More about Less

Fast Speech Phonology: the Cases of French and Dutch

Een wetenschappelijke proeve op het gebied van de Letteren

Proefschrift

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- Keksekça ?
Ceux de nos lecteurs qui seraient tentés de voir dans cette interpellation de Gavroche au boulanger un mot russe ou polonais, ou l'un de ces cris sauvages que les Yoways et les Botocudos se lancent du bord d'un fleuve à l'autre à travers les solitudes, sont prévenus que c'est un mot qu'ils disent tous les jours (eux nos lecteurs) et qui tient lieu de cette phrase : qu'est-ce que c'est que cela ?
Victor Hugo, *Les Misérables*

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Contents

1 Introduction

> The secret of a good sermon is to have a good beginning and a good ending, then having the two as close together as possible.
>
> George Burns

1.1 Introduction

As a linguist, one is often asked the question if one is not bothered by the occurrence of certain forms of colloquial, sloppy, or fast speech. These are often judged incorrect or "ugly" by speakers. The answer to this question is always the same: instead of studying the linguistic norm and informing the public on what is wrong and what is right, linguists investigate language use, and want to know why these new structures actually show up in the first place. Surprisingly, data used for linguistic research often reflect the standard language, thus disregarding all kinds of phenomena which are abundant in every day casual speech. It is part of this gap that this thesis is meant to fill.

The aim of this preliminary chapter is twofold. First, to define the field we are about to explore. Not only will we need to identify our subject, but also, the original character of the thesis with respect to earlier analyses of the same facts will have to established. To achieve these objectives, the next three sections will present the domain of fast speech phonology as a whole, the theoretical background of the thesis, and the two languages and phenomena it is meant to study, respectively.

The second aim of the chapter is to equip all readers with a general idea of the goals of the thesis, and the way they will (or will not be) achieved. Section 1.5 will therefore present the research questions, and section 1.6 will present the translation of these into the concrete division into chapters.

1.2 A Phonological Account of Fast Speech

In the early days of linguistics, i.e. in the late 19th and the beginning of the 20th century, the focus of phonology was on correct articulation. Many manuals were written to be used at primary and secondary schools in order to improve on the pupils' pronunciation. Even seemingly descriptive (i.e., non normative) accounts of 19th century speech contain judgments on the appropriateness of certain pronunciations, as the following example shows for Dutch.

(1) *Onze taal verwerpt de lettervereeniging* sr. *Vandaar komt het, dat nergens vóór de* r *eene bloote* s *als prothetische letter is aangenomen, maar steeds* st *of* sch *d.i.* sk *[…] en vandaar mede, dat wij voor* siroop *niet* sroop*, maar* stroop *[…] zeggen; bij onbeschaafden hoort met ook wel* asstrant *voor* assurant*, en* strevet *voor* servet*, dat eerst in* srevet *verbasterd was.*[1] (Brill 1854:43)

Later on, the goal shifted from prescriptive to purely descriptive: in stead of stating how one should pronounce, phonologists started to describe the pronunciations that actually existed, without attaching a value judgment to the different varieties. At the same time, the urge to find explanations for the existence of the various possibilities increased as well.

However, what is described and accounted for in most current day phonological analyses is still mostly "standard speech". That is, instead of taking the vast amount of variation in speech into account, for the sake of briefness and legibility, the author focuses on one style of speech, which is mostly the "standard" form. Of course, in order to be able to select a clear research subject, a researcher needs to focus on a homogenous set of data, which, for linguistics, means one particular variety of the language under investigation, preferably the one most commonly spoken and recognized as "standard" by the majority of speakers. In reality, as Morin (1987) correctly points out, the choice of this variety is often based on former normative judgments:

(2) Many analyses of French simply state that they are concerned with 'French', without further qualification. In many cases, one should probably take this to

[1] 'Our language rejects the union of letters *sr*. This is why nowhere before r a single s was accepted as a prothetic letter, but constantly *st* or *sch* i.e. *sk* […] and it is also for this reason, that we do not say *sroop*, but *stroop* for *siroop*; among the uncivilized, one also hears *asstrant* voor *assurant*, and *street* for *servet*, which had first been corrupted into *srevet*.' [our translation]

> mean 'standard French'. […] Surveys of manuals on French pronunciation […] show that, for several centuries, the social norm now known as standard French has been based on the speech of 'cultivated Parisians' (or 'de la bonne société parisienne'). (Morin 1987:816)

Unfortunately, then, the findings of sociolinguistic studies which deal specifically with variation in language were not always applied in the design of phonological theories aiming to describe languages: it is mostly an abstract "standard" variant, of which it is unclear where and by whom it is spoken, that is chosen as a testing ground.

As the notion of "standard speech" is not clear, it is not surprising that non-standard, informal, or sloppy speech is even less well defined. "Careless" realizations are often abstracted away from, and the question of how to account for them is left to sociolinguistics and phonetics. However, informal variants are an essential part of everyday speech, and therefore cannot be omitted in modern phonological accounts of language, as these aim to describe and to explain for all linguistic facts, and not only for those that are part of an often idealized, abstract, "standard" variant.

In order to contribute to the filling of this hole in theoretical phonology, this thesis will concentrate on *fast speech phonology*: what happens to the contrastive sounds of a language when speakers of that language start speaking faster or less carefully than they would in formal situations? The answer to this question will be sought in a speaker-oriented, theoretical approach. That is, unlike e.g. Ernestus (1999), which is the first analysis of casual Dutch speech data, we aim to provide an analysis that is not only based on the sounds as they are perceived, but also on the theoretical system that underlies the realization of these by the speaker.

The focus will be on two languages, which have two different ways of dealing with fast speech, as will be demonstrated further on. The languages were chosen from two different language families: from the Germanic family, Dutch was selected, which is the mother tongue of the author; French, a language which the author speaks fluently, was singled out from the group of Romance languages. The choice of these two languages, independent of the extent to which we master them, will be justified further on, as the various aspects of the subject are explored in more detail.

In this section, we have placed the thesis in the existing tradition by means of the type of data that will be used. The goal of the following section will be to answer the same question from a theoretical point of view: what are the fundamentals an analysis of fast speech will be based upon?

1.3 Theoretical Background

Over the years, phonology has not limited itself to the segment as a unit of meaning, but also investigated other (underlying) properties of sounds that contribute to the transfer of a linguistic message. Soon, the string of segments bearing phonological features as proposed in Chomsky and Halle's (1968) *The Sound Pattern of English* (SPE) did not prove sufficient to describe all kinds of phonological processes that concerned units of speech larger than the segment. Two of these are relevant to the subject of this thesis: the syllable and the foot.

Stress is a clear example of a meaningful sound difference that exceeds the level of the phonological segment. Consider the following examples.

(3)	a.	*voorkomen*	[vorˈkomen]	'to prevent'
	b.	*voorkomen*	[ˈvorkomen]	'to occur'

The two Dutch verbs in (3) each contain an identical string of segments. However, they have a different meaning because stress (indicated by ˈ) is on the second syllable in (3a), and on the first syllable in (3b). Syllables are thus organized into a prosodic structure, which is done by means of feet. The examples in (3) are compounds, and either stressed on the first or on the second part of the word. In morphologically non-complex Dutch words, stress is on one of the three final syllables, depending on the way these are constructed: it tends to prefer closed syllables to open ones. This shows that the assignment of stress is not conditioned by the number of segments that follow or precede it, but rather targets a syllable in a given position.

The model that will be used to describe the allegedly syllable- and footbased processes in this thesis is Optimality Theory (henceforth OT), which will be briefly described in the remainder of this section.

Chomsky and Halle (1968) started out a whole new trend in phonology: the description of phonological processes by means of mathematic rules. These rules have the form A → B / C_D, meaning that A changes into B in the context "between C and D", as the underscore indicates the place of the target in the context. Thus, a rule ə → Ø / C_V would mean that a schwa is deleted between a consonant and a vowel. These rules were used to arrive from the input to the output form.

As shown above, SPE does not allow accounting for syllabic and prosodic processes, which was one of the causes for its replacement as the dominant phonological theory by Autosegmental Phonology (Goldsmith

1976) in late 1980s. Placing e.g. syllables, tones, and feet on separate tiers, this framework takes into account constituents larger than the segment.

Another problem with SPE is the arbitrary nature of its rules that change input into output: if we have a rule ə → Ø / C_V, why not also have a rule Ø → ə / C_V? Although the enriched nonlinear phonological representation to some extent did constrain the set of possible rules, these still maintained their arbitrary character. For this and other reasons, Optimality Theory was introduced by Prince & Smolensky (1993). OT avoids arbitrariness by stipulating universal principles, which are to greater or to lesser extent obeyed in languages:

(4) In OT, the well-formedness of a linguistic expression is determined comparatively. An expression is well-formed because it is the best among a set of competing expressions, called *candidates.* […] Candidates are compared by a hierarchy of ranked, violable constraints. When two constraints disagree in their assessment of competing candidates, the constraint that is ranked higher is the one that takes precedence. (Frawley 2003:211)

OT thus replaces phonological rules by a series of restrictions, called constraints. Instead of generating one output by successive application of rules, an OT grammar evaluates all possible outputs and chooses the one that is optimal by evaluation of various constraints. The latter are less arbitrary than SPE rules, because they are claimed to be universal: all constraints occur in all of the world's languages, but their ranking is different from language to language.

The challenge for OT in this thesis will be to generate multiple outputs: the fast speech phenomena we are dealing with are variable, and therefore a speaker will not choose the same surface form every time (s)he utters the same word. However, in its most rigorous form, OT only allows for multiple outputs if two or more candidates have an equal number of violations for the crucial constraint, or if two or more constraints are unranked and the various outputs have the same total of violations. Moreover, even if there are more than one winning candidates, there is no way to distinguish between them as far as style and frequency of use are concerned.

Having established the theory in which our analysis of fast speech will be couched, let us now turn to the exact linguistic phenomena we want it to explain for.

1.4 Phenomena Studied

The vowel which forms the center of this thesis is traditionally called *mute-e* or *schwa,* and often realized as [ə]. This vowel is articulated with a central tongue position, and is the easiest vowel speakers of most European languages can articulate. Strikingly, it is the vowel that is produced during hesitations. [ə] being the vowel produced with the least effort, in a language like Dutch (but also in e.g. German), when speakers start speaking faster and hence more sloppily, they tend to change some of the vowels they articulate into this vowel. Reducing their effort even more, speakers of Dutch can arrive at complete deletion of the vocalic segment. An example of both reduction and deletion is given below.

(5) *En ook om die reden zal de CDA-fractie het initiatiefvoorstel steunen.*
ɛn#ok#ɔm#di#redən#zɑl#də#sedeja+frɑksi#ət#iniʃɑtif+vorstɛl#stønə
[ɛnokɔmdiredənzɑldəsedejafrɑksitinʃətifostɛlstønə]
'And for the same reason, the CDA group will support the proposal for an initiative'

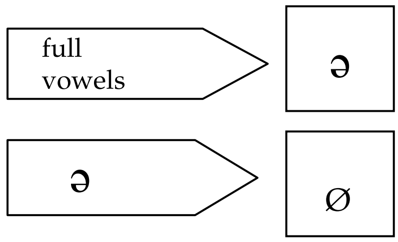
The second line in the example is a transcription in the international phonetic alphabet of the underling form of the sentence, uttered by Jan-Peter Balkenende, today's Dutch Prime Minister, well known for "swallowing" sounds, during a debate in the Dutch house of commons in 1999. The third line is a phonetic transcription of what was actually heard. The word *initatiefvoorstel* undergoes both reduction and deletion: the /a/ present in the underlying form is reduced to [ə], whereas the second /i/ sound has totally disappeared from the realization of the utterance. The description and explanation of this *vowel reduction* phenomenon in Dutch will be the first main topic of this thesis.

The second major subject relates to a second property of [ə]: its possibility to alternate with zero in French. As it is the least carefully articulated vowel it is likely to be the first to be dropped in fast speech. This is exactly the case in French fast speech, where only schwa can be deleted. Deletion of other vowels and reduction to [ə] as in Balkenende's speech are strictly excluded. An example of these *schwa/zero alternations*, cited from a large corpus of French speech (the PFC corpus, to be discussed in more detail in chapter 4), is provided below.

(6) c’est pas du tout une initiative nationale c’est vraiment une initiative de ce collège
s# ɛ#pɑ#dy# tu# yn# inisjativ# nasjɔnal# s# ɛ#vrɛ + mɑ̃#yn# inisjativ# də#sə# kɔlɛʒ
[sɛpɑdytuyninisjativnasjɔnalsɛvrɛɑ̃yninisjativdəskɔlɛʒ]
‘it’s not at all a national initiative, it’s really an initiative of this school’

Speaker 75clb1, a member of the ‘bonne société de Paris’, unlike Balkenende fully articulates the vowels of *initiative*, but leaves out the schwa in *ce*. As shown, all other vowels present in the phonological representation have to be kept intact in the phonetic realization. The situations in Dutch and French are schematized below.

(7) a. Dutch
b. French



The choice of the two languages as the two testing grounds for this thesis now becomes clear: they seem to exactly mirror each other, [ə] being the result of the fast speech process in Dutch, and the source of it in French. The key to an explanation of these facts is presented by, among others, Van Oostendorp (2000), who supposes that [ə] is a vowel without phonological features (“empty vowel”), whereas all other vowels (“full vowels”) are specified for a certain amount of vowel features. In Dutch then, the reduction process is described by the dropping of all features. For French it could be claimed that only vowels without features can deleted. However, as we shall see further on in this thesis, the solution is not as easy as it seems. The ultimate goal will be to design a uniform phonological fast speech theory that can account for the state of affairs in both languages.

1.5 Research Questions

In order to achieve this last goal, designing a uniform fast speech theory, this thesis will aim to answer three major questions, namely:

Q1. What exactly happens in fast speech phenomena?
Q2. How are fast speech phenomena conditioned?
Q3. How can both the answers to Q1 and Q2 be described in OT?

In order to find an answer to all of these questions, we will concentrate on two fast speech phenomena: vowel reduction in Dutch and schwa deletion in French. In our search for answers to Q1, we will investigate the existing literature, filling gaps with new material from speech corpora and studio experiments. The exact triggers to the reduction processes (Q2) will be investigated in a similar way. As pointed out earlier, describing variation in Optimality Theory, a model that in its essence links one input form to one single output, forms an interesting challenge. Therefore, once Q1 and Q2 have been answered, we will turn to Q3 to try and incorporate the conditioning of fast speech processes into an OT account.

For both languages under investigation, we will attempt to find specific answers to all three questions. For Q2, it will be examined for each of the two if the classical assumptions on the conditioning factor behind the process hold true. This means that for Dutch, we will investigate if the foot is the conditioning factor in vowel reduction, and for French, the same will be done for the syllable in schwa/zero alternations. The role of style levels in both processes will receive special attention in this discussion.

The answer to Q3 requires an integration of these levels into OT, and a picture of how reduction and alternations can be placed into a hierarchy of constraints which also has to account for e.g. stress facts and segmental processes. Finally, a theory that explains for both phenomena will also have to clarify why vowel reduction does not exist in French, whereas schwa/zero alternations are a lot less frequent in Dutch.

The table below gives an overview of the various research questions and the partial questions they consist of.

(8) Language specific research questions for Dutch and French

a. Dutch: vowel reduction	b. French: schwa/zero alternations
Q1. What exactly is vowel reduction?	*Q1. What exactly are schwa/zero alternations?*
Q2. Is the foot the conditioning factor?	*Q2. Is the syllable the conditioning factor?*
- Can the positions where deletion is found be described in terms of feet? - What role do style levels play in reduction?	- Can the positions where deletion is found be described in terms of syllables? - What role do style levels play in deletion?

Q3. How can reduction be described in OT?

- How to account for different speech styles?
- At what level does reduction take place?
- How can the difference with French be accounted for?

Q3. How can the alternations be described in OT?

- How to account for different speech styles?
- At what level do alternations take place?
- How can the difference with Dutch be accounted for?

1.6 Outline of the Thesis

The remainder of this thesis is divided into three parts. The first part, consisting of chapters 2 through 4, deals with French schwa/zero alternations. After introducing the existing literature in chapter 2, we will thoroughly examine these accounts in chapter 3 in order to provide an exact formulation of eventual gaps and contradictions in the literature. These will help formulate accurate research questions for corpus research into French schwa as described and discussed in chapter 4.

In the next part, comprising chapters 5 and 6, the focus is on Dutch vowel reduction, again starting out with a discussion of the literature in chapter 5. Chapter 6 then describes experiments conducted in order to establish the foot structure of Dutch, using a corpus of speech as well as laboratory experiments.

Chapter 7 forms the concluding part of the thesis, and will provide an in-depth analysis of both fast speech phenomena.

2 The French Schwa Debate

> if there is any disagreement on introspective judgments, the judgment of those who are familiar with the theoretical issues may not be counted as evidence.
>
> Labov (1975:31)

2.1 Introduction

From a classical, grammatical point of view, Modern French is one of the best-studied languages in the world, and schwa seems one of the most frequently treated subjects dealt with in its description. However, studies concerning schwa make use of a very limited set of empirical data. Most of the data are introspective, i.e. the author "creates" them by checking his own pronunciation. The introspective data are very diffuse, which could be due to the variation in schwa realizations existing among individual speakers of French. François Dell, whose data have served as a source to many authors, describes this problem as follows:

(9) Le comportement de schwa est l'un des domaines où les variations d'un locuteur à l'autre sont très fréquentes, même entre gens dont les prononciations sont très semblables. Il est donc à prévoir que de nombreux lecteurs, même universitaires, parisiens, et de la même génération [que Dell, TG], se trouveront en désaccord sur un point ou sur un autre avec les données qui servent de base à notre discussion.[2]

(Dell 1973:195)

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[2] 'The behavior of schwa is one of the fields where variation from speaker to speaker is very frequent, even between people whose pronunciations are very similar. It can therefore be expected that many speakers, even those with a university degree, who are also Parisian and from the same generation [as Dell, TG], will disagree on some point with the data that serve as a basis to our discussion.'

An additional problem is the fact that the original introspective data were copied by non-native authors, who often added little "corrections", or omitted inconvenient data, in order to serve the purposes of their theory. This leaves us with a heterogeneous set of data, containing a great number of contradictions. Over the years, the debate has been fierce and acrimonious. Consider for example the following citation from Morin (1987), who criticizes Noske's (1982) account of the French schwa facts:

(10) Noske (1982) rediscovers Pulgram's [(1961), TG] program and claims to have a solution. In his analysis, however, the problematical data have been declared irrelevant […] or 'incorrect'.[…] It is Noske's prerogative to present a syllabic analysis of shwa deletion of French where this offers no challenge. In Maori, apparently, shwa deletion is even simpler. The point of the matter is, however, that his analysis does not contribute to the debate. (Morin 1987:835)

Before experimental research can address the different areas in which the authors disagree, an exact picture of the discussion is needed in order to focus on contexts of schwa deletion on which the opinions of the different authors seem to vary and to exclude contexts that are unanimously agreed upon. This and the following chapter will therefore discuss the existing accounts. The present chapter introduces the various approaches, in order to give the reader a broad impression. More specific points of disagreement will be discussed in chapter 3.

This chapter is organized as follows. In section 2.2, we will give a general outline of the debate, establishing an exact definition and typology of our subject. Section 2.3 proposes a typology of analyses, which will subsequently be applied to the accounts discussed in sections 2.4 through 2.9. Finally, section 2.10 will summarize the results of this chapter's comparison.

2.2 Definition and Typology of French Schwa

2.1.1 Definition

Before we can start out our discussion of analyses proposed for French schwa, the reader needs a definition of the subject: what exactly is French schwa? In this section, a few possible definitions will be reviewed in order to obtain a clear picture. Let us start out with a simple description of the phenomenon:

(11) Definition: *French schwa is an instance of [ə] that alternates with zero.*

To a layman, definition (11) might seam a helpful one. For most instances of schwa/zero alternations, it holds true.

(12)	a.	la pelous(e)	[lapəluz]	'the grassfield'
	b.	la p(e)lous(e)	[lapluz]	id.

As (12) shows, the sense of the word *pelouse* does not change as we omit the first vowel. (12a) is simply a more carefully pronounced variant of (12b). Thus far, definition (11) is useful: *pelouse* contains an instance [ə] that can or cannot be pronounced. However, the forms in (12) contain a second instance of written *e*, which also represents [ə], a segment that can or cannot be pronounced, *viz*. the final letter. This instance of "schwa" behaves quite differently from the first one. It is only pronounced in very careful speech, such as read aloud texts, elsewhere it deletes automatically. Final "schwas" always behave differently from word-internal schwas, and can freely be omitted in most cases. Moreover, the debate on French schwa/zero alternations focuses mostly on word-internal instances of schwa, and as we would like to our thesis to contribute to this debate, we will exclude final instances of *e* from our definition. There is another type of vowel that can be excluded in a similar way:

(13)	a.	un film français 'a French film'	[œ̃filmfʁɑ̃sɛ], [œ̃filməfʁɑ̃sɛ]
	b.	un contexte pénible 'a difficult context'	[œ̃kɔ̃tɛkstpenibl], [œ̃kɔ̃tɛkstəpenibl]

The word-final [ə] that can be produced between the second and third consonant in the sequence [lmfʁ] in (13a) is used to facilitate pronunciation in informal speech. The same holds true for the [ə]-vowel in (13b)[3], which only differs from *film français* by the fact that there is a vowel present in writing. If we compare these cases to the situation for [pluz]/[pəluz], we can see that it is exactly the reverse: [ə] is added in informal speech to facilitate pronunciation of clusters in *film français* and *contexte pénible*, whereas it is deleted in the same style in *pelouse*. Clearly, we are dealing with two different phenomena here, and it is on the *pelouse*-type vowels we will focus in this thesis, excluding word-final schwa-like vowels from our subject, in the following way:

[3] From Noske (1992:198).

(14) *French schwa is a word-internal instance of [ə] that can change into zero in informal speech.*

However, one exception has to be made here: when word-final [ə] is the only vowel of the word, i.e., when schwa is in a monosyllabic word, the so-called clitics in French, it behaves differently from other word-final instances.

(15)	a.	*j(e) t(e) l(e) d(e)mand(e)	*[ʃtldmɑ̃d]	'I ask it you'
	b.	j(e) te l(e) demand(e)	[ʃtəldəmɑ̃d]	

As the examples in (15) show, clitic-final schwas are not deleted as easily as word-final [ə] segments, probably because this would produce unacceptable consonant clusters such as [ʃtldm] in (15a). Rather, they delete in an alternating way as in (15b), which is one of the possible realisations of this phrase.

As clitics are very common (words like *je, que, te*, etc. are among the most frequent of the language), and as schwa deletion in this case is far from being as automatic as in the other word-final cases, we cannot exclude schwa/zero alternations in these forms from our discussion. Therefore, a distinction between word-final and clitic-final instances of [ə] must be made in our definition. This can be done by simply adding the stipulation that the vowel subject to the analysis has to be word-internal or in a clitic:

(16) *French schwa is a word-internal or clitic-final instance of [ə] that can change into zero in informal speech.*

This definition of schwa does not hold true for all regional varieties of French. Consider the following two realizations of *la pelouse*:

(17)	a.	la pelous(e)	[lapəluz]
	b.	la pelouse	[lapəluzə]

(17b) is a typical pronunciation we find in the south of France, the so-called Midi region. Together with the realization of a nasal consonant after the nasal vowels, consequent realization of all word-internal and word-final instances of [ə] is the most important characteristic of this regional variant of French[4]. The variety of French that is considered "Standard" is spoken in the area that is roughly situated to the north of the river Loire, and which corresponds

[4] Durand & Eychenne (2004) propose an account of schwa in Midi French, using data from the PFC corpus we will also employ further on in this thesis.

historically to the area where the *langue d'oïl* was spoken in the Middle Ages. It is this variety of French, which is spoken on radio and television and described (or even proscribed) in dictionaries, and which furthermore is subject to most accounts of our subject, that we will study in this thesis.

