epenthetic vowel is much lower than that of the canonical vowel, but the second formant value is roughly the same in the canonical vowel and the epenthetic one. This means that there is clearly a centralising effect, and that this is brought on mostly by the factor tongue height, rather than front- or backness. In the chart in Figure 6-5 this shows in the inserted vowel in *kerk* and *berg* being more fronted than the one in *arm* and *harp*. It seems, then, that the quality of the epenthetic vowel in these items is not stable, and depends to some degree on the quality of the vowel in the preceding syllable. (Despite these differences, the epenthetic vowel will be referred to as 'schwa' or [ə] in what follows.)

The spectral properties of the epenthetic vowel support the possibility that the process displays at least partly phonetic rather than phonological characteristics in Bruges: not only the epenthetic schwa does seem to be a full segment of either full vowel or canonical schwa length, and its spectral properties are largely determined by the quality of the canonical full vowel in the preceding syllable. Again, however, comparison with data from another city cast doubt upon this analysis.

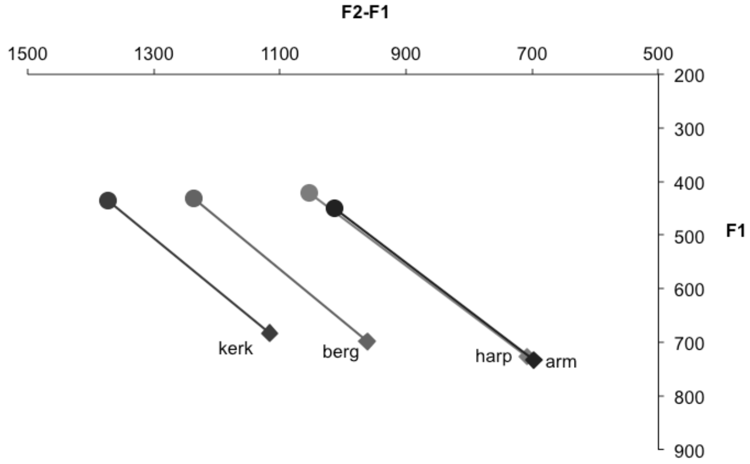

Figure 6-5 Locations in a two-dimensional vowel space of canonical vowels /ɛ,ɑ/ (diamonds) in *kerk, berg, harp, arm*, and their corresponding epenthetic vowels (circles) in Bruges. Means (*n*=198).

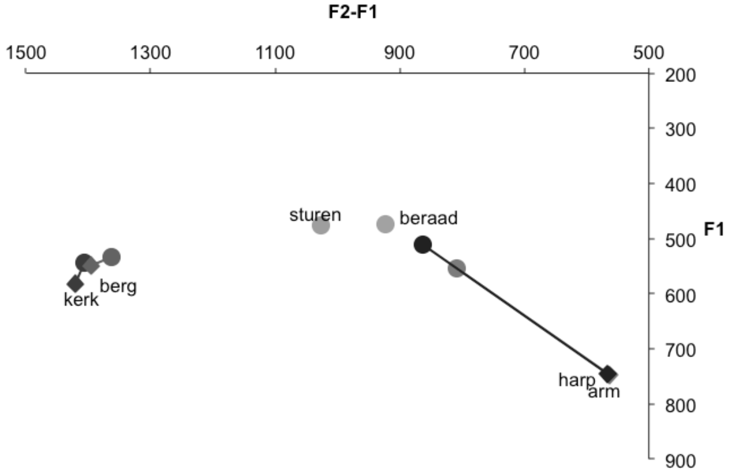

Figure 6-6 Locations in a two-dimensional vowel space of canonical vowels /ɛ,ɑ/ (diamonds) in *kerk, berg, harp, arm*, and their corresponding epenthetic vowels (circles) in Nijmegen. Reference points are for schwa realisations in *sturen* and *beraad*. Means (*n*=204).

Figure 6-6 shows the canonical vowels of *harp, kerk, arm, berg* in the Nijmegen subcorpus plotted with their epenthetic vowels (again F1 and F2 were measured at midpoint of the vowel, and subtraction of F2 by F1 was used as a normalisation measure). Also plotted are the values for canonical schwa in *be̲raad* and *sture̲n*. These measurements show that, while both the full and epenthetic vowels of *harp* and *arm* are in roughly the same area of the vowel space in Nijmegen and Bruges, those for *kerk* and *berg* (the canonical vowels, especially) are far removed from them. Most importantly, the difference in quality between the various epenthetic vowels is larger than in Bruges; in other words, the coarticulatory effect of the canonical vowel is even greater. This is of course entirely unexpected if the Bruges pattern is to reflect a phonetic process, and that in Nijmegen a phonological one. While lexically-present schwa shows a large degree of variation in its articulatory location, it is not "targetless" in that it is merely a function of surrounding vowels (Browman and Goldstein 1990b). In fact, canonical schwa in the two items included here, *beraad* and *sturen*, should display roughly the maximum amount of coarticulatory variation, as the stressed vowels in these words are maximally apart in the vowel space (high front /y/ vs. low /a/). This therefore introduces a further complication for the either/or view of schwa-insertion/intrusion.

The following section examines the phenomenon of schwa-insertion between *r* and following coronal obstruents. Surprisingly, this was found in the urban accent data, while it has in fact usually been assumed to be impossible in Dutch: the context is explicitly ruled out by Trommelen (1993:175) and Booij (1995:241). Possible reasons for this may include the fact that it is simply less frequent, and much more geographically limited. It may also be less perceptually salient in this context. In any case, comparing the similarities or differences between schwa-insertion before coronal obstruents and that before the traditional schwa-insertion consonants may shed light upon the status of schwa-insertion in the various urban accents: if schwa-insertion in the coronal obstruent context turns out to be more obviously phonetic (more gradient, displaying more characteristics of an "intrusive" element rather than a planned vowel, etc.), it can provide a benchmark for the other type of schwa-insertion.

6.3.5 Schwa-insertion before coronal obstruents

Descriptions of schwa-insertion in Dutch usually agree on the environment where it may occur: between a liquid and a following nasal (labial or coronal) or a following non-coronal obstruent. Put another way, the only licit word-final liquid-consonant clusters in which schwa cannot appear are clusters of a liquid plus a coronal obstruent (see (6.9) on page 237). However, the urban accent data contradict this categorical claim: schwa-insertion between *r* and following coronal obstruents does in fact occur, although it is far less frequent than in the so-called schwa-insertion contexts recognised in the literature. Table 6-18 shows the percentages of schwa-insertion in the five items with *r*+coronal obstruent clusters in the data.

It is obvious from these data that schwa-insertion is much less frequent and wide-spread before coronal obstruents than before non-coronal obstruents and nasals (cf. Table 6-2). In most of the cities in the corpus, it is a marginal phenomenon. However, in Bruges it is rather common, with around a third of the *worst* and *kers* tokens including schwa. The accent with the second highest token frequency of schwa in these items is Amsterdam, but the numbers here are just a fraction of those of Bruges. The one accent where it is entirely absent is that of The Hague.

Table 6-18 % of schwa-insertion in clusters of *r*+coronal obstruent. All *r*+coronal obstruent tokens (*bord,paard,worst,kers,kaars*), *n*=3988. No. of speakers: 408.

city	*total*		*bord*		*paard*		*worst*		*kers*		*kaars*	
	n	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Antwerp	6	1.5	0	0.0	0	0.0	3	3.8	2	2.6	1	1.3
Bruges	83	19.7	15	17.9	3	3.6	25	30.1	30	36.1	10	12.0
Ghent	6	1.4	0	0.0	0	0.0	4	4.8	2	2.4	0	0.0
Hasselt	3	0.8	0	0.0	0	0.0	2	2.5	1	1.3	0	0.0
Amsterdam	14	3.5	1	1.3	0	0.0	4	5.1	6	7.6	3	3.8
Rotterdam	3	0.7	0	0.0	0	0.0	0	0.0	2	2.4	1	1.2
Utrecht	7	1.8	1	1.3	0	0.0	2	2.5	1	1.3	3	3.9
Leiden	1	0.3	0	0.0	0	0.0	1	1.3	0	0.0	0	0.0
The Hague	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Nijmegen	4	1.0	0	0.0	0	0.0	2	2.5	1	1.3	1	1.3
total	127	3.2	17	2.1	3	0.2	43	5.4	45	5.7	19	2.4

Table 6-19 Absolute and relative numbers of alveolar *r* and uvular *r* in clusters of /r/+coronal obstruent when [ə] is present (*n*=127). No. of speakers: 55.

city	*n*	*alveolar*		*uvular*	
		n	*%*	*n*	*%*
Antwerp	6	6	100.0	0	0.0
Bruges	83	83	100.0	0	0.0
Ghent	6	6	100.0	0	0.0
Hasselt	3	3	100.0	0	0.0
Amsterdam	14	14	100.0	0	0.0
Rotterdam	3	3	100.0	0	0.0
Utrecht	7	4	57.1	3	42.9
Leiden	1	1	100.0	0	0.0
The Hague	0	0	0.0	0	0.0
Nijmegen	4	0	0.0	4	100.0
total	127	120	94.5	7	5.5

Schwa-insertion before coronal obstruents is almost exclusively a feature of the Bruges accent, and this section will examine the phonetic properties of schwa in this context in the Bruges accent only. Recall that the Bruges accent is almost exclusively an alveolar-*r* variety, and the attested schwas in the coronal obstruent context are all produced by alveolar *r* speakers. In fact, schwa-insertion in this environment is almost entirely a feature that accompanies alveolar variants of *r*, as is shown in Table 6-19.

Schwa appearing between uvular *r* and a coronal obstruent turns out to be a marginal phenomenon, while after alveolar *r* it is at least found in all accents with a substantial number of alveolar *r* speakers (although, with the exception of Bruges, it is by no means general or even very common). Schwa-insertion in this context, then, seems to be closely tied to the specific realisation of /r/ as alveolar tap or trill (of the 119 alveolar *r* realisations before schwa in these contexts, 100 are alveolar taps, and 19 are alveolar trills).

6.3.5.1 *The duration of schwa before coronal obstruents in Bruges*

The duration of the schwa in *bord*, *worst* and *kers* as uttered by those speakers who realise schwa in these contexts was measured via the same method as that used in section 6.3.4.1. That is, only items in the word list reading task were measured, as they have a relatively constant speech rate, whereas that of the picture task varied greatly. The results are in Table 6-20 below, with the average values for *harp*, *kerk*, *arm*, *berg* added for reference.

Table 6-20 Duration in ms of [ə] in /r/+coronal obstruent items in Bruges (*n*=36).

item	*n*	*mean*	*min*	*max*	*stdev*
bord	7	34	21	63	15
worst	14	35	12	84	20
kers	15	37	19	66	14
harp	25	34	16	58	12
kerk	24	39	16	66	13
arm	26	34	17	50	10
berg	24	42	22	70	13

It is striking how similar the mean duration of schwa in the coronal obstruent contexts is to that in the generally recognised schwa-insertion contexts. That is, although schwa between *r* and coronal obstruents is less frequent than between *r* and nasals or non-coronal obstruents, there is no difference between the two for those speakers that can have schwa in both. What is also noticeable is that the range of the duration of schwa in the coronal obstruent contexts exceeds that of the so-called schwa-insertion context, and that the longest schwas observed in the coronal obstruent context are well within the range of canonical schwa (the highest value for *worst*, 84 ms, is close to the mean duration of canonical schwa in Bruges, at 83 ms). On the other hand, the shortest schwas are once again equal in length to the open phases of alveolar trills, supporting an analysis in which this schwa is an artefact of either gestural coordination or the consequence of aerodynamics. In sum, schwa-insertion in the coronal obstruent context is less frequent and more variable, but amounts to the same averages in terms of duration as those found for the schwa-insertion context items. The following section takes a look at the spectral properties of schwa in the coronal obstruent context.

6.3.5.2 *The spectral properties of before coronal obstruents in Bruges*

Figure 6-7 shows the vowels (canonical and epenthetic) in the coronal obstruent context words (*bord*, *worst*, *kers*) plotted in a two-dimensional vowel space. Measurements of F1 and F2 were taken from the vowels' midpoints using PRAAT. What is most noticeable is that the epenthetic vowel in this context has very similar characteristics to those in the 'schwa-insertion' contexts (*harp*, *kerk*, *arm* and *berg*). That is, relative to the stressed vowel, the formants of the epenthetic vowel shift toward the centre of the vowel space.

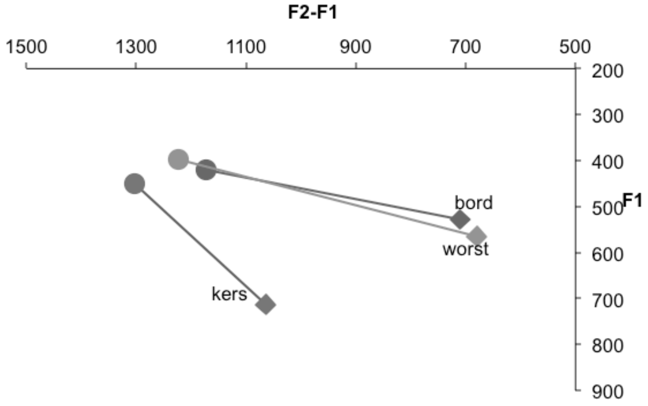

Figure 6-7 Locations in a two-dimensional vowel space of canonical vowels (diamonds) and epenthetic vowels in /r/-coronal obstruent clusters (circles) in Bruges. Means (*n*=36).

The formant values of the schwa vowel in *kers*, *bord* and *worst* converge to a great degree: the back vowel /ɔ/ seems to exert little effect, as the schwa vowel between *r* and the [s] or [t] in these words is almost as fronted as the schwa that appears in kers.

Figure 6-8 combines the plotted formant values of the vowels in *bord*, *kers* and *worst* from Figure 6-7 and those of the general schwa-insertion items *harp*, *kerk*, *arm* and *berg* from Figure 6-5. It is obvious how alike the schwa in *kers* is to those in *kerk* and *berg*, and also that the coarticulatory effect of /ɔ/ on the schwa is less than that of /ɑ/; i.e., the fact that /ɔ/ is a back vowel does not diminish the front-central character of epenthetic schwa.

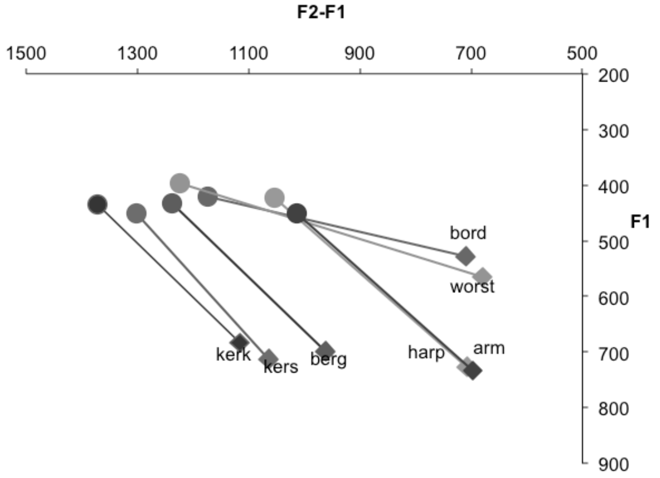

Figure 6-8 Locations in a two-dimensional vowel space of canonical vowels (diamonds) and epenthetic vowels (circles) in /r/+coronal and /r/+non-coronal coda clusters in Bruges. Means (*n*=135).

6.3.5.3 *Schwa-insertion before coronal obstruents: analysis*

What both the duration measurements and the formant measurements of schwa in the coronal obstruent contexts show is that, in Bruges, there is little or no difference between the intrusive schwa in this context and that in the 'standard' schwa-insertion context from a phonetic point of view (if anything, schwa in the coronal obstruent context exhibits *fewer* coarticulatory vowel effects than that in the schwa-insertion context). It seems that there is no reason to assume that there is a difference from the point of view of the phonology either. This has obvious repercussions on the analysis of schwa-insertion in Bruges. The relatively strong relationship between the quality of the stressed vowel in the items and that of the schwa that appears lends some support to an analysis of schwa-intrusion, rather than insertion. However, the fact that these effects are stronger in Nijmegen than in Bruges cast doubt on this analysis. As shown above, as the realisation of /r/ is in fact correlated with the appearance of the intrusive vowel, a pure gestural coordination analysis such as that in standard Articulatory Phonology falters on this issue in any case. Finally, while the intrusive vowel in the two contexts may be highly similar, there is a clear difference in terms of frequency of occurrence: many more speakers realise schwa much more consistently in the 'standard' context than in the coronal obstruent context. Therefore, if the large amount of gradience and variability in the coronal obstruent context were reason to decide on a "phonetic" status for the process here, the process in the schwa-insertion context would have to be of a different nature. If the spectral and durational measurements hint at a more complex status for the process than simply "phonological", it should at least be "semi-phonological", based on its rate of application. While such a "semi-phonological" status has no place in a strictly modular framework, it does fit within Scobbie's (2007) "overlap" area, as explained below in more detail.

The question of whether something is a phonetic or a phonological process may in fact not be the right one to ask. In every one of the cases examined, there is an amount of *knowledge* of sound structure on the part of the speaker involved, and this can be considered phonological knowledge under an inclusive view of what phonology is about (see e.g. Docherty and Foulkes 2000); whether the speaker has to learn to realise epenthetic schwa as not shorter, somewhat shorter, or much shorter than canonical schwa makes no difference in that respect. What becomes clear, however, is that there is a stronger link between the phonetic origins of schwa-intrusion/insertion and the synchronic process in the Bruges coronal obstruent data than in the schwa-insertion context data; and that this is in turn stronger than that in Utrecht and Rotterdam, with that in Nijmegen possibly weakest (at least in terms of duration). So while the Nijmegen data lend themselves most obviously to a "purely phonological" approach (although, again, the *r* allophony data show that the process must be phonological in all of the accents considered, with the possible exception of some of the Bruges speakers), there is no clear line to be drawn separating the phonological and the phonetic. There are, however, different levels of "phonologisation", in terms of a progressive detachment from the phonetic surface origins of the process, to be inferred from these data. Phonologisation in this sense is not a label for a change that has taken place across generations, where one generation of speakers has generalised a previously low-level rule to the categorical phonology. Instead, the process of schwa-insertion/intrusion demonstrates the much more complex reality of phonologisation as a gradual shift from "more phonetic" (but not automatic, and under speaker control) to "more phonological" (but not quite categorical or fully discrete). In other words, rather than the "boundary dispute" of Myers (2000) which was the point of departure for this investigation, schwa-insertion in Dutch operates in the area where phonetics and phonology "overlap" (Scobbie 2007). Scobbie uses the term "overlap" rather than "interface" to indicate that, while phonology and phonetics are categorically distinct, there can be phenomena which are indeterminate between the two types of knowledge, or involve elements of both (for the speaker as well as for the analyst). The crucial implication of the phenomena discussed in this chapter, and throughout this thesis, is that this overlap area may be very large, leaving little room for either "pure" phonetics or phonology once the analyst zooms in enough to examine fine phonetic detail and the social factors associated with it.

In sum, schwa-insertion in the coronal obstruent context in Bruges shows that there is an element of phonetic naturalness to the process of schwa-insertion after *r* in general, and that we can establish its origins (in gestural coordination) even though the link between current realisations and that natural process may have been severed by phonologisation. This is evidenced by the differing ways in which schwa-insertion takes place synchronically in the various urban accents, and especially by its current status in Nijmegen, where the connection between the realisation of /r/ and the appearance of a vocalic element is absent, and where the vocalic element itself does not show the characteristics of an intrusive vowel. Another source of evidence for the phonetic origins of schwa-insertion could come from its occurrence in other languages. The appearance of a vocalic element in a liquid context is not very well-described, but there are mentions in a variety of languages: Hall (2006b) lists 18 languages, as disparate as Finnish, Irish, English and Hausa, with similar phenomena. As briefly discussed in Chapter 4 (section 4.3.2), a 'vocoid' element appears *before r* in onset clusters as well in the urban accent data, and this has also been reported for a number of languages including Greek, Swedish, Slovenian and Spanish. The latter in fact shows schwa-insertion both before and after *r* in clusters, and a brief discussion of the Spanish facts in light of those from Dutch, concludes section 6.3.

6.3.5.4 Schwa-insertion after r *in Spanish*

Schwa-insertion after *r* in clusters in Spanish has long been established in the literature. First noted by Lenz (1892-1893) for Chilean Spanish, it has since been described for many other varieties of Spanish, as an inherent "elemento vocálico", "elemento parásito" (Malmberg 1965:32-33) or "elemento esvarabático" (Blecua Falgueras 2001:33). There is one major distinction between Dutch and Spanish with respect to this process: as Spanish has no native words that end in rC, schwa-insertion always occurs *across* syllable boundaries. It occurs with any kind of -r.C- cluster. Examples are in (6.12).

(6.12) Spanish r.C clusters and schwa-insertion

carpa	[ˈkaɾəpa]	
carta	[ˈkaɾəta]	
carca	[ˈkaɾəka]	
arma	[ˈaɾəma]	(Romero 2008)
la fuerza	[laˈfwɛɾəsa]	
los árboles verdes	[loˈsaɾəβoles ˈβeɾəðes]	
cargar	[kaɾəˈɣaɾə]	(Malmberg 1965)

In all cases, it is the tapped [ɾ] of Spanish, not the trill [r] that is involved in this process. Malmberg describes the tap as including a very brief closure, as well as a vocalic portion either before or after it, meaning that the closure is "always intervocalic" (1965:33fn5).

The duration of the epenthetic vowel is said to "in some cases be as long as a full, unstressed vowel" (Malmberg 1965:33), though on average they are usually shorter. Blecua Falgueras (2001) measures epenthetic vowels with 32 ms average length, in a range of 8-56 ms, while Schmeiser (2009) reports durations between 15 and 34 ms (with means around 23). The duration is influenced by the following consonant, although results vary greatly. In general, sonorant clusters (-ɾ.m-) induce greater length for the epenthetic vowel than obstruent ones, while there are also indications that clusters with velar consonants condition longer durations (Ramírez 2006).

The formant structure of the epenthetic vowel is the source of some debate. While an early study such as that of Navarro Tomás (1918, cited in Blecua Falgueras 2001) claims it takes on the resonance characteristics of the preceding vowel, Malmberg claims it is a schwa-like, neutral vowel instead, and Massone (1988) reports formant values close to those of trilled [r]. Ramírez' more elaborate study mostly seems to confirm Quilis' (1981) middle-ground position in showing formant frequencies similar to those of the adjacent vowels, but in a reduced vowel space (2006:54). The formants are considerably weaker than those of full vowels, akin to those in the open phases of a trilled [r]. Proctor (2009) finds no evidence for an influence of the preceding vowel, and his data (from speakers of Caribbean Spanish) show that the epenthetic vowel has its own formant structure.

Similarly to Bruges Dutch, the Spanish facts can be interpreted to lend themselves to an intrusive, i.e. phonetic, analysis: Romero (2008) argues explicitly on the basis of his experimental data that the intrusive vowel is non-syllabic, and an epiphenomenon of the gestural coordination of [ɾ] and the following consonant, and not the result of "any independent process of epenthesis" (2008:59). This is akin to Gafos' (2002) and Hall's (2003) claims that intrusive vowels lack an independent gesture, as modelled for Bruges schwa-insertion in Figure 6-3 above (Bradley's (2004) representation of an intrusive vowel appearing with [ɾ] in Peninsular Spanish is in fact very similar to the former). Proctor (2009) characterises the svarabakhti element as "intrinsic to the rhotic, rather than intrusive". His ultrasound data show that the dorsal gestures associated with the vocalic element are not a carryover from the preceding lexical vowel, but consistent with those of [ɾ] realisations in intervocalic contexts. Despite these accounts of the process as non-phonological, i.e. intrusive or intrinsic, the history of Spanish shows that vowel epenthesis in this context can become phonological, and even lexicalised. As Malmberg (1965:33-34) notes, the epenthetic vowel can take on the role of an actual vowel, as has occurred in a number of Spanish dialects for forms such as *tiguere* (<*tigre*), *corónica* (<*crónica*), and, with /l/, in *Ingalaterra* (<*Inglaterra*). The phenomenon is commonly known from the history of the Romance languages, in both directions (Spanish *gritar* < Lat. *quiritare*, French *droit* < Lat. *directum*, Portuguese *fevereiro* < Lat. *februario*). This shows that while the current short intrusive vowel of Spanish may be an epiphenomenon of gestural coordination, speakers may come to reinterpret such vowels, however short, as part of the phonological structure.

Malmberg explicitly refers to the *difficulty* of consonant+*r* clusters, and calls both phenomena ways of avoiding problems of articulation. Interpreted in a more formal sense, the function of epenthesis as a repair strategy is also discussed by Hall (2011), but final liquid-obstruent clusters are not particularly unwellformed from a phonological point of view (e.g. sonority-based phonotactics) or on grounds of cross-linguistic markedness. It seems most likely that the origin of schwa-intrusion indeed lies in an articulatory conflict, in the sense of Bell-Berti and Harris (1981; see also Recasens and Pallarés 1999; Gick and Wilson 2006), and more specifically in the coordination of two consonantal gestures. The *synchronic* phonology, however, does not need to contain reference to conflicts or repairs, given that there are phonetic implementation rules (in what is traditionally called the phonetics-phonology interface) that force the realisation including the vocalic portion, however short it is. Again, it is important to keep the diachronic and synchronic levels separate – the first being for the explanation of the origin, the other for the current distribution and phonological patterns.

6.4 Conclusion

While previous chapters have focussed on the sociophonetic aspects of Dutch *r*, explaining *r*-variation and its distribution within a model of sound change, this chapter has looked at the potential impact of *r*-variation on aspects of Dutch phonology. A look at the phonotactic distribution of *r* shows it behaves like a sonorant liquid quite independently of its realisational variation. Attempts to find a cross-linguistically valid representation for *r* run into problems when they try to do too many things at once: accounting for the phonotactic behaviour of *r* within a phonological system, for its phonetic diversity but apparent phonological unity across the world's languages, for gross allophonic patterns and its finer realisational variability in a single language are all independent tasks for the analyst, and only some of them require, or can easily yield to, treatment in what is generally considered phonology. The general view of representations as strongly impoverished and free of redundancy is not helpful here, as it is only one level of description. Speakers also have access to knowledge of fine phonetic detail, as they are not only able to replicate them in complex patterns of gradient variability, but also to use them for social indexation. Exemplar Theory models this type of knowledge by viewing representations as consisting of clouds of remembered tokens, from which abstraction and higher-level generalisations are possible (and necessary). Finally, explanations for cross-linguistic unity or the origins of phonetic diversity are not to be sought within synchronic phonology at all, but in diachrony: in the histories of particular languages, as well as more general theories of sound change, such as that laid out in the previous two chapters.

The largest part of this chapter was devoted to an examination of the process of schwa-insertion in *r*C clusters, which has in the past received both phonological and phonetic treatments. This showed how a combination of large-scale data and detailed phonetic analysis can shed new light on such issues. The section presented novel data (not only in the sense of new duration and spectral measurements, but also the previously unreported appearance of schwa in coronal obstruent contexts) and showed large differences between a number of urban accents of Dutch. These differences, mainly in the duration of the epenthetic element, show that the place of articulation of a speaker's *r* variants is of possible influence on the status of the process in the various accents. Specifically, the origin of schwa-insertion in these contexts seems to lie in patterns of gestural coordination between alveolar *r* and following consonants. The data suggest that the process of schwa-insertion for uvular *r* speakers seems more divorced from these phonetic origins, and displays more phonological characteristics (as it is more categorical and schwa is longer). On the other hand, as is made clear by the relative lack of differences between speakers from Rotterdam and Utrecht, even though their dominant *r* variants have a different place of articulation, the differences between accents are not reducible to the *r* variants used by their respective speakers.

An important conclusion of the discussion of schwa-insertion was that the process should, for most speakers, be treated as essentially a phonological one. The crucial deciding factor here are the variants speakers use when they insert schwa:

these turned out to be their typical intervocalic onset ones, which shows that the epenthetic vowel forms a syllabic nucleus and must be part of a higher level of linguistic organisation. It was also shown, however, that previous phonological accounts make a number of incorrect predictions, and fail to account for the specifics of schwa-insertion, both phonetically and distributionally. Given the gradience of schwa epenthesis patterns, from close to its likely phonetic origins to far removed from them, an either/or decision in questions of phonological/phonetic status is not always helpful, and some phenomena may occupy an overlap area of the two levels of description. This tallies with the analysis of phonetic variation in the previous two chapters, which also showed more or less robust patterns in the use of variants, but only rarely purely phonetic ones (insensitive to geographical or social variation) or purely phonological, i.e. categorical, ones (the strongly abstract allophonic pattern found with some of the speakers in the ultrasound study being an exception). In addition, the schwa-insertion data showed that it is not only the origin of the phonetic variants themselves that we can establish by examining their current patterning; the origin of phonological processes in phonetic ones can also be made clearer, allowing us to track their subsequent levels of phonologisation in the synchronic system.

7 Summary, discussion and conclusions

Chapter 1 set out an empirical and a theoretical aim for the present study. Its empirical aim was to chart the extent and nature of Dutch *r*-variation, and the theoretical aim to provide an integrated account taking in both the sociophonetic variation and its phonological implications. This chapter summarises the main findings of the study and points towards future directions for research.

7.1 The *HEMA* corpus of urban accent data

The survey of previous accounts of Dutch *r*-variation in Chapter 2 showed that, while there is a large amount of data on *r*-variation in Dutch dialects, prior to this study there was a lack of information on intra-dialectal and intra-speaker variation, largely due to the fact that data were never collected specifically for this purpose. The study by Tops (2009), carried out in parallel (and partly in collaboration) with the present study, and focusing on specific areas in Flanders, is the one exception. Most crucially, what was lacking was data from larger urban communities, which are expected to show more variation and dynamism than smaller or rural communities. In addition, what data was available from cities such as Leiden, The Hague and Ghent promise especially intriguing variants and/or patterns of variation, including change-in-progress. Finally, previous studies suggest that a large (and possibly increasing) amount of *r*-variation is found in colloquial Standard Dutch, but these studies, too, were based on relatively small data sets. What was needed, therefore, was purposely collected data on urban Standard Dutch *r*, especially concerning the influence of social and geographical factors on any variation.

To this end, a large-scale corpus was collected containing realisations of *r* in various contexts from ten urban accents of colloquial Standard Dutch. In each of ten larger cities in the Netherlands and Flanders, approximately 40 speakers were given a picture naming and a word list reading task containing 25 and 28 *r*-items, respectively. The speakers were recorded in an informal setting under non-laboratory circumstances. The data were analysed by transcribing the variants of *r* used in each item, based on auditory and visual (waveform and spectrographic) evidence. Labels for the transcriptions were arrived at exploratorily, without pre-defined limits to their number and nature. The design of and results from this study are in Chapter 3, and the main findings are summarised in the remainder of this section.

7.1.1 Dutch *r* variants

The 20 *r* variants that were distinguished in the urban accent data are in Table 7-1 (repeated from Table 3-4 in Chapter 3, section 3.2).

Table 7-1 Dutch *r* variants.

IPA	*descriptive label*
r	voiced alveolar trill
r͡r̥	partially devoiced alveolar trill
r̥	voiceless alveolar trill
r͡ɹ̝	alveolar trill/tap followed by homorganic frication
ɹ̝	voiced (post)alveolar fricative
ɹ̝̊	voiceless (post)alveolar fricative
ɾ	voiced alveolar tap
ɾ̥	voiceless alveolar tap
ɹ	alveolar approximant
ʀ	uvular trill
ʀ̝	uvular fricative trill
ʁ	uvular fricative
ʁ̞	uvular approximant
ɻ	retroflex/bunched approximant
j	palatal approximant
ɛ	low-mid front vowel
ə	central vowel (schwa)
ɐ	low vowel
ØC̠	elision of /r/ with retraction of the following C
Ø	elision of /r/

There are nine alveolar variants, four uvular variants, five vocalic (approximant and vowel) variants, and two non-segmental (elision) variants. The alveolar variants are distinguished by manner of articulation and voicing. The uvular variants are distinguished by manner only, but voicing is predictable: the trill and approximant are voiced; the fricative trill and the fricative are voiceless. The vocalic variants are distinguished by place of articulation, and the non-segmental variants by whether rhotic features are recoverable on a following consonant.

7.1.2 The use of *r* variants across accents

This section reiterates the patterns found in the urban accent data, as reported in Chapter 3. Table 7-2 provides a summary of the major linguistic and sociolinguistic *r*-variation in and between the cities in the data. The first seven rows provide information on the use of *r* variants in the urban accents. From top to bottom, they show:

Table 7-2 Summary of *r*-variation data (rows) per urban accent (columns) and in total (rightmost column). For more information see running text.

city *feature*	*Ant*	*Bru*	*Gnt*	*Has*	*Ams*	*Rot*	*Utr*	*Ldn*	*Hag*	*Nmg*	*All*
total # variants	15	15	17	14	17	19	20	19	14	16	20
major variants	ɾ r͡ɹ̝	ɾ r r͡ɹ̝	R̝ ʁ ʁ̝ R ɾ	R̝ R ɾ ʁ ʁ̝	ɾ ɻ ʁ̝	ɾ ɻ R	ʁ̝ R ɻ	ɻ R ʁ̝	ɻ R ʁ̝ ʁ	ʁ̝ R ʁ	ɾ ʁ̝ ɻ R
# variants onset	9	8	9	9	10	10	10	10	7	10	12
major variants onset (incl intervocalic)	ɾ r ɹ	ɾ r	ʁ̝ R ɾ R̝	R ɾ ʁ̝ R̝	ɾ ʁ̝	ɾ R ʁ̝	ʁ̝ R ɾ	R ʁ̝ ʁ ɾ	R ʁ̝ ʁ	ʁ̝ R R̝	ɾ ʁ̝ R
# variants coda	15	15	17	14	17	19	20	19	13	15	20
major variants coda (incl schwa-ins)	r͡ɹ̝ ɾ	ɾ r͡ɹ̝ r ɾ̥	R̝ ʁ	R̝ ʁ r͡ɹ̝	ɻ ɾ	ɻ ɾ	ɻ ʁ̝ R	ɻ	ɻ ʁ̝	ʁ̝ ɻ ə ʁ	ɻ ɾ
%mixing speakers	9.8	2.3	26.2	10.0	20.0	18.6	22.5	31.0	5.6	9.8	15.7
place:score	9.8	7.1	74.9	63.8	29.1	46.1	71.2	66.6	79.8	90.2	53.4
place: sex	m>f	—	—	—	—	—	f>m	—	m>f	—	—
place: age	—	—	—	y>o	—	—	—	—	o>y	—	—
place: syll	—	—	—	—	—	—	i,o,s >c	i,o> s,c	o,i> s,c	o,i,s >c	o.i> s>c
cons: score	95.6	97.5	93.2	94.6	80.2	68.1	69.8	66.7	62.4	66.0	79.6
cons: sex	—	—	—	—	—	—	—	f>m	—	f>m	—
cons: age	—	—	—	—	—	—	—	o>y	—	—	o>y
cons: syll	c,s,o >i	s> c,o,i	c>s> o>i	c> o,i,s	o,i>s >c	o,i> s>c	o,i> s>c	o,i> s>c	o,i> s>c	o>i> s>c	o>i> s>c
r/ba: score	0.0	0.0	0.0	0.0	17.9	23.6	20.2	38.0	34.8	7.4	14.0
r/ba: sex			—		—	f>m	—	—	f>m	—	f>m
r/ba: age			—		—	y>o	—	y>o	y>o	—	y>o
r/ba: syll			—		c>s >o,i	c>s >o,i	c> s,o,i	c>s >i,o	c>s >o,i	c> s,o,i	c>s >o,i
ə-ins: score	95.1	84.1	20.5	87.5	80.9	67.4	85.0	49.3	45.4	92.6	70.9
ə-ins: sex	—	—	—	—	—	—	—	—	m>f	—	—
ə-ins: age	—	—	—	—	—	o>y	—	o>y	o>y	—	o>y
ə-ins: syll	s>c >o,i	s>c >o,i	s> c,o,i	s>c >o,i	s> c,o,i	s> c,o,i	s> c,o,i	s> c,o,i	s> c,o,i	s> c,o,i	s> c,o,i

- total # variants: the total number of variants used in the urban accents, out of the 20 variants that were distinguished between in the analysis of the data.
- major variants: the major *r* variants are those variants that make up over 10% of all *r* tokens in the respective accents.
- # variants onset: the number of variants used in onsets in the respective accents. The onset context here comprises both word-initial and intervocalic onsets.
- major variants onset (incl intervocalic): the major variants in the onset, i.e. those variants that make up over 10% of all onset *r* tokens in the urban accents.
- # variants coda: the number of variants used in codas in the respective accents. The coda context here comprises both word-final codas (this includes singleton word-final *r* and *r*+coronal obstruent clusters) and the schwa-insertion context (*r*+non-coronal consonant clusters).

- major variants coda (incl schwa-ins): the major variants used in codas, i.e. those variants that make up over 10% of all coda *r*-tokens in the urban accents.
- %mixing speakers: the percentage of mixing speakers, i.e. the number of speakers who use both alveolar and uvular consonantal variants, relative to all speakers in the respective accents.

The rightmost column in Table 7-2 contains information about the total data set. The total number of variants found here is 20, obviously equal to the number of variants distinguished in the data analysis. The urban accents differ in the extent to which they are present. All 20 occur in Utrecht, and all but one in Leiden and Rotterdam. The urban accents with the lowest number of variants are Hasselt and The Hague, but even here 14 different variants are used. These absolute numbers should not be overinterpreted, since they of course depend on the choices made during data analysis. Decisions as to how many variants to code for were influenced by the perceived need to make distinctions and constrained by the degree of difficulty in distinguishing variants. Nevertheless, the relative numbers make clear just how wide-ranging the variation is, with three-quarters to all of the variants represented in each of the urban accents. Additionally, they illustrate aspects of the extent of the variation: there are fewer variants in The Hague, relative to Leiden and Rotterdam, for instance, because it has such a strong preference for uvular *r*, whereas uvular and alveolar *r* are much more balanced in the latter two cities. Similarly, the generally smaller number of variants in the Flemish cities compared to the Dutch ones is indicative of the absence of many of the vocalic variants in the former.

The list of major variants illustrates not only which variants are important where (for instance, the distribution of the alveolar vs. the uvular ones across the accents, or how the retroflex/bunched approximant is a major variant in the Netherlandic accents but not in the Belgian ones), but also something about the range of the variation: whereas only two variants in Antwerp make up over 10% of all *r* tokens each (suggesting that the other 13 variants found there have relatively minor roles), no fewer than five variants in Ghent and Hasselt have a frequency of at least 10%, showing that there is a more even spread of variants in these cities.

The number of variants used in onsets ranges from 7 to 10. While substantial, these numbers are considerably smaller than the total numbers of variants used in the respective accents. The choice of variants in onsets is limited, and as a look at the major variants shows, this is largely due to the lack of approximant and vocalic variants in the onset. Indeed, the major variants in the onset show a relatively large degree of uniformity among the urban accents: voiced alveolar taps and/or uvular approximants and trills predominate in all accents. The voiced alveolar tap is by far the most frequent alveolar variant, outnumbering the stereotypical alveolar *r* variant, the trill, in all accents; the latter is in fact only a major variant in the two dominantly alveolar *r* cities of Antwerp and Bruges. In the other urban accents, uvular variants, particularly the approximant and the trill, dominate, although there is more of a balance in Amsterdam and Rotterdam.

Considerably less limited than onsets, the number of variants used in codas is almost always equal to the total number of variants used in each urban accent. Note that the coda context here includes the schwa-insertion context, in which, as shown in Chapter 6, speakers tend to use their onset variants when they realise these items with schwa-insertion, so it stands to reason that in almost all cases, the variants in the onset are a proper subset of those used in the coda, and the variants used in the coda contain all or almost all variants used in the accent. Even without taking the schwa-insertion context into account, however, the coda context simply allows for more variation, as both consonantal and, particularly in the Netherlandic accents, approximant and vocalic variants are available there.

Despite the larger total number of variants, in most accents in fact fewer *major* variants are used in the coda (the exceptions being Bruges and Nijmegen). These major variants also show a clearer pattern separating the urban accents: the retroflex/bunched approximant dominates in the Netherlands (though less so in Nijmegen), while in the Belgian Dutch accents it is either alveolar taps and trills-with-frication (Antwerp and Bruges) or uvular fricatives and fricative trills (Ghent and Hasselt). In Leiden, although a total of 19 variants are used in coda position, the retroflex/bunched approximant is the only variant with a token frequency of over 10% (and it in fact makes up 84% of all *r* tokens in the word-final coda there).

Finally, the percentage of mixing speakers adds an extra level of insight to the information about how many and which variants occur; for instance, while the major variants in onsets are the same in Ghent and Hasselt, and these accents also have the same total number of variants in onsets, the number of mixing speakers in Hasselt is relatively low, while that in Ghent is among the highest in the corpus. In other words, the fact that the voiced alveolar tap is a major variant in Ghent is to quite some extent the influence of mixing speakers, whereas in Hasselt it will be largely due to its minority of exclusively alveolar *r* speakers. As discussed in Chapter 3, it is hard to establish a pattern to the numbers of mixing speakers found in the urban accents. A comparison of the percentage of mixing speakers with the place of articulation index score (the following row in the table) shows that the lowest numbers of mixing speakers (less than 10% of the total number of speakers) are found in those cities that have either the lowest place index scores (Antwerp and Bruges) or the highest (The Hague and Nijmegen). This is of course to be expected, as particularly low or high place index scores suggest a high level of uniformity in the place of articulation of *r*. However, it is not the case that those cities whose place index score is closest to 50 (that is, where the token frequencies of alveolar and uvular *r* are roughly equal) are necessarily the ones with the highest numbers of mixing speakers. While alveolar and uvular *r* seem most balanced in Rotterdam (index score 46.1), the number of mixing speakers is not particularly high, relative to those in other cities (18.6%), whereas the highest numbers of mixing speakers are found in Leiden (31.0%) and Ghent (26.2%), where there is in fact a clear tendency towards one of the places of articulation for their consonantal *r* realisations (uvular). In general, the number of mixing speakers in the data is higher than that in the rapid anonymous survey data in Tops (2009), most likely because the *HEMA* corpus simply contains more tokens per speaker.

All in all, the top half of Table 7-2 shows the *breadth* of Dutch *r*-variation: the numbers of variants used, the wide variety of realisations, and the marked differences between the urban accents. At the same time, it shows the broad strokes of obvious patterns in the data: a) how particular variants show up again and again as major variants in the accents (only 10 out of the total number of 20 appear as major variants in any of the accents), b) how either alveolar or uvular *r* dominates in particular cities (especially in the onset), and c) how the Belgian Dutch accents differ from the Netherlandic ones in their preference for consonantal (trill, tap and fricative) variants in the coda, rather than approximant and vocalic ones. The index scores in the bottom half of the table bring out the latter two patterns more strongly, while adding the dimension of social variation.

7.1.3 Sociolinguistic and allophonic variation: index scores

The remaining information in Table 7-2 summarises the results of the analyses using the index scores from Chapter 3. In each case, this gives the mean score for each index, followed by any significant effects (ANOVA) of the social factors sex (*f*=female, *m*=male) and age (*y*=young, *o*=old), and of the linguistic factor of syllable position (*o*=word-initial onset, *i*=intervocalic, *s*=schwa-insertion context, *c*=coda).