Of course, as mentioned in chapter 1, the definition of "Standard French" remains problematic. The variety of French spoken in Paris for example has served as a basis for a number of studies, but other authors reject this because Parisian French is usually ahead of the other northern varieties in diachronic development, such as the neutralization of the nasals /ɛ̃/ and /œ̃/. Beside this geographical variation, one also has to take into account the variation with respect to social class and intra-speaker variation, i.e. variation with respect to style level. That is, limiting ourselves to French as it is spoken in the *langue d'oïl* area, we will also have to limit ourselves to a restricted group of speakers (say, middle class speakers) and a restricted set of language usage, carefully distinguishing between formal and informal speech.

Morin (1987), providing a clear picture of the disagreement in various papers on the phonology of French which are simply caused by a different definition of Standard French, shows that comparing various accounts of the same phonological phenomenon is hard when they are not based on the exact same variety of the language. Furthermore, as Morin shows, accounts of French are often based on facts from different variants of French, which creates the "possibility that the object of study is no longer a reasonable model of the language under study, but some linguistic Frankenstein" (Morin 1987:819). Therefore, we will have to be careful in comparing the existing accounts on schwa deletion and try to establish if they refer to the same idiolect.

In order to at least exclude the Southern varieties of French, our subject should in any case be modified to the following:

(18) *Standard French schwa is a word-internal or clitic-final instance of [ə] that can change into zero in informal speech.*

The next problem with the definition thus far is that a realized version of schwa is almost never actually pronounced as [ə] in French. In most cases, it is rounded, yielding a pronunciation that is phonetically identical to that of the mid rounded vowel [œ], approaching that of its tense counterpart [ø] in open syllables (cf. e.g. Anderson 1982:537, Dell 1973:196). Our definition excludes instances of these vowels that do not alternate.

(19)	a.	melon	[məlɔ̃], [møl ɔ̃], [mœlɔ̃]	[mlɔ̃]	'melon'
	b.	écœurer	[ekœʁe]	*[ekʁe]	'to pall'
	c.	déjeuner	[deʒøne]	?[deʒne]	'to have lunch'

The alternating vowel in (19a) is included in our definition because it may be omitted, whereas the vowel [œ] in (19b) is not, because the pronunciation *[ekre] is excluded. Case (19c) shows that speakers can have doubts on the status of a front rounded vowel. The vowel in *déjeuner* may (historically) be considered non-alternating, and therefore a case of /ø/or /œ/, or by a smaller group of speakers to be schwa and therefore alternating, yielding a possible pronunciation [deʒne].[5] This hesitation is also shown in Martinet and Walter's (1973) dictionary of French pronunciation, where nine of the tested subjects declared pronouncing [deʒøne], seven said [deʒœne], and one speaker omitted the vowel.

Dauses (1973) conducted a test with 86 pupils and teachers from Paris and its suburbs, in which he had the subjects judge if they pronounced in a identical way pairs of the type *ce que vous dites* [səkəvudit] vs. *ceux que vous dites* [søkəvudit]. From this survey, Dauses (1973:28) concludes that there is a large tendency among young people to pronounce [ə] as something like [ø] or [œ]. The realizations of the pairs were also recorded, after which the subjects took another, unrelated, test. Next, they had to decide which of the members of the pairs they heard in a recording of their own voice. In the pairs where schwa was opposed to [œ], there was only one pupil who did not confuse the two, and who distinguished between *jeudi* and *je dis* [ʒødi] ~ [ʒədi]. However, she did declare pronouncing *comme jeudi* and *comme je dis* in an identical way (Dauses 1973:33). Dauses' survey forms a clear indication that the pronunciations of [ə] and [œ], and in some cases even of [ə] and [ø], are very close to one another, if not identical. In order to distinguish between schwa and the two other vowels however, we will continue to use [ə] in our transcriptions to indicate an alternating instance of the vowel under discussion. Inclusion of the realizations [ø] and [œ] yields the following definition of our subject.

(20) *Standard French schwa is a word-internal or clitic-final instance of [ə], [œ], or [ø] that can change into zero in informal speech.*

[5] Bernard Bichakjian (p.c.)

In addition to non-alternating [œ] and [ø], our definition also excludes instances of *e* in spelling that for orthographical reasons have been considered to be schwas in other accounts.

(21)	a.	pelage	[pœlaʒ], *[plaʒ]	'fur'
	b.	plage	[plaʒ], *[pœlaʒ]	'beach'
	c.	quenouille	[kœnuj], *[knuj]	'distaff'

In the pair (21ab) [œ] is used to distinguish two different meanings. The [œ] segment in (21a) cannot be dropped, as this would lead to homophony with (21b). Deletion of an [œ] in this context is possible in other words, such as *pelouse* 'grass field' [pœluz], [pluz]. For these reasons, [œ] in this example is considered to be an instance of /œ/, rather than of schwa, under our definition: the phoneme /œ/, which does not alternate with zero, cannot delete in *pelage*, and distinguishes this word from *plage*. The same goes for [œ] in (21c), which cannot be dropped either, although there is a possibility of dropping schwa between [k] and [n], yielding a [kn] cluster, such as in *tu veux que nous le fassions* [tyvøknulfasjɔ̃]. Note however that the onset [kn] is excluded in French except in a few loan words, which might prevent deletion of the schwa in this case.

These examples show that our definition only includes vowels that *actually alternate* with zero, excluding those that *could* alternate, considering their syllabic position, but do not. All vowels of the latter type are thus not considered to be schwas in our line of thought, which eliminates part of the need to explain for cases of "undeletable schwa". After all, our focus is on the process which deletes alternating vowels in informal speech.

However, not all instances of non-alternating [œ] might have to be excluded from our definition of schwa. Consider the following examples, which are central to a number of accounts, particularly those couched within the framework of Government Phonology (Charrette 1991, Scheer 1998, 1999, 2000).

(22)	a.	grenouille	[gʁœnuj], *[gʁnuj]	'frog'
	b.	brebis	[bʁœbi], *[bʁbi]	'goat'

In the examples in (22), the [œ] sound does not alternate and could therefore be claimed to be excluded from the schwa domain. However, as the authors we mentioned argue, in these cases, even if there were a schwa present, it could not alternate, because of the presence of a preceding cluster. Therefore, we cannot be sure about the status of [œ] in this context: does it not alternate because there is a cluster present, or because it is an instance of /œ/?

If we adopt the former solution, all instances of [œ] following a cluster are considered to be the vowel /œ/. This would mean that schwa would never occur after a cluster, or to put it more precisely, after an onset cluster, which is mostly of the type obstruent-liquid in French. The restriction of schwa to syllables with a simplex onset would have to be explained for by our theory. Such a limitation would be quite similar to that according to which schwa is limited to open syllables, which is widely admitted. Consider the paradigm of the verb *jeter*.

(23) *jeter* [ʒə.te] 'to throw' Root: [ʒət]

Present

singular		plural	
1. *je jette*	ʒə ʒət+Ø → ʒəʒɛt	1. *nous jetons*	nu ʒət+ɔ̃ → nuʒətɔ̃
2. *tu jettes*	ty ʒət+Ø → ʒəʒɛt	2. *vous jetez*	vu ʒət+e → vuʒəte
3. *il jette*	il ʒət+Ø → ilʒɛt	3. *ils jettent*	il ʒət+Ø → ilʒɛt

In the forms where the root [ʒət] is followed by a zero suffix, i.e. in all singular forms and in the 3rd person plural, schwa ends up in a closed syllable, and therefore changes into its lax counterpart [ɛ]. In cases where the suffix starts with a vowel, schwa is saved, because its syllable is open. For these and other reasons, it has often been claimed that the occurrence of schwa in French, as that of [e], is limited to the open syllable. There is therefore no reason why it could not be stipulated in the same way that it is restricted to open syllables with a simplex onset. This restriction has also been used for Dutch schwa by Van Oostendorp (2000:175ff), in whose analysis the unmarked vowel (which bares no phonological features) is restricted to the unmarked syllable.

An objection to this could be raised using the example of the verb *crever*. The central vowel in the first syllable of this verb alternates with [ɛ]: *crever* [kʁœve] ~ *je crève* [ʒəkʁɛv]. However, it cannot be a schwa like the first vowel in *jeter* in our analysis, because it follows a complex onset. In our view, the paradigm of *crever* was fixed when schwa-like vowels were not yet limited to syllables with a complex onset. Historically, they originate from /e/, which also cannot occur in a closed syllable in French (cf. *espérer* [ɛspere] ~ *j'espère* [ʒɛspɛʁ]), but for which no onset restriction exists. Also, the weak variant of [e], [ə], might not have been an alternating vowel from the beginning. However, a diachronic linguistic analysis of these facts is beyond the scope of this thesis.

Even if schwa according to our definition does not occur after complex onsets, there is a possibility for [ə]-like vowels to alternate after groups of consonants, as we will see further on. However, there are no such cases in which the cluster forms a legal onset. For this reason, we will stick with definition (20), excluding all non-alternating instances of [ə] and [œ] from our description, and thus automatically the first vowels of *grenouille* and *brebis.*

In a very specific case, the vowel of the third person object clitics can be stressed: in the imperative mode. The clitic is moved from preverbal to postverbal position, and receives stress, which is always sentence-final. This is only the case for affirmative imperatives, as in negative ones (*Don't…*), the clitic is not moved. Examples are given below.

(24)	a1.	Donne-le !	[dɔnˈlœ]	'give it !'
	a2.	Ne le donne pas !	[nœl(œ)dɔnˈpɑ]	'don't give it!'
	b.	*Donne-me-le	[dɔnmœˈlœ]	
	c1.	Donne-le-moi !	[dɔnləˈmwa]	'give it to me!'
	c2.	Ne me le donne pas !	[nœmœldɔnˈpɑ]	'don't give it to me !'

As (24c1) shows, unlike *le,* the first person clitic *me* changes to *moi* (as second person *te* changes to *toi*) in the post-imperative position, but not in the negative form (24c2), where the clitic precedes the verb. Therefore, the correct form meaning 'give it to me' is not (24b), as claimed by Van Oostendorp (2000:248), but (24c1). Similarly, it can be claimed that the third person clitic *le* [l(œ)] (of which the vowel alternates with zero in the negative form) changes into [lœ], with a non-alternating, stressable vowel [œ], in the stressed context. As the vowels of *moi* and *toi* then, the vocalic part of the stressed counterpart of the clitic *le* is not under discussion here. Unlike the typologies proposed by, among others, Noske (1992) then, ours does not include a "stressed variant" of schwa.

Let us finally, after having defined the subject of our analysis, turn our attention to the phonological status of schwa. For André Martinet, schwa had no phonemic value at all:

(25) le *e* muet n'est pas un phonème. Son apparition est prévisible, puisqu'elle est en principe déterminée par la loi des trois consonnes. Il ne fait pas l'objet d'un choix d'un locuteur et a la fonction d'un lubrifiant. (Martinet 1969:216)

According to Martinet, the appearance of schwa in formal speech is entirely predictable by the *Loi des trois consonnes*, which in Martinet's case says that if there is a sequence of three consonants, schwa is inserted between the last two in order to keep the sequence pronounceable. This law was originally formulated by scholars in the late 19th century in order to account for the fact that schwa could not be deleted if this deletion would create a sequence of three consonants.

Another argument against a phonemic status for schwa is that it is never used to distinguish meaning. The following apparent counterexamples are cited by Verluyten (1988:1):

(26)	a.	blond ~ belon	[blɔ̃] ~ [bœlɔ̃]	'blond', 'type of oyster'
	b.	plage ~ pelage	[plaʒ] ~ [pœlaʒ]	'beach', 'fur'

However, as we have seen above, schwas of this type cannot really be considered schwas. As they do not alternate, we consider them to be instances of the phoneme /œ/. Schwa as discussed here is not a phoneme in the pure sense of the word, namely a segment which serves to distinguish meaning in a given language. On the other hand, even when deleted, it seems to play a role in phonological processes. For example, as we will see in chapters 3 and 4, schwa, even if deleted, is implied in syllabification.

In order to underline that schwa is not a phoneme in the proper sense of the word in our opinion, we will add the stipulation "without a change of meaning" to (20), so that the following final definition is obtained:

(27) Definition: *Standard French schwa is a word-internal or clitic-final instance of [ə] or [œ] that can change into zero in informal speech without a change of meaning.*

Having established this definition, we can now turn to a typology of our subject.

2.2.2 Typology

In the literature (e.g. Noske 1992, Van Oostendorp 2000), the classic subdivision that is made in typologies of French schwa is the following:

(28) A classical typology of French schwa
  a. Word-internal schwa
  b. Word-final schwa (except in clitics)
  c. Epenthetic schwa

This typology is based on the different behavior of "schwa" in these three contexts. As we have seen in the preceding section, (28bc) are excluded from our definition of French schwa. In the classical view therefore, our focus would be on one type of schwa only. However, not all schwas included in (28a) behave in the same way. Partly following among others Côté (2000), Dauses (1973), and Dell (1973), we propose the following subdivision:

(29)	a.	Schwa in clitics	"Clitic"
	b.	Schwa in word-initial syllables (except in clitics)	"Initial"
	c.	Schwa at morpheme boundaries	"Morphemic"

As indicated, types (29a-c) will from now on be referred to as "clitic schwa", "initial schwa", and "morphemic schwa", respectively. In what follows, we will provide the reader with a few examples of each type.

2.2.2.1 Clitic Schwa

Schwa/zero alternations in the so-called clitics, i.e. prepositions or pronouns consisting of a consonant plus a schwa (*ce, de, je, le, me, ne, que, te*), are very common. Examples are given below.

(30)	a.	avec d(e) la crème	[avɛgd(ə)lakʁɛm]	Dauses (1973)
	b.	la queue d(e) c(e) r(e)nard	[lakødsəʁənaʁ], [lakødəsʁənaʁ], etc.	Dell (1973)

As shown in (30b), clitics can be consecutive, yielding rows of consecutive schwa syllables, in which case schwa alternates with zero in every syllable, but cannot be zero in all positons at the same time: a pronunciation [lakødsʁnaʁ] would be impossible. An even more complicated situation arises with three or more clitics in a row (e.g. *ne me le demande pas*).

2.2.2.2 Initial schwa

The schwa present in monosyllabic clitics behaves differently from that in the first syllable of polysyllabic words, such as the following:

(31)	a.	c(e)rise	[s(ə)ʁiz]	'cherry'
	b.	f(e)nêtre	[f(ə)nɛtʁ]	'window'
	c.	s(e)maine	[s(ə)mɛn]	'week'

As is the case for clitics, possible realization of schwa as zero in these cases is determined by the preceding word. In the literature, a distinction is often made between phrase-initial and word-initial schwa syllables, most of the analyses only discussing one of the two.

2.2.2.3 Morphemic schwa

Contrary to the former two types of schwa, morphemic schwa, which is schwa at a morphemic boundary, is a lot more stable, and surfaces almost always as schwa on the surface level. Schwa can be used to precede derivational endings, such as in (32ab), inflexional suffixes as demonstrated in (32d), or other endings which closely resemble one of these categories, as in (32c).

(32)	a.	justement	[ʒystəmɑ̃]	'right' (adv.)
	b.	heureusement	[øʁøzmɑ̃]	'luckily'
	c.	appartement	[apaʁtəmɑ̃]	'apartment'
		d. porterai	[pɔʁtəʁe]	'carry FUT 1sg.'

As shown in our examples, schwa in these cases is conserved when it is preceded by a group of consonants, which however is not tautosyllabic as were the obstruent-liquid clusters we discussed in the preceding section. Deletion seems to take place after a single consonant as in (32a), and be excluded after two, as in the other examples.

2.3 Typology of Existing Analyses

Starting out with Palsgrave (1530), there is a large tradition in accounts of French pronunciation, which in the first centuries of their existence mainly aimed to improve the speech of foreigners. A major characteristic of these pronunciation guides is that they are generally normative, that is, there are exact rules that indicate how a given word *should* be pronounced. The following example, cited in Thurot's historical overview of grammars of French (1881:146-147) will make this clear. The 17th century grammarian Chifflet reacts to his contempory Oudin who claims that schwa is omitted in *leçon*, *devant*, *acheter*, etc. in the following way:

(33) Je dis de cette prononciation affectée qu'elle est fausse, injurieuse à nostre langue et totalement pernicieuse à la poësie françoise. Elle est fausse, parce qu'elle anéantit des syllabes entières, qui ont droit d'estre distinguées des autres, quoy que j'avouë qu'elles sont fort courtes, et qu'il les faut prononcer briévement. Elle est injurieuse à nostre langue, d'autant qu'elle la rendroit

> dure, scabreuse et frémissante, à cause du choc des consonnes, contre l'extréme inclination qu'elle a à la douceur. (Chifflet 1659:22)[6]

Although Chifflet thus rejets this pronunciation as insulting and harmful, his contemporaries find that it is quite common: already at the time, "*cette pronunciation tendait à prévaloir*" (Thurot 1888:147). However, as we will see further on, in general, grammarians focus on desired, instead of actual pronunciation. The introduction of non-normative linguistic accounts is of fairly recent date, and to be situated at the beginning of the past century.

Note that it is not the aim of this thesis to give a complete overview of the historical development of French schwa, but rather to investigate the current situation. To achieve this goal, we will focus on the most recent accounts, and try and trace the sources they make use of. In general, most data used in contemporary analyses do not seem to originate from sources earlier than Grammont (1894), which we will therefore use as our starting point.

As indicated in the introduction to this chapter, the debate on schwa/zero alternations in French is fierce. The origin of most dissent lies in the different ways data are obtained. First, there is the group of normative accounts starting out with Palsgrave, as demonstrated above. A more linguistic, c.q. descriptive approach, is adopted by those who base their analysis on introspective data. However, departing from one's own pronunciation to describe a linguistic problem might lead to (deliberate or accidental) adaptation of the data for the sake of the analysis. Furthermore, introspective data may be influenced by an implicit (or in some cases, even explicit) norm: the author, without realizing, corrects his own pronunciation to the one he feels to be the standard one.

Accounts of the introspective type have led to reactions, based on observations in the linguistic field, which unfortunately do not describe the issue of schwa/zero alternations as a whole, but rather focus on a small subset of data, supposed to be incorrect by the author. This subset is then replaced by observations from everyday speech or from laboratory experiments. These accounts will be referred to as partial observations here. There is only a small set of analyses purely based on an empirical set of data,

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[6] 'Of this artificial pronunciation I say that it is wrong, insulting to our language and entirely harmful to French poetry. It is wrong, because it destroys complete syllables, which should be distinguished from others, although I admit that they are very short, and that they have to be pronounced very briefly. It is insulting to our language in as it would make it hard, improper, and rustling, because of the shock between consonants, which is against the extreme inclination the language has towards softness'.

in which no intuitions or prescriptions play a role: the experimental type. Finally, a number of accounts do not add new data to the debate, but only reproduce examples from other authors to base their theory upon, or in support of a theory on another field of linguistic research: reproductive accounts. The various types are summarized in the following table.

(34)

Type of account	*Type of data used*	*Data described*	*Example*
Prescriptive	academic	all	Fouché (1956)
Introspective	introspective	all	Dell (1973)
Partial observations	observations	part	Morin (1987)
Experimental	observations	all or part	Dauses (1973)
Reproductive	proposed by others	part	Van Oostendorp (2000)

In the remainder of this chapter, we will discuss some examples of each kind of approach, focussing on how the theoretic approach of the author can influence the data presented, mainly in the case of accounts based on introspective or reproduced data or on partial observations, as in these cases the choice of the data is essential for the analysis adopted. The sections are organized more or less chronologically: first (section 2.4), we will treat a major contribution to theoretic debate: Grammont's *Loi des trois consonnes*. Sections 2.5 and 2.6 will next treat another important contribution, Dell's introspective data and the use of these made by proponents of different types of linguistic theory. Sections 2.7 and 2.8 will treat two types of accounts which are based on neither of these date sources: the Government Phonology accounts, and Côté's (2000) perceptive account of French schwa. Section 2.9 will round off the discussion with the only data sources which in our view are to be used in this debate: experimental data. Finally, section 2.10 will present our conclusion.

2.4 The "Loi des Trois Consonnes"

Grammont (1894) proposes a general rule for schwa deletion: *la Loi des trois consonnes*. This law was subsequently included in Grammont's 1914 *Traité pratique de prononciation française,* of which we will cite the 1922 edition here. The law states the following : "L'e étymologique ou non, n'apparaît que lorsqu'il est nécessaire pour éviter la rencontre de trois consonnes comprises entre deux voyelles fermes" (Grammont 1894:53). That is, schwa only surfaces if it is necessary to avoid the encounter of three consonants between two "ferm" vowels (i.e. all vowels but schwa). More specifically, the author states that the realization of schwa depends on the number of consonants that precede it:

(35) a. Quand il [schwa, TG] n'est séparé de la voyelle qui précède que par une seule consonne, il tombe toujours.
b. Quand il est séparé de la voyelle qui précède par deux consonnes, il se prononce toujours.

Grammont (1922:104-105)

However, Grammont cites numerous exceptions to both his *Loi des Trois Consonnes* and the two rules in (35). The *Loi des trois consonnes* has been subject to numerous attacks. Philippe Martinon, a contemporary, cites several counterexamples to argue that "il y a là une tendance très générale […] qui se manifeste certainement dans la pluralité des cas. Mais une tendance n'est pas une loi. " (Martinon 1913:157-58). However, as noted by Durand & Laks (2000), the original *Loi des trois consonnes* was not intended as a law, but rather as a tentative to formulate a tendency, not a "law" in the neo-grammarian sense of the word (*Ausnahmslosigkeit der Lautgesetze)*. Martinon does not propose a rule to replace the *Loi des Trois Consonnes*, but prefers an exhaustive list of possible occurrences. The prescriptive nature of the data is demonstrated by citations like "cette prononciation n'est plus admise dans la bonne conversation", (Martinon 1913:159) and "il faut bien dire *le r'pas* et non *l'repas*" (Martinon 1913:177). However, some tendencies reported to appear in "vulgar" language became generally accepted later on, like deletion of the liquid preceding schwa, as in *quatre* [kat].

Another rejection of strict application of Grammont's law and a listing of facts can be found in Pierre Fouché's (1956) pronunciation guide. Fouché discards the *Loi des Trois Consonnes* on the basis of examples like *pas d' scrupules* [pa d skʁypyl], which show the occurrence of four consecutive consonants after schwa deletion. For the description of the deletion phenomenon, Fouché distinguishes between schwa in monosyllabic and in polysyllabic words, and between initial, final and word-internal syllables. For every context, he gives the deletion possibilities, which in his view depend on the consonantal environment. He then analyses sequences of successive schwa syllables, from two to nine (!) consecutive schwa syllables in one sentence. It is unclear whether the possibilities Fouché mentions are a description of reality, or the author's opinion on how facts should be. Among other things, the following definition of the speech he refers to points in the latter direction:

(36) [La conversation soignée] se reconnaît à un ensemble de faits phonétiques communs à tous les milieux parisiens cultivés, faits constituant à leur tour une sorte de norme d'après laquelle toute autre prononciation que la sienne est sentie comme déplacée ou comme défectueuse.[7] (Fouché 1956:iii)

Weinrich (1958) describes the historical phonology of the Romance languages, and devotes a chapter to "das französische Drei-Konsonanten-Gesetz". In this chapter, he discards Grammont's law on the basis of arguments already provided by Martinon and Fouché (*pas d' scrupules*). He also rejects Fouchés account, because of the large number of rules and exceptions. Grammont's law is reformulated as follows: "Wenn […] eine Zweiergruppe im absoluten Anlaut möglich ist, so kann sie auch mit einem *voraufgehenden* beliebigen Konsonanten zusammen eine Dreiergruppe bilden" (Weinrich 1958:252). In Weinrich's opinion, then, all consonants that occur together in word onsets can also be found in syllable onsets (a principle already formulated by Kurylowicz 1948), forming a cluster with the consonant in the preceding coda, so that three and four member groups can easily be formed. This produces clusters in which either the middle segment is [s], or the last segment is a liquid (cf. Weinrich 1958:255).