7.1.3.1 Place of articulation

The first is the score for place of articulation, where zero means 'exclusively alveolar *r*' and 100 'exclusively uvular *r*'. It shows that Antwerp and Bruges are closest to the former, and Nijmegen to the latter, although most urban accents are in between the two extremes. A comparison of the place of articulation index with the major variants and the percentage of mixing speakers helps to interpret these intermediate scores. For instance, the index score in Hasselt is 63.8, the major variants include all of the uvular variants, and the percentage of mixing speakers is relatively low at 10%. This suggests that a majority of speakers have exclusively uvular realisations, a smaller but substantial number are exclusively alveolar *r* speakers, and even fewer vary between alveolar and uvular *r*. While Leiden has a very similar index for place of articulation, 66.6, its most frequent variant, in codas as well as overall, is the retroflex/bunched approximant, and its number of mixing speakers is relatively high, at 31%. This shows that its place of articulation index score is not so much the result of there being two groups of speakers, with alveolar and uvular *r* realisations respectively, but of there being, on the one hand, a great many retroflex/bunched approximant tokens (which are weighted as 50 for the purposes of calculating this index score), and, on the other, a much larger group of speakers who use both alveolar and uvular *r*.

While for place of articulation, there are no significant effects of speaker sex or age in the data as a whole, sex is significant in Antwerp, Utrecht and The Hague, and age in Hasselt and The Hague. The effects there go in both directions, however, which partly explains why there is no overall effect. The most easily interpretable effects are those in Hasselt, where younger speakers have higher scores, i.e. they favour back variants of *r*, suggesting a change in progress towards uvular *r*, and those in The Hague, where older speakers and men have higher scores. Again, examining the major variants is necessary to explain these effects, and the differences between Hasselt and The Hague; in the former case the preference for uvular *r* comes at a cost to alveolar *r*, while in the latter case, it is older speakers that may retain uvular variants in all positions, whereas young speakers and women overwhelmingly have retroflex/bunched approximants in codas.

There are effects of syllable position on the score for place of articulation in Utrecht, Nijmegen, The Hague and Leiden; these all go in the same direction, as higher scores are found in word-initial and intervocalic onset position, and significantly lower scores in the coda. In Utrecht and Nijmegen, the schwa-insertion context patterns with the onset contexts, whereas in Leiden and The Hague it patterns with the coda. The explanation for these effects seems to lie in the high frequency of retroflex/bunched approximants and vocalic variants in the coda contexts (as is general in the Netherlandic contexts), which bring the score down relative to the onset context, in which uvular *r* is most common in these cities. In Leiden and The Hague, furthermore, there are more tokens in the schwa-insertion context *without* schwa-insertion, and in these cases, too, approximant and vocalic variants (central, rather than front or back articulations) are most frequent. The absence of an effect of syllable position in Amsterdam and Rotterdam is caused by the relatively large proportion of alveolar variants in the onset (as evidenced by the lower index scores), which means that central variants in the coda do not lower the index score further. In Amsterdam, in fact, they could potentially cause the opposite effect (higher scores in codas than in onsets), but apparently this is not strong enough to become significant. The effects in the four Dutch cities and the tendencies elsewhere, however, are strong enough for the effect to be significant in the urban accent data as a whole, and in fact show a stronger patterning compared to that found in any of the cities: the higher scores in word-initial and intervocalic onsets are significantly different from the lower ones in the schwa-insertion context and the coda, and these latter two are also significantly different from each other.

7.1.3.2 Consonantality

The score for consonantality is relatively high in all Belgian Dutch accents, intermediate in Amsterdam, and relatively low in the other Netherlandic Dutch accents. A score of 100 would mean ‘exclusively consonantal *r*’, and the Belgian Dutch accents approach this score; a score of 0 would mean ‘exclusively vocalic *r*’, but none of the accents come close to this score. Despite the rise of approximant variants in the coda context, there is still a majority of consonantal variants in all other contexts.

There is no overall effect of sex for consonantality in the urban accent data, but in Leiden and Nijmegen scores are higher for female speakers. The differences are not very large, and they are hard to interpret by themselves, but it is interesting that in Leiden the effect of sex is coupled with an effect of age: younger speakers have lower scores. If there is a change in progress here towards less consonantal variants, it is men that are leading the change here; this is the only instance of this combination of factors in the data. Finally, despite the fact that Leiden is the only city in which there is a significant effect of age on consonantality, there is also an overall age effect when the data from all cities are considered together. Younger speakers have lower scores overall, indicating that there may indeed be a change underway towards less consonantal *r*.

All urban accents show significant effects of syllable position on consonantality, and there is also an overall effect for all of the data. This is the case even though the effects in the individual cities go in opposite directions. The opposition here is again one of the Belgian Dutch accents versus the Netherlandic ones. In the former, the coda context conditions the highest scores for consonantality, and intervocalic onsets generally the lowest. The schwa-insertion context can pattern with either one, or, in the case of Ghent, be significantly different from both the coda and the onset. In the Netherlandic accents, it is consistently the coda where the lowest scores for consonantality are found (due to the many approximant and vowel tokens), and it is onsets in which the highest scores are found. Apparently the data from the four Flemish cities is outweighed by those from the six Dutch cities, as the pattern found in the latter is also found overall: all four syllable positions are significantly different from each other, with the highest scores in the word-initial onset context, and progressively lower ones in the intervocalic onset, the schwa-insertion context, and the coda.

7.1.3.3 The retroflex/bunched approximant

The index scores for the retroflex/bunched approximant simply show how frequent this one variant is relative to all other variants. As also shown above, it is in fact a major coda variant in all Netherlandic accents, and only in Nijmegen is it not the most frequent variant in that context. Nijmegen is the only Dutch city in the corpus not in the western *Randstad* area, and the urban accent data here confirm earlier studies (though not the earliest assumptions) that this area is where the variant is spreading from. The highest scores are found in the western near-coastal cities, Leiden and The Hague.

The effects of the social factors sex and age on the incidence of the retroflex/bunched approximant are large enough to be significant in the corpus as a whole. This variant is found more with female than with male speakers, and more with young speakers than with older ones. These effects are also found in Rotterdam and The Hague, and the age effect alone in Leiden. The tendencies for both factors exist in all other Netherlandic Dutch accents. The Flemish cities do not contribute to this statistic, as the variant is virtually absent from Belgian Dutch.

The effects of syllable position are significant in all the Netherlandic accents and in the data overall. These go in the expected direction: the retroflex/bunched approximant is found most in coda positions, and least in word-initial and intervocalic onsets; the schwa-insertion context generally takes an intermediate position. In two of the accents, Utrecht and Nijmegen, the schwa-insertion context is in fact not significantly different from the onset contexts (although the tendency is in the same direction as in the other cities and in the data overall). This is most likely related to the process of schwa-insertion (see chapter 6): that is, the retroflex/bunched approximant appears in the schwa-insertion context when schwa is in fact not present, and when it is, other variants are used in this context. Utrecht and Nijmegen have the highest scores for schwa-insertion among the Netherlandic accents (see below), and consequently the incidence of the retroflex/bunched approximant is lower in this context than elsewhere.

Together, the index scores and associated significant social factors demonstrate the rise of the retroflex/bunched approximant in the Netherlandic accents, which has rapidly become the dominant *r* variant in coda among younger speakers in the Netherlands. This change in progress also marks the strongest disconnect between the Netherlandic and Belgian Dutch accents; more so than the relative prevalence of uvular *r*, which became acceptable in the Standard Dutch of the Netherlands first but is now gaining ground in Flanders, it seems that the different patterns of onset-coda allophony in the Netherlands and Flanders serves to distinguish their standard accents where *r* is concerned. While the major onset variants overlap strongly (alveolar taps, uvular approximants and trills), it is in codas that the Netherlandic and Belgian Dutch accents take different turns: in the Belgian accents, for both dominantly alveolar and uvular *r* speakers, coda variants are usually devoiced and fricativised versions of the onset ones; in the Netherlandic accents, again for both alveolar and uvular onset *r* speakers, the tendency is for coda variants to be vocalic approximants with a more central place of articulation – the typical realisation being the retroflex/bunched approximant.

7.1.3.4 Schwa-insertion

The final index score in Table 7-2 refers to the process of schwa-insertion. The scores reflect the relative frequency of the presence of schwa in the schwa-insertion context items (*harp*, *arm*, *kerk*, *berg*). A score of 100 would mean that schwa-insertion is completely general for all speakers, and some of the accents (Antwerp, Nijmegen) approach this score. A score of 0 would mean that schwa-insertion is completely absent; while none of the accents come close to zero, the lowest score (Ghent) is in fact 20.5, so just over a fifth of all schwa-insertion context tokens are realised with schwa there. Leiden and The Hague show that truly intermediate scores are also a possibility. As noted in chapter 3, the rather similar scores in Leiden and The Hague in fact hide an important difference between them: in Leiden, there is only a small minority of speakers that treat the schwa-insertion context as non-distinct from the coda context, and realise these items without schwa-insertion and with their coda *r* variants (mostly, the retroflex/bunched approximant). Most speakers in Leiden in fact alternate between realisations with and without schwa in these items. In The Hague, however, there appears to be much more of a categorical split between speakers who consistently realise the schwa-insertion context items with schwa (and an onset *r* variant), and speakers who never do (and use a typical coda variant). As also discussed in Chapter 6, this shows that there are three different types of speakers when it comes to schwa-insertion: those for whom schwa-insertion is categorical in this context (as section 6.3.4.3 shows, this is around 47% of speakers), those for whom it is categorically absent (15%), and those who are variable (38%), which contradicts claims from some of the literature on the process.

There are effects of speaker age in three of the urban accents, Rotterdam, Leiden and The Hague, as well as in the overall data. These effects are in the same direction for all of the accents, with schwa-insertion being more prevalent among older speakers than young speakers. In all likelihood, this indicates a change in progress, with schwa-insertion becoming less common in younger generations, and it is almost certainly related to the rise of the retroflex/bunched approximant, as the two do not generally co-occur. In fact, the three cities where age effects are found for schwa-insertion are exactly the ones that also display significant effects of age for the retroflex/bunched approximant, in the opposite direction: the latter is *more* common with younger speakers. In The Hague, there is also a significant effect of speaker sex, and this too goes in the opposite direction to the effect found with the retroflex/bunched approximant: whereas the approximant is found more with female speakers, schwa-insertion is found more with male speakers. The two indexes are obviously related, and the sex effects strongly support the hypothesis that the age-bound variation is a change in progress, as changes in the standard language are often led by women.

The final row in the table shows the significant effects of syllable position on the schwa-insertion index. To some extent, this is trivial: schwa-insertion occurs significantly more in the schwa-insertion context than in all other syllable contexts, as this is the reason for distinguishing it as a separate syllable context in the first place. However, interestingly, in three cities (Antwerp, Bruges and Hasselt) the coda context is also significantly different from all others: the index score here is lower than in the schwa-insertion context, but higher than in the onset contexts (while there is no difference between codas and onsets in the other accents, nor in the data overall). That is, schwa-insertion is found in word-final clusters of *r* + coronal obstruent (*bord*, *paard*, *worst*, *kers*, *kaars*), although to a lesser extent than in the traditional schwa-insertion context. This is a new finding of the present study emerging from the urban accent corpus and, as shown in Chapter 6, this coda schwa-insertion in fact has potentially important implications for the treatment of schwa-insertion in general in phonological frameworks, as it uncovers a possible explanation for the origins of schwa-insertion in phonetic constraints, and adduces additional evidence for the phonological status of the process in most, though not necessarily all, accents of urban Dutch.

7.1.4 The urban accent corpus: conclusions

The chief empirical findings emerging from the *HEMA* corpus are:

1. A large number of variants of *r* are found in urban accents of colloquial Standard Dutch. Around 20 variants can be discriminated on the basis of distinctive acoustic and auditory parameters and their inferred articulatory correlates. In the individual accents, around 10 of these generally occur in onsets, and up to all 20 in codas.
2. The number of major variants, those with a token frequency of over 10%, is much smaller; on average, there are three major onset variants in each of the accents (as well as in the data overall), and two or three coda ones.
3. The most common realisations in the onset are the voiced alveolar tap, the uvular approximant, and the uvular trill. Together, these three make up 76% of all onset *r* tokens. The most common realisations in word-final codas are the retroflex/bunched approximant, the voiceless alveolar tap/trill with frication, and the uvular fricative. Together, these make up 54% of all coda *r* tokens.
4. A large majority of speakers (84.3%) have either alveolar or uvular consonantal *r*, and do not alternate between these two places of articulation. Those that do

are very unevenly distributed across the urban accents, although it is unclear why these speakers behave differently from the majority.

5. Place of articulation in general is very unevenly distributed among the urban accents, and there is no clear larger geographical pattern. Instead, individual accents can be strongly dominated by front variants (Bruges and Antwerp), back variants (Nijmegen and The Hague), or display more inter-speaker variation (all others, of which Rotterdam is the extreme case, with alveolar and uvular *r* speakers roughly equally divided).
6. Manner of articulation (consonantality) shows a clearer geographical pattern: *r* in the Belgian Dutch accents is almost entirely consonantal (trills, taps, and fricatives), while in the Netherlandic accents consonantal variants co-occur with approximant and vocalic ones, especially in the coda. In fact, most Netherlandic speakers have a strong categorical consonantal onset ~ approximant coda allophony.
7. A number of, likely related, changes in progress are witnessed in the Netherlandic accents. The retroflex/bunched approximant, already by far the most frequent *r* variant in codas in all Dutch cities except Nijmegen, is on the rise. It displays an apparent-time pattern of change in the data overall, and in three of the six Netherlandic Dutch accents individually. The change seems to be led by young women, as sex is a significant factor in two of the cities and in the overall data.
8. The change towards the retroflex/bunched approximant in the coda is also visible in the effect of age on consonantality, as younger speakers have less consonantal *r* realisations in the data for all accents; it is furthermore accompanied by a decrease in schwa-insertion in *r*C clusters in the same accents. The use of retroflex/bunched approximant realisations of *r* is strongly inversely correlated with the appearance of schwa in the relevant context, and as younger speakers in the Netherlands increasingly shift to [ɻ], they are increasingly less likely to insert schwa, even though the retroflex/bunched approximant is still much less common in the schwa-insertion context than in word-final codas.

7.2 A model of rhotic relationships

The principal theoretical contribution of the present study lies in the development of an explicit model of diachronic relationships between *r* variants, intended to explain the synchronic patterning of *r* variants by showing how they may have originated. This model takes its cue from, and expands on, that of Lindau (1985) as well as Magnuson's (2007) update. Lindau's and Magnuson's models aim to address the problem of defining the class of rhotics, for which it has turned out impossible to find a single shared phonetic property. Instead, they propose to characterise *r*-sounds in terms of the Wittgensteinian notion of "family resemblance". That is, while it is not true that every *r*-sound shares a phonetic property with every other *r*-sound, it is true that every *r*-sound shares something with *at least one other*: alveolar and uvular trills are both trills, uvular trills and uvular approximants are both uvular, uvular approximants and retroflex approximants are both approximants, etcetera. In all, this creates a network of speech sounds that resemble each other in at least one aspect.

The problems with this approach as a working model of rhotic classhood were discussed in Chapter 1: Lindau's model in particular is incomplete in that it contains a limited number of rhotics and that not all relationships are made clear. While this is largely remedied by Magnuson, other problems are shared by both and are brought on by their cross-linguistic perspective: the models are unrestrictive with regards to what might be considered rhotics (the phonetic relationships that are indicated could potentially be extended to many other speech sounds), and do not predict or explain how the disparate sounds may all come to function as *r*. To explain the many variants of *r* in a single language, such as those of Dutch, necessitates at the same time a more stringent approach, as well as one that takes in more sources of evidence than static phonetic resemblance alone.

The specific proposal made in this thesis is to characterise *r*-variants not in terms of family resemblances but *family relationships*. This makes a stronger claim: while resemblance among variants is established on the basis of common phonetic properties alone, a relationship as defined here necessitates a diachronic link between two variants. Such links are established by examining the diachronic (apparent time changes in the original data used, as well as historical evidence) and geographical variation in the data. It is by inspecting very closely the phonetic detail of *r*-sounds in connection with their linguistic distribution in a large corpus such as the urban accent data that enables the establishment of the *origin* of particular variants in others. Specifically, this origin often lies in what happens to certain *r*-sounds in casual speech processes, particularly, though not exclusively, lenition. The approach follws up on a tentative proposal by Barry (1997) and Schiller's (1998) account of uvular variants of German *r*, and is in line with what appears to be Ladefoged and Maddieson's (1996:245) interpretation of Lindau's original suggestion.

The family relationships between Dutch *r* variants were explored in Chapters 4 and 5. Drawing together historical, distributional and phonetic evidence establishes the links between individual variants or groups of variants. Combining these leads to the model in Figure 7-1. The relationships in the top half of Figure 7-1, the trills, taps, and fricatives, were established in Chapter 4, and those for the approximants and vowels in Chapter 5. The following two sections summarise the main findings.

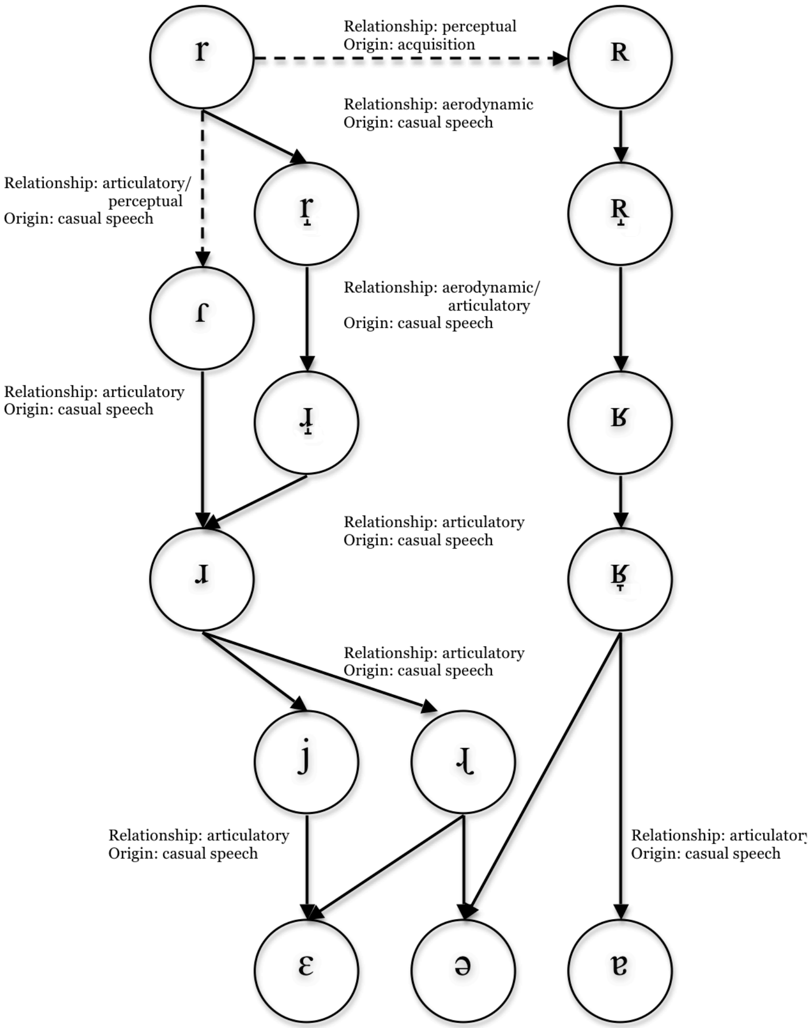

Figure 7-1 Family relationships between Dutch *r* variants. Place of articulation on the x-axis, manner of articulation on the y-axis.

7.2.1 Trills, taps and fricatives

The relationship between the alveolar trill and the uvular trill is perceptual: they share a vibrational pattern with very similar acoustic characteristics (the opening and closure phases have roughly equal duration, and the formant structure during the opening phases is that of a central vowel quality, with fairly evenly spaced formants in both cases). These perceptual similarities are striking since the articulatory properties are very different. Furthermore, the distribution of alveolar vs. uvular variants, including the trills, shows a clear geographical patterning, and the large majority of speakers do not alternate between the two places of articulation, as they do between different manners of articulation. Historical evidence regarding the origin of uvular *r* in Dutch points to it being an innovative form vis-à-vis alveolar consonantal *r*. An explanation for the origin of uvular trilled *r* cannot lie in articulatory reduction, as opposed to that for many other variants (pace Morin 2013). Chapter 4 discusses the hypothesis that uvular *r* in the Germanic and Romance languages goes back to an affectation popularised in Parisian higher circles, but finds little evidence to support the claim and, more importantly, finds counterevidence in the geographical patterning of uvular *r*. The history of a number of European languages and more recent changes in progress also show the innovation and selective expansion of uvular *r* where alveolar *r* is present, though not vice versa. In addition, acquisition studies show the spontaneous development of uvular *r* by individual speakers in dominantly alveolar *r* speaking communities, but again not the opposite (see section 4.1.5). This strongly suggests the origin of uvular *r* to lie in acquisition and to be based on the perceptual similarities between uvular and alveolar *r* – similarities that go beyond those for the trills alone (Engstrand et al. 2007).

The other relationship characterised as principally perceptual rather than articulatory or aerodynamic is that between the alveolar trills and taps. As shown in Chapter 4, despite their different articulatory configurations, tap and trill are very similar perceptually (and even easily confused). Like alveolar trills, taps have a momentary, dynamic nature, and they are accompanied by a vocoid portion that is highly similar in duration and to the opening phases of trills. Taps are, however, articulatorily simpler and more robust, which makes them good historical lenition candidates of alveolar trills. Their origin is therefore indicated in the diagram as lying in casual speech processes, even though there is no direct articulatory reduction.

The articulatory complexity and aerodynamic circumstances of alveolar and uvular trills were argued to form the origin of trilled fricatives and fricatives. Fricative variants are expected to occur during casual speech as a result of trill failure, resulting from small changes in articulatory setting or differences in air pressure. In other words, their origin lies in the trade-off between the tight phonetic constraints that apply to trill production and the common processes of (temporal and gestural) reduction that take place in casual speech. These processes are strongly context-sensitive, and fricatives occur exactly where trill failure is most likely: fricativisation of the alveolar trill, for instance, is most frequent in the context of high vowels, and at the word edges. Predicting the occurrence of fricative *r* is not deterministic, however, as there are no contexts in which it is entirely general. Conversely, it is also not the case that all fricative *r* tokens are synchronically failed trills; they are available as stylistic variants to many speakers, especially in coda positions (where they make up 45% of all alveolar *r* and 75% of all uvular *r*), and there is geographical and social variation in the relative numbers of fricatives, so speakers are able to use them alongside other variants as markers of identity.

In this thesis, *lenition* has been the point of departure for describing the relationships between variants at each end of the arrows in Figure 7-1, all but one pointing downward on the axis of manner of articulation. However, in all cases in the top half of the diagram, characterising the relationships between variants as one of *lenition* is at least controversial. The emergence of uvular trills, for instance, is demonstrably not the result of articulatory reduction of alveolar trills. While the acquisition data discussed in section 4.1.5 indicate that the relationship between alveolar and uvular *r* is unidirectional, with uvular *r* being innovated in alveolar *r* speaking communities but not vice versa, phonetically speaking uvular trills are not "simpler", "reduced" or "a step toward zero". The relationship between the alveolar trill and tap is one of a more complex vs. a less complex articulation, and a shift towards a tap can diachronically be described as lenition under most traditional definitions of the term, but, as recapitulated above, there is again no direct articulatory reduction involved. Finally, the emergence of fricative *r* from trills does involve articulatory reduction and was argued in Chapter 4 to be a true case of lenition. While this runs counter to the traditional view of lenition as a rise in sonority (a change from a true liquid such as a trill to a fricative in fact entails a decrease, if the sonority scale is assumed to have a phonetic basis), the interpretation of lenition in this thesis insists on the involvement of articulatory reduction, following Bauer (1988; 2008). In all, this leads to the following proposals for the analysis of *r* variants. The uvular trill should not be analysed as a lenited form of the alveolar trill, and their relationship is primarily perceptual; the alveolar tap is a lenition form in the diachronic sense, but not synchronically, due to the absence of a direct articulatory link; fricative variants *are* lenition forms, despite not fitting the "increased sonority" definition. The general implication for theories of lenition is that the sonority scale using fixed phonetic classes is unhelpful if diachrony is not taken into account; fricatives may be derived from stops or from trills, and in both cases constitute lenition.

7.2.2 Approximants and vowels

The *r* variants in the bottom half of Figure 7-1 are all characterised as related in terms of articulatory reduction, and as having their origin in casual speech. Moving down from the fricatives to the consonantal approximants (see section 5.1.3) and from these to the vocalic approximants and vowels involves, in each case, an increase in the degree of articulatory openness, or in Articulatory Phonology terms, from "narrow" to "mid" to "wide" tongue tip or tongue body constriction degrees. This is where the concept of lenition would appear to play its most obvious role. However, as discussed in Chapter 5, even here it is not so straightforward.

Importantly, not all approximants are created equal: there is a sharp difference between the "consonantal" approximants, [ɹ] and [ʁ̞], and the "vocalic" ones. The former are approximants in that there is no occlusion or close approximation of the articulators, but they are otherwise very similar to the alveolar tap [ɾ] and the uvular fricative [ʁ], respectively. Distributionally, too, they follow these variants in occurring mostly in onsets. In contrast, the vocalic approximants, [ɻ] and [j], and the vowels diverge more strongly from the consonantal (trill, tap, fricative) variants, in aligning with the rhyme, rather than the onset, of the syllable. While the consonantal approximants can be straightforwardly analysed, therefore, as articulatorily reduced versions of the tap and the uvular fricative, respectively, the picture for the vocalic ones, especially the retroflex/bunched approximant, is more complex. A summary of the issues is given in 7.2.2.1; it is followed by a brief discussion of vowel realisations of Dutch *r*.

7.2.2.1 The retroflex/bunched approximant

The major point at which a lenition approach to the bottom half of Figure 7-1 runs into trouble is that the retroflex/bunched approximant does not fit neatly into the pattern of progressive articulatory reduction that is implied by the y-axis in the diagram. As shown by the articulatory study discussed in section 5.2.2, the gestural configurations of both the retroflex and the bunched variant display a considerable degree of complexity when compared with the variant it is argued to ultimately derive from, the alveolar approximant, involving at least two constrictions. In addition, the retroflex/bunched approximant was shown to be a *categorical* coda allophone for speakers, i.e. one that is not part of a continuum with other, more consonantal variants these speakers use in the onset. Finally, the retroflex/bunched approximant is a coda variant both for speakers who have alveolar *r* in onsets, and speakers with uvular onset *r*. For these reasons, it is difficult to analyse the retroflex/bunched approximant in terms of lenition. However, while the variant has an obviously different status from many others synchronically, there is good diachronic evidence to analyse it as a lenition variant after all: the characteristic F3 lowering that is common to both the retroflex and the bunched configuration (the reason these need to be considered as one variant in the first place) turns out also to be present in other, more consonantal alveolar *r* variants, including alveolar trills in accents where the retroflex/bunched approximant is not present. In addition, cross-linguistic evidence regarding its patterning with other variants strongly suggests the retroflex/bunched approximant should be classed with alveolar variants rather than uvular ones. Therefore, the retroflex/bunched approximant is able to find its place in the model of rhotic relationships: the retroflex (though not the bunched) variant will indeed have originated in articulatory reduction of a more consonantal apical *r*. However, this leaves its consequent development, in terms of its broadening to bunched alternants and in terms of its spreading throughout the speech communities (including to speakers who have no alveolar *r* variants) to be explained. Such an explanation involves studying its precise phonetic properties (including the perceptual near-equivalence between retroflex and bunched articulations), the phonological systems it forms part of, and the sociolinguistic situation surrounding it. All three were in fact touched upon in the present study, and the major findings are summarised below.

The ultrasound tongue imaging study described in Chapter 5 serves as a first step in examining the phonetics of the Dutch retroflex/bunched approximant (see also Scobbie and Sebregts 2010). A principal finding of this study, reflected in the label chosen for the variant, was that there is indeed variation among Dutch speakers in how the approximant is realised, similar to that found for American English [ɹ]. Secondly, while the articulatory differences between the retroflex and the bunched variant are large, perceptually they are very similar, so much so that in the acoustics-only urban accent data, they cannot be separated. The acoustic target for both articulatory configurations appears to be a low F3, or an F2/F3 near-conflation. The relatively robust acoustics which can be achieved by various articulations, i.e. its *quantal* nature (Stevens 1989), may explain, from a phonetic point of view at least, the retroflex/bunched approximant's success in spreading beyond speakers for whom it is an innovative reduction variant.

The articulatory study also produced important information about the phonological systems of the speakers involved: it turned out that the onset variants speakers combine the retroflex/bunched approximant with do not influence, and are not sensitive to, the articulatory strategy with which the coda approximant is realised. That is, the study found all possible combinations of onset *r* (alveolar or uvular) with approximant coda *r* (retroflex or bunched). This means that some – and, based the urban accent data, potentially many – speakers have a highly abstract pattern of onset/coda *r* allophony: they combine uvular trills or fricatives in onsets with retroflex approximants in the coda, variants for which virtually no gestures overlap. This provides another piece of the puzzle: it makes it more likely that the retroflex/bunched approximant is a "borrowing" of sorts by uvular *r* speakers, not a development along a phonetic continuum from the onset variants they use. Support for this hypothesis also comes from other languages with uvular *r*, such as German and Danish, from which this pattern is absent. While certain dialects of Norwegian *do* have the uvular+retroflex pattern, they are located in precisely those areas where an alveolar~uvular "dialect contact" situation exists, similar to that in Netherlandic Dutch.

Finally, the sociolinguistics of the retroflex/bunched approximant are crucial to explaining its rapid rise: despite attracting negative comments in popular media, it is a high prestige variant, as shown by the studies by Van Bezooijen and colleagues (van Bezooijen et al. 2002; van Bezooijen and van den Berg 2004; van Bezooijen 2005). The results from the urban accent data confirm this, by showing that the retroflex/bunched approximant is most frequent among young female speakers, exactly the group that would be expected to lead such a change.

In conclusion, the retroflex/bunched approximant holds a special place in the model of rhotic relationships. Viewed from a diachronic perspective, it is likely that it finds its origin in the lenition of more constricted, alveolar, variants. However, synchronically, it cannot be analysed as articulatorily reduced vis-à-vis any of the variants above it in the diagram, and it has a different status from most of the other variants, namely that of a categorical allophone, represented in the phonology, not just phonetically. The current spreading of the variant within the speech community likewise is not linked to its articulatory properties, but largely to its sociolinguistic status, perhaps aided by its perceptual properties (see Rácz 2013 for discussion of the notion of salience as an explanatory factor in sound change).

7.2.2.2 Other vocalic variants

The final set of *r* variants in Figure 7-1 is that of the palatal approximant [j], and the vowels, which can be of a mid front [ɛ], central [ə], and low [ɐ] character. As shown in section 5.3, the vowel variants are strongly context-dependent: they occur most in absolute word-final position, and after front vowels. In addition, they are mainly a feature of particular accents, especially Rotterdam and Nijmegen, and hardly occur at all in Amsterdam, Leiden, and the Belgian Dutch accents. The distributions of the three vowel variants over speakers show quite clearly which other variants they are related to. All of them are found most with speakers who also use other vocalic variants. The mid front vowel, for instance, is mostly found in Rotterdam, with speakers who also use another variant that is largely confined to Rotterdam, the palatal approximant. In fact, the two variants are most likely part of a continuum of relatively front approximant realisations, from more glide-like to more open ones. Low vowel realisations occur most in Nijmegen, and co-occur with other approximants, but also with more consonantal uvular *r* variants, which suggests a link between low vowel and uvular variants as found in present-day Standard German *r*-allophony. Finally, schwa-like realisations are found with most speakers generally, but alternate most with retroflex/bunched approximants, and the phonetic link between these variants is supported by evidence from the UTI study.

In general, the vocalic variants conform to expectations as the most lenited realisations of *r*, both in their distribution over contexts and in how they alternate with other variants within speakers. However, the data show a significant effect of age on the incidence of the vowel variants in what is at first glance the unexpected direction: vowel variants are more frequent among older speakers. Superficially, this contradicts the idea of the more lenited forms being the innovative ones. The explanation for the apparent-time pattern is simple, however: the retroflex/bunched approximant is dominant in codas to such an extent among younger Netherlandic Dutch speakers, that its rise is to the detriment of all other variants, including the other vocalic ones. This shows that the idea of progressive lenition in the rhotic relationships model, although predicting directionality, is not deterministic, and that social factors are able to disturb the general trends.

7.3 Implications of the family relationships model

7.3.1 Capturing the unity in *r*-variation

The model of rhotic family relationships addresses the question of what unites the many variants of *r*. It does so in the first instance specifically for Dutch *r*, but it should be applicable more generally to any language. Languages with substantial *r*-variation like that in Dutch, such as Spanish (Lipski 1990) and Portuguese (Rennicke 2013), are predicted to have similar patterning and the same directionality, although the particulars, both phonetically and socially, may be very different. The model takes a radically different view from other attempts to characterise all *r*-sounds as belonging to a single class.

Given that there is no single phonetic property that is shared by all rhotics, attempts to capture the cross-linguistic identity of *r*-sounds have been mostly within more formal phonological approaches. Specific proposals were discussed in section 6.2.3, and include specifying all *r*-sounds as having the feature [+rhotic] (Hall 1997), as having no particular featural content but occupying a fixed point on the sonority scale (Wiese 2001a), or as sharing a structural configuration (Walsh Dickey 1997). Such approaches are inevitably ad-hoc, non-restrictive, may involve circularity, and are insufficient (and sometimes inadequate) for the data they try to cover. The present study therefore rejects capturing the unity of the rhotic class by means of synchronic, universal abstract features within the phonology.

The present model follows those of Lindau (1985) and Magnuson (2007) in claiming that the unity of rhotics lies in the shared properties of overlapping sets of members of its class, not in a single phonetic or phonological feature that is characteristic of them all. In addition, it improves on its forerunners by not only noting phonetic resemblances between *r* variants, but also drawing explicit links between them in terms of diachronic patterns of lenition. Making the relationships between variants explicit takes the focus away from what they share, i.e. their resemblances, and turns it instead on how they differ. That alveolar trills and alveolar fricatives are both alveolar does not establish their relationship: there are many other alveolar speech sounds, and many of these do not belong to the class of rhotics. What is of interest is the knowledge that trills are likely to fail under specific circumstances, and that the result of this failure is a fricative – this knowledge comes from detailed phonetic studies into the aerodynamics of trill production. Armed with the information of where such trills are most likely to lead to fricatives (in casual speech; in the context of voiceless consonants and high vowels), the following step in the analysis is to check the distribution of alveolar trills and fricatives in the data to determine whether the predictions from the phonetic studies are borne out in the synchronic variation data. If this is the case, it provides grounds for establishing a diachronic relationship between the two variants rooted in lenition processes in casual speech. Additional evidence may come from historical sources, or, as in this case, from the existence of intermediate realisations (fricative trills and trilled fricatives).

This model is predictive in a number of ways. First, it predicts the direction of changes. These are located in casual speech, and mostly involve lenition, defined foremost as articulatory reduction. In line with most theories of lenition, changes should therefore be from "stronger" to "weaker" articulations, and take place in weaker contexts before stronger ones. Of course, this necessitates a theory of what "stronger" and "weaker" mean in these contexts. The traditional view of a strength hierarchy as an inverse sonority hierarchy, with obstruents at one end and vowels on the other, perhaps needs some modification in order to work for *r*. Fricative variants, in particular, are shown to be lenited forms of (the contextually stronger, but aerodynamically vulnerable) trills. Trills appear at the top of the hierarchy, which may reflect that it is one of complexity (articulatorily and aerodynamically) rather than degree of constriction. Alternatively, trills (and taps) might be analysed as types of stops, in which case the traditional hierarchy can remain unchanged.

A second predictive element in the model is that if the two sources of evidence do not align, i.e. if the predicted phonetic environments for specific variants do not square with the distributional patterns in the data, this must be the effect of social factors. While the model (like any model of sound change) is not deterministic – no changes *must* happen or are fully automatic – the prediction concerning directionality entails that changes in the opposite direction should not occur. The case of the retroflex/bunched approximant shows that sometimes they do: an articulatorily relatively complex variant, it is spreading rapidly among speakers of the Netherlandic accents of Dutch, including to the detriment of more reduced variants. Furthermore, it has entered into unexpected patterns of allophony for individual speakers, appearing to have become a phonological rather than a phonetic allophone. The model can, in other words, only be one element in the explanation of patterns of *r*-variation; sociolinguistic evidence is absolutely crucial. This is also illustrated by the situation regarding uvular vs. alveolar *r*: although there is abundant evidence for the directionality between them, the current distribution of alveolar and uvular variants in urban Dutch and their relationship not being one of articulatory reduction show the importance of external evidence.

7.3.2 The role of diachrony in linguistic theory

The model of rhotic relationships places the locus of explanation of sound patterns, including patterns of phonetic variation, in diachrony rather than synchrony. It aligns itself, therefore, with the *evolutionary* models discussed in Chapter 1, section 1.3.3. The central idea is that phonetic biases lead to variation and change, as new variants emerge in specific contexts and come to alternate with pre-existing ones. In Croft's (2006) terms, this is the situation of "altered replication". Over time, particular variants may increase in frequency, to the detriment of others ("differential replication"). In addition, the initially fine phonetic variation may congeal into more robust patterns of variation, including broader allophonic patterns, and potentially lead to phonological reanalyses. The current study of Dutch *r*-variation contains both such robust patterns and a plethora of finer-grained phonetic variation. The model developed in Chapters 4 and 5 attempts to explain both types of variation focusing primarily on altered replication, i.e. the circumstances under which particular variants are predicted to emerge. However, as shown on a number of occasions, a full account of the patterns of *r*-variation also needs to take in evidence of differential replication, i.e. the social mechanisms driving variation and change. These were the focus of Chapter 3, specifically, but also invoked on a number of occasions for explanatory purposes in later chapters.

The results of the present study illustrate the importance of a diachronic perspective in explaining sound patterns, in this case: patterns of variation. Note, however, that a diachronic *perspective* does not entail that only diachronic *evidence* is useful. On the contrary, this study primarily makes use of new data describing synchronic patterns. These distributional patterns are viewed, however, from the perspective of their inferred origins in generally well-understood processes in casual speech.

7.3.3 Lenition and articulatory reduction

The primary phonetic bias examined in the present study is that of lenition, under a strict definition as articulatory reduction. As indicated in Figure 7-1, this has been argued to be at the basis of most of the variants. There are a number of exceptions or *apparent* exceptions. A true exception is the origin of uvular *r*. As an innovation in alveolar *r* communities, it arises during acquisition, most likely on the basis of its perceptual similarities to alveolar *r*. The alveolar tap, meanwhile, does not arise as the result of the failure to meet a phonetic target (a trill), but it is a reduction in that a less complex (and more robust) articulation substitutes a more complex, perceptually similar, one.

Two other types of *r* are apparent exceptions. For the fricative variants, while the impetus is articulatory, aerodynamic circumstances play a role in facilitating the reduction. The retroflex/bunched approximant, finally, is the most complex case. Synchronically, as the ultrasound study showed, it cannot be analysed as "reduced" in any way, compared to the more consonantal *r* variants. In both its retroflex and bunched variants, it has a dual constriction, and neither of the constriction locations are straightforwardly related to those of other variants. In addition, the articulatory study showed that some speakers have strongly categorical allophonic patterns, including uvular trill ~ retroflex approximant, for which there seems to be no articulatory relationship between the allophones. On the other hand, there is evidence, both from acoustic data from the urban accent corpus and from the ultrasound data, that the retroflex approximant may have originated from reduction of more constricted alveolar variants after all. First, the acoustic target the retroflex/bunched approximant seems to entail, a low F3 or F2/F3 conflation, is also present in more constricted variants, including trills and taps. This suggests that this acoustic cue to rhoticity, likely not the most important one in more constricted variants, has taken on a much more prominent role. Secondly, one of the speakers in the ultrasound study had consonantal alveolar *r* in onsets, and a post-alveolar/retroflex approximant in coda with much less of the characteristic perceptuo-acoustic effect. She in fact showed exactly the kind of pattern expected in the incipient stages of a change toward a retroflex/bunched approximant: her coda allophones did look like articulatorily reduced variants of those in onsets, and her target for the coda seemed more articulation- than perception-based, to the point of having gestures after the cessation of voicing (i.e. without acoustic payoff).

In other words, in examining the retroflex/bunched approximant from the perspective of ongoing sound change, we are able to see three stages of such a change: the context in which the change can take place (speakers whose coda allophones are consonantal variants of *r*, but which show the acoustic F3 effect without reason to assume it forms part of the phonological specification or phonetic target), its origin in articulatory reduction (speakers whose post-alveolar/retroflex coda allophones are reduced variants of their onset allophones), and its outcome (speakers whose coda allophones appear to have an acoustic target but are articulatorily unrelated to their onset ones). It also shows that synchronically, for speakers with the latter pattern, the coda variant does not need to be "weaker" in any way in terms of numbers of features or gestures present, and a process like lenition, or "vocalisation" does not need representation in a phonological grammar.

Of course, speakers may synchronically weaken articulations, and trade off ease of articulation and the need for perception as per Lindblom (1990), but this takes place on a continuum during speech *production*, and needs no place in the phonology. Crucially, lenition is a diachronic, asymmetrical process, which creates variation; the variants of a single functional unit create a pattern of variation, which will be copied by a new generation of language learners (they need to in order to sound native), and since generations of speakers overlap, rather than succeed each other discretely, these patterns overlap too.

7.3.4 Representational issues

Approaches to lexical representations of /r/ were considered in Chapter 6. The discussion centred on the question of the possible purposes of such representations. These include accounting for the phonotactic behaviour in a phonological system (idiolect), modelling *r*-allophony, also within a language system, accounting for the cross-linguistic unity of *r*-sounds, and accommodating their large-scale variation. The conclusion was that these goals are incompatible, and that they in fact require generalisations at different levels, and sometimes in completely different spheres of linguistic description. Accounting for *r*'s similar behaviour across languages should, as argued at several points throughout this thesis, not be the purpose of a phonological representation at all. The relationships between *r* variants is a diachronic one, its cross-linguistically shared universals and tendencies find explanation in phonetic biases that hold in interaction and acquisition, as well as in social factors, and the fact that *r* behaves similarly in many languages despite being phonetically diverse can often be traced to a shared history between these languages.

For the classical phonological purpose of characterising phonological behaviour, a relatively small number of features is likely to be enough as long as /r/ is characterised as a non-nasal, non-lateral sonorant. This represents a high level of linguistic organisation and abstraction. This can in principle also be used to describe allophonic patterns, but as discussed in section 6.2, this quickly runs into trouble given the wide variation of *r* and the difficulty involved in deciding top-down (limited by the feature set) which allophones are encoded phonologically and which are not. The Exemplar Theory framework that served as the underlying assumption for representations in this thesis conversely encodes all variation by definition, as encountered tokens are stored including their phonetic detail. Hybrid models include both these phonetically-detailed (and socially-indexed) representations, as well as higher-level generalisations over them. This means that the question of phonological vs. phonetic allophones is approached bottom-up: such generalisations are made over clusters of tokens. If a cluster containing particular *r* variants remains categorically distinct (phonetically and distributionally) from other *r* tokens, this will be evidence for the speaker to set up a different (phonological) category. As argued above, an example of such a categorical allophone is the retroflex/bunched approximant. If, on the other hand, particular *r* variants differ only gradiently from others (for example, alveolar trills containing more or less voicing, running from fully voiced to voiceless), these will not constitute a new category. Until, that is, it is found that such fine-grained, gradient variation can come to function socially, as it was with coda trill voicing in Antwerp and Bruges. Sociolinguistic information, as much as the linguistic-distributional, can lead speakers to make generalisations. The data in the present study show that careful examination of phonetic data provides evidence for the social and linguistic categories that speakers may set up.