To this general rule, a few counterexamples are cited, but their number is by far inferior to that of the exceptions in the accounts of Fouché and Grammont. However, as Dauses shows, citing Baldinger (1958), Weinrich's law on the one hand predicts presence of schwa in cases where it may be deleted, for example where the two last consonants of the group do not form a correct onset, as in *il ne rest' pas longtemps* [stp] (Dauses 1973:64). On the other hand, it implies pronunciations like [sklɛt] for *squelette*, a case in which deletion is prohibited according to all other authors.[8]

Pulgram (1961) refines Weinrich's law in the following way:

(37) a. An /ə/ must be articulated where its omission would produce a non-occurring […] consonant cluster *within a syllable ;*

b. In all other cases the articulation of the /ə/ is optional, dependent on style and subcode […].

(Pulgram 1961:317, emphasis ours)

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[7] '[Careful pronunciation] is recognized by a number of phonetic facts which are common to all cultivated Parisian circles, facts which represent a sort of norm according to which every pronunciation other than one's own is felt to be misplaced or incorrect'.

[8] The first vowel of [skœlɛt] is even excluded from our discussion, as it does not comply with definition (27): the vowel [œ] does not alternate.

Thus, by adding the stipulation "within a syllable", Pulgram allows clusters consisting of a coda cluster plus a following onset cluster, which were disallowed by Weinrich, who focussed on possible word onsets preceded by at most one consonant. Thus *il ne reste pas longtemps* is allowed by Pulgram, as it contains the legitimate coda [st] followed by the onset [p], whereas Weinrich would exclude it because [tp] is not an onset cluster. By proposing syllabic clusters as a condition to schwa deletion, Pulgram introduces a new concept into accounts of French schwa/zero alternations, a concept which became the norm with the advent of non-linear phonology, as we will see further on.

Delattre (1966), who like Dauses rejects strict application of the *Loi des trois consonnes*, proposes another basic rule for schwa pronunciation, similar to (35ab):

(38) Suivi d'une consonne ou plus, l'ə intérieur tombe après une seule consonne et se maintient après deux ou plus […] Le nombre de consonnes qui *suit* l'ə est donc sans effet.[9] (Delattre 1966:17)

Four groups of exceptions to (38) are cited based on partial observations, e.g. the monosyllabic clitics *ce, de, je, le, me, ne, que* and *se* for which the author even establishes exact numbers representing the percentage of times the deletion occurs (Delattre 1966:31). Furthermore, he points out that the rule is not consequently respected in fast or careless speech, as shown by the following observation:

(39) Il n'est pas rare d'entendre des Français dire [ʒystmɑ̃], [fɔrtmɑ̃] etc. Cela peut arriver dans un style pressé ou négligé, par exemple. Cependant la norme dans le langage naturel des gens cultivés est [ʒystəmɑ̃], [fɔrtəmɑ̃].[10]

(Delattre 1966:19)

To summarize, the *Loi des trois consonnes*, a tendency first formulated by Grammont, and reformulated subsequently by among others Weinrich and Delattre, has been subject to a great amount of discussion in the literature. As

[9] 'Followed by one consonant or more, the internal ə is deleted after a single consonant and is maintained after two or more. The number of consonant that *follows* the ə thus has no effect.'

[10] 'Hearing Frenchmen say [ʒystmɑ̃], [fɔrtmɑ̃] is not uncommon. This can happen in a fast or sloppy speech, for example. However, the norm in natural speech of cultivated people is ʒystəmɑ̃], [fɔrtəmɑ̃].'

we will see further on, it is central to the French schwa debate. Counterexamples often originate from introspection and/or partial observations. However, as pointed out by Durand & Laks (2000), Grammont meant to demonstrate a tendency in the French language, and not a normative rule. In this sense, as Durand & Laks point out, the *Loi des trois consonnes* is rather a constraint of the OT type, than a rule in derivational SPE terms. Exceptions to the "law" must therefore not be interpreted as arguments to reject it, but rather as examples of cases in which a general principle is not obeyed.

2.5 Dell (1973): Introspection?

In the 1970s and 1980s, linguistic theory was dominated by the derivational rule-based theory set out by Chomsky and Halle (1968). A very complete account of schwa deletion in terms of this framework is provided by François Dell. Dell (1973) is the first to propose a set of generative rules to account for all schwa/zero alternations. At the beginning of his discussion of schwa, he underlines that the data cited all originate from introspection: "Un mot d'abord sur le parler qui est décrit ici. C'est celui de l'auteur."(Dell 1973:195). Contrary to most of the authors cited thus far, Dell does therefore not attempt to describe "la bonne prononciation française […] de la bonne société parisienne" (Grammont 1922:1), but merely depicts his own pronunciation, which he claims to be representative of Standard French. However, we should wonder if introspection data originating from a well-educated linguistically trained speaker are truly representative of normal speech and uninfluenced by the norm. Particularly, Dell, who studied with Fouché, seems to have translated a great deal of Fouchés normative pronunciation rules into his descriptive SPE-framework, as we will demonstrate below. In (40), an overview of Dell's rules is presented. # in these rules means a word boundary, whereas + indicates a morpheme boundary. A pause is symbolized by §. The minimal number of all elements can be indicated by a subscribt number, e.g C_1 means one or more consonants.

(40)	*Rule*	*Description*	*Example*
a.	ELIS: ə→ Ø / _ [-seg] V_1 (obligatory)	Schwa deletion if the following morpheme begins with a vowel	*l'avion* /lə#avjɔ̃/ → [lavjɔ̃]
b.	V-E: ə → Ø / V _ (obligatory)	Schwa deletion after a vowel	*avoue* [avu]

c.	PAUSE: ə → Ø / VC_0 _ § (obligatory)	Schwa deletion before a pause	*elle est trop petite* [pətit]
d.	E-FIN_1 : ə → Ø / VC _ # (obligatory)	Word final schwa deletion after a single consonant (polysyllabic words)	*petite roue* [pətitru]
e.	E-FIN_2 : ə → Ø / CC _ # (optional)	Word final schwa deletion after two consonants	*le texte* [tɛkst] *du discours*
f.	LIQUEF: L → Ø / O _ $\#_1$ C (obligatory)	Deletion of a liquid after schwa deletion	*pauvre vieillard* [povrəvjɛjar] / [povvjɛjar]
g.	INI : ə → Ø §C_ (optional)	Schwa deletion in the initial syllable of words beginning with one consonant	*revenez* [rvene] *demain*
h.	INI-EX: ə → [-règle INI] /[-son,-cont]_$\#_0$[-son,-cont] (obligatory)	Exception to INI: between two non-continuant obstruents	*te casse pas la tête* [təkaspalatɛt] *te fais pas de bile* [tfɛpadbil]
i.	VCE_1: ə → Ø / V$\#_1$C_ (optional)	Schwa deletion in the first syllable of a word if preceded by one consonant.	*pas de scrupules* [padskrypyl]
j.	VCE_2 : ə → Ø /VC_ (obligatory)	Word-internal Schwa deletion if preceded by one consonant.	*centenaire* [sɑ̃tnɛr]
k.	E-FUT: ə → Ø / _ +r+ (optional)	Schwa deletion in future/conditional forms	*voleras* [vɔlra]

In general, schwa deletion in Dell's account depends essentially on the segments that precede it (VCE and E-FIN rules). The rules INI and INI-EX reflect the tendency of schwas in initial syllables to be preserved. Like Delattre, Dell also takes different speech styles into account: he remarks that the frequency of application of E-FIN_2 "est d'autant plus grande que le locuteur apporte moins de soin à sa prononciation et que le debit est rapide" (Dell 1973:224)[11], but that its application mostly depends on the nature and number of the consonants. The latter aspect of Dell's account is present in Fouché's as well, and comparing the rules of these two authors, we find that they bare other close resemblances, as demonstrated in the following table.

[11] 'increases when the speaker pronounces less carefully and when speech rate is high'

(41)

Dell (1973)	*Fouché (1956)*
ELIS: ə → Ø / _ [-seg] V_1 (obligatory)	*E* muet final de polysyllabe ou E de monosyllabe suivis d'un mot commençant par une voyelle […] L 'e meut ne se prononce pas, quel que soit le nombre de consonnes qui précède (p. 135)
PAUSE: ə → Ø / VC_0 _ § (obligatory)	l'*e* muet tombe, qu'il soit précédé d'une ou de plusieurs consonnes prononcées (p. 94)
E-FIN$_1$: ə → Ø / VC _ # (obligatory)	Chute : • lorsque l'*e* muet final est précédé d'une seule consonne prononcée et suivi d'un mot commençant par une consonne ou deux (p. 95) • lorsque l'*e* muet final est précédé de deux consonnes prononcées et suivi d'un mot commençant par une seule consonne prononcée (p. 96)
E-FIN$_2$: ə → Ø / CC _ # (optional)	
INI : ə → Ø §C_ (optional)	• Prononciation soignée : lorque le débit est normal, l'*e* muet se prononce (p. 121) • Prononciation familière : l'*e* muet peut tomber après un [l], un [m] ou un [n] initiaux [de] mot ou de groupe (p. 121)
INI-EX: ə → [-règle INI] / [-son,-cont]_ $\#_0$[-son,-cont] (obligatory)	
VCE_1: ə → Ø / $V\#_1C$_ (optional)	• *E* muet se conserve lorsqu'il est précédé de deux ou trois consonnes prononcées (p. 97) • *E* muet tombe lorsqu'il n'est précédé que d'une seule consonne prononcée (p. 97)
VCE_2 : ə → Ø /VC_ (obligatory)	

As shown in (41), Fouché's and Dell's accounts propose mostly the same rules, which is likely to be caused by the fact that although Dell claims that his data are purely introspective, they were influenced by Fouché's academic data. On the other hand, there are differences in the concrete contexts in which the rules apply. For example, Fouché's rule on initial schwa in casual speech only applies after [l,m,n], whereas Dell's rule (40h) is optional but does not apply between two obstruents. However, Fouché (1956:122) also refers to schwa between identical obstruents (*te tires-tu* *[ttiʁty]) as an impossible deletion context.

Dell's data (and therefore indirectly, Fouché's) and examples have been copied in many other accounts of French schwa/zero alternations without explicit reference to Dell. However, as we have seen, the data only represent the speech of one person, who moreover is (linguistically) educated and inspired by normative data. The following two sections treat two recent approaches to the schwa problem, Autosegmental and Government

Phonology, for which authors based themselves entirely or partly on Dell's intuitions.

2.6 Autosegmental Phonology

2.6.1 Introduction

In the 1980s, phonologists began to realize that a lot of phonological processes were not conditioned by segments and their features, but by larger entities, such as syllables and rhythmic constituents called feet (cf. chapter 5 of this thesis). They arrived at the conclusion that a linear string of segments is not sufficient to account for phonological processes. The existence of larger entities in non-linear or *Autosegmental Phonology* (Goldsmith 1976) cannot be proved by merely listening to human speech, but is motivated by the existence of phonological phenomena based on them. In Autosegmental Phonology, features, segments, duration, tones, syllables and feet are incorporated into different *tiers*. A phonological process can take place on any of these tiers, and have consequences for the others. For example, compensatory lengthening constitutes an ideal argument for a separate duration tier. A process of vowel lengthening in Ingwaeonic (a dialect of West Germanic) will demonstrate this.

(42)	a.	C V C C	b.	C V C C	*durational tier*
		g ɑ n s 'goose'		g ɑ s	*segmental tier*

(cf. Gussenhoven & Jacobs 1998:158)

When the [n] was deleted, the [ɑ] took over its slot on the duration tier, and therefore got lengthened. That is, when [n] disappeared, its C-slot on the duration tier did not, and subsequently was filled with segmental content from the neighboring V-slot. Autosegmental Phonology thus easily explains for the fact that [ɑ] lengthens when [n] deletes, a fact for which linear phonology needed two independent rules, which could not as easily be related to each other. In order to account for the difference between schwa and full vowels, the two possibilities (43a,b) could be conceived of once we adopt non-linear phonology:

(43) Schwa as compared to full vowels in non-linear phonology

a. empty vowel (Anderson 1982)	b. floating segment (Tranel 1987)	c. full vowel
V		V
		|
	[ə]	[a]

Schwa is either considered a vocalic element with no features (among others, Anderson 1982 and the analyses treated below), or a segment without an element on the duration tier (among others, Tranel 1987). In this section, we will discuss two accounts which make use of Dell's data: Noske (1992) and Van Oostendorp (1995, 2000).

2.6.2 Noske (1992)

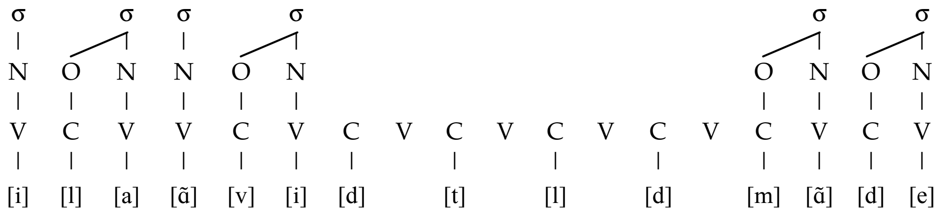
Noske proposes the following syllabification algorithm, which also incorporates instances of (deleted) schwa:

(44)
a. syllable imposition triggered by as yet unsyllabified full vowels (including nonalternating schwas), followed by mapping;
b. *optional* syllable structure imposition, triggered by as yet unsyllabified empty V's (alternating schwas), followed by mapping;
c. dumping;
d. syllable imposition triggered by consonants.

(Noske 1992:207)

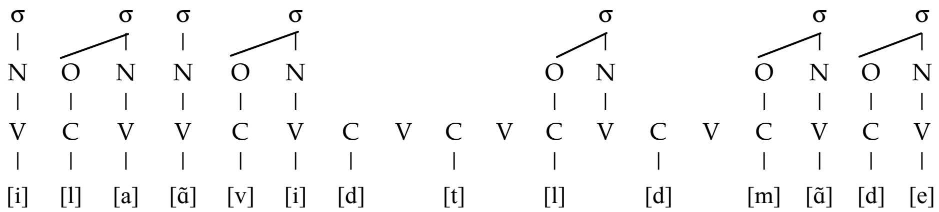
This algorithm, according to the author, allows accounting for all types of schwa deletion in French (types cited from Dell 1973). An example will illustrate how this works. The sentence *il a envie de̲ te̲ le̲ de̲mander* (Dell 1973:245, Noske 1992:203) contains four instances of schwa, and therefore four empty vowels. Rule (44a) imposes syllable structure, stipulating that a nucleus must be placed wherever there is a full vowel. Noske claims that the basic structure of a syllable (σ) in French is Onset-Nucleus (O N), so that we obtain the following structure for our example phrase.

(45)



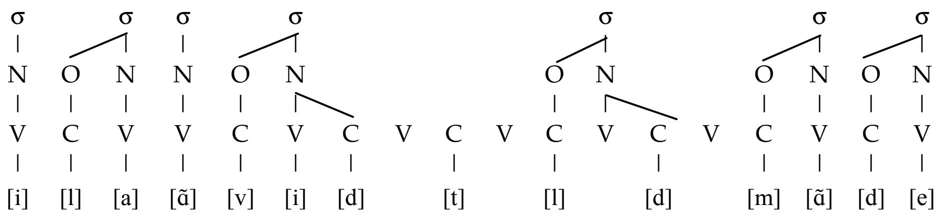
As rule (44b) applies optionally, there are sixteen (2^4) possibilities for the syllabification of the empty vowels in this phrase. Let us take a case in which (44b) only applies to the third empty vowel.

(46)



Dumping rule (44c) incorporates as many consonants as possible into existing syllables. As [d] is a possible coda in French, both [d]'s in our example are joined to the syllable preceding them.

(47)



At this point, only the [t] segment is still left unsyllabified, as [dt] is an illegal coda and [tl] an illegal onset in French. Rule (44d) "saves" this consonant, creating a syllable for it, which causes the empty vowel following [t] to be realized. Our example would then be pronounced *il a envie d' te le d'mander* [ilaãvidtələdmãde].

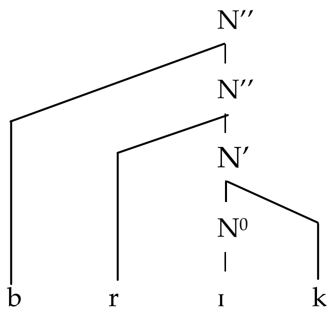
Essentially using Dell's data, Noske thus proposes and account that is purely based on the possibilities for consonants to be resyllabified into correct syllable onsets and codas.

2.6.2 Van Oostendorp (1995,2000)

Dell's data and Noske's analysis are subsequently partly copied by Van Oostendorp (1995,2000). In his (1995) Ph.D. dissertation[12], this author focuses on Dutch schwa, of which he distinguishes three types: underlying schwa (U-schwa), schwa as the result of the reduction of a full vowel (R-schwa) an epenthetic schwa (E-schwa). To make a distinction between schwa and full vowels, Van Oostendorp assumes that schwa, contrary to full vowels, does not have vocalic features and consists only of an empty [-cons] root. This is comparable to the "empty vowel" solution proposed for autosegmental phonology by Anderson (1982), which as we saw was also used by Noske.

To describe the Dutch reduction phenomenon, whereby full vowels reduce to schwa, Van Oostendorp proposes general constraints of the type PROJECT and CONNECT. These constraints can be used to associate vocalic features to prosodic prominence (e.g. PROJECT (Ft, *V*) for the association of the head of a foot to vocalic features, and therefore not to schwa, or PROJECT (Ft_2, *V*) for the head of a binary foot to contain vocalic features). The effect of this in Dutch is the prevention of reduction to schwa in prosodically strong positions. Furthermore, the following X-bar syllable structure (cf. also e.g. Levin 1985) is assumed:

(48) Syllable structure according to Van Oostendorp (2000:9)



This model represents the complexity of syllables as follows: if there is a branching N', the syllable has a coda; if N'' branches, there is an onset. For the analysis of French, Van Oostendorp uses the following constraints:

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12 The original dissertation was almost integrally reprinted in 2000. We will cite from the most recent edition.

(49)

	Constraint	Definition	Use in French
a.	CONNECT (N′, lax)	If N^0 branches (i.e. in a closed syllable), the vowel in the nucleus has the feature lax	Exclusion of both tense vowels and schwa in closed syllables.
b.	PROJECT (N′′, -cons)	Excludes degenerate syllables by demanding a vowel in the nucleus	In combination with *[-cons] and PARSE-VOWEL: Schwa reduction

CONNECT constraints form a combination of two PROJECT constraints. For example, the constraint in (49a) is a combination of PROJECT (N′, lax) and PROJECT (lax, N′): if a syllable has a coda, the nucleus has to contain the feature [lax], and if the nucleus contains the feature lax, the syllable has to have a coda. Thus, the [lax] – branching rhyme connection functions in both ways. Whereas in Dutch, this constraint ranks low, and words like *kijker* [kɛɪ.kəṟ] are possible, in French, it is highly ranked, influencing the paradigms of *jeter*-like verbs which as we have seen change schwa into [ɛ] when it ends up in a closed syllable. Insertion of a feature [lax] into the representation of schwa leads to an implossible vowel, as "French does not allow vowels with only a specification for aperture features", [coronal] is added as the unmarked place feature (Van Oostendorp 2000:239-240).

In French, CONNECT (N′, LAX) is dominated by a constraint prohibiting the co-occurrence of the features [labial] and [lax] in order to preserve the absence of [lax] in labial vowels in pre-coda position, as (50b) shows.

(50) a. *jeter* : laxing of schwa in closed syllables

Input	Candidates	* [labial, lax]	CONNECT (N′, lax)
/ʒət+e/	☞ .ʒə.te.		
	.ʒɛ.te.		*!
/ʒət+Ø/	.ʒət.		*!
	☞ .ʒɛt.		

b. *sauter*: laxing blocked by markedness constraint[13]

Input	Candidates	* [labial, lax]	CONNECT (N′, lax)
/sot+e/	☞ .so.te.		
	.sɔ.te	*!	*

[13] To account for the presence of underlying lax vowels (e.g. *bol* [bɔl]), Van Oostendorp proposes the constraint PARSE-LAX. However, how can we determine whether a vowel is underlyingly lax (Paula Fikkert, p.c.)?

/sot+Ø/	☞ .sot.		*
	.sɔt.	*!	

Now consider an example of how PROJECT (N′′, -cons) triggers schwa deletion in French: *tu devenais* 'you became' (copied from Noske) and its four theoretically possible pronunciations (viz. pronunciation of both schwas, of either one, or deletion of both).

(51) *tu devenais*

a. tu devenais [ty.də.və.nɛ]

b. tu dev(e)nais [ty.dəv.nɛ]

c. tu d(e)venais [ty.dvə.nɛ]

d. ?tu d(e)v(e)nais [tyd.v.nɛ][14]

Whereas the deletion of one schwa is allowed, both schwas cannot be omitted at the same time. The ranking PROJECT (N′′, -cons) » *[-cons] correctly describes this:

(52) Exclusion of degenerate syllables

/tydəvənɛ/	PROJECT (N′′, -cons)	*[-cons]
a. ty.də.və.nɛ		****!
☞ b. ty.dəv.nɛ		***
☞ c. ty.dvə.nɛ		***
d. tyd.v.nɛ	*!	**

Candidate (52a) is ruled out, because it contains an extra violation of *[-cons] in comparison with (52b) and (52c). However, (52d), which has even fewer violations of this constraint than the optimal candidates, is also ruled out because it contains a degenerate syllable. In order to prevent full vowels from deleting to satisfy *[-cons], the vocalic feature faithfulness constraints PARSE-FEATURE are all ranked above this constraint. Only schwa, which has no vocalic features, can then satisfy *[-cons] by deleting.

Van Oostendorps's analysis, in spite of being set in OT, is not very different from Noske's: there are as many occurrences of schwa deletion as possible, as long as the remaining consonants can be correctly syllabified. Please note that, like Noske, Van Oostendorp does not specify the constraints or rules governing the syllabification process: it is not stipulated whether, say

14 The status of this example is unclear: although it is excluded by most authors, at the beginning of a longer phrase, the two schwas might be omitted at the same time (e.g. *il devenait vraiment chiant*) (Bernard Laks, p.c.).

[rt] is a possible onset or coda. Another similarity between the two accounts lies in the data: examples used by Van Oostendorp are mostly Noske's, and therefore indirectly Dell's (and Fouché's).

2.7 Schwa and Proper Government

2.7.1 Introduction

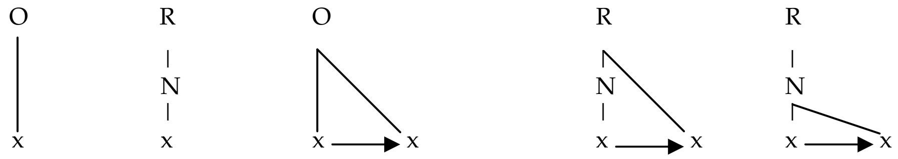
In the following two subsections, we will discuss in more detail two accounts of schwa/zero alternations within the framework of Government Phonology. A major characteristic of these approaches is that they reject other phonological models, and start out with a completely new theory to account for linguistic facts. However, as we will show, the data used are still mostly from earlier accounts such as Dell's, to which a certain amount of data from unknown origin is added. We will first briefly introduce Government Phonology (henceforth GP) and its most important principles.