7.4 Closing remarks

7.4.1 How extraordinary is Dutch *r*-variation?

It is implicit in the topic of the present study that Dutch *r*-variation represents something out of the ordinary, that the variation is *particularly* large and complex. This notion was, in fact, the basis for this study. The many examples from other languages will have made it clear, however, that Dutch (interpreted as the sum of all its varieties) does not necessarily stand out all that much from other languages, especially more or less closely related ones. In varieties of German, in particular, *r* can be alveolar or uvular, and range in manner from trills, taps, and fricatives to approximants and vowels, as well as being able to disappear completely, all very similarly to Dutch (Ulbrich 1972; Schiller 1998; Ulbrich and Ulbrich 2007), while Swedish (Muminovic and Engstrand 2002) and Norwegian (Kvale and Foldvik 1992) show only marginally narrower ranges of variation. The Dutch-like *r*-variation in Spanish (Lipski 1994; Penny 2000; Blecua Falgueras 2001) has been remarked upon a number of times throughout this thesis, as has that in Portuguese (Mateus and d'Andrade 2000; Oliveira and Cristófaro-Silva 2002; Jesus and Shadle 2005; Rennicke 2013). And while there appears to be less variation in Italian, there is more than often assumed (Romano 2013). In languages such as Polish and Greek, too, where *r* is generally described as an alveolar trill or tap, fricative and approximant realisations have been found (Jaworksi and Gillian 2011; Baltazani and Nicolaidis 2013). In fact, the amount of *r*-variation found in a particular language seems mostly a corollary of how well-described it is in sociophonetic studies, rather than the other way around. This may also be why less variation seems to exist outside of the European languages, although it cannot be ruled out that many of the changes (and much current-day variation as a result of it) in the latter (at least those of Indo-European origin) actually have a shared source. Nevertheless, where careful phonetic studies do exist, they describe similar degrees of *r*-variation, as for Japanese (Magnuson 2008) and Arabic and Farsi (Rafat 2010).

Where the variation in Dutch does appear to be extraordinary is that almost all of the variants described here are acceptable in the standard variety – at least in the Netherlands. In the countries where the languages mentioned above are spoken, *r*-variation is either limited to certain social domains, is a feature of particular geographical dialects, or is considered 'pathological' – that is, as speech errors. That Netherlandic Standard Dutch allows so much variation probably says as much about the situation concerning the standard language in the Netherlands as it does about Dutch *r* itself. As Smakman (2006:38) explains, in the Netherlands, more so than in Flanders, the standard language is the variety used for everyday interaction in informal circumstances. In addition, the *Randstad* area, where five out of the six cities in the urban accent corpus are located, is socially dominant within the country, and its non-standard linguistic features are gradually assimilated into what is considered standard (cf. Pinget et al. 2014). Finally, what is considered Standard Dutch permits a large degree of regional variation at present (Smakman 2006:283). While the situation regarding everyday use of the standard is different in Flanders, Belgian Standard Dutch may also exhibit an increasing permissiveness, at least with regards to *r*, as the rise of uvular *r* shows (Tops 2009:198).

The finding that Dutch *r*-variation, upon closer inspection of data sources from other languages, may be less exceptional than it seems at first illustrates the importance of studies that take in phonetic, social and dialectal detail – not just for the purpose of cataloguing this detail, but also for the linguistic theories it informs.

7.4.2 Synthesising sources of linguistic evidence

Labov (1972b) discusses methodological issues in linguistic research, labelling the subfields of linguistics according to where their practitioners are found working: “the library, the bush, the closet, the laboratory, and the street” (1972:99), referring to historical linguistics, anthropological or field linguistics, theoretical linguistics, experimental linguistics and sociolinguistics, respectively. He concludes that linguists should seek convergence, and combine data from various sources and methods for a “broad attack” on complex problems. The present study is an attempt to attack *r*-variation from various directions, using the methodologies appropriate for each viewpoint. Labov’s library refers to the traditional data method of historical linguistics, examining texts – the historical record. This method is invoked in Chapter 2 for the survey of previous accounts of Dutch *r*-variation, and most crucially in Chapter 4, for exploring the question of the origin of uvular *r* in Germanic (and, by extension, Dutch). However, Labov suggests that there is another source available for questions in the diachronic realm: present-day changes. Processes of change going on around us, he argues, are the same as have operated in the past, and will continue to operate (“the uniformitarian principle”). He advocates use of the Neogrammarian hypothesis of exceptionless change (as a heuristic, not in a substantive sense) in trying to find the regularity in sound change, which can in turn help to establish which current-day patterns of variation need additional explanation. Labov thus advocates the use of the present to explain the past. However, by adding in the additional source of evidence from laboratory-controlled phonetic evidence on the *source* of sound change, as done in this thesis in Chapters 4 and 5, it is also possible to do the opposite, explaining the present by inferring the past (importantly, by introducing experimental phonetic data, circularity is avoided).

An additional source of experimental, “laboratory” data in this thesis comes from the articulatory study of retroflex/bunched approximant *r* in Chapter 5. These data have also proven not only interesting for the sake of establishing the phonetic reality of present-day *r* variants, but also to contribute to charting its possible historical development, and to informing the theoretical debate on its current phonological status. The main source of data used here, however, has been a combination of the “bush” and “street”. The data collection method used for the urban accent corpus was that of field linguistics, elicitation, while the design of the study was sociolinguistic, aimed at finding the effects of geography, sex and age of the speaker on the variation. For Labov, the method of the "street" is observation – the recording of spontaneous utterances – rather than elicitation. This is perhaps the greatest limitation of the current study: elicited speech gives the researcher control over the context, but not over the extent to which speakers accommodate or monitor their performance. Being able to gather a large amount of controlled data outweighed the need for more naturalistic speech in this case, but the use of *r* in spontaneous speech is an important avenue for further research, especially given the emphasis on casual speech processes for explanation. Whether the hypothesised processes of lenition mirror those found in speech performance is an empirical question whose answers will help to improve the rhotic relationships model.

Finally, a characterisation of the theoretical side of linguistics as "the closet" shows, as relevant as much of the discussion in it is, the age of Labov's article. It suggests theory formation exists only as a purely solipsistic exercise, whereas multiple sources of evidence, some (such as brain imaging, computational modelling) barely imaginable in 1972, now inform modern theories, in attempts towards Labov's "convergence" ideal. If modern linguists use a closet, it is because that is where their library card, hiking boots and lab coat are stored.

References

Andersen, H. 1972. Diphthongization. *Language* 48(1): 11-50.

Anttila, A. 1997. Variation and phonological theory. In Hinskens, F., R. v. Hout & W. L. Wetzels (eds.), *Variation, Change and Phonological Theory,* Amsterdam: John Benjamins.

Articulate Instruments, Ltd. 2010. Articulate Assistant User Guide, Version 1.18.Edinburgh, UK: Articulate Instruments Ltd.

Auger, J. 2002. Phonological variation and Optimality Theory: Evidence from word-initial vowel epenthesis in Vimeu Picard. *Language Variation and Change* 13: 253-303.

Backley, P. 1993. Coronal: the undesirable element. *UCL Working Papers in Linguistics* 5: 301-323.

Baetens-Beardsmore, H.B. 1971. *Le Français régional de Bruxelles.* Brussels: Presses Université de Bruxelles.

Bailey, G., T. Wikle, J. Tillery & L. Sand. 1993. Some patterns of linguistic diffusion. *Language variation and change* 5: 359-390.

Baker, A. 2008. Addressing the actuation problem with quantitative models of sound change. *University of Pennsylvania Working Papers in Linguistics* 14(1): 29-41.

Baker, A., D. Archangeli & J. Mielke. 2011. Variability in American English s-retraction suggests a solution to the actuation problem. *Language Variation and Change* 23(3): 347-374.

Baltazani, M. & K. Nicolaidis. 2013. The many faces of /r/. In Spreafico, L. & A. Vietti (eds.), *Rhotics: New Data and Perspectives,* Bozen-Bolzano: Bozen-Bolzano University Press. 125-144.

Barnes, J.A. 2002. *Positional Neutralization: A Phonologization Approach to Typological Patterns.* PhD thesis, University of California, Berkeley.

Barry, W.J. 1996. Some fundamental problems of looking at connected speech. *Arbeitsberichte des Instituts für Phonetik und Digitale Sprachverarbeitung der Universität Kiel (AIPUK)* 31: 113-117.

Barry, W.J. 1997. Another R-tickle. *Journal of the IPA* 27(1-2): 35-45.

Basbøll, H. 2005. *The Phonology of Danish.* Oxford: OUP.

Bates, D. & M. Maechler. 2009. lme4: Linear mixed-effects models using S4 classes, R-package 0.999375-32.

Baudouin de Courtenay, J. [1895] 1972. An Attempt at a Theory of Phonetic Alternations. In Stankiewicz, E. (ed.), *A Baudouin de Courtenay Anthology: The Beginnings of Structural Linguistics,* Bloomington, IN: Indiana University Press. 144–212.

Bauer, L. 1988. What is lenition? *Journal of Linguistics* 24: 381-392.

Bauer, L. 2008. Lenition revisited. *Journal of Linguistics* 44: 605-624.

Beckman, M.E., B. Munson & J. Edwards. 2007. Vocabulary growth and the developmental expansion of types of phonological knowledge. In Cole, J. & J. Hualde (eds.), *Laboratory Phonology IX.* 241-264.

Bell-Berti, F. & K.H. Harris. 1981. A temporal model of speech production. *Phonetica* 38: 9-20.

Berg, B. van de. 1974. *Foniek van het Nederlands, 5e druk met medewerking van G.L. Meinsma*. The Hague: Van Goor.

Berg, B. van de. 2003. Phonology & Morphology of Dutch & Frisian Dialects in 1.1 million transcriptions. Goeman-Taeldeman-Van Reenen project 1980-1995. *Meertens Instituut Electronic Publications in Linguistics*. Amsterdam: Meertens Instituut.

Bergem, D. van. 1994. A model of coarticulatory effects on the schwa. *Speech Communication* 14(2): 143-162.

Bezooijen, R. van. 2003. De huig-r in het Nederlands: routes en mechanismes. In Koole, T., J. Nortier & B. Tahitu (eds.), *Artikelen van deVierde Sociolinguistische Conferentie,* Delft: Eburon. 80-89.

Bezooijen, R. van. 2004. Hoe vej is de ej?: De verspreiding van de Gooise r. *Onze Taal* 73(1): 7-9.

Bezooijen, R. van. 2005. Approximant *r* in Dutch: routes and feelings. *Speech Communication* 47(1-2): 15-31.

Bezooijen, R. van, S. Kroezen & R. van de Berg. 2002. Front approximant /r/: a new and vigorous change in Dutch. In Broekhuis, H. & P. Fikkert (eds.), *Linguistics in the Netherlands 2002,* Amsterdam: John Benjamins.

Bezooijen, R. van & R. van den Berg. 2004. De Gooise r: wie ziet er wat in en waarom? *Taal en Tongval* 56(Themanummer 17): 86-108.

Bhat, D.N.S. 1974. The Phonology of Liquid Consonants. *Working Papers on Linguistic Universals* 16: 73-104.

Blanquaert, E. 1934. *Praktische Uitspraakleer van de Nederlandse Taal*. 6th edn. Antwerpen: De Sikkel.

Blecua Falgueras, B. 2001. *Las Vibrantes del Español: Manifestaciones Acústicas y Procesos Fonéticos*. Universidad Autónoma de Barcelona.

Blevins, J. 2004. *Evolutionary Phonology*. Cambridge: CUP.

Bloch, O. 1927. L'assibilation d'R dans les parlers gallo-romans. *Revue de Linguistique Romane* 3: 92-156.

Boersma, P., J. Dekkers & J. van de Weijer. 1998. Introduction: OT: phonology, syntax and acquisition. In Dekkers, J., F. v. d. Leeuw & J. v. d. Weijer (eds.), *OT: Phonology, Syntax and Acquisition*.

Boersma, P. & D. Weening. 2001. Praat: doing phonetics by computer [Computer program], http://www.praat.org.

Booij, G. 1995. *The Phonology of Dutch*. Oxford: Clarendon Press.

Booij, G. 2002. *The Morphology of Dutch*. Oxford: OUP.

Boomershine, A. R. 2005. *Perceptual Processing Of Variable Input In Spanish: An Exemplar-Based Approach To Speech Perception*. PhD thesis, Ohio State University.

Borger, L., H. Fricke & M. Kvēpa. 2012. Language shift in Leiden. Change in the realization of the phoneme /r/ by speakers of Leids. Ms. University of Leiden.

Borowsky, T. & B. Horvath. 1997. L-Vocalisation in Australian English. In Hinskens, F., R. v. Hout & W. L. Wetzels (eds.), *Variation, Change and Phonological Theory,* Amsterdam: John Benjamins.

Botma, E.D. 2011. Sonorants. In Oostendorp, M. v., C. J. Ewen, E. V. Hume & K. Rice (eds.), *The Blackwell Companion to Phonology,* Malden, MA. / Oxford: Wiley-Blackwell. 171-194.

Botma, E.D., K. Sebregts & D. Smakman. 2012. The phonetics and phonology of Dutch mid vowels before /l/. *Laboratory Phonology* 3(2): 273-298.

Bradley, T.G. 2004. Gestural timing and rhotic variation in Spanish codas. In Face, T. L. (ed.), *Laboratory Appoaches to Spanish Phonology,* Berlin: Mouton de Gruyter.

Brink, D.T. 1970. *Problems in Phonological Theory: a Generative Phonology of Dutch*. Ann Arbor, Michigan: University Microfilms.

Britain, D. 2004. Geolinguistics – Diffusion of Language. In Ammon, U., N. Dittmar, K. Mattheier & P. Trudgill (eds.), *Sociolinguistics: International Handbook of the Science of Language and Society,* Berlin: Mouton De Gruyter. 34-48.

Broadbent, J. 1991. Linking and intrusive r in English. *UCL Working Papers in Linguistics* 3: 281-302.

Browman, C.P. & L. Goldstein. 1990a. Representation and reality: physical systems and phonological structure. *Haskins Laboratories Status Report on Speech Research* SR-105/106: 83-92.

Browman, C.P. & L. Goldstein. 1990b. "Targetless" schwa: an acoustic analysis. *Haskins Laboratories Status Report on Speech Research* SR-101/102: 194-219.

Browman, C.P. & L. Goldstein. 1992. Articulatory phonology: an overview. *Phonetica* 49: 155-180.

Bruce, G. & O. Engstrand. 2006. The phonetic profile of Swedish. *STUF - Language Typology and Universals* 59(1): 12-35.

Bybee, J.L. 2000. The phonology of the lexicon: evidence from lexical diffusion. In Barlow, M. & S. Kemmer (eds.), *Usage-Based Models of Language,* Stanford: CSLI. 65-85.

Bybee, J.L. 2001. *Phonology and Language Use*. Cambridge: CUP.

Bybee, J.L. 2012. Patterns of lexical diffusion and articulatory motivations for sound change. In Solé, M. J. & D. Recasens (eds.), *The Initiation of Sound Change: Perception, production, and social factors* Amsterdam: John Benjamins.

Catford, J.C. 1977. *Fundamental Problems in Phonetics*. Edinburgh: Edinburgh University Press.

Cedergren, H. & D. Sankoff. 1974. Variable rules: Performance as a statistical reflection of competence. *Language* 50(2): 333-355.

Chambers, J.K. & P. Trudgill. 1998. *Dialectology*. Cambridge: Cambridge University Press.

Chomsky, N. 1965. *Aspects of the Theory of Syntax*. Cambridge: MIT Press.

Chomsky, N. 1993. A Minimalist Program for Linguistic Theory. In Hale, K. & S. J. Keyser (eds.), *The View from Building 20,* Cambridge, MA: MIT Press.

Chomsky, N. & M. Halle. 1968. *The Sound Pattern of English*. New York: Harper & Row.

Coetzee, A.W. & J. Pater. 2010. The place of variation in phonological theory. In Goldsmith, J., J. Riggle & A. Yu (eds.), *The Handbook of Phonological Theory,* Oxford: Blackwell.

Cohen, A., C.L. Ebeling, K. Fokkema & A.G.F. van Holk. 1961. *Fonologie van het Nederlands en het Fries. Inleiding tot de Moderne Klankleer*. The Hague: Martinus Nijhoff.

Cohn, A.C. 1993. Nasalisation in English: Phonology or phonetics. *Phonology* 10: 43-81.

Cohn, A.C. 2006. Is there gradient phonology? In Faneslow, G., C. Fery, R. Vogel & M. Schlesewsky (eds.), *Gradience in Grammar: Generative Perspectives,* Oxford: Oxford University Press.

Colantoni, L. 2006. Increasing periodocity to reduce similarity: an acoustic account of deassibiliation in rhotics. In Díaz-Campos, M. (ed.), *Selected Proceedings of the 2nd Conference on Laboratory Approaches to Spanish Phonetics and Phonology,* Somerville, MA: Cascadilla Proceedings Project.

Collins, B. & I. Mees. 1996. *The Phonetics of English and Dutch*. Leiden: E.J. Brill.

Croft, W. 2000. *Explaining Language Change : An Evolutionary Approach*. London: Longman.

Croft, W. 2006. Evolutionary models and functional-typological theories of language change. In Kemenade, A. v. & B. Los (eds.), *Handbook of the History of English,* Oxford: Blackwell.

Cucchiarini, C. & H. van den Heuvel. 1995. /r/-deletion in Standard Dutch. *Proceedings of the Dept. of Language and Speech, University of Nijmegen* 19: 59-65.

Cucchiarini, C. & H. van den Heuvel. 1998. Postvocalic /r/-deletion in Standard Dutch: how experimental phonology can profit from ASR technology. *Proceedings of the 5th International Conference on Spoken Language Processing* 5: 1759-1762.

Cucchiarini, C. & H. van den Heuvel. 1999. Postvocalic /r/-deletion in Dutch: more experimental evidence. *Proceedings of the 14th International Congress of Phonetic Sciences* 3: 1673-1676.

Damsteegt, B.C. 1969. *Over Relevante Kenmerken van Fonemen en de Nederlandse [r].* Leiden: Universitaire Pers.

De Gruyter, O. 1909. *Het Gents dialect. Klank- en vormleer.* PhD thesis, R.U. Gent.

De Schutter, G. 1999. Het Antwerps. Een Schets van zijn Evolutie tussen 1898 en 1998. In Kruijsen, J. & N. v. d. Sijs (eds.), *Honderd Jaar Stadstaal,* Amsterdam: Contact. 301-315.

De Schutter, G. & J. Taeldeman. 1993. Studies in r-klein I. /r/ na vocaal in onbeklemtoonde lettergreep. *Taal en Tongval* 45: 155-172.

De Schutter, G. & J. Taeldeman. 1994. Studies in r-klein II. /r/ in hoofdtonige syllabe voor medeklinker. *R - zes visies op een kameleon. Taal en Tongval* 46(Themanummer 7): 73-109.

Delattre, P. 1965. *Comparing the Phonetic Features of English, French, German and Spanish: An Interim Report.* Heidelberg: Julius Groos Verlag.

Delattre, P. & D. C. Freeman. 1968. A dialect study of American r's by x-ray motion picture. *Linguistics* 44: 29– 68.

Denton, J.M. 2003. Reconstructing the articulation of Early Germanic *r. *Diachronica* 20(1): 11-43.

Diaz-Campos, M. 2008. Variable production of the trill in spontaneous speech: Sociolinguistic implications. In Colantoni, L. & J. Steele (eds.), *Selected Proceedings of the 3rd Conference on Laboratory Approaches to Spanish Phonology,* Somerville, MA: Cascadilla Proceedings Project.

Docherty, G & P. Foulkes. 2000. Speaker, speech, and knowledge of sounds. In Burton-Roberts, N., P. Carr & G. Docherty (eds.), *Phonological Knowledge,* Oxford: OUP.

Donselaar, W. van, C. Kuijpers & A. Cutler. 1999. Facilitatory effects of vowel epenthesis on word processing in Dutch. *Journal of Memory and Language* 41: 59-77.

Dresher, B.E. 2009. *The Contrastive Hierarchy in Phonology.* Cambridge: Cambridge University Press.

Dresher, B.E. 2011. The phoneme. In Oostendorp, M. v., C. J. Ewen, E. V. Hume & K. Rice (eds.), *The Blackwell Companion to Phonology,* Malden, MA. / Oxford: Wiley-Blackwell.

Duran, D., J. Bruni, H. Schütze & G Dogil. 2011. Context sequence model of speech production enriched with articulatory features. *ICPhS XVII: Proceedings of the 17th International Congress of Phonetic Sciences*: 615-618.

Durian, D. 2007. Getting [S]tronger Every Day?: Urbanization and the socio-geographic diffusion of (str) in Columbus, OH. *NWAV 35 Conference Proceedings. University of Pennsylvania Working Papers in Linguistics* 13(2): 65-79.

Elias, M. 1977. *Plat Haags. Een verkennend onderzoek naar enkele aspecten van het taalgebruik en de taalattitude van mannelijke Hagenaars in en om de Schilderswijk*. Amsterdam: Universiteit van Amsterdam.

Elias, M. 2002. *Taal in Stad en Land: Haags*. The Hague: SDU.

Enbe, C.R. & Y. Tobin. 2007. Sociolinguistic variation in the intonation of Buenos Aires Spanish. *Sociolinguistic Studies* 1(3): 374-382.

Engstrand, O., J. Frid & B. Lindblom. 2007. A perceptual bridge between coronal and dorsal /r/. In Solé, M.-J., P. S. Beddor & M. Ohala (eds.), *Experimental Approaches to Phonology,* Oxford: OUP.

Ernestus, M. 2011. Gradience and categoricality in phonological theory. In Oostendorp, M. v., C. J. Ewen, E. V. Hume & K. Rice (eds.), *The Blackwell Companion to Phonology,* Malden, MA. / Oxford: Wiley Blackwell.