Initiated and elaborated by, among others, Jonathan Kaye, Jean Lowenstamm and Jean-Roger Vergnaud (henceforth KLV), GP, like OT, dispenses with the rule component of the grammar: "A complete phonological system consists […] of […] principles along with sets of parameter values." (KLV 1985:305). For the description of the relations that are expressed as syllabic in other frameworks, KLV (1990) propose the notion of phonological government, which is defined as follows:

(53) Government is defined as a binary, asymmetric relation holding […] between two skeletal positions. For a governing relation to hold, two types of conditions must be met: formal and substantive. Formal conditions will involve the notions of locality and directionality. The substantive conditions define to what segmental material a skeletal point may be associated. (KLV 1990:198)

Locality means that the governor must be adjacent to the governee, whereas directionality implies that the government relation applies either from left to right, or from right to left. To replace the syllable, the constituents Onset (O) and Rhyme (R) are proposed. Both of these constituents can be branching. If they are, a local government relation holds: the left member of the branching constituent governs the right member. Furthermore, KLV (1990:199) "stipulate that the left branch of every Rhyme is the Nucleus constituent." (54) shows the possible syllabic constituents that follow from these structural criteria. In this example, arrows from governor to governee are used to indicate local governing relations.

(54)



simplex onset | simplex rhyme | branching onset | branching rhyme - VC | branching rhyme - VV

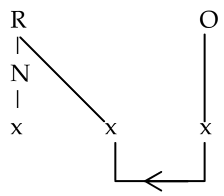
The constituents O, R and N are allowed to branch, which yields the possibilities of a branching onset, a coda and a nucleus containing a geminate or a diphthong, respectively. Thus, the syllable and the coda have disappeared as constituents (cf. KLV 1990:200ff).

In addition to governing relations within constituents, KLV (1990:210) also propose interconstituent government, for which the following two principles hold:

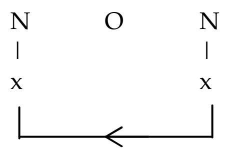
(55) a. Only the head of a constituent may govern.
b. Only the nucleus (or a projection thereof) may govern a constituent head. (KLV 1990:210)

Contrary to government relations within constituents, interconsituent relations apply from right to left. Thus, the following relations are possible:

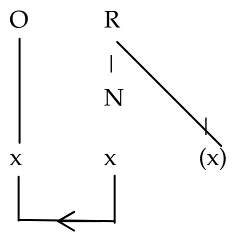
(56) a. Interconstituent government between an onset and a preceding rhymal position



b. Interconstituent government between contiguous nuclei



c. Interconstituent government between a rhyme and an onset



(cf. KLV 1990:210-211)

According to KLV (1990:211), this explains why possible syllable onset clusters (constituent government) are often the exact mirror of possible coda-onset sequences (interconstituent government): there is a difference in direction between the government relations. The two final principles this introductory section discusses are Proper Government and the Empty Category Principle, which are needed to describe relations between two nuclei:

(57) *Proper Government* (KLV 1990:219):
a. The governor may not itself be governed
b. The domain of proper government may not include a governing domain

(58) *Empty Category Principle* (ECP, KLV 1990:219):
A position may be uninterpreted phonetically if it is properly governed

Proper Government, which was first introduced by Kaye (1987:11) is a governing relationship between two adjacent nuclei, as in (56b), and it is therefore used by Government Phonologists to account for schwa deletion phenomena in French. Concretely, a schwa may be left uninterpreted (according to the ECP) if it is followed by a full vowel that properly governs it. According to (57b), there may not be a consonant cluster (a domain of constituent government) between the two.

Government Phonology thus describes phonological processes in terms of lateral relations, instead of the vertical foot-syllable-segment relations in "classical" approaches. Proper Government and the Empty Category Principle are powerful instruments that can account for French schwa/zero alternations, as demonstrated by the accounts proposed by Charette and Scheer, which will be discussed below.

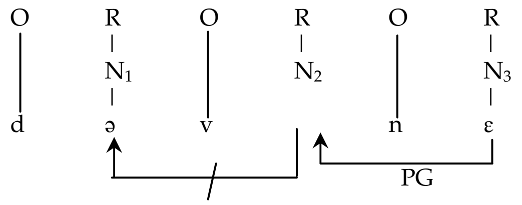
2.7.2 Charette (1991)

Charette uses Proper Government (henceforth PG) to account for schwa/zero alternations. Recall that the direction of PG is from right to left, and that the locality condition also holds here: the nuclei must be adjacent, which means that there may not be another nucleus between them. To illustrate this, we will show how Charette's Proper Government accounts for schwa deletion in the example we used for our discussion of Van Oostendorp's account in the last section. Recall the pronunciations of *tu devenais*, which are repeated below for convenience.

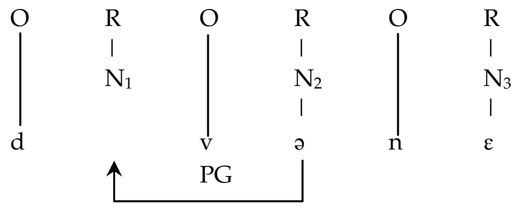
(59)		*tu devenais*	
	a.	tu devenais	[ty.də.və.nɛ]
	b.	tu dev(e)nais	[ty.dəv.nɛ]
	c.	tu d(e)venais	[tyd.və.nɛ]
	d.	*tu d(e)v(e)nais	[tyd.v.nɛ]

(59b) and (59c) are derived in the following way:

(60) a. *dev(e)nais*



b. *d(e)venais*

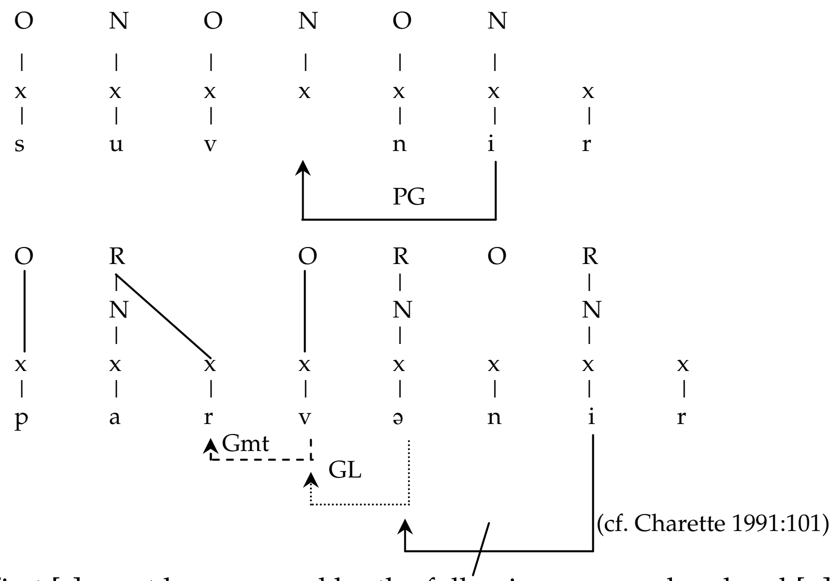


In (60a), N_2 is properly governed by N_3 which has phonetic content, and therefore, N_2 may remain empty. N_1, therefore, cannot be properly governed, as the governed nucleus N_2 itself is not allowed to govern (cf. (57b)), and for this reason, N_1 must be pronounced. This yields pronunciation (59b). As a properly governed nucleus can also be pronounced in spite of being governed ("a position *may* be uninterpreted"), (60a) can also produce pronunciation (59a) if N_2 is phonetically interpreted although properly governed. If, on the other hand, there is no PG relation between N_3 and N_2, then N_2 is allowed to govern N_1, as in (60b), pronunciation (59c) is obtained. In this case, N_2 cannot be governed by [ɛ], because it is itself a governor. Note that (59d) is excluded by Proper Government, because of the impossibility for an empty position to govern: it was shown in (60a) that N_2 could not govern N_1 if it was itself governed by N_3.

An important issue for the GP analyses is the fact that schwa cannot be deleted after a consonant cluster. The explanation Charette provides for the fact that a cluster αβ (α and β form a complex onset) or βα (β is in a coda, α in an onset) blocks schwa deletion is that "for a governing relation to hold between a non-nuclear head α and its complement β, α must be government-licensed by its nucleus" (Charette 1991:101). That is, α must have a filled nucleus to its right side. Thus, if schwa is deleted in a nucleus, the non-nuclear head α that precedes it, is no longer government-licensed. For this reason, it can no longer govern its complement, the coda consonant or branching onset depender β. The following example illustrates this by comparing the verb *souv(e)nir*, in which case schwa can be deleted, to *parvenir*, where this is claimed to be impossible.

(61) a.

b.



In (61b), the first [r] must be governed by the following non-nuclear head [v] (Gmt). In order to do so, [v] must be government-licensed by its nucleus, schwa (GL). This [ə] then, unlike the one in (61a), cannot be properly governed, because if it would delete, [v] would no longer be licensed to govern [r].

Charette uses two data sets: one on her own Quebec dialect, and one on "Parisian French". However, her opinions on the latter clearly differ from

Dell's observations, when she states that whereas *parvenir* has an obligatorily realized schwa for reasons demonstrated below, *cette cerise* does not:

(62) Dell, Selkirk and Anderson mention that a schwa occurring in the leftmost nucleus of a word is syncopated when it is preceded by a word ending with a vowel. That is, they claim that while *la cerise* is pronounced [lasriz], *cette cerise* is realized with a schwa [sɛtsəriz]. While I suspect that this is not the case in Parisian French, it is certainly not the case in my dialect of Quebec French.

(Charette 1991:87, underscoring ours)

It is however not clear on what sources Charette's Parisian French data are based ("I suspect"), and as we will see in the following chapter, although they might be based on partial observations, they are often very different from those of other authors, which makes them highly questionable.

2.7.3 Scheer (1998, 1999, 2000)

Scheer proposes another approach to the problem of vowels alternating with zero. Within the framework of Government Phonology, he argues for a strict CVCV structure. That is, onset and rhyme only consist of one segment each. If, for example, a complex onset appears on the surface, Scheer assumes that underlyingly, there is a CVCV sequence in which the first V remains empty. Similarly, a coda is assumed to be the onset of a syllable with an empty V. This can be schematized as follows:

(63) a. Complex onset, e.g. French *tri* b. Coda, e.g. French *tir*

```
a.                      b.
O   N   O   N           O   N   O   N
|   |   |   |           |   |   |   |
C   V   C   V           C   V   C   V
|       |   |           |   |   |
t       r   i           t   i   r
```

To clarify the way Proper Government functions in this approach, let us reconsider the examples *souvenir* and *parvenir*.

```
(64) a. O N O N O N O N          b. O N O N O N O N O N
        | | |   | | |               | | |   | | | | |
        s u v   n i r               p a r   v ə n i r

           PG                            PG          PG
```

In Scheer's (1998) account, only Proper Government is needed to explain the difference between *souvenir* and *parvenir*. In the case of *souvenir*, as can be seen in (64a), [i] properly governs the schwa to its left, which then may delete. In (64b), the schwa is needed to properly govern the nucleus to its left, because otherwise, the vowel [ɨ] would be filled in by default. This is avoided because the French vowel inventory does not include [ɨ] (Scheer 2000:123). As schwa is indispensable in the Proper Government of the nucleus to its left, it cannot be properly governed by [i].

As far as data are concerned, Scheer uses Dell as a primary source (explicit reference to Dell is made in Scheer 2000). However, in Scheer (1999), more data are introduced without reference to a source: it is claimed that for some speakers, deletion is possible after an obstruent-liquid cluster. The author not being a native speaker of French, the data cannot result from introspection, but as their source is not indicated, we are not sure whether they are reproductive data or partial observations.

2.8 Côté (2000)

In her Ph. D. dissertation, Côté proposes a new set of OT constraints, based on perceptual factors. She proposes a list of generalizations, which mainly concern the obligatory adjacency of consonants to vowels if these consonants are stops which are not followed by [+continuant] segments and which do or do not agree with a following consonant with respect to a given feature, or are adjacent to a boundary. These generalizations are then expressed in a series of MAX-constraints (against deletion), and in a number of markedness constraints (e.g stop → V "a stop must be followed by a vowel"). These constraints can be ranked with a constraint against epenthesis DEP-V in order to account for the presence of absence of vowel deletion and vowel epenthesis in a language.

For French, Côté assumes that the majority of cases treated by the other accounts as schwa deletion are in fact cases where schwa is not inserted, whereas the cases where schwa fails to be deleted are treated as instances of obligatory insertion. Within the various groups of cases she distinguishes, detailed data are provided to illustrate insertion in particular contexts. Even within the contexts that are traditionally distinguished (e.g. C_CC), she finds differences between insertion possibilities depending on the nature of the consonants, differences that are not found in the accounts discussed thus far. Côté's data are indeed highly original, as are Charette's, and for the same reasons as mentioned in Charette's case, they need to be verified.

To clarify the functioning of Côté's constraints, we will take one example from the boundary cluster group here.

(65)

	Boundary	*Example*	*Schwa*
	a. Clitic	*tu* ǀ *fais que* ǀ *te* ǀ *moucher* [tyfɛkətəmuʃe] 'you only blow your nose'	obligatory
	b. Prosodic word	*infecte* ǀ *manteau* [ɛ̃fɛkt(ə)mɑ̃to] 'stinking coat'	optional
	c. Intonational phrase	*l'insecte,* ǀ *mets-le là* [lɛ̃sɛktmɛlœla] 'the insect, put it there'	excluded

(cf. Côté 2000:279)

According to Côté, schwa is more easily inserted if the boundary between two consonants is weaker, which is explained for by the following inherent ranking of markedness constraints:

(66) $\text{stop}]_{\varnothing} \leftrightarrow \text{V} \gg \text{stop}]_{\text{PW}} \leftrightarrow \text{V} \gg \text{stop}]_{\text{IP}} \leftrightarrow \text{V}$

$\text{stop}]_{\varnothing} \leftrightarrow \text{V}$	a stop that is followed by a null boundary (= clitic boundary) must be adjacent to a vowel.
$\text{stop}]_{\text{PW}} \leftrightarrow \text{V}$	a stop that is followed by a prosodic word boundary must be adjacent to a vowel.
$\text{stop}]_{\text{IP}} \leftrightarrow \text{V}$	a stop that is followed by an intonational phrase boundary must be adjacent to a vowel.

(cf. Côté 2000:280)

The pattern observed in (65) follows from this ranking if we insert DEP-V, the constraint against vowel insertion, into it. As schwa is inserted after a clitic boundary, $\text{stop}]_{\varnothing} \leftrightarrow \text{V}$ must be ranked about DEP-V. In the case of the PW boundary, the effect is optional, and the constraints $\text{stop}]_{\text{PW}} \leftrightarrow \text{V}$ and DEP-V are therefore not ranked. However, in the IP boundary context, there is no insertion, so that DEP-V must dominate $\text{stop}]_{\text{IP}} \leftrightarrow \text{V}$. Tableau (67) shows the results of this ranking for our examples (65abc).

(67) Input	Candidates	stop]$_{ø}$ ↔ V	DEP-V	stop]$_{PW}$ ↔ V	stop]$_{IP}$ ↔ V
a. /t]$_{ø}$ muʃe/	☞ təmuʃe		*		
	tmuʃe	*!			
b. /ɛ̃fɛkt]$_{PW}$ mɑ̃to/	☞ ɛ̃fɛktəmɑ̃to		*		
	☞ ɛ̃fɛktmɑ̃o			*	
c. /lɛ̃sɛkt]$_{IP}$ mɛlœla/	lɛ̃sɛktəmɛlœla		*!		
	☞ lɛ̃sɛktmɛlœla				*

Côté's account provides a highly detailed data set, unfortunately lacking a clear origin. In the next section we will discuss two accounts which use actual speakers' realizations as their source.

2.9 Corpus Studies

2.9.1 Dauses (1973)

One of the rare corpus studies on our research topic is Dauses' (1973) thesis, which we already briefly mentioned in the preceding section. In his dissertation, Dauses investigates the phonological status of schwa, the *Loi des trois consonnes* and voicing assimilation. He tested mainly secondary school pupils in St. Cyr, a suburb near Paris. Instead of recording subjects and subsequently analysing the results, he asked them to fill out questionnaires on their pronunciation and read a few phrases aloud. Examples of test phrases are given below.

(68)	a.	Il reste dessous	'It stays beneath'
	b.	Il reste deux sous	'There are two *sous* [coins, TG] left'
	c.	Ce jeune vaurien …	'This young loafer'
	d.	Je ne vaux rien	'I'm not worth anything'

(68ab) and (68cd) are minimal pairs: the difference between them lies purely in the presence of a schwa or [ø]/[œ]. The members of all minimal pairs used were not read one after another, but ordered in a random way in order to prevent the subjects from making distinctions they would not make otherwise. Next, the subjects were asked to fill out questionnaires on assimilation and phonological status of schwa. A few examples from the latter are given below.

(69) a. c'est une propriété assez morc'lée.
'it is a rather cut up property'
b. on a acheté ce tourn'-disque il y a une semaine.
'we bought this record player a week ago'
c. il vers'ra l'argent sur votre compte.
'he will transfer the money to your account'
d. non, il ne box' pas ce soir.
'no, he's not boxing tonight'

For all 68 phrases in the questionnaire, the subjects were asked to rate them on a 4 point scale, going from "I would also pronounce the word without the *e* replaced by an apostrophe in this word in colloquial speech" to "A pronunciation without the *e* seems completely unacceptable to me, even in colloquial speech". Finally, the subjects had to listen to their own recordings from the first test, and judge whether they pronounced schwa or [ø]/[œ]. Possible forms were indicated for each phrase as in (70), and the subjects had to pick the phrase they heard.

(70)	a.	dessous	'beneath'	deux sous	'two *sous*'
	b.	je ne vaux …	'I'm not worth ... '	jeune vaurien	'young loafer'

As might be expected from section 2.2, the production/perception experiment showed that the borders between the sounds [ə], [œ] and [ø] are very vague, and that schwa is often realized as [œ], or at least perceived as such (Dauses 1973:36ff). The questionnaires mainly showed that the longer the phrase in which schwa occurs, and the further it is away from the stressed phrase-final syllable, the easier it is deleted, if the consonantal environment is kept equal. Compounds and schwa at boundaries (clitics, *futur* and *conditionnel* forms of verbs) were analysed as separate categories, because schwa seemed to behave differently in these contexts. Furthermore, more factors should be taken into account such as the exceptional status of some consonants, frequency, or the aversion of the language for assimilations and elisions resulting from schwa deletion (Dauses 1973:74).

Dauses' findings are very useful and rare in the schwa debate because the origin of the data is neither introspective nor reproductive: they result from tests. By means of these new data, Dauses is capable, better than the authors cited in the previous section who base themselves on intuitions or partial observations, to criticize the *Loi des trois consonnes*. However, the test on schwa deletion performed is based on subject's intuitions instead of on actual realizations. In the 1970s, analysis of schwa realizations was difficult with the existent technology, and transcription by ear was not easy for Dauses, not being a native speaker of French. With modern day technology and French transcribers, results of production tests can be a lot more reliable, and are preferable over intuitive judgments.

2.9.2 Hansen (1994)

The second corpus-based study we will discuss here is the one made by Hansen (1994) in order to verify the hypothesis that there is an increasing tendency for schwa in initial syllables to be conserved. She tested this by examining two corpora: one made by Péretz-Juillard (1977) and her own corpus, recorded in 1989. Both data sets were collected in Paris, included different age groups, and equal proportions of men and women.

Hansen concentrated on initial schwa, departing from the fact that conservation of this vowel is categorical for words like *belette, querelle* and *semestre,* and on observations from the literature that this phenomenon spreads through the lexicon. In order to check this effect, she compared the (earlier) Péretz-Juillard corpus to her own. The spreading hypothesis was falsified: neither was there more retention of schwa in the 1989 corpus, nor were younger people more inclined to schwa conservation. On the contrary, both the data from the 1970s and Hansen's own data show that younger people drop more schwas than their parent's generation (Hansen 1994:34). However, the facts we reported thus far coming from the informal speech part of the data, the data from read aloud text do show more retention, especially in young people, who thus delete more than adults in informal speech and less in formal speech. Hansen (1994:36) concludes that this might be due to a greater linguistic uncertainty of young people when they find themselves in a formal situation, but also to a higher prestige of the retention of schwa for this age group.

Taking a closer look at her data, Hansen finds that there is a tendency for a group of words to conserve their schwa, and for other words to consequently lose it. In *semaine* (0%), *sera/serait* (0%), *demi* (2%) and *petit* (6%), schwa is never or almost never pronounced in informal speech, whereas *depuis* (75%), *secrétaire* (90%) and *relation* (100%) (almost) always keep their vowel, even when a vowel precedes them. As predicted by Walter (1982), words beginning with *re-* (as a prefix or not) lose their first vowel less frequently than comparable words with another initial consonant. However, this effect is only present with very infrequent words, which leaves Hansen undecided as to whether the conserving effect of *re-* might be neutralized by frequent use (Hansen 1994:43).

Like Dauses, Hansen provides an interesting contribution to the French schwa debate, adding new and unbiased data to the discussion.

2.10 Conclusion

In this chapter, we have provided an overview of existing accounts of French schwa deletion. At the end of the nineteenth century, Grammont (1894) proposed the *Loi des trois consonnes*, which has been subject to debate in numerous pronunciation guides (among which the accounts of Martinon and Fouché). These guides all cite a number of rules and an equally important number of exceptions. The accent was moved to general principles in the 1950s and 1960s as is shown by, among others, Weinrich (1958), Pulgram (1961) and Delattre (1966). The general rules have later on been developed into a derivational system by Dell (1973), which is the best known account of French schwa. With the advent of Autosegmental Phonology, schwa developed into the empty vowel (Anderson 1982) or floating segment (Tranel 1987). Noske (1992) propoped an autosegmental algorithm based on the syllable as a conditioning factor and inspired Van Oostendorp (2000) to base his Optimality Theoretic account on the syllable as well.

The analyses mentioned thus far are generally based on one data set, which is essentially that of Fouché (1956) and Dell (1973). Another line of research has been followed by the proponents of Government Phonology, who developed a set of principles to describe the deletion processes, accounting for data that are clearly different. Côté's (2000) account is another reaction on the syllabic approach, and it proposes a perceptual view of her own data, considering in detail all the differences between contexts, some of which might not have been described thus far. Dauses (1973) and Hansen (1994) increase the data set used by providing analyses of actual speech acts.

In the next chapter, we will discuss in more detail the contexts in which the accounts introduced in this chapter disagree in the explanation provided or even disagree in including them in their list of possible deletion contexts.

3 *Three Contexts of Dissent*

Un expert, c'est une opinion.
Deux experts, c'est la contradiction.
Trois experts, c'est la confusion.
[One expert makes an opinion.
Two experts make contradiction
Three experts make confusion.]

French juridical proverb

3.1 Introduction

Chapter 2 provided an outline of the major accounts of French schwa deletion. In this chapter, we aim to discuss a number of schwa deletion contexts in which the opinions are diverse on the possibility of deletion and its conditions. This is necessary in order to limit our corpus study to those contexts that have caused disagreement in the past, as it seems superfluous to carry out research into issues that are unanimously agreed upon. As we will show, scholars disagree about schwa deletion in the following cases:

(71) a. Schwa preceded and/or followed by a consonant cluster (section 3.2);
b. Schwa adjacent to a boundary (section 3.3);
c. Consecutive schwa syllables (section 3.4).

The following sections will each treat one of the problematic contexts in more detail. In all three, both the differences in the data provided and the differences in theoretical approach will be addressed, because we believe that these are closely related: the descriptive model chosen by a given author often influences the data selected to serve as evidence. The results of our comparisons will be summarized in section 3.5.

3.2 Schwa and consonant clusters

The presence of this section in this chapter might appear odd to the reader, to whom it has just been demonstrated in the preceding chapter that [ə]-like vowels after consonant clusters, such as in *gre̲nouille*, are not schwas according to our definition. However, in *grenouille*, we are dealing with a vowel that is *always* preceded by a cluster, as its syllable has a complex onset. As we have seen, these onsets are often of the type obstruent-liquid. There are other possibilities for consonant clusters to arise, the most important of which is the enchaining of lexical items to build intonational groups. For example, schwa is not preceded by a cluster in *la fenêtre* [laf(ə)nɛtʁ], but is so in *cette fenêtre* [sɛtfənɛtʁ]. It is with schwas of the latter type that we will deal in this section.