Flemming, E. 2001. Scalar and categorical phenomena in a unified model of phonetics and phonology. *Phonology* 18: 7-44.

Flemming, E. 2002. *Auditory Representations in Phonology*. New York: Routledge.

Foley, J. 1977. *Foundations of Theoretical Phonology*. Cambridge: CUP.

Foulkes, P. & G Docherty. 2006. The social life of phonetics and phonology. *Journal of Phonetics* 34: 409-438.

Foulkes, P. & G. Docherty (eds.). 1999. *Urban voices: accent studies in the British Isles.* London: Arnold.

Foulkes, P., J.M. Scobbie & D. Watt. 2010. Sociophonetics. In Hardcastle, W., J. Laver & F. Gibbon (eds.), *The Handbook of Phontic Sciences,* Oxford: Wiley Blackwell. 703-764.

Fowler, C. 1986. An event approach to the study of speech perception from a direct-realist perspective. *Journal of Phonetics* 14: 3-28.

Fowler, C. 1996. Listeners do hear sounds, not tongues. *Journal of the Acoustical Society of America* 99: 1730-1741.

Gafos, A. 1999. *The Articulatory Basis of Locality in Phonology*. Oxford: Garland Science.

Gafos, A. 2002. A grammar of gestural coordination. *Natural Language and Linguistic Theory* 20(2): 269-337.

Gąsiorowski, P. 2006. A shibboleth upon their tongues: Early English /r/ revisited. *Studia Anglica Posnaniensia* 42: 63-76.

Gick, B. 2002. The use of ultrasound for linguistic phonetic fieldwork. *Journal of the IPA* 32(2): 113-122.

Gick, B. & F. Campbell. 2003. Intergestural timing in English /r/. In Solé, M.-J., D. Recasens & J. Romero (eds.), *Proceedings of the 15th international congress of phonetic sciences,* Barcelona: Universitat Autónoma de Barcelona. 1911–1914.

Gick, B., F. Campbell, S. Oh & L. Tamburri-Watt. 2006. Toward universals in the gestural organization of syllables: A cross-linguistic study of liquids. *Journal of Phonetics* 34(1): 49-72.

Gick, B., A. Min Kang & D.H. Whalen. 2002. MRI evidence for commonality in the post-oral articulations of English vowels and liquids. *Journal of Phonetics* 30: 357-371.

Gick, B. & I. Wilson. 2006. Excrescent schwa and vowel laxing: Cross-linguistic responses to conflicting articulatory targets. In Goldstein, L., D. H. Whalen & C. T. Best (eds.), *Papers in Laboratory Phonology VIII: Varieties of Phonological Competence,* Berlin/ New York: Mouton de Gruyter. 635-660.

Giegerich, H. 1999. *Lexical Strata in English: Morphological Causes, Phonological Effects*. Cambridge: CUP.

Goeman, A. & J. Taeldeman. 1996. Fonologie en morfologie van de Nederlandse dialecten. Een nieuwe materiaalverzameling en twee nieuwe atlasprojecten. *Taal en Tongval* 48: 38-59.

Goeman, A. & H. Van de Velde. 2001. Co-occurrence constraints on /r/ and /ɣ/ in Dutch dialects. In Van de Velde, H. & R. v. Hout (eds.), *'r-atics. Sociolinguistic, phonetic and phonological Characteristics of /r/,* Brussels: Etudes et Travaux - ILVP/ULB.

Goldinger, S.D. 1996. Words and voices: Episodic traces in spoken word identification and recognition memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 22.: 1166-1183.

Goldinger, S.D. 1997. Words and voices: perception and production in an episodic lexicon. In Johnson, K. & J. W. Mullenix (eds.), *Talker Variability in Speech Processing,* San Diego: Academic Press.

Goldstein, L. & C. Fowler. 2003. Articulatory Phonology: a phonology for public language use. In Schiller, N. O. & A. S. Meyer (eds.), *Phonetics and Phonology in Language Comprehension and Production: Differences and Similarities,* Berlin: Walter de Gruyter.

Gordon, M., P. Barthmaier & K. Sands. 2002. A cross-linguistic acoustic study of fricatives. *Journal of the IPA* 32: 141-174.

Goudsblom, J. 1964. Het Algemeen Beschaafd Nederlands. *Sociologische Gids* 11(3): 106-124.

Grønnum, N. 1998. Danish. *Journal of the IPA* 28: 99-105.

Grootaers, L. & J. Grauls. 1930. *Klankleer van het Hasseltsch dialect*. Leuven: De Vlaamsche Drukkerij.

Guenther, F. H., C. Y. Espy-Wilson, S. E. Boyce, M. L. Matthies, M. Zandipour & J. S. Perkell. 1999. Articulatory tradeoffs reduce acoustic variability during American English /r/ production. *Journal of the Acoustical Society of America* 105(5): 2854-2865.

Guion, S.G. & R.P. Wayland. 2004. Aerodynamic coarticulation in sound change or how onset trills can condition a falling tone. In Agwuele, A., W. Warren & S.-H. Park (eds.), *Proceedings of the 2003 Texas Linguistics Society Conference*. 107-115.

Gurevich, N. 2011. Lenition. In Oostendorp, M. v., C. J. Ewen, E. V. Hume & K. Rice (eds.), *The Blackwell Companion to Phonology,* Malden, MA. / Oxford: Wiley-Blackwell.

Gussenhoven, C. 1992. Dutch. *Journal of the IPA* 22: 45-47.

Gussenhoven, C. & A.P.A. Broeders. 1976. *The Pronunciation of English. A Course for Dutch Learners*. Groningen: Wolters-Noordhoff/Longman.

Guy, G. 2003. Variationist approaches to phonological change. In Joseph, B. D. & R. D. Janda (eds.), *The Handbook of Historical Linguistics,* Oxford: Blackwell. 369-400.

Haeringen, C.B. van. 1924. Eenheid en nuance in beschaafd-Nederlandse uitspraak. *De Nieuwe Taalgids* 18: 65-86.

Haeringen, C.B. van. 1951. Standaard Nederlands. *De Nieuwe Taalgids* 44: 316-320.

Haeringen, C.B. van. 1962. *Gramarie, keur uit het werk van zijn hoogleraarstijd*. Utrecht/Assen: Van Gorcum.

Hall, D.C. 2006a. *The Role and Representation of Contrast in Phonological Theory*. PhD thesis, University of Toronto.

Hall, N. 2003. *Gestures and Segments: Vowel Intrusion as Overlap*. PhD thesis, University of Massachussetts. ROA-637.

Hall, N. 2006b. Cross-linguistic patterns of vowel intrusion. *Phonology* 23(3): 387-429.

Hall, N. 2011. Vowel epenthesis. In Oostendorp, M. v., C. J. Ewen, E. V. Hume & K. Rice (eds.), *The Blackwell Companion to Phonology,* Malden, MA. / Oxford: Wiley-Blackwell.

Hall, T.A. 1997. *The Phonology of Coronals*. Amsterdam: John Benjamins.

Hall, T.A. & S. Hamann. 2010. On the cross-linguistic avoidance of rhotic plus high front vocoid sequences. *Lingua* 120(7): 1821-1844.

Hamann, S. 2003. *The Phonetics and Phonology of Retroflexes*. Utrecht: LOT.

Hansson, G.O. 2008. Diachronic explanations of sound patterns. *Language and Linguistics Compass* 2(5): 859-893.

Harris, J. 1985. *Phonological Variation and Change*. Cambridge: CUP.

Harris, J. 1990. Segmental complexity and phonological government. *Phonology Yearbook* 7: 255-300.

Harris, J. 1994. *English Sound Structure*. London, UK: Blackwell.

Harst, S. van der. 2011. *The Vowel Space Paradox*. Utrecht: LOT.

Harst, S. van der, H. Van de Velde & M.E.H. Schouten. 2007. Acoustic characteristics of Standard Dutch /ɣ/. *Proceedings of the 16th International Congress of Phonetic Sciences*: 1469-1472.

Hart, J. 't. 1969. Fonetische steunpunten. *De Nieuwe Taalgids* 62: 168-174.

Hawkins, S. 2003. Roles and representations of systematic fine phonetic detail in speech understanding. *Journal of Phonetics* 31: 373-405.

Hayes, B.P. 2000. Gradient well-formedness in Optimality Theory. In Dekkers, J., F. v. d. Leeuw & J. v. d. Weijer (eds.), *Optimality Theory: Phonology, Syntax, and Acquisition,* Oxford: Oxford University Press.

Hayes, B.P., R. M. Kirchner & D. Steriade (eds.). 2004. *Phonetically based phonology*. Cambridge: Cambridge University Press.

Helgason, P. 1999. Preaspiration and sonorant devoicing in the Gräsö dialect: preliminary findings. *Proceedings of the XIIth Swedish Phonetics Conference (FONETIK 99)*: 77-80.

Heselwood, B. & L. Plug. 2011. The role of F2 and F3 in the perception of rhoticity: evidence from listening experiments. *ICPhS XVII: Proceedings of the 17th International Congress of Phonetic Sciences*: 867-870.

Heuvel, H. van den & C. Cucchiarini. 2001. /r/-deletion in Dutch: rumour or reality? In Van de Velde, H. & R. v. Hout (eds.), *'r-atics. Sociolinguistic, Phonetic and Phonological characteristics of /r/,* Brussels: Etudes et Travaux, ILVP/ULB. 185-198.

Heuven, V.J., van & H. Van de Velde. 2010. De uitspraak van het hedendaags Nederlands in de Lage Landen. In Fenoulhet, J. & J. Renkema (eds.), *Internationale neerlandistiek: een vak in beweging. (Reeks Lage Landen Studies),* Gent: Academia Press. 183-209.

Hinskens, F., R. van Hout & W.L. Wetzels (eds.). 1997. *Variation, Change and Phonological Theory*. Current Issues in Linguistic Theory. Amsterdam: John Benjamins.

Hintzman, D.L. 1986. "Schema abstraction" in a multiple-trace memory model. *Psychological Review* 93: 411-428.

Honeybone, P. 2008. Lenition, weakening and consonantal strength: tracing concepts through the history of phonology. In Brandão de Carvalho, J., T. Scheer & P. Ségéral (eds.), *Lenition and Fortition,* Berlin: Mouton de Gruyter. 9-93.

Honeybone, P. 2011. Variation and linguistic theory. In Maguire, W. & A. M. S. McMahon (eds.), *Analysing Variation in English,* Cambridge: Cambridge University Press. 151-177.

Honeybone, P. 2012. Lenition in English. In Nevalainen, T. & E. Traugott (eds.), *The Oxford Handbook of the History of English,* Oxford: Oxford University Press.

Hout, R. van. 1989. *De structuur van taalvariatie : een sociolinguïstisch onderzoek naar het stadsdialect van Nijmegen*. Dordrecht: Foris.

Howell, R.B. 1986. Notes of the rise of non-apical [r] in Dutch: denying the French connection. *Canadian Journal of Netherlandic Studies* 7: 24-66.

Hualde, J. 1992. *Catalan*. London & New York: Routledge.

Humbert, H. 1996. De kameleontische aard van de Groningse /r/ verklaard vanuit representationeel perspectief. *Taal en Tongval* 48(2): 139-162.

Hume, E.V. 2004. Deconstructing markedness: a predictability-based approach. *Proceedings of the Berkeley Linguistics Symposium*.

Hyman, L. 1975. *Phonology: Theory and Analysis*. New York: Holt, Rinehart and Winston.

Inouye, S. 1995. *Trills, taps and stops in contrast and variation*. PhD thesis, UCLA.

Jansen, W. 2004. *Laryngeal Contrast and Phonetic Voicing: A Laboratory Phonology Approach to English, Hungarian and Dutch*. Groningen: GroDil.

Jassem, W. 1968. Acoustic description of voiceless fricatives in terms of spectral parameters. In Jassem, W. (ed.), *Speech Analysis and Synthesis,* Panstwowe Wydawnictwo Naukowe. 189-206.

Jaworksi, S. & E. Gillian. 2011. On the phonetic instability of the Polish rhotic /r/. *Poznań Studies in Contemporary Linguistics* 47(2): 380-398.

Jesus, L.M.T. & C.H. Shadle. 2005. Acoustic analysis of European Portuguese uvular [χ, ʁ] and voiceless tapped alveolar [ɾ̥] fricatives. *Journal of the IPA* 35(1): 27-44.

Johnson, K. 1997. Speech perception without speaker normalization: an exemplar model. In Johnson, K. & J. W. Mullenix (eds.), *Talker Variability in Speech Processing,* San Diego: Academic Press.

Johnson, K. 2001. Spoken language variability: implications for modeling speech perception. In Smits, R., J. Kingston, T. M. Nearey & R. Zondervan (eds.), *Proceedings of the Workshop on Speech Recognition as Pattern Classification (SPRAAC),* Nijmegen: Max Planck Institute for Psycholinguistics.

Johnson, K. 2006. Resonance in an exemplar-based lexicon: The emergence of social identity and phonology. *Journal of Phonetics* 34: 485-499.

Johnson, W. & D. Britain. 2003. L Vocalisation as a naturally occurring phenomenon. *Essex Research Reports in Linguistics* 44: 1-37.

Johnstone, M.J. 2006. *The Central Role of Variation and Change in Linguistic Theory*. University of Cambridge.

Kaiser, L. 1928. Bijdragen tot de kennis der Nederlandse spraakklanken. II. Oo, eu en ee, al dan niet gevolgd door r. *Verslagen der Afdeeling Natuurkunde* 37: 177-185.

Keating, P.A. 1990. Phonetic representations in a generative grammar. *Journal of Phonetics* 18: 321-334.

Kirchner, R.M. 1997. Contrastiveness and Faithfulness. *Phonology* 14(1): 83-111.

Kirchner, R.M. 2001. *An Effort Based Approach to Consonant Lenition*. New York: Routledge.

Kirchner, R.M. 2004. Consonant lenition. In Hayes, B. P., R. Kirchner & D. Steriade (eds.), *Phonetically Based Phonology,* Cambridge: CUP.

Kloeke, G.G. 1938. De Haagse volkstaal in de 18e eeuw. *Tijdschrift Nederlandse Taalkunde* 17.

Kloots, H., G. de Schutter, S. Gillis & M. Swerts. 2002. Sjwa-insertie in eindclusters: variatiepatronen in het Standaard-Nederlands. *Nederlandse Taalkunde* 7(2): 97-126.

Kloots, H., S. Gillis, S. De Maeyer & J. Verhoeven. 2012. De duur van de svarabhaktivocaal in het Standaardnederlands. *Tijdschrift Nederlandse Taal- en Letterkunde* 128(1): 3-19.

Kloots, H., S. Gillis & J. Verhoeven. 2009. Merk toch hoe sterk. Sjwa-insertie in spontaan gesproken Standaardnederlands. *Nederlandse Taalkunde* 14: 45-65.

Knight, R.-A., C. Villafaña Dalcher & M.J. Jones. 2007. A real-time case study of rhotic acquisition in Southern British English. *Proceedings of the 16th International Congress of Phonetic Sciences*: 1581-1584.

Kocjančič, T. 2004. Acoustic-phonetic analysis of children's /r/. *IFA report,* vol. 144. University of Amsterdam.

Koopmans-van Beinum, F. 1969. Nog meer fonetische zekerheden. *De Nieuwe Taalgids* 62: 245-250.

Koopmans-van Beinum, F. 1994. What's in a schwa? *Phonetica* 51: 68-79.

Kostakis, A. 2007. More on the origin of uvular [ʀ]: phonetic and sociolinguistic motivations. *IULC Working Papers Online* 7(02): 1-20.

Kristoffersen, G. 2000. *The Phonology of Norwegian*. Oxford: OUP.

Kruschke, J.K. 1992. ALCOVE: An exemplar-based connectionist model of category learning. *Psychological Review* 99(1): 22-44.

Kruszewski, M. [1881] 1995. On sound alternation. In Koerner, K. (ed.), *Writings in General Linguistics,* Amsterdam/Philadelphia: John Benjamins.

Kuijpers, C. & W. van Donselaar. 1998. The influence of rhythmic context on schwa epenthesis and schwa deletion. *Language and Speech* 41(1): 87-108.

Kvale, K. & A. K. Foldvik. 1992. The multifarious r-sound. *Proceedings of the Second International Conference on Spoken Language Processing (ICSLP '92)*: 1259-1262.

Labov, W. 1963. The social motivation of a sound change. *Word* 19: 273-309.

Labov, W. 1969. Contraction, deletion and inherent variability of the English copula. *Language* 45: 715-762.

Labov, W. 1972a. *Sociolinguistic Patterns*. Philadelphia: University of Pennsylvania Press.

Labov, W. 1972b. Some principles of linguistic methodology. *Language in Society* 1(1): 97-120.

Labov, W. 1981. What can be learned about change in progress from synchronic descriptions? In Sankoff, D. & H. Cedergren (eds.), *Variation omnibus,* Carbondale: Linguistic Research. 177-199.

Labov, W. 1994. *Principles of Linguistic Change*. Oxford: Blackwell.

Ladd, D.R. 2006. 'Distinctive phones' in surface representation. In Goldstein, L. M., D. H. Whalen & C. T. Best (eds.), *Laboratory Phonology 8,* Berlin: Mouton de Gruyter. 3–26.

Ladefoged, P. 1975. *A Course in Phonetics*. New York: Harcourt Brace Jovanovich.

Ladefoged, P., A. Cochran & S. Disner. 1977. Laterals and trills. *Journal of the IPA* 7: 46-54.

Ladefoged, P. & I. Maddieson. 1996. *The Sounds of the World's Languages*. Oxford: Blackwell.

Larsen, A.B. 1926. *Sognemålene*. Oslo: Det Norske Videnskaps-Akademi.

Lass, R. 1997. *Historical Linguistics and Language Change*. Cambridge: CUP.

Lass, R. & J. Anderson. 1975. *Old English Phonology*. Cambridge: CUP.

Laver, J. 1994. *Principles of Phonetics*. Cambridge: CUP.

Lavoie, L.M. 2001. *Consonant Strength: Phonological Patterns and Phonetic Manifestations*. New York: Garland.

Lenz, A. 2008. Vom Dialekt zur regionalen Umgangssprache - Zur Vielfalt regionaler Sprechwesien. In Munske, H. H. (ed.), *Sterben die Dialekte aus? Voträge am*

Interdisziplinären Zentrum für Dialektforschung an der Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen: Friedrich-Alexander Universität.

Lenz, R. 1892-1893. Chilenische studien. *Beihefte der Zeitschrift Phonetische Studien* I-VII.

Lewis, A.M. 2004. Coarticulatory effects on Spanish trill production. In Agwuele, A., W. Warren & S.-H. Park (eds.), *Proceedings of the 2003 Texas Linguistics Society Conference,* Somerville, MA: Cascadilla Proceedings Project. 116-127.

Liberman, A. & I. Mattingly. 1985. The motor theory revised. *Cognition* 21: 1-36.

Lin, S.S., P. Speeter Beddor & A.W. Coetzee. 2011. Gestural reduction and sound change: an ultrasound study. *ICPhS XVII: Proceedings of the 17th International Congress of Phonetic Sciences*: 1250-1253.

Lindau, M. 1985. The story of /r/. In Fromkin, V. A. (ed.), *Phonetic Linguistics. Essays in honour of Peter Ladefoged,* Orlando: Academic Press. 157-68.

Lindblom, B. 1990. Explaining phonetic variation: a sketch of the H&H Theory. In Hardcastle, W. J. & A. Marchal (eds.), *Speech Production and Speech Modelling,* Dordrecht: Kluwer. 403-439.

Lindblom, B. 2000. Developmental origins of adult phonology: the interplay between phonetic emergents and the evolutionary adaptations of sound patterns. *Phonetica* 57: 297-314.

Linde, K. van der. 2001. *Sonority Substitutions*. Groningen: GroDil.

Lipski, J.M. 1990. Spanish taps and trills: phonological structure of an isolated opposition. *Folia linguistica* 24(4): 153-174.

Lipski, J.M. 1994. *Latin American Spanish*. Harlow, Essex: Longman.

Little, S. 2012. *A Sociophonetic Study of the Metropolitan French [R]: Linguistic Factors Determining Rhotic Variation*. Senior Honors Undergraduate Thesis, The Ohio State University.

Lodge, K. 2009. *Fundamental Concepts in Phonology: Sameness and Difference*. Edinburgh: Edinburgh University Press.

Machač, P. 2009. Implications of Acoustic Variation for the Segmentation of the Czech Trill /r/. In Esposito, A. & R. Vích (eds.), *Cross-Modal Analysis of Speech, Gestures, Gaze and Facial Expressions, Lecture Notes in Artificial Intelligence,* Berlin, Heidelberg: Springer. 173-181.

Macpherson, I.R. 1975. *Spanish Phonology: Descriptive and Historical*. Manchester: Manchester University Press.

Maddieson, I. 1984. *Patterns of Sounds*. Cambridge: CUP.

Magnuson, T.J. 2007. The story of /r/ in two vocal tracts. *Proceedings of the 16th International Congress of Phonetic Sciences*: 1193-1196.

Magnuson, T.J. 2008. *What /r/ Sounds Like in Kansai Japanese: A Phonetic Investigation of Liquid Variation in Unscripted Discourse*. MA thesis, University of Victoria.

Malmberg, B. 1965. *Estudios de Fonética Hispánica*. Madrid: CSIC.

Massone, M.I. 1988. Estudio acústico y perceptivo de las consonantes nasales y líquidas del Español. *Estudios de Fonética Experimental* III: 13-34.

Mateus, M.H. & E. d'Andrade. 2000. *The Phonology of Portuguese*. Oxford: OUP.

McCarthy, J.J. & A.S. Prince. 1995. Prosodic Morphology. In Goldsmith, J. (ed.), *The Handbook of Phonological Theory,* Oxford: Blackwell.

McClelland, J. L. & J.L. Elman. 1986. The TRACE model of speech perception. *Cognitive Psychology* 18: 1-86.