Two important groups of explanations can be distinguished in the literature: first, the *Loi des trois consonnes*, which was central to the debate, especially in the first six decades of the 20th century, and second the syllable-based approach, which became more popular with the advent of Autosegmental Phonology in the 1980s. Section 3.2.1 will treat the former, and section 3.2.2 the latter approach, whereas section 3.2.3 will review some accounts which cannot be classified as belonging to either of the two main groups of analyses.

3.2.1 Loi des Trois Consonnes

As we have seen in the preceding chapter, Grammont states his classical law, which closely resembles an OT-constraint *avant la lettre*, in the following way:

(72) L'e étymologique ou non, n'apparaît que lorsqu'il est nécessaire pour éviter la rencontre de trois consonnes comprises entre deux voyelles fermes.[15]
(Grammont 1894:35)

A slightly different description is given by Martinon:

(73) a. Entre deux consonnes, […] l'e muet tombe régulièrement, à condition que les consonnes ainsi rapprochées puissent s'appuyer sur deux voyelles non caduques, une devant, une derrière. (Martinon 1913:164)[16]
b. si l'e muet est précédé de deux consonnes différentes, en principe il ne tombe pas non plus, puisque le français tolère mal trois consonnes de suite […] A vrai dire, là même, quand on parle vite, il y en a bien

[15] 'E, etymological or not, only appears when it is necessary to avoid the encounter of three consonants between two firm vowels.'
[16] 'Between two consonants, […] mute e regularly deletes, under the condition that the consonants which are put nearer to each other can be supported by two pronounced vowels, one before and one after.'

quelques-uns qui tombent encore, toutes les fois qu'il n'y a pas incompatibilité entre les consonnes. (Martinon 1913:167)[17]

In most cases, the rules in (72) and (73) have the same effects: after a cluster, schwa will not be deleted, either because this would produce a three-member cluster (Grammont), or because it is preceded by two different consonants (Martinon). However, Martinon indicates that an exception is possible in some cases, if the surrounding consonants are "compatible". This view, according to which the cluster *preceding* schwa determines the deletion possibility of the segments, has been adopted by most authors. (74) quotes some examples.

(74) a. E muet se conserve lorsqu'il est précédé de deux ou trois consonnes" (Fouché 1956:97)[18]

b. Suivi d'une consonne ou plus, l'ə intérieur tombe après une seule consonne et se maintient après deux ou plus […] Le nombre de consonnes qui *suit* l'ə est donc sans effet. (Delattre 1966:17)[19]

Following consonants have also lost relevance in Dell's rules VCE_1 and VCE_2, repeated below, which are responsible for internal schwa deletion.

(75)	a.	VCE_1: ə → Ø / V#$_1$C_ (optional)	Schwa deletion in the first syllable of a word if preceded by one consonant.	*pas de scrupules* [padskrypyl]
	b.	VCE_2 : ə → Ø /VC_ (obligatory)	Word-internal schwa deletion if preceded by one consonant.	*centenaire* [sɑ̃tnɛr]

These rules only delete schwas preceded by a single consonant: the contexts in which they apply are defined as follows: V(#)C_(#)C (Dell 1973:259).

Dauses (1973:57ff) criticizes variants of the *Loi des trois consonnes* proposed by Delattre (1966), Malécot (1954), Weinrich (1958) and Pulgram (1961). His main claim is that these simplify the facts, and that more factors

[17] 'If mute e is preceded by two different consonants, in principle it does not delete either, because French difficultly allows for three adjacent consonants […]. In fact, even then, when one speaks quickly, there are still some which delete, every time the consonants are not incompatible.'

[18] 'Mute e is conserved when it is preceded by two or three consonants.'

[19] 'When followed by one or more consonants, the internal ə deletes after one consonant and is conserved after two or more […]. Thus, the number of consonants *following* ə has no effect.'

play a role in schwa deletion. Furthermore, Dauses' experimental findings often contradict the partial observations or introspective data provided by the authors cited. For example, Delattre claims that schwa preceded by two consonants that are "*syllabiquement unies*" is always maintained. This "union" between two consonants is achieved when the first one is more "closed" than the other, the most closed consonants being obstruents and the least closed being liquids. Thus, two consonants are "*sylabiquement unies*" when the second one has a higher sonority than the first one. All examples Delattre quotes contain obstruent-liquid clusters: *vendredi, simplement,* etc. (Delattre 1966:19). Dauses wonders if the generalization made holds for all consonants, and not just for obstruent-liquid clusters. In fact, in *boxera*, with a [ks] cluster followed by schwa, 48.9% of Dauses' subjects deleted the schwa, which according to this author shows that even though clusters are "*syllabiquement unies*", deletion is very well possible (Dauses 1973:59).

In sum, we can conclude that all authors cited in this section agree on the fact that there is *something like* the *Loi des trois consonnes* that plays a role in French schwa deletion: clusters have a preserving effect. However, there is a lot of disagreement on the exact formulation and status of the law, and on the exact factors influencing deletion. As we will see in the following section, the same holds true for the syllabic approaches.

3.2.2 The Syllable

According to a great number of authors, the possibility of deleting schwa after a consonant cluster depends on the possibility of placing the remaining consonants in syllables. As we have seen in chapter 2, Weinrich (1958) replaces Grammont's *Loi des trois consonnes* by a rule stating that schwa can be deleted if the cluster created consists of at most one consonant followed by a legitimate word onset. A similar solution is proposed by Pulgram (1961): a legitimate coda followed by a legitimate onset. The possibility for a cluster to occur as an onset or a coda is tested by checking its occurrence at the beginning and ending of a word, respectively (cf. Kurylowicz 1948). Pulgram (1961:316) provides a list of these clusters.

As Dauses shows, Pulgram's analysis runs into problems with words like *appartement* [apaʁtəmɑ̃] and *justement* [ʒystəmɑ̃], which are obligatorily pronounced with a schwa according to most (if not all) other authors, but where deletion is allowed according to Pulgram. Another objection one could raise to Pulgram's approach is that at word end, many more different coda clusters are possible than elsewhere in the word (cf. Féry 2001), and that prepausal clusters therefore do not coincide with possible word-internal codas. Referring to these would solve the problem for (76ab).

(76) a. appartement [apaʁtəmɑ̃] ‘apartment’
b. justement [ʒystəmɑ̃] ‘justly’
c. marguerite [maʁgəʁit] ‘daisy’

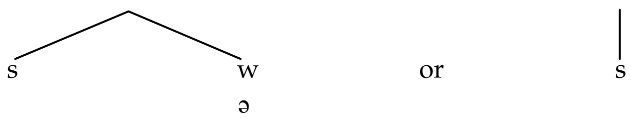
However, this does not help for *marguerite* [margərit], which in Weinrich’s and Pulgram’s view would be pronounced [mar.grit], [r] being a correct coda, and [gr] a correct onset. We will use the set of examples in (76) as a testing ground for syllable-based analyses throughout this section.

Bouchard (1981) incorporates stress into his syllable-based approach. He proposes the following two rules for French schwa:

(77) a. RULE A Delete a vowel in a weak position of a foot (obligatory) (cf. Bouchard 1981:17)
b. RULE B Reduce a vowel under <u>w</u> in a 2-stress foot (optional) (cf. Bouchard 1981:24)

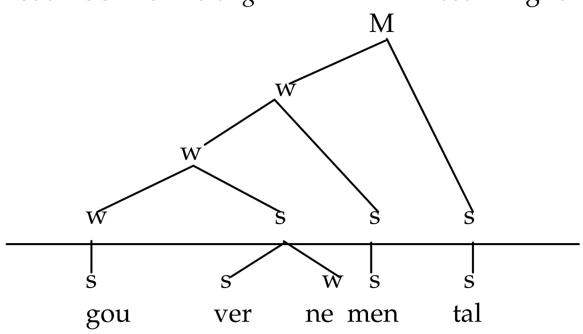
The feet Bouchard refers to are constructed in the following way: schwa is the only vowel that can be in a weak position of a left-dominant (strong-weak) foot. Every schwa syllable is then incorporated into a binary foot together with the syllable on its left.

(78) The French Foot according to Bouchard (1981:18)



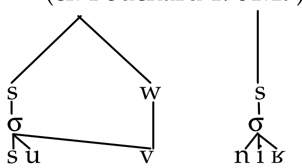
Feet are constructed from right to left. If there is no schwa syllable present, a monosyllabic foot consisting of a single strong node is constructed. An example is provided in (79).

(79) Prosodic structure of *gouvernemental* according to Bouchard (1981:22)

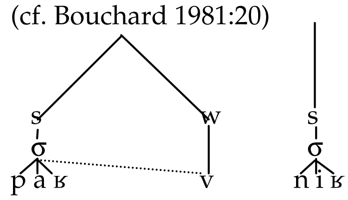


Schwa can subsequently be deleted along the lines of Rule A, but this can only happen if the consonant preceding it can be incorporated into the coda of the preceding syllable (i.e., the syllable in the strong node). As in Bouchard's view, the French syllable can maximally contain one coda consonant, schwa deletion by rule A is prohibited if schwa is preceded by any two consonants, and therefore also in our cases *appartement* and *justement*. Also, compare the verbs *souv(e)nir* and *parvenir*

(80) a. *souvenir*
(cf. Bouchard 1981:19)



b. *parvenir*
(cf. Bouchard 1981:20)



In the case of *souvenir*, the schwa in the weak node can be dropped, because the [v] in its onset can be joined as a coda to the syllable in the strong node. In (80b), it is impossible to join [v] to the preceding syllable, as [paʁ] already contains a coda consonant.

Bouchard's rule (77b), which is "a reduction rule, not a deletion rule" (Bouchard 1981:24), is not constrained by French syllable structure, but only by the universal sonority scale. The rule deletes or reduces schwa in all syllables which do not bare primary or secondary stress. In Bouchard's case, the last syllable of a phrase bares primary stress, the penultimate has secondary stress, the antepenultimate ternary stress, and so on. Thus, although in both (81a) and (81b), the schwa escapes deletion by rule A because [n] cannot be joined to the preceding syllable as this syllable already contains a coda, in (81b) it can be deleted by rule B because the result V[ʁnm]V is an allowed sequence in universal sonority according to Bouchard. However, rule B does not apply to (81a), because the foot (vɛʁ.nə), which is penultimate, bears secondary stress.

(81) a. gouvernement
b. gouvern(e)mental (Bouchard 1981:22)

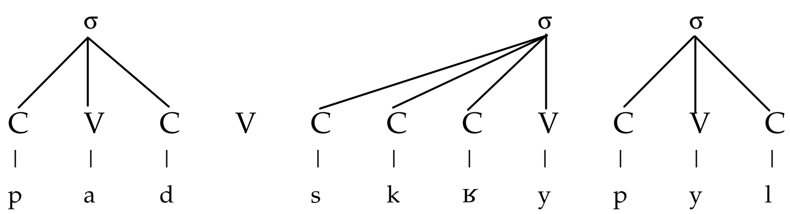
In phrase-internal position, rule B can apply to *appartement, justement,* and *marguerite,* because the second two consonants of the clusters [ʁtm], [stm] and [ʁgʁ] satisfy Bouchard's sonority condition. However, if these words are in the final position of a phrase, deletion can not occur, as schwa is in the penultimate syllable which bares secondary stress.

The effects of Rule B are not incorporated into most other syllable-based accounts of French schwa/zero alternations. Anderson (1982) proposes an account that incorporates the "syllable-condition" on Rule A in a different way: first, a resyllabification rule resyllabifies the onsets of schwa syllables into the coda of the preceding syllable; next, the syllable containing schwa, which is now fully free of segmental content (no onset, an empty nucleus, and no coda) is deleted by a rule against empty syllables.

Noske (1992:195) proposes the two-sided open syllable as a context for schwa deletion. That is, schwa is deleted in the contexts VC_CV and VC_OLV (OL = obstruent-liquid cluster). The explicit reference to an OL cluster seems contrary to the classical assumption that the consonants that follow schwa are irrelevant to the deletion process. If we assume that OL is the only possible configuration for an onset cluster in French, Noske's deletion context is identical to that of the other authors: clusters other than OL would be split up between the preceding and the following syllable, putting schwa in a closed syllable, where it cannot occur according to most definitions.

However, consider clusters starting with [s], as in e.g. *j'ai le stylo* [ʒeləstilo] 'I have the pen'. The schwa in this example is not in a VC_OLV context, but it is a double sided open syllable: [ʒe.lə.sti.lo]. It is unclear whether Noske intends to include this context in his inventory of possible schwa deletion contexts. A similar example is *pas de scrupules*, pronounced [padskʁypyl], from Fouché (1956:99), copied by Dell (1973:230) as an instance of VCE$_1$, which shows that contrary to Dell's, Noske's structural description does not predict deletion in this case.

(82) *Pas d(e) scrupules*



As shown in (82) however, the empty vowel following [d] can remain unsyllabified and therefore be deleted in the pronunciation, because [d] can be syllabified into the coda of the preceding syllable [pa], and hence there is no need for a syllable with this empty vowel as a nucleus. Thus, despite the fact that one would not expect deletion to take place here considering the deletion contexts cited by Noske ([skʁ] is an OOL cluster), the syllabification algorithm he proposes, and which we repeated below, does predict loss of the vowel.

(83) a. syllable imposition triggered by as yet unsyllabified full vowels (including nonalternating schwas), followed by mapping;
b. *optional* syllable structure imposition, triggered by as yet unsyllabified empty V's (alternating schwas), followed by mapping;
c. dumping;
d. syllable imposition triggered by consonants. (Noske 1992:207)

[a] and the two [y]'s create a syllable in step (44a), preceded by a single onset consonant. Next, in step (44c), all remaining consonants are incorporated into syllables, if possible. As [skʁ] is a possible onset, and [d] a possible coda, the empty vowel between the two is not realized in step (44d): there is no consonant left to trigger this.

A similar line of thought leads to deletion in our three examples *appartement, justement* and *marguerite*. For example in *marguerite,* if schwa is not inserted by (44b), [g] is automatically joined to the onset of the syllable [ʁit] by (44c): [gʁ] is a legitimate onset in French.

Van Oostendorp (1995/2000) provides an OT-based explanation for the preservation of schwa when followed by a cluster, which is partly inspired by Noske's autosegmental account. As we have shown in the preceding chapter, he uses the constraint PROJECT N'', [-cons]) to prevent degenerate syllables from arising through schwa deletion triggered by *[-cons]. Tableau (84) shows the effect of the ranking of these constraints with respect to each other and to parsing constraints.

(84) /pad**V**skʁypyl/	PARSE-FEATURE	PROJECT (N, -cons)	*[-cons]
☞ a. [pad.skʁy.pyl]			***
b. [pa.də.skʁy.pyl]			****!
c. [pa.də.skʁypl]	*!		***
d. [pa.də.skʁ.pyl]	*!	*	***

As schwa has no vocalic features in Van Oostendorp's view, and therefore its deletion does not violate PARSE-FEATURE, whereas deletion of another vowel does (cf. candidates (84c) and (84d)). Candidate (84b), the "full" form, is disfavored because of the presence of an extra vowel in comparison to the other candidates. As in Noske's account, the syllable is considered to be the conditioning factor here and deletion is claimed to take place in "two-sided open syllables" (Van Oostendorp 2000:254), but the analysis predicts more possibilities for schwa to delete. Note that neither Noske nor Van Oostendorp integrates rules or constraints to the description in order to define the French syllable. Moreover, even if these were defined, Van Oostendorp's account, like Noske's, predicts deletion in *marguerite*.

(85) /maʁgVʁit/	PARSE-FEAT	NO CODA	PROJECT (N, -cons)	*[-cons]
☹ a. [maʁ.gə.ʁit]		**		***!
💣 b. [maʁ.gʁit]		**		**
c. [maʁ.g.ʁit]		**	*!	**
d. [maʁg.ʁit]		***!		**

This ranking predicts (85b), with a deleted schwa, to be the optimal candidate, which cannot be the author's intention, because he aims to account for schwa deletion in two-sided open syllables only. Every time schwa is preceded by a single consonant, this consonant is syllabified into the coda of the preceding syllable instead of into the onset of the schwa syllable, so that schwa can delete. Deletion of schwa is impossible in the case of a preceding consonant cluster, because the two consonants should not be able to be syllabified into a coda together. A degenerate syllable is then assumed to be created, which is excluded by PROJECT (N, -cons), as shown by candidate (85c).

However, the analysis runs intro trouble once obstruent-liquid clusters are considered: even if we would include a constraint preventing a certain type of onsets from occurring, [gʁ] remains a possible onset in French (cf. very common words like *grand* 'big' et *gros* 'fat') and therefore, candidate (85b) is selected as optimal. Consider also examples like *une mer grosse et agitée* and *une mar(re) grise*, which show that the sequence [ʁgʁ] is perfectly acceptable in French.

Another problem for the proposed analysis is that it can only partially account for the data from sources Van Oostendorp cites. Consider the following pair from Anderson (1982):

(86)	a.	*la pelouse*	[lapəluz], [lapluz]
	b.	*cette pelouse*	[sɛtpəluz], *[sɛtpluz]

(according to Anderson 1982:538)

In Anderson's account, deletion of schwa in (86b) is prevented by the prohibition to delete two schwas in consecutive syllables: the word *cette* is claimed to end in a schwa, which is deleted, thus making deletion of a schwa in the next syllable impossible. However, Van Oostendorp's constraint hierarchy predicts schwas to be deleted wherever possible, as long as disallowed syllables are avoided. As [sɛt.pluz] contains two well-formed French syllables, exclusion of this instance of deletion is impossible in this account. [sɛt.pluz] is an attested sequence in French: *sept pelouses* 'seven grassfields'. The question now is whether Van Oostendorp's data are different from those used by Anderson, or whether the predictions of his ranking are not consistent with the data used. As the data set explicitly cited by Van Oostendorp is rather limited, this question is hard to answer. Note by the way that the source of Anderson's data is unclear as well: in his paper, Anderson does not discuss the variation in the data nor does he indicate his sources.

Summarizing, we have shown that the syllabic accounts differ in the possible clusters that can occur in onsets and codas. Moreover, in part of them, these conditions are not formulated explicitly. We might also want to distinguish between word-internal clusters and those that occur around word boundaries. Finally, in a number of analyses, the predictions made by the rules or constraints formulated are not carried out in the data used.

3.2.3 Other Solutions

3.2.3.1 Côté (2000)

Côté argues that the data in, among others, Noske's account are based on what she calls the *loi des deux consonnes*, comparable to Grammont's *Loi des trois consonnes*: "schwa is pronounced in every potential site […] that is preceded by two consonants" (Côté 2000:102). According to Côté, grammaticality judgments by authors like Anderson and Noske are purely based on the *loi des deux consonnes*. Her own data are not compatible with this law, but she does not deny its validity for formal speech:

(87) I do not exclude the possibility that the *loi des deux consonnes* really is absolute for some speakers (who[m] I do not know), hence these authors' judgments. But I would rather interpret their judgments as stemming from a certain polarization and idealization of the data, which favors the ungrammaticality judgment attributed to all forms that disobey the *loi des deux consonnes*.

(Côté 2000:104)

Côté's data therefore clearly differ from those provided by the syllable-based accounts. This is best seen in her post-cluster data, part of which is copied below.

(88) Distribution of schwa according to Côté (2000:85)

a.	At clitic boundaries:		
	1.	Obligatory	*Annick le salut* [sic] /anik lə saly/
	2.	Optional	*Esther le salut* [sic] /ɛstɛʁ l(ə) saly/
b.	Morpheme-internally:		
	1.	Obligatory	*une demande* /yn dəmɑ̃d/
	2.	Optional	*une fenêtre* /yn f(ə)nɛtʁ/

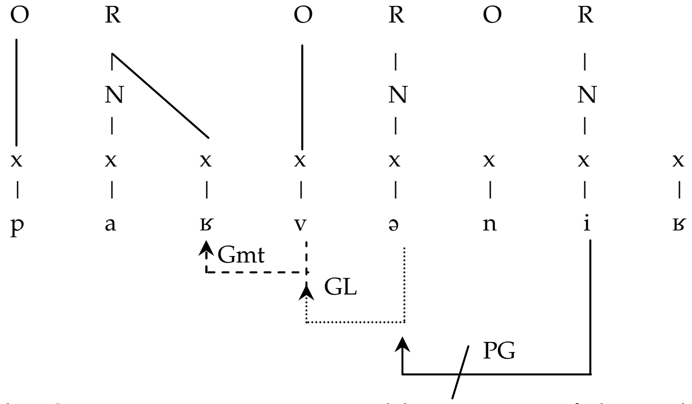
Examples (88a1) and (88b1) are in line with Noske and Van Oostendorp: unsyllabifiable consonants need a schwa to their side (assuming [dm] to be excluded as an onset). But the facts in (88a2) and (88b2) show that according to Côté, absence of schwa is possible after a cluster in certain contexts. Note that as demonstrated in chapter 2, the origin of the data is not clear, and that they are contradicted by other accounts. For instance, Côté allows for the fricative+liquid cluster [fn], whereas Noske and Van Oostendorp would exclude this because they take French syllabification as a basis for possible schwa deletions, and [fn] is not a legitimate onset.

3.2.3.2 Government

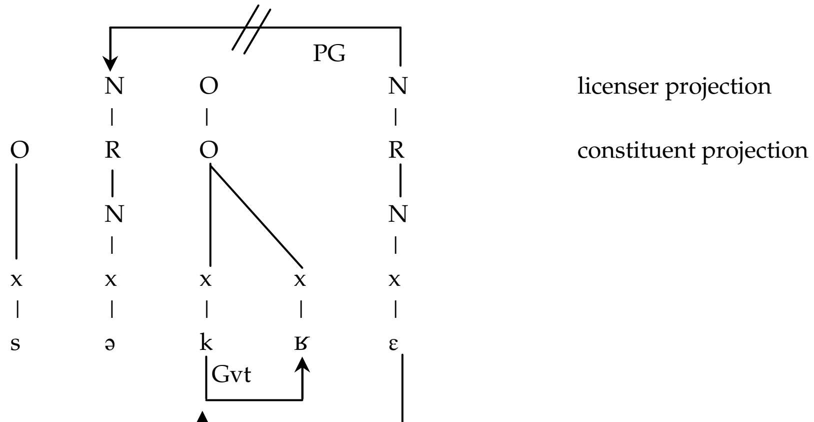
In their GP-based accounts, Charette (1991) and Scheer (1998, 1999, 2000) state that reduction in the two contexts C_CC and CC_C is generally excluded. Charette (1991:104) assumes the following two principles:

(89) a. An empty nucleus is realized as zero when it is properly governed by an adjacent unlicensed nucleus.
b. A non-nuclear head may govern a complement iff it is government-licensed, i.e. governed by a non-properly governed nucleus.

The effect of these on the pronunciation of the two verbs *souvenir* and *parvenir* was demonstrated in chapter 2. In *parvenir,* schwa is conserved because of the cluster that precedes it. It is again the cluster that precedes schwa that saves the vowel from deleting in this case. Charette's analysis of *parvenir* is repeated below. Schwa cannot be deleted in this context, because it has to government-license (GL) [v], so that this segment can govern its depender, [ʁ].

(90) 

However, in the Government accounts, unlike in some of the earlier cluster-based data we discussed in section 3.2.1, the cluster following schwa also plays a role, because it is this cluster that stands between schwa (the governee) and the following nucleus, the governor. The head of the cluster is a licenser (because it governs a depending segment) and is therefore projected on the licenser projection tier. Therefore, the nuclei that surround it are no longer adjacent on this tier. This is shown below.