McGowan, R.S. 1992. Tongue-tip trills and vocal-tract wall compliance. *Journal of the Acoustical Society of America* 91(5): 2903-2910.

McMahon, A.M.S. 2000. *Lexical Phonology and the History of English*. Cambridge: CUP.

Mees, I. & B. Collins. 1982. A phonetic description of the consonant system of Standard Dutch (ABN). *Journal of the IPA* 12: 2-12.

Mendoza-Denton, N., J. Hay & S. Jannedy. 2003. Probabilistic sociolinguistics: beyond variable rules. In Bod, R., J. Hay & S. Jannedy (eds.), *Probabilistic Linguistics,* Cambridge, Mass.: MIT Press.

Mielke, J. 2004. *The Emergence of Distinctive Features*. PhD thesis, Ohio State University.

Milroy, J., L. Milroy, S. Hartley & D. Walshaw. 1994. Glottal stops and Tyneside glottalization: competing patterns of variation and change in British English. *Language Variation and Change* 6(3): 327-357.

Morin, Y.-C. 2013. From apical [r] to uvular [ʀ]: what the apico-dorsal r in Montreal French reveals about abrupt sound changes. In Sánchez Miret, F. & D. Recasens (eds.), *Studies in phonetics, phonology and sound change in Romance,* Munich: Lincom Europa. 65-93.

Moulton, W. G. 1952. Jacob Böhme's uvular r. *Journal of English and Germanic Philology* 51: 83-89.

Mowrey, R. & W. Pagliuca. 1995. The reductive character of articulatory evolution. *Rivista di Linguistica* 7(1): 37-124.

Müller, D. 2010. Phonetic factors influencing /l/-rhoticisation in Greek. In Botinis, A. (ed.), *Proceedings of the third ICSA Tutorial and Research Workshop in Experimental Linguistics (ExLing),* Athens, Greece: University of Athens.

Muminovic, D. & O. Engstrand. 2002. /r/ i några svenska dialekter. In Sundman, I. M. & A.-M. Londen (eds.), *Svenskans Beskrivning 25 Åbo: Förhandlingar vid Tjugofemte Sammankomsten för Svenskans Beskrivning*: Åbo 2001. 200-207.

Munson, B. 2010. Levels of Phonological Abstraction and Knowledge of Socially Motivated Speech-Sound Variation: A Review, a Proposal, and a Commentary on the Papers by Clopper, Pierrehumbert, and Tamati, Drager, Foulkes, Mack, and Smith, Hall, and Munson. *Laboratory Phonology* 1(1): 157-77.

Myers, S. 2000. Boundary disputes: The distinction between phonetic and phonological sound patterns. In Burton-Roberts, N., P. Carr & G. Docherty (eds.), *Phonological Knowledge: Conceptual and empirical issues,* Oxford: Oxford University Press.

Nagy, N. & W.T. Reynolds. 1997. Optimality theory and variable word-final deletion in Faetar. *Language Variation and Change* 9(1): 37-56.

Newton, B. 1972. *The Generative Interpretation of Dialect*. Cambridge: CUP.

Nicolaidis, K. & M. Baltazani. 2011. An electropalatographic and acoustic study of the Greek rhotic in /Cr/ clusters. *ICPhS XVII: Proceedings of the 17th International Congress of Phonetic Sciences,* Hong Kong, China. 1474-1477.

Nooteboom, S. 2004. Waar komen de letters van het alfabet vandaan? Een verlate reactie op het werkcollege “Alfabetiek”, gegeven door prof. dr. ir. H. Mol in 1964/1965 (Afscheidscollege). Utrecht: Faculteit der Letteren, Universiteit Utrecht.

Nosofsky, R. 1986. Attention, Similarity, and the Identification-Categorization Relationship. *Journal of Experimental Psychology: General* 115(1): 39-57.

Ohala, J.J. 1981. The listener as a source of sound change. In Masek, C. S., R. A. Hendrick & M. F. Miller (eds.), *Papers from the Parasession on Language and Behavior,* Chicago: Chicago Linguistics Society. 178 - 203.

Ohala, J.J. 1983a. The origin of sound patterns in vocal tract constraints. In MacNeilage, P. F. (ed.), *The production of speech,* New York: Springer-Verlag. 189 - 216.

Ohala, J.J. 1983b. The phonological end justifies any means. In Hattori, S. & K. Inoue (eds.), *Proceedings of the XIIIth Int. Congress of Linguists,* Tokyo: Sanseido Shoten. 232 - 243.

Ohala, J.J. 1993. The phonetics of sound change. In Jones, C. (ed.), *Historical Linguistics: Problems and Perspectives,* London: Longman. 237-278.

Oliveira, M.A. de & T. Cristófaro-Silva. 2002. Variação do "r" pós-consonantal no Português Brasileiro: Um caso de mudança fonotática ativada por cisão primária. *Letras de Hoje* 37: 25-47.

Oostendorp, M. van. 2002. *Taal in Stad en Land: Rotterdams*. The Hague: SDU.

Ortmann, A. 1998. Consonant epenthesis: Its distribution and phonological specification. In Kehrein, W. & R. Wiese (eds.), *Phonology and Morphology of the Germanic Languages.,* Tübingen: Niemeyer. 51-76.

Oyen, L. van. 1968. *Dialektatlas van Zuid-Holland en Utrecht*. Antwerp: De Sikkel.

Padgett, J. 2002. Russian voicing assimilation, final devoicing, and the problem of [v] (or, the mouse that squeaked). Ms. ROA-528. UC Santa Cruz. http://people.ucsc.edu/~padgett/locker/newvoice.pdf.

Penny, R. 2000. *Variation and Change in Spanish*. Cambridge: CUP.

Pierrehumbert, J.B. 1990. Phonological and phonetic representation. *Journal of Phonetics* 18: 375-394.

Pierrehumbert, J.B. 1999. What people know about sounds of language. *Studies in the Linguistic Sciences* 29(2): 111-120.

Pierrehumbert, J.B. 2001. Exemplar dynamics: word frequency, lenition and contrast. In Bybee, J. L. & P. Hopper (eds.), *Frequency effects and emergent grammar,* Amsterdam: John Benjamins. 137-157.

Pierrehumbert, J.B. 2002. Word-specific phonetics. In Gussenhoven, C. & N. Warner (eds.), *Laboratory Phonology 7: Phonology and Phonetics,* Berlin / New York: Mouton de Gruyter. 101-140.

Pierrehumbert, J.B. 2003a. Phonetic diversity, statistical learning, and acquisition of phonology. *Language and Speech* 46: 115-156.

Pierrehumbert, J.B. 2003b. Probabilistic phonology: discrimination and robustness. In Bod, R., J. Hay & S. Jannedy (eds.), *Probabilistic Linguistics,* Cambridge, Mass.: MIT Press.

Pierrehumbert, J.B. 2006. The next toolkit. *Journal of Phonetics* 34(4): 516-30.

Pierrehumbert, J.B., M.E. Beckmann & D.R. Ladd. 2000. Conceptual foundations of phonology as a laboratory science. In Burton-Roberts, N., P. Carr & G. Docherty (eds.).

Pinget, A.-F., M. Rotteveel & H. Van de Velde. 2014. Standaardnederlands met een accent. *Nederlandse Taalkunde* 19(1): 3-45.

Pisoni, D.B. 1997. Some Thoughts on "Normalization" in Speech Perception. In Johnson, K. & J. W. Mullennix (eds.), *Talker Variability in Speech Processing,* San Diego: Academic Press. 9-32.

Ploch, S. 1993. *The vocalic systems of standard German and Augsburg Swabian and rhotic effects on the internal structure of vowels*. MA thesis, SOAS, University of London.

Plug, L. 2001. A non-segmental view on /r/-deletion in standard Dutch. Presented at *10th postgraduate conference*, Manchester, UK.

Plug, L. & R. Ogden. 2003. A parametric approach to the phonetics of postvocalic /r/ in Dutch. *Phonetica* 60: 159-186.

Prince, A.S. & P. Smolensky. 1993. *Optimality Theory: Constraint Interaction in Generative Grammar*. Oxford: Blackwell.

Proctor, M. 2009. *Gestural characterization of a phonological class: The liquids*. PhD thesis, Yale University.

Proctor, M. 2011. Towards a gestural characterization of liquids: Evidence from Spanish and Russian. *Laboratory Phonology* 2(2): 451-485.

Quené, H. 2008. Multilevel modelling of between-speaker and within-speaker variation in spontaneous speech tempo. *Journal of the Acoustical Society of America* 123(2): 1104-1113.

Quilis, A. 1981. *Fonética Acústic de la Lengua Española*. Madrid: Editorial Gredos.

R Development Core Team. 2005. *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria: ISBN 3-900051-07-0.

Rácz, P. 2013. *Salience in Sociolinguistics*. Berlin/New York: De Gruyter Mouton.

Rafat, Y. 2010. A sociophonetic investigation of rhotics in Persian. *Iranian Studies* 43(5): 667-682.

Ramírez, C.J. 2006. Acoustic and perceptual characterization of the epenthetic vowel between the clusters formed by consonant + liquid in Spanish. In Díaz-Campos, M. (ed.), *Selected Proceedings of the 2nd Conference on Laboratory Approaches to Spanish Phonetics and Phonology,* Somerville, MA.: Cascadilla Proceedings Project. 48-61.

Recasens, D. 1987. An acoustic analysis of V-to-C and V-to-V coarticulatory effects in Catalan and Spanish VCV sequences. *Journal of Phonetics* 15: 299–312.

Recasens, D. 1991. On the production characteristics of apicoalveolar taps and trills. *Journal of Phonetics* 19: 267-280.

Recasens, D. 1999. Lingual coarticulation. In Hardcastle, W. J. & N. Hewlett (eds.), *Coarticulation. Theory, Data and Techniques,* Cambridge, UK: Cambridge University Press.

Recasens, D. 2002. Weakening and strengthening in Romance revisited. *Rivista di Linguistica* 14(2): 327-373.

Recasens, D. & M.D. Pallarés. 1999. A study of /ɾ/ and /r/ in the light of the "DAC" coarticulation model. *Journal of Phonetics* 27: 143-169.

Reenen, P. van. 1986. The vocalisation of /l/ in standard Dutch, a pilot study of an ongoing change. *Linguistics in the Netherlands*: 189-98.

Reenen, P. van. 1994. Driemaal /r/ in de Nederlandse dialecten. *Taal en Tongval* 46(Themanummer 7): 54-72.

Rennicke, I. 2013. The phonological status of rhotics in Brazilian Portuguese: an exemplar-based approach. Presented at *'r-atics4,* Grenoble.

Rogier, D. 1994. De verspreiding van een hooggewaardeerd taalkenmerk: de huig-R rond Gent. *Taal en Tongval* 46(Themanummer 7): 43-53.

Romano, A. 2013. A preliminary contribution to the study of phonetic variation of /r/ in Italian and Italo-Romance. In Vietti, A. & L. Spreafico (eds.), *Rhotics. New Data and Perspectives,* Bozen Bolzano: Bozen Bolzano University Press. 209-226.

Romero, J. 2008. Gestural timing in the perception of Spanish r+C clusters. In Colantoni, L. & J. Steele (eds.), *Selected Proceedings of the 3rd Conference on Laboratory Approaches to Spanish Phonology,* Somerville, MA.: Cascadilla Proceedings Project. 59-71.

Rūķe-Draviņa, V. 1965. The process of acquisition of apical /r/ and uvular /R/ in the speech of children. *Linguistics* 3(17): 58-68.

Runge, R.M. 1974. *Proto-Germanic /r/. The pronunciation of /r/ Throughout the History of the Germanic Languages*. Göppingen: Verlag Alfred Kümmerle.

Sankoff, D. 1987. Variable rules. In Ammon, U., N. Dittmar & K. J. Mattheier (eds.), *Sociolinguistics: An International Handbook of the Science of Language and Society,* Berlin: Walter de Gruyter. 984-997.

Sapir, E. 1925. Sound patterns in language. *Language* 1: 37-51.

Schatz, H.F. 1986. *Plat Amsterdams in its social context. A sociolinguistic study of the dialect of Amsterdam*. Amsterdam: Meertensinstituut.

Scheer, T. 2014. How Diachronic is Synchronic Grammar? Crazy Rules, Regularity, and Naturalness. In Honeybone, P. & J. Salmons (eds.), *The Oxford Handbook of Historical Phonology,* Oxford: Oxford University Press.

Schiller, N.O. 1998. The phonetic variation of German /r/. In Butt, M. & N. Fuhrhop (eds.), *Variation und Stabilität in der Wortstruktur,* Hildesheim: Olms. 261-87.

Schiller, N.O. & C. Mooshammer. 1995. The character of /r/-sounds: articulatory evidence for different reduction process with special reference to German. *Proceedings of the 13th International Congress of Phonetic Sciences*: 452-455.

Schmeiser, B. 2009. An acoustic analysis of intrusive vowels in Guatemalan Spanish /rC/ clusters. *University of Pennsylvania Working Papers in Linguistics* 15(1).

Schönfeld, M. 1970. *Historische grammatica van het Nederlands (editie A. van Loey)*. 8th edn. Zutphen: Thieme.

Scobbie, J.M. 2004. Labiodental /r/ from alveolar /r/: lip or lingual vs. lip & lingual. Presented at *Ultrapolooza (2nd Ultrasound Round Table)*, The University of British Columbia, Vancouver.

Scobbie, J.M. 2005. The phonetics-phonology overlap. *QMUC Speech Science Research Centre Working Paper* WP1: 1-30.

Scobbie, J.M. 2007. Interface and overlap in phonetics and phonology. In Ramchand, G. & C. Reiss (eds.), *The Oxford Handbook of Linguistic Interfaces,* Oxford: OUP.

Scobbie, J.M. & K. Sebregts. 2010. Acoustic, articulatory and phonological perspectives on allophonic variation of /r/. In Folli, R. & C. Ulbrich (eds.), *Interfaces in linguistics: New research perspectives,* Oxford: Oxford University Press. 131-169.

Scobbie, J.M., A.A. Wrench & M. van der Linden. 2008. Head-Probe stabilisation in ultrasound tongue imaging using a headset to permit natural head movement. *Proceedings of the 8th International Seminar on Speech Production*: 373-376.

Sebregts, K. 2004a. Cluster simplification and variation of Dutch /r/ and /x/. Presented at *VarPhon*, Universität Potsdam, Germany.

Sebregts, K. 2004b. Dutch /r/ variation and the representation of complexity. Presented at *The 12th Manchester Phonology Meeting*, University of Manchester, UK.

Sebregts, K., E. Tops, R. van Bezooijen, H. Van de Velde, R. van Hout, R. Willemyns & W. Zonneveld. 2003. Socio-geografische, fonetische en fonologische variatie in /r/. Een onderzoek in Nederlandse en Vlaamse grote steden. In Koole, T., J. Nortier & B. Tahitu (eds.), *Artikelen van deVierde Sociolinguistische Conferentie,* Delft: Eburon. 375-385.

Selkirk, L. 1984. On the major class features and syllable theory. In Aronoff, M. & R. Oehrle (eds.), *Language sound structure,* Cambridge, Mass: MIT Press. 107-136.

Shockey, L. 2003. *Sound Patterns of Spoken English*. Malden, MA: Blackwell.

Silverman, D. 2006. *A Critical Introduction to Phonology: Of Sound, Mind, and Body*. New York: Continuum.

Silverman, D. 2011. Usage-based phonology. In Botma, E. D., N. C. Kula & K. Nasukawa (eds.), *The Bloomsbury Companion to Phonology,* London, New York: Bloomsbury.

Šimáčková, Š. 2001. Retracted pronunciation of *r* by Czech speakers. Presented at *r-atics 2*, Brussels.

Šimáčková, Š. 2002. Rhoticizm. *INFO-CHILDES mailing list*. February 2002, week 1. http://listserv.linguistlist.org/cgi-bin/wa?A2=ind0202a&L=info-childes&D=1&P=699.

Simonsen, H.G. 2002. Re: rhoticizm. *INFO-CHILDES Mailing list*. February 2002, week 2. http://listserv.linguistlist.org/cgi-bin/wa?A2=ind0202b&L=info-childes&D=1&F=P&S=&P=685.

Simpson, A.P. 1999. Fundamental problems in comparative phonetics and phonology. Does UPSID help to solve them? *Proceedings of the 14th International Congress of Phonetic Sciences* 1: 349-352.

Smakman, D. 2006. *Standard Dutch in the Netherlands. A Sociolinguistic and Phonetic Description*. Utrecht: LOT.

Solé, M.-J. 1992. Experimental Phonology: the case of rhotacism. In Dressler, W. U., H. C. Luschützky, O. E. Pfeiffer & J. R. Rennison (eds.), *Phonologica 1988,* Cambridge: CUP. 259-271.

Solé, M.-J. 1998. Phonological universals: trilling, voicing and frication. *Berkeley Linguistics Society* 42: 427-442.

Solé, M.-J. 1999. The phonetic basis of phonological structure: the role of aerodynamic factors. *Proceedings of the 1st Congress of Experimental Phonetics*: 77-94.

Solé, M.-J. 2002. Aerodynamic characteristics of trills and phonological patterning. *Journal of Phonetics* 30: 655-688.

Son, R. J. J. H. van & L. C. W. Pols. 1990. Formant frequencies of Dutch vowels in a text, read at normal and fast rate. *Journal of the Acoustical Society of America* 88: 1683-1693.

Sóskuthy, M. 2013. *Phonetic Biases and Systemic Effects in the Actuation of Sound Change*. PhD thesis, University of Edinburgh.

Spajic, S., P. Ladefoged & P. Bhaskararao. 1996. The trills of Toda. *Journal of the IPA* 26(1): 1-22.

Statistics Belgium. 2014. Loop van de bevolking 2010-2014. *Belgian Federal Government*. http://statbel.fgov.be/nl/statistieken/cijfers/.

Stausland Johnsen, S. 2012. A diachronic account of phonological unnaturalness. *Phonology* 29: 505-531.

Steriade, D. 1982. *Greek prosodies and the nature of syllabification*. PhD thesis, MIT.

Stevens, K.N. 1989. On the quantal nature of speech. *Journal of Phonetics* 17: 3-46.

Stone, M. 1997. Laboratory techniques for investigating speech articulation. In Hardcastle, W. J. & J. Laver (eds.), *The Handbook of Phonetic Sciences,* Oxford: Blackwell.

Straka, G. 1965. Contribution à l'histoire de la consonne R en Français. *Neuphilologische Mitteilungen* 66(3): 572-606.

Strik, H., A. Russel, H. van den Heuvel, C. Cucchiarini & L. Boves. 1997. A spoken dialog system for the Dutch public transport information service. *International Journal of Speech Technology* 2(2): 121-131.

Stroop, J. 1997. Wordt het Poldernederlands model? *Taal en Tongval* 49(Themanummer 10): 10-29.

Stroop, J. 1998. *Poldernederlands. Waardoor het ABN verdwijnt*. Amsterdam: Bert Bakker.

Strycharczuk, P. 2012. *Phonetics-Phonology Interactions in Pre-Sonorant Voicing*. PhD thesis, University of Manchester.

Strycharczuk, P. & K. Sebregts. 2014. Erring on the side of phonology. In Auer, A. & B. Köhnlein (eds.), *Linguistics in the Netherlands 2014,* Amsterdam: John Benjamins.

Stuart-Smith, J. 2007. Empirical evidence for gendered speech production: /s/ in Glaswegian. In Cole, J. & J. Hualde (eds.), *Change in Phonology (Laboratory Phonology 9),* Berlin: Mouton de Gruyter. 65-86.

Taeldeman, J. 1985. *De Klankstructuur van het Gentse Dialekt. Een synchrone beschrijving en een historische en geografische situering*. Gent: Universa.

Taeldeman, J. 2005. The influence of urban centres on the spatial diffusion of dialect phenomena. In Auer, P., F. Hinskens & P. Kerswill (eds.), *Dialect Change: Convergence and Divergence in European Languages,* Cambridge: Cambridge University Press. 263-284.

Tiede, M., S. Boyce, C. Holland & A. Chou. 2004. A New Taxonomy of American English /r/ using MRI and Ultrasound. *Journal of the Acoustical Society of America* 115: 2633.

Tops, E. 2009. *Variatie en Verandering van de /r/ in Vlaanderen*. Brussels: VUBPress.

Torp, A. 2001. Retroflex consonants and dorsal r - mutually excluding innovations? - On the diffusion of dorsal r in Scandinavian. In Van de Velde, H. & R. v. Hout (eds.), *'r-atics: Sociolinguistic, Phonetic, and Phonological Characteristics of /r/,* Brussels: Etudes et Travaux ULB/IVLP.

Torre, E.J. van der. 2003. *Dutch Sonorants. The Role of Place of Articulation in Phonotactics*. Utrecht: LOT.

Trautmann, M. 1880. Besprechung einiger schulbücher nebst bemerkungen über die r-laute. *Anglia* 3: 204-22.

Trautmann, M. 1884. *Die Sprachlaute im Allgemeinen und die Laute des Englischen, Französischen und Deutschen im Besonderen*. Leipzig: Gustav Fock.

Trommelen, M. 1984. *The Syllable in Dutch*. Dordrecht: Foris.

Trommelen, M. 1993. Lexical word-processes in Dutch. *The Linguistic Review* 10: 161-184.

Trommelen, M. & W. Zonneveld. 1989. Stress, diphthongs, r in Dutch. In Bennis, H. & A. v. Kemenade (eds.), *Linguistics in the Netherlands,* Dordrecht: Foris.

Trudgill, P. 1974. Linguistic change and diffusion: description and explanation in sociolinguistic dialect geography. *Language in Society* (3): 215-246.

Ulbrich, C. & H. Ulbrich. 2007. The realisation of /r/ in Swiss German and Austrian German. *Proceedings from the 16th International Congress of Phonetic Sciences*: 1761-1764.