(91) *secret* 

(Cf. Charette 1991 :115)

In *secret*, [k] governs [ʁ]. In order to do so, it must be government-licensed by the following vowel. Because of this governing relation, [k] is projected on the licenser projection tier. Proper Government is now blocked, because there is an intervening O between the two nuclei on this tier, and schwa is obligatorily present: according to Charette, *secret* is pronounced [səkʁɛ], and not *[skʁɛ]. In her analysis, then, deletion of schwa is not only excluded when the empty vowel is preceded by a consonant cluster, but also when it is followed by one.

Thus, two slightly different processes of licensing play a role in Charette's account: direct licencing in cases like *parvenir*: the onset is licensed by its (empty) nucleus to govern the preceding coda; and indirect licensing, where the head of a branching onset is licensed by the nucleus that follows the depender, and which therefore is no longer able to govern an empty nucleus in the preceding syllable (e.g. *secret*). In Charette's view, there is no difference between possible schwa omissions in these two cases. Lyche & Durand (1996), criticizing Charette's Governement approach by providing additional data, state that there is.

(92) A major problem here concerns the validity of positing an empty nucleus in [*vendredi*] in the first place, since there is no possible alternation and the vowel is stable. […] On the other hand, in the class of words represented by [*gouvernement*], many words allow an **optional** non-realization of the nucleus.
(Lyche & Durand 1996:451)

For words like *orphelin, département, parchemin,* and *infirmerie,* Lyche & Durand (1996:451) state that deletion of the vowel *is* possible, but optional. They propose a strength scale for licensing to account for these facts. Also, as in Rialland (1986), a distinction between two types of schwa is proposed to explain for the difference. As mentioned before, under our definition of French schwa, vowels that do not alternate in any speech style or dialect are excluded from the research domain. Schwa in our view only occurs in syllables of the form CV, i.e. open syllables with a simplex onset. The indirect licensing cases are then simply explained for by the fact that one of these vowels is not schwa, and the other is.

Scheer (1999), in another GP approach, distinguishes between absolute exclusion of deletion, deletion by some speakers of French, and deletion by the majority of speakers, as shown in (93). Data seem to be based on the author's own observations, and are not corpus-based.

(93) Schwa deletion possibilities according to Scheer (1999:90):

a.	Deletion prohibited		
	VOL_CV	*vendredi*	*[vɑ̃dʁdi]
b.	Deletion possible for some speakers of French		
	VLO_CV	*margu(e)rite*	[maʁgʁit]
	VC_OL	*le d(e)gré*	[lədgʁe]
c.	Deletion possible for the majority of speakers		
	VC_CV	*r(e)venir*	[ʁəvniʁ]

(93a) is a case of non-alternating [ə]/[œ], which we will not discuss because in our view it is not a schwa. As demonstrated by the other examples, according to Scheer, deletion is also possible if the cluster preceding schwa is an LO cluster, or if an OL cluster follows schwa. Note that the variation predicted resembles that predicted by Bouchard's phonetic deletion rule B, provided that the word is not in phrase-final position (as this would imply secondary stress on the penultimate syllable). However, Scheer does not distinguish between various positions of the CV sequence with respect to stress. Let us consider how he accounts for his data. (93bc) are formally represented as below.

(94) a. *marguerite*

C V C V C V C V C V
| | | | | | |
m a ʁ   g   ʁ i t
IG Lic
PG

b. *degrée*
C V C V C V
| | | |
d ə g   ʁ e
IG
PG

c. *revenir*
C V C V C V C V
| | | | | |
ʁ ə v ə n i ʁ
PG

The only example in which only Proper Government applies is (94c). In this case, it can take effect and either the first or the second schwa is dropped. We will discuss consecutive schwa syllables in more detail in section 3.4. As was the case in Bouchard's account, (94ab) need additional explanation. To account for these, Scheer (1999:98) proposes the principle of Infrasegmental Government (IG). IG is a governing principle which only can only exist when the governor is licensed by the nucleus directly to its right. It occurs between a consonant that has a given element (elements in GP are comparable to distinctive features in traditional phonology) and a consonant that does not. The former is the governor, the latter the governee. To put this in more specific terms, a liquid may govern a stop, because stops either have no element on the I/U line or the A line (cf. Scheer 1999:98), whereas liquids have an element on both lines. This implies that nasals can govern fricatives, as the latter lack an element on the I/U line and the former do not. Thus, *une fenêtre* can be pronounced [ynfnɛtʁ]. Moreover, an IG relation can be established between a liquid and one of the sibilants [s, ʃ, ʒ], although these segments have the same elements as liquids (Scheer 1999:102).

What this means for the examples above is that in (94b), Infrasegmental Government occurs between the consonants surrounding the underlyingly empty nucleus. If an IG relation holds between these consonants, the nucleus included between them can remain phonetically uninterpreted and circumscribed by Proper Government (Scheer 1999:98). [e] can properly govern schwa in the first syllable of *degré*, because the nucleus between them is already "taken care of" by IG. (94a) is a similar case, except that IG here causes the deletion of an underlying schwa, instead of non-realization of an empty nucleus. PG passes the governing domain between [g] and the second [r] and it can thus ensure that the nucleus between the first [r] and [g] is not realized. Examples (94ab) represent the pronunciation of a limited group of speakers, a group that Scheer (1999:100) considers to be a more advanced group: the evolution of French goes into the direction of the admission of more IG relations, and therefore of schwa deletion in more contexts.

The data provided by Scheer thus present an interesting perspective of schwa deletion as a process gaining access to an increasing number of vowels. However, as was the case for Côté's data, the origin of the facts is unclear.

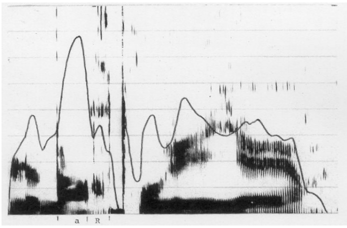
3.2.3.3 Experimental Research into Post-Deletion Clusters

The clusters resulting from schwa deletion have also been subject to some experimental, phonetic research. Rialland (1986) compared the phonetic properties of these resulting clusters to those of underlyingly present clusters. Consider the following two examples:

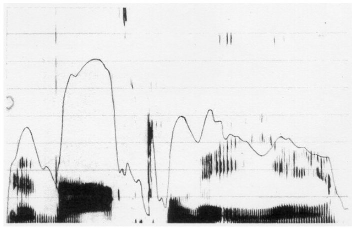
(95) a. *Le bas retrouvé hier* [ləbaʁtʁuvejɛʁ] 'the sock found back yesterday'
b. *Le bar trouvé hier* [ləbaʁtʁuvejɛʁ] 'the bar found yesterday'
(Rialland 1986:195)

The reduced pronunciation of (95b) contains the same segments as that of (95a). If we were to assume that both examples were syllabified the same way in the phonological component of the grammar, as is supposed by syllable-based analyses, they would sound phonetically alike. In fact, Rialland shows that this is not the case. The spectrograms she made of the two utterances are copied in (96).

(96) a. *le bas retrouvé* (Rialland 1986:195)



b. *le bar trouvé hier* (Rialland 1986:196)



According to Rialland, these spectrograms clearly show that:

(97) - le *r* de *bar* […] est très faible comme le sont les *r* de fin de syllabe en français […]. Le *r* de *r(e)* est, lui, fort et vibré, contrairement aux *r* en finale de syllabe.[20]

- le *a* de *bar* […] est de 80% plus long que le *a* de *bas* […]. Or, il est connu qu'une voyelle devant un *r* tautosyllabique connaît un rallongement.[21]

(Rialland 1986:196)

In this and comparable cases, Rialland finds a consequent difference between an underlying CC cluster and the result of the deletion of schwa from a CəC sequence (a finding confirmed by Fougeron and Steriade 1997). For this reason, she concludes that the syllable cannot be the conditioning factor in the schwa deletion process, a point which she underlines with the following observations:

(98) a. *Je n'ai pas pensé une seconde que tu l(e) f(e)rais*
[ʒənɛpapɑ̃se ynsəgɔ̃d kəty**lfʁ**ɛ]
'I didn't think for a second that you would do it'

b. *Tu crois qu'il faut qu(e) j(e) fasse tout ?*
[tykwʁa kilfo **kʃ:f**astu]
'Do you think i have to do everything?'

c. *Il n'en revenait pas*
[ilnɑ̃**ʁv:n**ɛpa]
'He couldn't get over it' (Rialland 1986 :215-216, emphasis ours)

[20] 'The *r* in *bar*[…] is very weak, like syllable-final *r* in French […]. The *r* of *r(e)*, on the other hand, is strong and vibrated, contrary to syllable-final *r*.'

[21] 'The *a* in *bar* […] is 80% longer than the *a* in *bas* […]. Now, it is known that a vowel is lengthened before tautosyllabic *r*.'

These data are counter to those supporting the *Loi des trois consonnes*, as groups of three or even four consonants result from schwa deletion. Furthermore, they contradict the syllabic analyses as clusters are created that cannot be syllabified into "core" syllables of French.

A final remark needs to be made on data collected in laboratories. Although the data obtained are much more reliable than those of the trained linguist using introspection or partial observations influenced by his own perception, they remain artificial, in that subjects might be tempted to pronounce phrases that never occur in real life. For example, in everyday speech, the contrast *le bar trouvé ~ le bas r(e)trouvé* is not (only) made by the phonetic characteristics of both realizations, but also by the context in which the utterance is produced. Standing in a bar for example, one would rather expect to hear the former than the latter group of words. Moreover, when short fragments are uttered instead of full phrases, the result might be blurred by excessive speech monitoring by the speaker.

For these reasons, laboratory data, necessarily exempt of pragmatic and sociolinguistic context, and possibly also without the context of a phrase, lack the spontaneity and representative character of actual daily speech. This issue will be treated in more detail in the following chapter, where we will check the correctness of Rialland's findings in a corpus of spontaneous speech.

3.2.4 Conclusion

Summarizing the results of this section, table (99) shows the differences between a number of the accounts discussed. It lists 'yes' if deletion of schwa is allowed in a given context according to the author mentioned on top of the column, and 'no' if the contrary is the case.

(99)

Author	Delattre/Dell/ Noske/van Oostendorp	Bouchard	Charette	Scheer	Côté	Rialland
Conditioning factor	*syllable*	*syllable, sonority*	*cluster: number of segments*	*cluster: number of segments and their elements*	*cluster percep-tion*	*clusters: number of segments and their features*
VC_C *rev(e)nir*	yes	yes	yes	yes	yes	yes
VC_CC (CC is not OL) *pas d(e) scrupules*	yes	yes (sonority + unstressed)	no	yes	yes[22]	yes (depends on cluster)
VC_OL *le d(e)grée*	yes	yes	no	yes	yes	yes (depends on cluster)
VCO_L *margu(e)rite*	no[23]	yes (unstressed)	no	yes	yes	yes (depends on cluster)
VCC_C (C_C is not OL) *vendr(e)di*	no	no	no	no	no	yes (depends on cluster)

A quick glance at the table is sufficient to see that there is a vast amount of disagreement, especially in the middle three rows: for some authors, the environments in which clusters prevent schwa deletion, or the segmental conditions under which this happens, are different from others. In particular, Rialland's data are in contradiction with the *Loi des trois consonnes* used as a basis for the vast majority of accounts. As we have seen, Bouchard, Côté, Noske/Van Oostendorp, Pulgram, and Rialland have diverging opinions on possible clusters after schwa deletion. For these reasons, schwa deletion in a cluster environment is worthwhile of corpus-based research, focusing on the exact clusters in which deletion is permitted for a large number of speakers.

The next section will discuss schwa deletion adjacent to boundaries, another context that has been subject to lot of dissent among authors.

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22 In some cases, depending on major class features of the surrounding segments.

23 Predicted by Van Oostendorp's constraint hierarchy, but not reflected in his data.

3.3 "Initial" Schwa

3.3.1 Introduction

In this section, we will treat schwa in a boundary context. However, the [ə]/[œ] sound that is sometimes present at final/word boundaries does not concern us, as we excluded it from our definition of schwa in chapter 2. Therefore, this section will only deal with schwa in initial syllables, which we labeled "initial schwa" in the same chapter. The main opinion for this context is that deletion is more frequent than for schwa in other positions in the phrase. However, there is a considerable amount of disagreement:

(100) La syllabe initiale après une pause est un des contextes où le comportement de schwa varie de plus en plus d'un locuteur à l'autre, ce qui expliquerait que les intuitions sur ce qui est bien formé ne soient pas aussi tranchées qu'ailleurs.
(Dell 1973:228)[24]

Various causes for a separate status of the initial syllable have been proposed, which will be discussed further on in this section. A small number of accounts diverge from the main point of view, treating word-initial instead of phrase-initial schwa, or assuming a stronger status for this schwa than for the internal schwas. The latter is typically the case of the GP-accounts, which for this reason will be the subject of a separate subsection.

3.3.2 Psychological vs. Mechanical Factors

In his analysis of initial schwa, limited to phrase-initial clitics (*ce, de, je, le, me, ne, que, se, te*) Delattre (1966) mentions two types of factors playing a role in its deletion: "mechanical" factors, i.e. the influence of the surrounding consonants, and "psychological" factors, a category which contains among other aspects the influence of stress.

With respect to the surrounding consonants, it is clear that there are more deletion possibilities in the initial syllable than elsewhere in the phrase. Initial schwa almost behaves like schwa in a syllable preceded by a vowel, with a few exceptions, mostly explained for by cluster limitations. However, the various authors do not agree on the exact cluster conditions. For example,

[24] 'The initial syllable after a pause is one of the contexts where the behavior of schwa varies more and more from one speaker to another, which would explain for the fact that intuitions on wellformedness are not as clear-cut as elsewhere'.

according to Grammont, schwa in initial syllables is dropped when it is preceded by a continuant consonant, but not if both the preceding and the following consonant are continuant, e.g. *ce sac*. If it follows a stop, schwa is generally conserved (e.g. *que dites-vous?*), but it may be deleted if the following consonant is not a stop, e.g. *d(e)main.* Grammont claims that stops have a preserving effect on schwa in the phrase-initial syllable. Delattre globally copies these distinctions between consonants, discriminating between these by means of articulatory force and aperture factors.

But, according to Dell, initial deletion is possible after a single consonant, *except* when it is surrounded by two non-continuant obstruents (cf. Grammont's *que dites-vous*). This is expressed by the rules INI (optional) and INI-EX (obligatory):

(101) a. INI-EX: ə → [-règle INI] / [-son, -cont] _ $\#_0$ [-son, -cont]
b. INI: ə → Ø / §C_ (Dell 1973:227)

Note that contrary to Grammont, Dell would predict deletion in the case of *ce sac.* Noske and Van Oostendorp, taking mostly Dell's data as a basis for their analyses, state that "a preconsonantal schwa following an initial consonant can be deleted with the possibility of leaving a highly marked onset cluster not found in other positions" (Noske 1992:196) and that "more complex onsets are allowed word-initially than in other positions" (Van Oostendorp 2000:253), as in:

(102) a. *Revenez demain!* [r(ə)vənedəmɛ̃]
b. *Te fais pas de bile!* [t(ə)fɛpadəbil]
(Dell 1973:227, Noske 1992:196, Van Oostendorp 2000:253)

Rialland cites a number of cases of initial deletion, stating simply that "un [ə] peut être élidé en position initiale"(Rialland 1986:194). Consider some of her examples:

(103) Examples from Rialland (1986:194)
a. *L(e) penses-tu vraiment?*
b. *R(e)tourne-toi*
c. *N(e) cours pas*
d. *P(e)tit gars*

Rialland's data seem to predict a larger amount of deletion than those of other, mostly earlier authors; cf. for example Dell's rules in (101). Unfortunately, she does not give an exact list of possible clusters. This is done by Klausenburger (1970), who lists clusters that may occur once a schwa has been deleted from a word-initial or phrase-initial syllable, most of which are combinations of liquids and stops, but combinations of only liquids (*r(e)marque*) or of only stops (*b(e)donner*) may also occur, although the latter group of possibilities is very small. However, the clusters [rt] and [pt], from (103), are not listed in the class of "Para-clusters resulting from the loss of phrase-initial /ə/ (Klausenburger 1970:70). In sum, although various authors do agree on larger possibilities of deletion in initial syllables, and on the fact that these are limited according to the segmental identity of the surrounding consonants, the exact definition of possible clusters is not clear.

Let us now pass on to the psychological factors Delattre proposes. The phrase-initial position is claimed to have an attractive effect on the onset consonant of the second syllable, which causes deletion of schwa in the first syllable. For this reason, the first schwa of a phrase deletes if followed by a full vowel (the full vowel wins in the race towards the initial position, e.g. *j(e) m'en vais*), but also causes it to be conserved if followed by another schwa, because in that case, in which two "equal" segments compete, the one closer to the beginning prevails (*je n(e) m'en vais pas*, Delattre 1966:29). Delattre (1966:30) also observes that speech rate has a large influence on schwa deletion in this context, but still, generalizations are claimed to be possible. He provides precise chances of omission of every schwa in a monosyllabic clitic:

(104)	*je, ce, se*	$^{9}/_{10}$	
	le	$^{3}/_{4}$	
	ne, me	$^{2}/_{3}$	
	de	$^{1}/_{2}$	
	te, que	$^{1}/_{3}$	(cf. Delattre 1966:31)

This list is claimed to result from the combination of both mechanical and psychological factors. For instance, the clitics containing voiceless obstruents (*te, que*) are least likely to have their vowel reduced. Only when the mechanic resistance against deletion comes to a maximum, as in the case of two consecutive voiceless stops, it can overrule the psychological factors that trigger deletion (Delattre 1966:32).

In a footnote, Dell adds the following psychological factor to his essentially mechanic analysis:

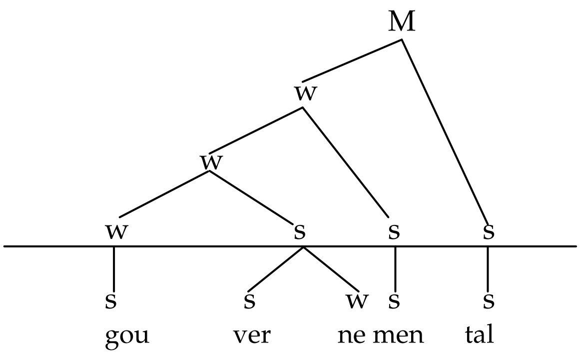
(105) schwa tombe d'autant plus facilement que le groupe au début duquel il figure est long, c'est-à-dire d'autant plus facilement qu'il est éloigné de l'accent principal du groupe. (Dell 1973:228)[25]

In both the accounts of Dell and Delattre, schwa deletion is thus claimed to be related to the position of stress – the distance of schwa to main stress determines the ease with which it is deleted. As in French, stress is phrase-final, it is the length of the phrase that is the determining factor here. A similar reference to the distance of the schwa syllable to main stress can be found in Bouchard's account. The initial position is an ideal instance of Bouchard's "2-stress foot", as it is the furthest possible away from the final, primary stress position. Bouchard's deletion rules and word structure are repeated below.

(106) a. RULE A Delete a vowel in a weak position of a foot (obligatory) (cf. Bouchard 1981:17)

b. RULE B Reduce a vowel under w in a 2-stress foot (optional) (cf. Bouchard 1981:24)

(107) Prosodic structure of *gouvernemental* according to Bouchard (1981:22)



The rule of obligatory schwa deletion (rule A) cannot apply to initial syllables, as in order for this rule to take effect, the schwa syllable must be in a binary foot together with another syllable preceding it. Rule B applies to all schwas (vowel under w) outside the last two syllables of a word, even though they are not in a binary foot. Clitics are incorporated with neighboring content words into trees like (107). The fact that only rule B can

[25] 'Schwa is deleted more easily when the group at the beginning of which it occurs is long, which means it deletes easier when it is further away from the group's main stress.'

apply to the initial position, "combined with the fact that Rule B is optional […] leads to great variability" in this position (Bouchard 1981:26).

Côté, at first glance, diverges from the mechanical restrictions cited thus far: according to her, in phrase-initial syllables, "schwa is generally optional, irrespective of the nature of the consonants", because "phrase-initial sequences may violate the Sonority Sequencing Principle." (Côté 2000:87). This means that they can be more marked than phrase-internal clusters. This effect is claimed to be caused by the preceding boundary. Consider the following examples:

(108) Effect of surrounding IP vs. PW boundary on the behavior of schwa (cf. Côté 2000:130)

a.	*une demande* 'a request'	/yn dəmɑ̃d/ [yn $_{PW}$[dəmɑ̃d]
b.	*Anne, demande-la* 'Anne, ask for it'	/an dəmɑ̃d la/ [an $_{IP}$[d(ə)mɑ̃dla]

(108) shows that according to Côté, the boundary adjacent to the cluster determines its possibility to surface without schwa insertion. If the cluster is preceded by a Prosodic Word (PW) boundary, schwa is obligatory, but if an Intonational Phrase (IP) boundary precedes it, schwa may optionally be omitted. The occurrence of a realized schwa is considered least likely at the beginning of an intonational phrase, and most likely when it is not followed by a boundary, all else being equal.

In sum, we have seen that the main factor for the increased deletion possibilities for schwa is the distance to main (phrase-final) stress, which is the largest in phrase-initial syllables, a tendency which seems to be reflected in Dauses' corpus:

(109) L'*e* instable précédé de deux consonnes et suivi d'une troisième tombe d'autant plus facilement que le groupe qui résulte de sa chute n'est pas suivi immédiatement de l'accent du groupe rythmique. Il est d'autant moins stable que l'accent du groupe rythmique est sur la seconde ou la troisième syllabe qui suit le groupe consonantique. (Dauses 1973:74)

Thus, Dauses' results are in line with those of Dell and Delattre: schwa deletes more easily if it is far away from primary stress, which is located at the end of the rythmic group or phrase.

3.3.3 Government and the Initial Syllable

Delattre adds another psychological factor to his analysis, which he calls initial prominence, and which is his view is responsible for retention of schwa in *word*-initial (as opposed to phrase-initial) syllables.

(110) il suffit de quelque insistance, de quelque ralentissement du rythme, ou autre effet, pour que l'ə réapparaisse et qu'on entende une syllabe de plus dans le rythme.[26] (Delattre 1966:21).

This position, viz. the preservation of schwa in word-initial syllables, is particularly that of the GP-accounts. However, Charette, in her GP-analysis of French schwa, claims that after a single consonant, schwa is dropped in a domain-initial syllable, e.g. *ch(e)val* pronounced [ʃfal], but *le che̱val* [ləʃəval]. These data are claimed to be from her own dialect, Quebec French, and for Parisian French the facts evoked are somewhat different: this language has one single pronunciation, [ʃəval], because "[i]n syllable-initial position in bisyllabic words the empty nucleus is not realized in Quebec French, whereas it has phonetic content in Parisian French." (Charette 1991:203). Moreover, Charette argues that in words of three or more syllables, the nucleus is realized in both dialects (e.g. *che̱valier* [ʃəvalje]). Thus, contrary to all of the authors cited in section 3.3.2, according to Charette, in Parisian French "a word-initial syllable is inaccessible to proper government whatever the status of the following nucleus" (Charette 1991:204). Lyche & Durand (1996:457) use these facts an others to support their claim that Charette's "data on Standard French would be challenged by any phonologist who is a native speaker of that variety or thoroughly familiar with it."

According to Scheer (1998), schwa is reduced in a CəCV context (e.g. *r(e)pas*), but not in a CəCCV (*secret*) or CCəCV[27] (*crever*) environment. In this respect, the data for schwa in initial position do not differ from those discussed in section 3.2.3.2: schwa cannot be deleted if it is preceded or followed by a cluster. After a cluster, schwa has to license the head of the cluster to govern its dependent (cf. *souv(e)nir* vs. *parvenir*). This explains for the absence of deletion in the CCəCV context. For cases like *secret*, Charette proposes a

[26] 'Any insistence, slowdown of rhythm, or other effect is sufficient for the ə to reappear and for an extra syllable to be heard in the rhythm.'

[27] Recall that the CCə context is non-existent in our account, because schwa is limited to CV syllables. In our opinion then, as we showed, the "stable schwa" in this context is an instance of the full vowel /œ/.

solution where Proper Government does not apply through another governing domain, as we have seen in section 3.2.3.2 as well (cf. example (91)), whereas Scheer (1998:55) provides a solution using Proper Government only. As shown above, Scheer (1999) adds Infrasegmental Government, and again, schwa in the initial syllable is not treated differently from occurrences in other parts of the word or phrase.

However, in Scheer (2000), which is devoted to "L'immunité de schwa en début de mot", a specific status is assigned to schwa in initial position. The paper begins as follows:

(111) Il s'agira dans cet article de revenir sur un ensemble d'observations fait par François Dell (1973:223ssq) selon lequel le schwa français a un comportement particulier lorsqu'il se trouve être la première voyelle d'un mot. En l'occurrence, il ne peut chuter dans cette position s'il est précédé d'un groupe consonantique, alors qu'il est optionnel ailleurs, dans les mêmes circonstances. (Scheer 2000:1)[28]

This statement seems to be in contrast not only with Scheer (1999), but also with our discussion of Dell's data so far. In fact, Dell does *not* state that schwa deletion in general is optional when it is preceded by a consonant cluster: none of his rules of schwa deletion apply in the context CC_ (cf. Dell 1973:258-260). This means that schwa conservation after a consonant cluster is not specific to the initial context in Dell's view, but that it is a general phenomenon. There is however a small group of exceptions:

(112) Contrairement à ce que nous avons affirmé plus haut, il semble que dans la parole très rapide le schwa d'un *petit* nombre de mots commençant par *#Cə-* puisse tomber même si le mot précédent est terminé par une consonne. (Dell 1973:230, emphasis ours)[29]

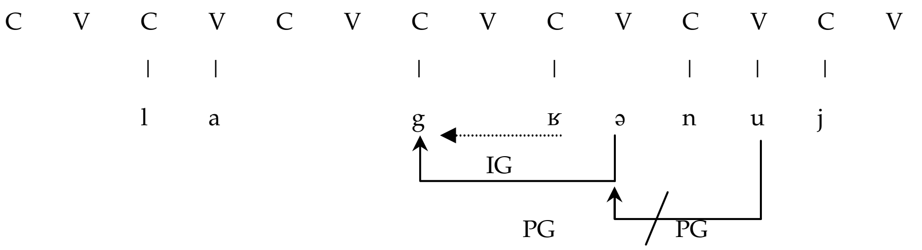
Thus, only in very fast speech, schwa in a limited number of words can be deleted in an initial syllable, even though it is preceded by a consonant

[28] 'In this article, we will come back to a number of observations made by François Dell (1973:223ff) according to which French schwa has a specific behavior when it is the first vowel of a word. Apparently, it cannot delete in this position if it is preceded by a group of consonants, although it is optional elsewhere, in the same circumstances.'

[29] 'Contrary to what we stated above, it seems that in very fast speech schwa can delete in a *small* number of words starting with *#Cə*, even when the preceding word ends in a consonant.'

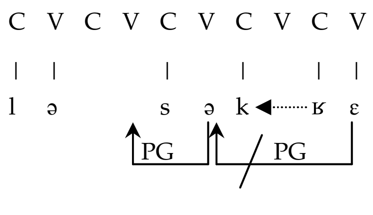
cluster. However, this is only possible if the cluster is separated by a word boundary: a C#C cluster. Deletion after a #CC cluster is always excluded in Dell's data and therefore initial syllables, except in some cases in very fast speech, do not constitute an exception to the general rules in Dell's account in this respect. However, as will be demonstrated, they do in Scheer's.

Scheer's basic assumption is that "schwa première voyelle d'un mot ne peut chuter qu'à l'expresse condition de n'être précédé que par une seule consonne" (Scheer 2000:116): schwa only deletes in word-initial syllables if it is preceded by one consonant. Note that in our view, a vowel preceded by a cluster in the initial syllable is not a schwa. According to Scheer, for whom this type of vowel is also a schwa, the explanation for the difference between the #Cə and #CCə contexts is an empty CV sequence present at the word boundary. The empty V must be properly governed in order for it not to surface as [ɨ]. This is shown below.

(113) 

(cf. Scheer 2000:124)

Because of the infrasegmental government between [g] and [ʁ], schwa can properly govern the empty nucleus preceding *grenouille*. Proper Government between [u] and schwa is blocked (a segment may not govern and be governed at the same time), because this would cause schwa to delete, in which case there would be no proper governor for the empty nucleus. This empty nucleus then would have to surface as [ɨ], as it is not specified to be filled with schwa in case it is not governed (cf. Scheer 2000:123). The language avoids this by realizing a schwa between [ʁ] and [n]. However, this analysis does not work for cases like *le secret* and *la semaine*, where conservation of schwa is also predicted:

(114) a. 

b.

```
C V C V C V C V C V
| |     |   | | |
l a     s ə m ɛ n
        PG  PG
```

Scheer admits that this is a problem: "La question de savoir pourquoi schwa initial peut chuter s'il est précédé d'une seule consonne (*la s'maine*) demeure" (Scheer 2000:125). The solution proposed by Lowenstamm (1999), viz. placing the definite article in the empty CV sequence, would yield the following result for *le secret*:

(115)

```
C   V   C   V   C   V   C   V
|   |   |       |       |   |
l   ə   s       k       ʁ   ɛ
                    IG
            PG
```

Scheer rejects this solution because it cannot explain for the following facts:

(116)	a.	*un livre d'art*	[œ̃livrədar]	[œ̃livdar]
	b.	*autrement*	[otrəmɑ̃]	[otmɑ̃]
	c.	*la grenouille*	[lagrənuj]	*[lagnuj]

Word-finally and word-internally, it is possible to delete the preceding liquid together with [ə] (cf. also Dell 1973:226). This is shown in (116ab). However, word-initially, simultaneous deletion of the two segments is excluded, as is illustrated by (116c). The difference is explained for in Scheer's account by supposing that if the entire CV sequence [ʁə] is suppressed, PG can pass round it and assure the non-realization of the nucleus following [v] in *livre d'art* and [t] in *autrement*. However, in the case of *la grenouille*, the presence of empty CV before the word demands the presence of [ʁə]:

(117) **g(re)nouille*

```
O N1 O N2 O N O N O N
     |    | | | | |
     g    r ə n u j
  PG1   PG2
```

(Cf. Scheer 2000:124)

Returning to Lowenstamm's proposal, we cannot put the article *la* into the ON_1 sequence here, because in that case the N_1 position would no longer require Proper Government (PG_1), making PG_2 possible and yielding **la g''nouille* (Scheer 2000:124). Note that if "schwa" in *grenouille*, as we pointed out in chapter 2, is a non-alternating vowel, and therefore *not* a schwa, Lowenstamm's proposal can be adopted throughout.

Summarizing, Scheer's data include possible deletion of schwa in word-initial #Cə contexts, versus no deletion in the environment #CCə. However, according to the government principles he uses, deletion becomes impossible in the #Cə context when it is in word-initial position, as the schwa is needed to govern the empty nucleus that precedes every word.

In sum, the GP-accounts take an original position in the debate, focusing on *word*-initial syllables and arguing for preservation. However, Charette's data are highly questionable, and Scheer's are partly on vowels we do not include in our definition of the phenomenon. Furthermore, both data sets contradict the assumption by Dell and others that the initial syllable is weak because of its distance to stress. On the other hand, the stronger initial position seems to be independently motivated by data from Hansen (1994), who constructed her corpus in order to find out if the retention of schwa in this position is getting more "popular" in Parisian French. However, as it is clear that in a number of words, schwa in the initial syllable stabilizes and thus turns into a full vowel, Hansen concludes that the stabilization process is a lexical one, and therefore, no conclusions can be drawn on the strength of the initial syllable in general.

3.3.4 Conclusion

The main factors playing a role in schwa deletion in initial syllables are "mechanical" (i.e. they concern the nature of the surrounding consonants) and "psychological" (in particular, the distance from main stress, which corresponds to the length of the phrase) in terms of Delattre (1966).

Although the majority of accounts claim that schwa is weaker in an initial syllable, the opposite position is defended by the GP-accounts, and partly by Hansen (1994). Note that in the OT-accounts (Noske 1996, Van Oostendorp 2000) which do not describe the special status of initial syllables, no data are cited for this deletion context.

Initial deletion is subject to a great amount of variation, which is partly lexical, and it is for this reason undoubtedly that authors seem to differ in their exact definition of possible clusters at the beginning of the phrase. However, it seems clear that these are not as limited as phrase-internal clusters.

3.4 Consecutive schwa syllables

3.4.1 Introduction

The third and final context discussed in this chapter is in fact a combination of multiple contexts: schwa in consecutive syllables. The empty vowel seems to behave differently if it is surrounded by other schwas. Therefore, the majority of accounts contain a separate section devoted to multiple schwa syllables. Martinon, who in general is far ahead of his contemporaries in stating non-normative pronunciation facts, in this case relates different realizations of consecutive schwas to styles of speech, and prefers one to another. Consider, for example, the following remarks on the pronunciation of *redevenir*, a verb containing three consecutive schwa syllables:

(118) Dans ces deux mots, le second *e* ne tombe jamais […] ; par suite, le troisième *e* tombe toujours ; quant au premier, il peut tomber après un son vocal ; mais on trouve plus élégant de le conserver. Ainsi, *vous redev'nez* est plus distingué ; *vous r'dev'nez*, plus populaire […]. Et peut-être les puristes seraient-ils tentés de dire *vous red'venez* […]; mais c'est là une prononciation affectée, qu'on doit absolument s'interdire […]. (Martinon 1913:175)[30]

The early accounts, like Martinon's, all stress the importance of the number and/or nature of surrounding consonants in the original, non-reduced word, the input. These will be the subject of the following section. In section 3.4.3, the output-conditioned models proposed in more recent accounts will be discussed. As the context of multiple schwas has often been used as an argument in favor of the syllable as a conditioning factor, it will be interesting to consider the responses of the opponents to this theory with respect to this context (section 3.4.4). Finally, section 3.4.5 summarizes our findings.

[30] 'In these two words, the second *e* never deletes […]; next, the third *e* always deletes; as far as the first is concerned, it can delete after a vocalic sound; but conserving it is judged more elegant. Thus, *vous redev'nez* is more distinguished, vous *r'dev'nez,* more common […]. And perhaps, purists might be inclined to say *vous red'venez*, but that is an affected pronunciation, that one must never use.'

3.4.2 Input Cluster Conditions

According to Fouché, deletion of schwa in two consecutive syllables follows the general pattern of the cluster contexts, viz. that schwa is deleted when preceded by one consonant, and conserved when preceded by two. The pattern described for two phrase-internal schwa syllables is the following:

(119)	a.	CəCə → CCə	two exceptional contexts	
	b.	CəCCə → CCCə	no exceptions	
	c.	CCəCə → CCəC	two exceptional contexts	
	d.	CCəCCə → CCəCCə	no exceptions	(cf. Fouché 1956:101ff)

Next, Fouché presents 83(!) possible pronunciations of sequences of more than two schwa syllables, starting out with three, and going up to nine consecutive syllables containing a schwa (e.g. *car de ce que je ne le redevenais pas, tu pouvais conclure que ..*'because from (the fact) that I did not become it again, you could have concluded that…'). For every number of syllables, Fouché distinguishes between: (a) the pronunciation needed if none of the syllables is the first of a polysyllabic word, (b) the pronunciation if this is the case for one or more syllables, in which group there is also a distinction between polysyllabic words starting with *re-* and others. For each of these groups, a preferred pronunciation is given, followed by the remark that some other pronunciation is also possible. Consider for instance the following pattern for four syllables not belonging to polysyllabic words:

(120) Formule 0 ə 0 ə.

Ex.: elle ne te le dit pas ; mais que je ne le sache pas !; et que je ne me fâche pas !; parce que je le veux ; c'est ce que je te disais ; c'est que je ne te dis pas cela ; est-ce que je te fais mal ?; est-ce que je le sais ?; qu'est-ce que je te dis !; etc.

REM. – On peut avoir aussi la formule 0 ə ə ə. (Fouché 1956:107)

The "*formule*" in the remark is proposed as an alternative, because a speaker, as the string of schwa syllables augments, might tend to realize them more, because of unconscious need for clearness or of a slow down in speech rhythm (Fouché 1956:105).

In both the pure clitic context and the two contexts containing polysyllabic words, Fouché excludes sequences of two syllables with a deleted schwa. For instance, in a three syllable sequence, of the eight logical possibilities, only '0 0 0', '0 0 ə', and 'ə 0 0' are excluded. However, for cases in which the last syllable is part of a polysyllabic word, the variant '0 ə ə' is also excluded, and 'ə ə ə' is only possible if the syllable is not *re-*.

In general, then, Fouché prefers alternating patterns to non-alternating ones, allowing forms with more released schwas as being more careful, and discarding forms with two adjacent "empty" syllables.

Delattre (1966:24) formulates a general principle: it is the first schwa that is important. This schwa is dropped after a single consonant, and maintained after a cluster. The following schwas then follow the same rule. However, there is an exception to this: if the first schwa of a series follows a word-initial single consonant, it does not necessarily delete, as we would expect, but it can also be maintained (cf. also our discussion of Delattre's account for initial schwa syllables in section 3.3.2). For instance, the expected *on m'le r'fuse* can be replaced by *on me l'refuse*, etc. (Delattre 1966:25).

The rules in Dell's account are also claimed to apply to schwas in sequences. However, their application is claimed to be limited by a principle avoiding simultaneous deletion of two consecutive schwas (cf. Anderson 1982:557ff), which, diverging from the *Loi des trois consonnnes*, states that no sequence of three consonants may occur in the output if there was a schwa between the last two in the input:

(121) VCE_1 (ou VCE_2) peut effacer autant de schwas qu'on veut, à condition que son output ne contienne aucun groupe de trois consonnes C_1 C_2 C_3, où C_2 et C_3 étaient séparées par un schwa dans l'input. (Dell 1973:245)

The output is not further constrained by (121): neither are the articulatory properties of the consonant sequence subject to any restriction, nor are sequences of three consonants excluded, like in Grammont's law. The following example illustrates the latter implication.

(122) *il veut que ce travail soit bien fait* (cf. Dell 1973:246)

			C_1		C_2		C_3		
a.	[v]	[ø]	[k]	[ə]	[s]	[ə]	[t]	[r]	[a]
						↓			
					VCE_2	Ø			

			C_1		C_2		C_3		
b.	[v]	[ø]	[k]	[ə]	[s]	[ə]	[t]	[r]	[a]
				↓					
			VCE_2	Ø					

			C_1		C_2		C_3		
c.	[v]	[ø]	[k]	[ə]	[s]	[ə]	[t]	[r]	[a]

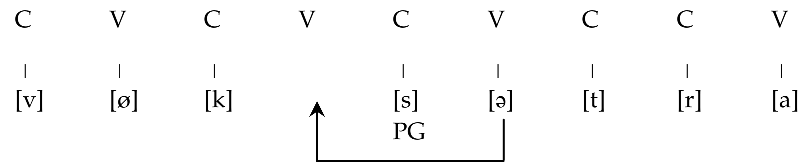
			C_1		C_2		C_3		
*d.	[v]	[ø]	[k]	[ə]	[s]	[ə]	[t]	[r]	[a]
			VCE_2	Ø		Ø			

Although (122a) contains a sequence of three consonants, it is not contrary to (121), because this principle only applies to $C_1C_2C_3$ sequences resulting for schwa deletion in $C_1əC_2əC_3$, and [str] in the input was a $C_1əC_2C_3$ sequence. Therefore, (122a) is a permitted form in Dell's account, but it is not according to Grammont's *Loi des trois consonnes*, which refers to any sequence of three consonants resulting from schwa deletion. (32b) is also a possible realization, in which VCE_2 applies to the first schwa. It would be impossible to delete both schwas, as in (122d), because in this case, principle (121) would be violated: C_1, C_2 and C_3 are adjacent in the output: [kst]. Note that [kst] is not an ill-formed cluster in French and that it surfaces in a number of words, e.g. *extraordinaire* (Dell 1973:246). Finally, (122c) is also a possible output because the application of rules like VCE_2 to the maximum result satisfying (121) is rather a tendency than a law, as we pointed out before, and this sequence represents a "diction soignée" (Dell 1973:244).

To account for the effects of principle (121) in French, Dell proposes to replace the principle of simultaneous application of rules, as present in Chomsky and Halle (1968), by iterative application of rules. This way, VCE_2 could be claimed to apply iteratively from left to right, as in Delattre's view, so that the second schwa can only be deleted if the first one has not been deleted earlier (cf. Dell 1973:248ff). This leaves us with the problem that VCE_2 is an obligatory rule, and that in principle every first schwa should be deleted if possible, which is not the case in Dell's own data. However, note that this is in line with Delattre's proposal, which provides left-to-right application of an optional cluster rule.

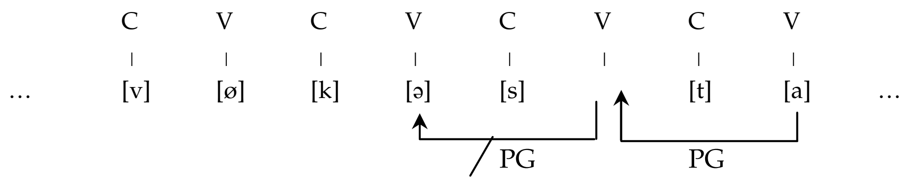
To conclude this section, we now turn to the GP models, which account for schwa deletion on the basis of the presence of clusters in the input. A government approach predicts the pattern shown in (122) above: either of two consecutive schwas can delete, but not both at the same time. The basic proper government process explains for this:

(123)



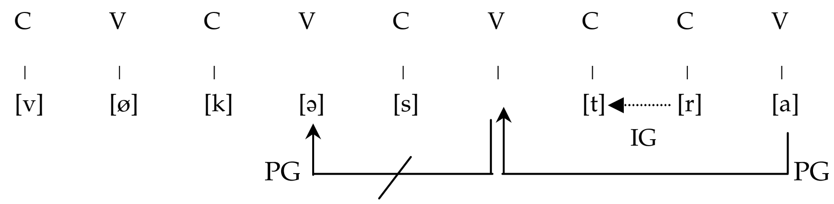
If the second schwa were also followed by a simplex onset (as in, for example, the informal *il veut que ce taff soit bien fait*), it could also have been properly governed and hence be deleted. In this case, the first schwa would have had to be conserved, because it could not have been governed by the second schwa: a governed segment may not itself govern another nucleus, as demonstrated in (124).

(124)



However, in (123), the second schwa is followed by the cluster [tr]. In contrast to Dell's account, Charette (1991) and Scheer (1998) do not allow schwa deletion in this context, since a cluster may not be crossed by a Proper Government relation. On the other hand, Scheer's (1999) and (2000) accounts include Infrasegmental Government. IG between [r] and [t] would enable [a] to properly govern the second schwa, which can therefore be deleted, and the first schwa would obligatorily be retained, as shown in (125).

(125)



This pattern is therefore identical to the one found in Dell's account: if one of the schwas is deleted, the other one is retained. Thus, the early Government approaches are more than Dell's analysis and Scheer's (1999) and (2000) accounts in accordance with the *Loi des trois consonnes*. Both viewpoints basically predict an alternating pattern, caused by iterative application of rules (VCE_2) or principles (Proper Government).

3.4.3 Output-based Conditions

One of the most famous output principles is Maurice Grammont's *Loi des trois consonnes* we discussed in the previous chapter. In addition to this general law, Grammont proposes the following restrictions for two consecutive schwa syllables: in $C_1\text{ə}_1C_2\text{ə}_2$, ə_2 is reduced, except when C_1 is a continuant and C_2 is not (cf. Grammont 1922:108). This is an input-output relation comparable to Dell's principle (121). However, the application of these rules is often blocked by analogy and the existence of "groupes figés". An example of the latter is the group *je ne*, because it is always realized as [ʒən] and never as [ʒnə] (cf. Grammont 1922:109). The analogy, in this case, consists either of the copying of the pronunciation of an initial group to its realization in the middle of a phrase (in the case of *je ne*, for example) or of the copying of the pronunciation of the group occurring after a consonant to all possible contexts. According to Grammont's rules, series of clitics are always realized with deletion of the second schwa only, because the first one cannot be deleted due to its initial or post-consonantal position. This realization is then copied to all other contexts, e.g. *il est sûr de n' pas échouer* (post-consonantal) → *j'ai pris la resolution de n' pas y aller* (post-vocalic) (cf. Grammont 1922:110). Moreover, numerous exceptions are cited, which we will not discuss in detail here for reasons of brevity.

In Noske's and Van Oostendorp's accounts, as shown earlier, the condition on the output is the possibility of syllabifying the remaining consonants. For the phrase *il a envie de te le demander* 'he would like to ask it you', out of 16 (2^4) logically possible outcomes, the following eight results are therefore possible[31] in their approach:

(126)	a.	il a envie de te le demander	[i.la.ã.vi.də.tə.lə.də.mã.de]
	b.	il a envie d(e) te l(e) demander	[i.la.ã.vit.təl.də.mã.de]
	c.	il a envie d(e) te le demander	[i.la.ã.vit.tə.tə.lə.də.mã.de]
	d.	il a envie de te l(e)demander	[i.la.ã.vi.də.təl.də.mã.de]
	e.	il a envie de t(e)le demander	[i.la.ã.vi.dət.lə.də.mã.de]
	f.	il a envie d(e) te le d(e)mander	[i.la.ã.vit.tə.ləd.mã.de]
	g.	il a envie de t(e) le d(e)mander	[i.la.ã.vi.dət.ləd.mã.de]
	h.	il a envie de te le d(e)mander	[i.la.ã.vi.də.tə.ləd.mã.de]

(Noske 1992:203, Dell 1973:245)

[31] Nor Dell, nor Noske, nor Van Oostendorp expresses a preference for either of the non-formal forms (126b-h).

Bouchard, who groups schwa syllables into binary feet, arrives at the same conclusions as these authors (cf. Bouchard 1981:19), except that his rule B of schwa deletion/reduction can delete even more schwas at the same time, as shown below, because contrary to the obligatory deletion rule A, it is based on universal sonority instead of French syllabification:

(127) *qu(e) j(e) t(e) le fasse*

kə	ʒə	tə	lə	
s	w	s	s	
				foot formation
kəʒ				Rule A and resyllabification
kʒ		tl		Rule B and Stray Segment Attachment
kʃ				Voicing Assimilation
	[kʃtlə]			(Bouchard 1981:28)

These larger possibilities of deletion call in mind Rialland's examples of deletion from (98), repeated below for convenience.

(128) a. *Je n'ai pas pensé une seconde qu(e) tu l(e̲) f(e̲) rais* [lfr]
b. *Tu crois qu'il faut qu(e̲) j(e̲) fasse tout?* [kʃf]
c. *Il n'en r(e̲)v(e̲)nait pas.* [rvn]
(cf. Rialland 1986:215)

Rialland points out that a fourth example can be found in Dell (1973): *fin de semaine* pronounced [fɛ̃ t smɛn] (Rialland 1986:216). She emphasizes that these are all exceptional cases, and that a special consonantal context is required, which she does not define, but for which "il est évident qu'il faut des fricatives" (Rialland 1986:216). The resulting clusters are in accordance with Côté's (2000) Sonority Sequencing Principle. According to this principle, a cluster like [kʃf] may surface because the middle segment [ʃ] is not exceeded in sonority by both of the surrounding segments. Bouchard's, Rialland's and Côté's data seem in direct conflict with those from the other accounts discussed. They contradict the accounts based on the *Loi des trois consonnes*, because of the encounter of three consonants. Furthermore, they contradict purely syllable-based accounts, because of the occurrence of clusters that do not occur as syllable-onsets elsewhere in the language. Finally, they contradict the government approach in two ways, because schwa is deleted when followed by a cluster, *and* when a following schwa is also deleted. However, the data provided do not at all seem extravagant to us, and we would like to verify if they can be confirmed by additional corpus research. Moreover, we can hypothesize that the data from Bouchard, Rialland and Côté on the one hand, and the other data on the other, represent two different style levels. Experimental research focusing on one style level would enable us to sort this out.