Ulbrich, H. 1972. *Instrumentalphonetisch-auditive R-Untersuchungen im Deutschen*. Berlin: Akademie-Verlag.

Välimaa-Blum, R. 2009. The phoneme in cognitive phonology: episodic memories of both meaningful and meaningless units? *CogniTextes: Revue de l'Association française de linguistique cognitive* 2.

Van Dam, M. 2007. *Plasticity of Phonological Categories*. Indiana University.

Van de Velde, H. 1996. *Variatie en Verandering in het Gesproken Standaard-Nederlands (1935-1993)*. Nijmegen: KUN.

Van de Velde, H. 1998. Norm en variatie. *Nederlandse Taalkunde* 3(3): 253-261.

Van de Velde, H. & R. van Hout. 1999. The pronunciation of (r). In Bezooijen, R. v. & R. Kager (eds.), *Linguistics in the Netherlands,* Amsterdam: John Benjamins. 177-188.

Van de Velde, H., E. Tops & R. van Hout. 2013. The spreading of uvular [R] in Flanders. In Spreafico, L. & A. Vietti (eds.), *Rhotics: New Data and Perspectives,* Bolzano: Bolzano University Press. 225-248.

Verhoeven, J. 1994. Fonetische eigenschappen van de Limburgse huig-r. *Taal en Tongval* 46(Themanummer 7): 9-21.

Verstraeten, B. & H. Van de Velde. 2001. Socio-geographical variation of /r/ in standard Dutch. In Van de Velde, H. & R. van Hout (eds.), *'r-atics. Sociolinguistic, Phonetic and Phonological Characteristics of /r/,* Bruxelles: ILVP/ULB.

Vieregge, W.H. & A.P.A. Broeders. 1993. Intra- and interspeaker variation of /r/ in Dutch. *Proceedings of Eurospeech '93* 2: 267-270.

Vihman, M. 1996. *Phonological Development*. Cambridge, MA.: Blackwell.

Vihman, M. 2002. Re: rhoticizm. *INFO-CHILDES Mailing list*. February 2002, week 1. http://listserv.linguistlist.org/cgi-bin/wa?A2=ind0202a&L=info-childes&D=1&F=P&S=&P=785.

Villafaña Dalcher, C., R.-A. Knight & M.J. Jones. 2008. Cue switching in the perception of approximants: evidence from two English dialects. *University of Pennsylvania Working Papers in Linguistics* 14(2): 63-71.

Voortman, B. 1994. *Regionale Variatie in het Taalgebruik van Notabelen. Een Sociolinguistisch Onderzoek in Middelburg, Roermond en Zutphen*. Amsterdam: IFOTT.

Waals, J. 1999. *An Experimental View of the Dutch Syllable*. Den Haag, Netherlands: HAG.

Wal, M. van der & C. van Bree. 1992. *Geschiedenis van het Nederlands*. Utrecht: Het Spectrum.

Walsh Dickey, Laura. 1997. *The Phonology of Liquids*. PhD thesis, University of Massachusetts.

Warner, N., A. Jongman, A. Cutler & D. Mücke. 2001. The phonological status of Dutch epenthetic schwa. *Phonology* 18(3): 387-420.

Watson, K. 2007. *The Phonetics and Phonology of Plosive Lenition in Liverpool English*. PhD thesis, Edge Hill/Lancaster University.

Wedel, A. 2007. Feedback and regularity in the lexicon. *Phonology* 24(1): 147-185.

Wedel, A. 2011. Self-organization in phonology. In Oostendorp, M. v., C. J. Ewen, E. V. Hume & K. Rice (eds.), *The Blackwell Companion to Phonology,* Malden, MA / Oxford: Wiley-Blackwell. 130-147.

Weijnen, A. 1941. *De Nederlandse Dialecten*. Groningen-Batavia: Noordhoff.

Weijnen, A. 1991. *Vergelijkende Klankleer van de Nederlandse dialecten*. The Hague: SDU.

Weinreich, U., W. Labov & M.I. Herzog. 1968. Empirical foundations for a theory of language change. In Lehmann, W. P. & Y. Malkiel (eds.), *Directions for Historical Linguistics,* Austin, Texas & London: University of Texas Press. 95-188.

Wiese, R. 2000. *The Phonology of German*. Oxford: Oxford University Press.

Wiese, R. 2001a. The phonology of /r/. In Hall, T. A. (ed.), *Distinctive Feature Theory,* Berlin: De Gruyter. 335-368.

Wiese, R. 2001b. The unity and variation of (German) /r/. In Van de Velde, H. & R. v. Hout (eds.), *'r-atics: Sociolinguistic, Phonetic and Phonological Characteristics of /r/,* Brussels: Etudes et Travaux, ULB/ILVP.

Willemyns, R. 2004. *Inleiding in de Variatielinguïstiek*. Brussels: VUB Press.

Willemyns, R. & W. Daniels. 2003. *Het verhaal van het Vlaams: De geschiedenis van het Nederlands in de Zuidelijke Nederlanden*. Antwerpen: Standaard Uitgeverij.

Wittgenstein, L. [1953] 1975. *Philosophische Untersuchungen*. Frankfurt am Main: Suhrkamp Verlag.

Wollock, J. 1982. Views on the decline of apical r in Europe: a historical study. *Folia Linguistica Historica* III(2): 185-238.

Wortel, D. 2002. *Taal in Stad en Land: Leids*. The Hague: SDU.

Wrench, A.A. & J.M. Scobbie. 2011. Very high frame rate ultrasound tongue imaging. *Proceedings of the 9th International Seminar on Speech Production (ISSP)*: 155-162.

Wright, R. 2004. A review of perceptual cues and cue robustness. In Hayes, B. P., R. M. Kirchner & D. Steriade (eds.), *Phonetically Based Phonology,* Cambridge, UK: CUP.

Zanone, P.G. & J.A.S. Kelso. 1992. Evolution of behavioral attractors with learning: nonequilibrium phase transitions. *Journal of Experimental Psychology: Human Perception and Performance* 18(2): 403-421.

Zhang, Z., S. Boyce, Espy-Wilson C. & M. Tiede. 2003. Acoustic Strategies for production of American English 'retroflex' /r/. *Proceedings of the 15th International Congress of the Phonetic Sciences*: 1125-1128.

Zonneveld, W. & M. Trommelen. 1980. Egg, onion, ouch! On the representation of Dutch diphthongs. In Zonneveld, W., F. v. Coetsem & O. W. Robinson (eds.), *Studies in Dutch Phonology,* The Hague: Martinus Nijhoff.

Zwaardemaker, H. & L.P.C. Eijkman. 1928. *Leerboek der Phonetiek. Inzonderheid met Betrekking tot het Standaard-Nederlandsch*. Haarlem: Bohn.

Zwicker, E. & R. Feldtkeller. 1967. *Das Ohr als Nachrichtenempfänger*. Stuttgart: S. Hirzel Verlag.

Żygis, M. 2004. (Un)markedness of trills: the case of Slavic r-palatalisation. *ZAS Papers in Linguistics* 37: 137-166.

Żygis, M. 2008. On the avoidance of voiced sibilant affricates. *ZAS Papers in Linguistics* 49: 23-45.

Samenvatting in het Nederlands

De uitspraak van de Nederlandse /r/ is opvallend variabel. Verschillende studies hebben opgemerkt dat zelfs het Standaardnederlands wel 6, of 10, of 20 varianten kent, afhankelijk van hoe fijnmazig de beschouwing is. Het gaat hierbij om variatie in de plaats van articulatie (die kan alveolair, palataal of uvulair zijn) de wijze van articulatie (die varieert van trilklanken en fricatieven tot approximanten en klinkers), en de stemgeving (hij kan stemhebbend of stemloos zijn). Tenslotte kan de /r/ helemaal *niet* uitgesproken worden (*r*-deletie). Deels gaat het hierbij om variatie *tussen* sprekers (bijv. de ene spreker gebruikt een alveolaire tril waar de ander een uvulaire fricatief gebruikt), maar er is ook veel zogenaamde binnensprekervariatie (bijv. één en dezelfde spreker gebruikt twee of meer verschillende varianten). Die binnensprekervariatie kan dan linguïstisch-contextueel bepaald zijn: een spreker gebruikt bijvoorbeeld een alveolaire tril in het syllabebegin (zoals in *riem*), maar een palatale approximant in de coda (het syllabeëinde, zoals in *boer*). Maar ook komt het voor dat één spreker twee of meer varianten gebruikt in dezelfde context: de ene keer zegt ze bijvoorbeeld *boer* met een palatale approximant, en een andere keer met een alveolaire tap. Ook de tussensprekervariatie kan samenhangen met verschillende factoren: uiteraard de plaats waar iemand vandaan komt (regionale of lokale accentvariatie), maar er zijn ook verschillen tussen jonge en oudere sprekers, en tussen mannen en vrouwen. Het onderzoek dat in dit proefschrift wordt besproken probeert de rol van deze verschillende dimensies te ontrafelen, en in kaart te brengen welke *r*'en voorkomen bij welke sprekers. De focus ligt hierbij op stedelijke accenten, vanwege de verwachting dat er zowel tussen steden als tussen sprekers binnen steden veel variatie zal zijn.

7.4.2.1 De data

Als belangrijkste bron van data gebruik ik een speciaal voor dit onderzoek verzameld corpus van spraakdata, het *HEMA*-corpus (zo genoemd omdat de opnamen gemaakt zijn in de koffieruimtes en restaurants van *HEMA*-vestigingen. In 10 steden in Nederland en Vlaanderen (Amsterdam, Rotterdam, Den Haag, Utrecht, Nijmegen en Leiden; Antwerpen, Gent, Brugge en Hasselt) zijn steeds 40 sprekers gevraagd om elk ongeveer 50 woorden met *r* in verschillende syllabeposities uit te spreken. Het corpus bestaat dus uit ongeveer 20.000 *r*-woorden. Daarnaast maak ik gebruik van een kleiner corpus van gedetailleerde articulatorische data. Met behulp van echografie zijn de precieze tongbewegingen tijdens het uitspreken van de *r* door 5 sprekers vastgelegd en geanalyseerd.

7.4.2.2 Doelstellingen

Het doel van het onderzoek is tweeledig. Vanuit sociolinguïstisch oogpunt is het interessant om te zien hoeveel van de variatie contextueel is, en hoeveel verklaard kan worden vanuit de externe factoren (stad, sekse, leeftijd). Als er verschillen tussen leeftijdsgroepen zijn zouden die bovendien kunnen wijzen op een in gang zijnde klankverandering. Er is reden om aan te nemen dat dat het geval zou kunnen zijn met de huig-*r* (uvulaire varianten) in Vlaanderen, en met de zogenaamde Gooise *r* (een retroflexe of "gebalde"[38] palatale approximant) in Nederland. Het tweede doel van het onderzoek is meer theoretisch van aard. Een foneticus of fonoloog zal zich vooral interesseren voor de contextuele variatie, maar om iets generaliserend te kunnen zeggen over de taalsystemen van individuele sprekers moet ook rekening gehouden worden met andere soorten variatie, en de vraag zal moeten worden beantwoord hoeveel van de fonetische variatie nu fonologisch relevant is. Daarnaast is de fonoloog geïnteresseerd in de vraag wat een categorie tot een categorie maakt: hoe kan het dat die /r/ zo variabel is, en, omgekeerd, hoe kunnen al die verschillende realisaties functioneren als één categorie (binnen één taal en in verschillende talen)?

7.4.2.3 Resultaten: de empirie

De Nederlandse /r/ vertoont zo mogelijk nog meer variatie dan gedacht. Niet alleen worden er inderdaad zo'n 20 varianten onderscheiden, veel van die varianten komen ook in alle stadsaccenten voor, en veel sprekers gebruiken een rijk palet. In de meeste stadsaccenten vinden we ongeveer 10 varianten aan het begin van de syllabe en 16 in de coda, en in Utrecht komen ze in die positie alle 20 voor. Sprekers hebben doorgaans echter wel sterke voorkeuren voor bepaalde varianten. In het syllabebegin zijn de stemhebbende alveolaire tap [ɾ], de uvulaire approximant [ʁ̞] en de uvulaire trilklank [ʀ] samen goed voor 76% van alle realisaties. In de coda zijn de Gooise *r* [ɻ], de stemloze alveolaire tap of trilklank met frictie [r͡ɹ̝] en de uvulaire fricatief [ʁ] het meest frequent (samen 54%).

De Gooise *r*, zo komt naar voren uit het articulatorisch onderzoek, kan inderdaad door sprekers als retroflexe óf als gebalde approximant worden gemaakt. Dit lijkt niet afhankelijk van de plaats van articulatie van de andere, meer consonantische varianten die deze sprekers ook gebruiken (zowel de retroflex als de gebalde approximant komen voor in de coda bij sprekers met zowel alveolaire als uvulaire varianten aan het syllabebegin).

Plaats van articulatie: de meeste sprekers hebben een voorkeur voor alveolaire óf uvulaire varianten voor wat betreft de meer consonantische realisaties, maar bijna 16% van de sprekers vertoont ook variatie tussen deze plaatsen van articulatie. Voorkeuren zijn ook sterk geografisch verdeeld: in Antwerpen en Brugge zijn bijna alleen alveolaire *r*-sprekers, terwijl *r*'en in Den Haag en Nijmegen het sterkst uvulair zijn. Maar in Rotterdam houden alveolaire en uvulaire varianten elkaar dan weer in evenwicht.

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[38] Engels: "bunched approximant", gevormd door balling van het tonglichaam, met een palatale articulatie.

Wijze van articulatie is nog sterker geografisch bepaald: de Vlaamse sprekers hebben vrijwel allemaal een voorkeur voor consonantische varianten (trilklanken, taps en fricatieven), terwijl sprekers in Nederland deze combineren met approximantische en vocalische varianten.

Er zijn duidelijke aanwijzingen voor een aantal relatief snel voortschrijdende veranderingen in *r*-gebruik, vooral in Nederland. De retroflexe/gebalde approximant (Gooise *r*) is sterk in opkomst en nu al de meest gebruikte variant in de coda in bijna alle onderzochte Nederlandse steden (de uitzondering is Nijmegen). Deze opkomst gaat samen met de ondergang van sjwa-insertie in coda-clusters van *r* + sonorant of niet-coronale obstruent (zoals in *harp* of *berg*). Sjwa-insertie lijkt sterk samen te hangen met het gebruik van consonantische varianten. Dat laatste wordt ook aangetoond aan de hand van een meer gedetailleerd fonetisch onderzoek op een deelcorpus van de *HEMA*-data: sprekers gebruiken doorgaans in de sjwa-insertiecontext dezelfde (meest consonant-achtige) varianten als in de intervocalische context (*beraad*, *sturen*).

Wat het onderzoek naar sjwa-insertie ook laat zien is dat de fonetische eiegnschappen van de sjwa (met name de duur) afhangen van welke *r*-variant er gebruikt wordt. Deze duurverschillen, zo gaat het betoog in hoofdstuk 6, weerspiegelen de fonetische herkomst van het (inmiddels gefonologiseerde) proces: de korter durende sjwa's bij alveolaire sprekers uit Brugge lijken meer op de automatische overgangsklank die waarschijnlijk aan de oorsprong van sjwa-insertie ligt, terwijl de langere sjwa's bij uvulaire sprekers uit Nijmegen een duidelijker categorisch fonologisch proces reflecteren.

7.4.2.4 Resultaten: de theorie

In dit proefschrift beargumenteer ik aan de hand van de data dat een groot deel van de linguïstische variatie verklaard kan worden aan de hand van fonetische processen die in spontane spraak voorkomen, in het bijzonder articulatorische verzwakking. Op basis van de fonetische eigenschappen van bepaalde *r*-varianten is te voorspellen dat andere varianten zich zullen voordoen in bepaalde contexten (zie Figuur 7-1). Zo is de alveolaire tril een *complexe* klank uit articulatorisch-aerodynamisch oogpunt. De aerodynamische omstandigheden voor het maken van een succesvolle trilklank zijn bijvoorbeeld gunstiger als de *r* tussen twee klinkers staat dan wanneer hij aan het eind van een woord staat, en gunstiger als hij voorafgaat een lage klinker zoals de [a] (in *beraad*) dan een hoge zoals de [i] (in *riem*). De voorspelling is dan dat er in *riem* meer alveolaire fricatieven zullen voorkomen (het meest waarschijnlijke resultaat van het mislukken van tongpunttrilling). Op deze manier is een model te maken van relaties tussen verschillende *r*-varianten: het bestaan van bepaalde varianten in een bepaalde context lokt het opkomen van andere varianten uit.

Het is hierbij wel van belang om twee zaken in het oog te houden. Ten eerste is het model niet deterministisch en categorisch: de voorspellingen zijn niet van de aard "*elke* alveolaire *r* voor een [i] wordt fricatief" (dit is simpelweg niet waar). Wel is het de verwachting dat er méér fricatieven zullen voorkomen in de [i]-context dan in de [a]-context. Ten tweede betekent dit niet dat elke alveolaire fricatieve *r* een mislukte trilklank is, d.w.z. dat elke spreker die er één produceert *eigenlijk* bedoelde een tril te maken. Waarschijnlijker is het dat sprekers een repertoire aan *r*-klanken hebben, en dat ze in staat zijn om de variatie die ze om zich heen horen na te bootsen. Ze horen vaker alveolaire fricatieve *r*-klanken vóór een [i], dus spreken ze ze zelf ook vaker zo uit. Wel zullen natuurlijk *sommige* van die fricatieven mislukte trilklanken zijn. Dat voorspelt overigens dan weer dat het aandeel van de verzwakte varianten (in dit geval fricatieven t.o.v. trilklanken) langzaam zal toenemen, en dat is wat klankveranderingsprocessen doorgaans ook laten zien – al gaan die processen soms erg langzaam en kan het generaties duren alvorens bepaalde varianten ook echt verdwijnen.

Deze analyse van variatie als voortschrijdende klankverandering kan de *r*-variatie echter maar voor een deel verklaren. Als alléén fonetische factoren een rol zouden spelen, zou de verwachting zijn dat de distributie van *r*-klanken in alle variëteiten van het Nederlands ongeveer hetzelfde is, maar dat blijkt bepaald niet zo te zijn. Zo zijn er grote verschillen tussen de verschillende steden, maar ook tussen sprekers binnen dezelfde stad. Een aantal van die laatste verschillen hangen samen met de factoren van sekse en leeftijd en zijn dus sociaal relevant: lidmaatschap van een bepaalde sociale groep, bijvoorbeeld “jonge vrouwen” bepaalt deels het *r*-gebruik. Soms gaat dat over individuele spraakgemeenschappen heen: de factoren “jong” en “vrouwelijk” zijn bijvoorbeeld significante voorspellers voor het gebruik van de Gooise *r* gemeten over het gehele corpus. Zo maakt de ruime variatie die inherent is aan (een aantal varianten van) *r* het dus mogelijk dat bepaalde varianten sociale indexeerders worden. Het is precies daar waar het model dan ook niet lijkt te werken: de relatief complexe articulatie van de Gooise *r* komt meer voor bij jongere sprekers, terwijl de verder verzwakte klinkerachtige varianten juist populairder zijn bij oudere sprekers. Dit gaat in tegen de verwachting dat de meest verzwakte varianten de meest innovatieve zijn, en juist daar komen dan ook sociale factoren om de hoek kijken.

In andere gevallen sluit de distributie van varianten juist goed aan bij de verwachtingen: zo is de factor leeftijd significant bij de subtiele variatie in verstemlozing van (getrilde en fricatieve) *r* aan het eind van de syllabe in Brugge. Hoewel de varianten van jongere en oudere sprekers veel op elkaar lijken, laten de jongere sprekers wat meer verstemlozing zien. Al met al is duidelijk dat de complexe patronen van *r*-variatie in het Nederlands alleen verklaard kunnen worden door rekening te houden met deels voorspelbare fonetische factoren en de in principe onvoorspelbare sociale. Het model van graduele voortgaande fonetische verzwakking (dat ik opbouw in hoofdstukken 4 en 5 van dit proefschrift) kan daarbij werken als een taalkundige barometer: geeft die plots vreemde waarden aan, dan moet er op zoek worden gegaan naar sociale factoren.

Tenslotte betoog ik dat het model wellicht geen oplossing, maar wel een uitweg biedt voor de zoektocht naar een ondeelbare en overkoepelende fonologische representatie van /r/ die recht doet aan zowel de stabiele functionele eigenschappen van /r/ als de grootschalige variatie in vorm. Naar mijn idee is die zoektocht vruchteloos, omdat heel verschillende doelstellingen ten grondslag liggen aan die twee aspecten van representatie. Het belangrijkste punt is dat voor de representatie van /r/ als fonemische categorie een klein aantal kenmerken genoeg is om bijvoorbeeld zijn fonologische eigenschappen te karakteriseren, maar dat de gemeenschappelijkheid van de verschillende *r*-varianten ligt in het diachrone domein, en wel in de processen van klankverandering die de ene aan de andere variant linken. Dit noem ik de "familierelaties" tussen varianten: de ene komt immers uit de andere voort.

Data uit andere talen, zoals op meerdere punten besproken in dit proefschrift, laten zien dat het Nederlands niet uniek is in het bestaan van vele *r*-varianten (alhoewel wellicht wel in de sociale distributie: er is erg veel variatie mogelijk binnen de standaardtaal). Het model kan getoetst worden aan deze andere talen.

Curriculum Vitae

Koen Sebregts (Goirle, 1972) grew up in Tilburg, where he graduated from secondary school (Theresialyceum) and studied Economics with Tax Law before moving on to Leiden University to study English Language and Literature. He specialised in linguistics, particularly in phonology, and graduated *cum laude* in 2001, having written a thesis on English *r*-liaison. He worked as a junior researcher at Utrecht University from 2001 to 2005, during which time he laid the foundation for the present study. Since 2005, he has held a number of teaching posts, at Leiden University's English department, at the English teacher training college of HU University of Applied Sciences, and at the departments of Dutch and English at Utrecht University. Since 2011, he has been employed at the latter institution as a lecturer in English linguistics.