Summarizing, there is no agreement on the possible clusters and their formal description. Some clusters surfacing after schwa deletion seem to differ from those attested elsewhere in the language, and experimental research is needed to establish the limits to cluster formation in this case.

3.4.4 Conclusion

(129)		*Grammont*	*Fouché Delattre Dell*	*Noske Van Oosten-dorp, Bouchard*	*Charette Scheer*	*Rialland Côté*
		Loi des Trois Consonnes	*preceding cluster*	*syllable*	*preceding and following cluster*	*cluster*
$C_1ə_1C_2ə_2C_3V$	$ə_1$ or $ə_2$	yes	yes	yes	yes	yes
	both	no, unless $C_2 = s$	no	no (B: yes if sonorous)	no	depends on cluster
$C_1ə_1C_2ə_2C_3C_4V$	$ə_1$ or $ə_2$	only $ə_1$	yes	yes, $ə_2$ only if $C_2C_3C_4$ is correct onset	only $ə_1$	depends on cluster
	both	no	no	no	no	no

The above table of deletion possibilities shows that there is a clear-cut two-way opposition in the data, with Côté and Rialland (and partly, Bouchard) on the one hand, and the rest of the accounts on the other. However, there are some minor differences within the “conservative” group with respect to deletion before clusters. Note that again, the resulting clusters are the basis of the debate.

3.5 Conclusion

This chapter provided an overview of the French schwa deletion data. The data were shown to be in conflict in the following contexts: schwa adjacent to clusters, schwa in boundary-adjacent syllables, and schwa in consecutive syllables. For each of these three contexts, we indicated the empirical questions experimental research should address. A summary of these results is presented below.

(130)	*Overview of issues to be addressed by experimental research*
clusters	✓ influence of the number of consonants and their place around schwa ✓ segmental conditions on surrounding consonants
boundaries	✓ initial boundaries: factors of influence ✓ segmental conditions on deletion in initial syllables
consecutive schwas	✓ possibility of schwa deletion in two consecutive syllables ✓ possible clusters resulting from deletion ✓ existence of multiple style levels

4 "*Phonologie du Français Contemporain*": *a Corpus Study of Schwa Deletion*

Savoir n'est pas penser, c'est avoir enregistré.
[To know is not to think, it is having recorded.]

Jean-Claude Clari, *Le mot chimère a deux sens*

4.1 Introduction

In the preceding chapter, three contexts of schwa deletion have been singled out for which no agreement has been reached in the literature, and at which this chapter proposes a closer look using a corpus of speech data, viz.:

(131) a. Schwa after a cluster *(appartement)*
b. Schwa in a phrase/word initial syllable *(Revenez demain)*
c. Schwa in consecutive syllables *(ne me le demande pas)*

All three contexts seem to be connected: we aim for describing possible resulting clusters after schwa deletion both word-internally and word or phrase initially. Special attention is devoted to what happens to possible clusters if more than one schwa disappears, which is the case in the last context. In this chapter, we will use data from a corpus in order to shed light on the conflicts in the mostly introspective data. Furthermore, we will verify to what extent the corpus provides innovative evidence for a few conclusions drawn from laboratory experiments.

The data we will use are part of a larger corpus formed by the 70[32] surveys of the project "*Phonologie du Français Contemporain*" (henceforth PFC). PFC is the most recent corpus of French speech, collected by a large number of researchers in France and other French-speaking countries. It will be described in more detail in section 4.2. In section 4.3, the sociolinguistic variables present in the corpus are discussed, and the choices made in

32 Status of the project in Summer 2007. PFC is an expanding corpus and the number of surveys still increases.

selecting a subset of the corpus for our analysis will be motivated. Next, section 4.4 will present the research method used in order to establish the absence or presence of schwa in the contexts mentioned above. The results of this analysis are provided in section 4.5. Next, some experiments which have been conducted in speech laboratories in the past, and which were already briefly discussed in the preceding chapter, will be treated in more detail. In section 4.6, these will be applied to the PFC corpus. Section 4.7 concludes this chapter, summing up its results and proposing our conclusion.

4.2 The PFC corpus[33]

The project *La phonologie du français contemporain : usages, variétés et structure* is directed by Jacques Durand (University of Toulouse), Chantal Lyche (University of Oslo and University of Tromsø), and Bernard Laks (University of Paris X). The main goal of the project is to provide a better image of spoken French for phonological and phonetic theory to address. In order to do so, speech data were collected all over France and also in other French speaking countries (the so-called *francophonie*), such as Belgium, Canada and African states.

For every *point d'enquête,* that is every location where data were collected, the speech of about 10 people was recorded. The procedure was as follows. The person conducting the survey first started a guided interview, collecting an amount of biographical and sociological information on the speaker (which was added to the speaker's file). Next, the speaker was asked to read a text aloud, in order to get a sample of more formal and careful speech. Thirdly, the speaker read a list of 94 words, which contained 47 minimal pairs. Lastly, there was a separate session during which the interviewer recorded a free conversation between a number of subjects who were closely personally related (cf. Durand & Lyche 2003). Every *point d'enquête* ideally contains recordings of an approximately equal number of men and women, representing at least two age groups.

For every speaker, 3 minutes of the guided interview and 3 minutes of free conversation were transcribed in French orthography. Next, special attention was paid to schwa and *liaison*, which were transcribed on separate tiers with PRAAT software (Boersma 2001). All transcriptions were verified by a second transcriber. The encoding of schwa was done in the following way:

33 More detailed information on the corpus can be found on the official PFC website: http://www.projet-pfc.net/

(132) PFC coding of schwa in a 4 digit number

first digit: presence of schwa

0	schwa absent
1	schwa present
2	presence of schwa questionable

second digit: location in the word

1	monosyllabic word
2	first syllable of polysyllabic word
3	second syllable and following of polysyllabic word
4	last syllable of polysyllabic word
5	metathesis

third digit: left context

1	vowel to the left (VCə)
2	consonant to the left (CCə)
3	beginning of intonational group
4	questionable presence of schwa to the left
5	simplified cluster

fourth digit: right context

1	vowel to the right (əV)
2	consonant to the right (əC)
3	strong intonational boundary and/or end of utterance
4	weak intonational boundary

Most of the codes are straightforward, but some might not be clear to the reader at first sight. The number 5 in the second digit, for example, means that metathesis has taken place. That is, instead of pronouncing [ʒəvø] for *je veux*, the speaker says [əʒvø], a phenomenon that exists mostly in the Northern varieties of European French, for example in the Walloon provinces in Belgium. In the third digit, a 1 does not entail that schwa is immediately preceded by a vowel, but that its syllable is. That is, schwa is only preceded by the simplex consonant of its onset. The number 2 means that the preceding coda is a consonant, i.e. schwa is preceded by a group of consonants. A 5 stands for a simplified cluster preceding schwa. This often happens to final obstruent-liquid clusters, as in *un liv(re) d'art* [œ̃livdaʁ]. If the presence of a schwa in the preceding syllable is questionable (2 in its first digit), this will be reflected by a 4 in the third digit of the next schwa. Thus, a schwa coded *xx4x* will always be preceded by another schwa coded 2*xxx*. Finally, consider the difference between 3 and 4 in the last digit, which is the difference between a strong and a weak intonational boundary. In the case of a strong boundary, an audible pause is present after schwa (or the moment where it could have been). A weak boundary is only heard after multiple listening of a fragment and/or phonetic analyses of it. In order to clarify this coding system, some examples are given in (133).

(133) a. 0132
unrealized schwa in a monosyllable, at the beginning of an intonational group and followed by a consonant
Je0132 fais du tricot. (rires) <E: Ah oui?> Oui.
(Speaker svamr1)
[ʃfɛdytʁiko awi wi]
'I do some knitting. (laughter) <E: Oh yes?> Yes.'

b. 1212
realized schwa in the first syllable of a polysyllabic word, preceded by a vowel and followed by a consonant
baisser de1212puis les élections.
(Speaker 85ajf1)
[bɛsedəpɥilezelɛksjɔ̃]
'decrease since the elections.'

The PFC website contains an easy to use search engine, which allows users associated with the project to search for specific schwa deletion cases in the whole of the corpus. After submitting a code, the user is provided with a list of speakers that produce or omit schwa in that particular context, and can see and hear the exact phrasal context in which production or omission occurs. It goes without saying that the PFC corpus is thus ideally suited for our research purposes.

4.3 Sociolinguistic Variation and the PFC Corpus

4.3.1 Introduction

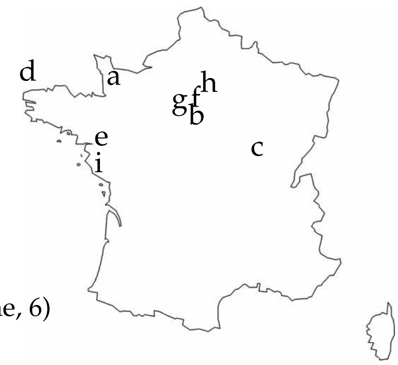
Language use is subject to two types of variation: inter-speaker variation and intra-speaker variation. Inter-speaker variation occurs between different speakers, on a regional level (diatopic variation), but also in the same region, e.g. in different social groups or between speakers of a different sex (diastratic variation). Inter-speaker (or diaphasic) variation occurs in the speech of one and the same speaker, acting in different situations, and therefore switching from standard to regional or dialectal speech, or changing style level. Before starting a corpus-based analysis, one should have a clear picture of the sociolinguistic variation involved. This is the aim of this section.

4.3.2 Diatopic Variation

France can globally be divided into two parts. After the fourth/fifth century, two dialect groups emerged form Vulgar Latin. In the Northern part, the *langue d'oïl* was spoken, and in the south, the *langue d'oc* was used, largely influenced by Provençal, the language of the Provence. In today's Southern, or Midi French, a lot of schwas that are deleted in Parisian French are conserved, as mentioned in chapter 2. In order to get a complete picture of what we could call "standard French", we decided to focus on the "*langue d'oïl*" area, roughly situated to the north of the river Loire. Furthermore, we excluded the *point d'enquête* Ogéviller (Meurthe-et-Moselle), as it is located near the German border, in an area that has been part of Germany in the past, and where pronunciation is therefore influenced by German. The following *points d'enquête* are relevant for our purposes:

(134) PFC *points d'enquête* in the North of France (department, number of speakers in parentheses)

a. Brécey (Manche, 11)
b. Brunoy (Essonne, 10)
c. Dijon (Côte d'Or, 8)
d. Île de Sein (Finistère, 15)
e. Nantes (Loire-Atlantique, 11)
f. Paris Centre (Ville de Paris, 12)
g. Puteaux-Courbevoie (Hauts-de-Seine, 6)
h. Le Raincy (Seine-Saint Denis, 1)
i. Treize-Vents (Vendée, 8)



This leaves us with 82 speakers in the North of France. However, as only part of the transcriptions of these speakers were available through the PFC website at the time this thesis was written, only (134abcfi) were used in the corpus survey. Together, these five *points d'enquête* contain 49 speakers. A full list of these, with their age, sex, and profession, is provided in Appendix A.

4.3.3 Diastratic Variation

Following De Jong's (1988) corpus-based *liaison* research, we divided our speakers into age categories in the following way: a group of speakers between 16 and 29 years old, a group of 31-50 years old, and a group of people older than 50. This yields the following distribution for our *points d'enquête*:

(135)

point	*age*	*age 30-50*	*age >50*
Brécey	3	4	4
Brunoy	2	0	8
Dijon	6	1	1
Paris	4	4	4
Treize-Vents	2	2	4
Total	17	11	21

This table shows that the corpus contains a relatively small middle group. However, according to Eurostat[34], the statistical information service of the European Union, the proportions of the age groups 0-24, 25-49, and >49 were 31.6 : 34.7 : 33.8 in 2004. This means that the groups represent about 31, 35, and 34 percent of the population respectively. The distribution of the Eurostat age groups in our corpus is 8 : 21 : 20, i.e. 16.3, 42.8, and 40.88%. Eurostat's definitions thus make the proportion of young people very small. The difference with De Jong's classification is caused by the relatively large number of speakers between 25 and 30 years old, who De Jong classifies as being part of the first, and Eurostat as being part of the middle group. If the first group is made up of 0-25 year olds, however, the distribution is 13 : 16 : 20, which seems much more fair. As slight manipulation of the boundaries of the age groups is enough to obtain a picture that seems acceptably well-balanced, it can be concluded that the subjects are sufficiently diverse as far as age is concerned. In our survey, no predictions can be made on any of the age groups proposed thus far, as each of these would comprise less than 30 people, so that results risk being statistically irrelevant. Therefore, assuming the group of 49 subjects is sufficiently well-balanced as far as age is concerned, it will be used to represent French society as a whole.

Another important social variable is sex. In general, women speak more carefully than men, and tend to use more (hyper)correct forms (cf. e.g. Fasold 1990). However, women are also the leaders in linguistic change,

34 http://europa.eu.int/comm/eurostat/

adopting new forms more quickly then men. This is what Labov (2001:367) calls the Conformity Paradox:

(136) Women deviate less than men from linguistic norms when the deviations are overtly proscribed, but more than men when the deviations are not proscribed. (Labov 2001:367)

In the case of schwa/zero alternations, although some schwas has been stabilized to /œ/and others which were stable in the past are now alternating, as shown in chapters 2 and 3, we are generally not dealing with a linguistic change of which speakers are conscious. Leaving out a schwa in fast speech is not judged as sloppy, so that it is not clear if women delete more schwas then men do. Ideally, in order to make sure that the difference between the genders does not influence the results, our corpus should contain about as many male as female speakers. Together, the *points d'enquête* under consideration contain 25 women and 24 men, which is an almost equal balance.

The third and final factor we will take into account here is socioeconomic stratification. Again following De Jong (1988), we will distinguish five social classes based on profession. That is, speakers were divided into five social class categories according to their jobs (as listed in Appendix A). Furthermore, the occupation of a speaker can be claimed to reflect his education: a general manager will normally have received better education than a construction worker. Mullineaux & Blanc (1982) developed the following scale to describe the social stratification of the Orléans Corpus:

(137) Social stratification scale. The table was adapted from Mullineaux & Blanc (1982) by De Jong (1988), the roman numbers are ours.

I	Higher professional	Owners of very large concerns, priests, doctors, engineers, architects
II	Lower professional	Junior school teachers, nurses, social workers, junior managers, technicians
III	Skilled non-manual workers	Clerks, secretaries, salesmen, shop assistants
IV	Skilled manual workers	Plumbers, joiners, tailors, mechanics, foremen, cooks, firemen
V	Semi- and unskilled workers	Machinists, dustmen, labourers, waiters, cleaners, messengers, maids

Classifying the professions from the table in appendix A into these five groups, and placing students in the middle group, the following distribution for our *points d'enquête* is obtained:

(138)

Point d'enquête	*I*	*II*	*III*	*IV*	*V*	*unclassified*
Brécey	0	3	7	1	0	0
Brunoy	1	4	3	2	0	0
Dijon	0	3	2	2	1	0
Paris Centre	0	1	0	0	0	11
Treize-Vents	0	1	2	5	1	0
Total	1	12	14	10	2	11

Unfortunately, our corpus only contains one speaker belonging to class I. Moreover, there were no data on the jobs of 11 out of 12 speakers from the *point d'enquête* Paris Centre. However, this survey was made among the *haute bourgeoisie*, which means that it involved the higher classes of society. For this reason, at least part of the Paris Centre speakers is likely to belong to class I. Furthermore, a small proportion for this group is expected: it forms the upper class of society which is classically the lowest in number.

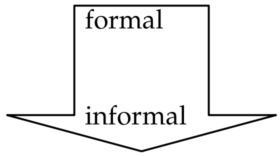
Note, moreover, that there is a very small proportion for group V: the corpus seems to lack information on the speech of the unqualified. This is not surprising as in most cases, speakers were often recruited around an acquaintance of the interviewer. The rest of the subjects are globally equally distributed among the other groups, with a small majority for the middle group III, which is caused by the students, who could be put into groups II or IV as well. Again, note that the corpus will be treated as a whole, since none of the subcorpora seem to form a representative testing group.

In sum, the corpus has a fairly normal distribution as far as age and sex are concerned, and most social classes, especially the middle ones, are represented in the group of 49 subjects.

4.3.4. Diaphasic Variation

As we have shown in the preceding chapters, schwa deletion in French is highly dependent on style level: the more formal the style, the fewer schwas are deleted. In order to incorporate these and other effects of intra-speaker variation, the PFC corpus consists of the following types of recordings:

(139) a. Read-aloud word list
b. Read-aloud text
c. Guided interview
d. Free conversation



Situation (139a) is the most formal one, whereas (139d) is the least formal. As Durand & Lyche (2003) indicate, the corpus has roughly two style levels: (139ab) serving mostly the purpose of recognizing the phoneme inventory of the speaker, (139c), the face-to-face interview represents the more formal style ("*style guidé*" in the words of Durand & Lyche), whereas the free conversation (139d) between multiple speakers from the same *point d'enquête* is an adequate representative of informal speech ("*style libre*"). We performed a pilot study on the initial syllable context in Dijon and Treize-Vents, which yielded the results below.

(140) Deletion in word-initial, non-phrase-initial syllables (Dijon and Treize-Vents)

	Guided interview	*Free conversation*
Deletion	319	429
No deletion	215	283

As shown, the differences between the guided interview ("formal") and the free conversation ("informal") situations are not as important as we might expect. Statistical analysis proves that the distribution of deletion and no deletion sites among the two situations is not significantly different ($\chi^2(1)= .03$, $p > .05$). Indeed, the guided interviews contained a lot of informal speech, e.g.:

(141) *C'était qu'avec des paysans* […] *mais c'était génial. Putain de la roulée j'en ai fumé, quoi parce que, du teuch.* (Speaker 85apr1)

'it was with peasants only […] but it was great. Damn, I smoked a lot of rolled stuff, you know, because [it was] shit'

Therefore, we decided to deviate from the formal/informal distinction as proposed by Durand & Lyche (2003), and use only the read-aloud text as a case of formal speech. A first problem with this approach is that whereas the text recorded in the free conversation situation is entirely variable, all speakers read the same text aloud. For this reason, we cannot compare, say the number of occurrences of deleted schwa after a consonant cluster in the read-aloud text to that of these occurrences in free conversation, as in the latter case, contrary to the former, the number of possible deletion sites is variable, and because the length of both sound files is not identical. However, a percentage of deleted schwas in relation to potentially deletable schwas could be given for both the formal and informal contexts instead.

The second problem is the fact that text read aloud by French speakers is far more than formal. When French children are taught how to read, the pronunciation of written *e*'s is explicitly enforced by teachers. When reading aloud poems, and in particular, classical alexandrines, there are very strict rules for the pronunciation of *e muet*: contrary to what happens in every-day speech, all pre-consonantal schwas are realized. Besides pre-vocalic schwa, this also typically excludes the verse-final vowel. It is only when exactly obeying this rule that one obtains the correct number of syllables per verse, e.g. twelve. This is demonstrated by the following alexandrine (somewhat striking by its content), pronounced by Mohammed in *Le Fanatisme ou Mahomet le prohète* by Voltaire.

(142) *Quiconque_ose penser n'est pas né pour me croire.*
1| 2 | 3 |4|5|6| 7 | 8 | 9| 10 |11| 12
[ki kɔ̃ ko zə̠ pɑ̃ se nɛ pɑ ne puʁ mə kʁwaʁ]
'whoever dares to think was not born to believe me'

Note especially the final *e* in *ose* which is pronounced, quite unlike in normal (even formal) speech. Thus, when confronted with written text, even if this is not an alexandrine, a speaker of French will pronounce even more schwas than in his usual formal speech. Component (139a) is therefore not entirely suited for an analysis of the highest style level of French, but will serve here as an indicator for the extreme opposite of fast speech.

The following table compares the total amount of deletions in word-initial, non-phrase initial syllables in the Dijon and Treize-Vents guided interview and free conversation recordings to that in the read-aloud text.

(143) Deletion in word-initial, non-phrase-initial syllables

	Guided interview + Free conversation	*Read-aloud text*
Deletion	748	43
No deletion	498	654

The distribution is now highly significant ($\chi^2(1)= 537.2$, $p < .001$), but this is also due to the difference in the total amount of deletion contexts. In order to compare the two groups, then, we have to compare percentages, and not absolute numbers. It is therefore the approach to the formal/informal style level distinction that is demonstrated in (144) that will be adopted throughout this chapter.

(144) Deletion in word-initial, non-phrase-initial syllables

	Guided interview + Free conversation	*Read-aloud text*
Deletion	748 (60.0%)	43 (6.2%)
No deletion	498 (40.0%)	654 (93.8%)
Total	**1,246**	**697**

Not all of the possible deletion contexts occur in the read-aloud text, which is provided integrally in Appendix B. The codes that are present in the text are listed below.

(145) Deletion contexts in read aloud text

a. After a cluster
  _322 … *le gouvernement prend…*

b. In a word-initial syllable (which is not phrase-initial)
  _112 … *opposants de tous…*
  _122 … *car le Premier Ministre…*
  _212 … *ses chemises en…*

c. In a phrase-initial syllable
  _131 *Le hazard…*
  _132 *De plus …*

d. In consecutive syllables
  _112 + _112 … *sentiment de se trouver…*
  _112 + _112 + _112 … *que de se trouver …*

In the remainder of this chapter, it is these contexts that will be used to establish a comparison between (extremely) formal and informal style levels.

4.4 Method

The contexts of schwa deletion defined in chapter 3 were translated into a set of codes suited for searching the PFC corpus in the following way:

(146) a. After a cluster 0322, 1322
1st digit 0 = no schwa, 1 = schwa present

	2nd digit	3 = second syllable or more of polysyllable
	3rd digit	2=consonant to the left
	4th digit	2 = consonant to the right
b.	Word-initial syllable	0112, 0122, 0212, 0222, 1112, 1122, 2112, 1222
	1st digit	0 = no schwa, 1 = schwa present
	2nd digit	1 = monosyllabic word, 2 = first syllable of polysyllabic word
	3rd digit	1= vowel to the left, 2 = consonant to the left (preceding word)
	4th digit	2 = consonant to the right
c.	Phrase-initial syllable	0132, 0232, 1132, 1232
	1st digit	0 = no schwa, 1 = schwa present
	2nd digit	1 = monosyllabic word, 2 = first syllable of polysyllabic word
	3rd digit	3 = beginning of intonational group
	4th digit	2 = consonant to the right

We systematically excluded the *xxx*1-type context from (146), as schwa is automatically deleted in front of a vowel. However, whereas no instances of word-internal or phrase-initial instances of prevocalic schwa were found, these do exist in clitics (codes 11*x*1). Examples are given below.

(147) a. 1111 Ouais, ouais le1111, ouais la vieille0412 ville0411 elle0411 est bien

[wɛ wɛ lə wɛ la jɛj vil ɛl ɛ bjɛ̃]

'Yes, yes the, yes the old city is good'

Speaker 21abm1, free conversation

b. 1121 Non, non, pas du tout mais euh, comme1414 euh, j'ai fini

[nɔ̃ nɔ̃ pɑ dy tu mɛ œ kɔm œ ʒe fini

mes exam0412s le1121 huit juin euh

mezɛgzam lə ɥit ʒɥɛ̃ œ]

'No, no, not at all but er, because er, I finished my exams on the 8th of June er'

Speaker 21aml1, guided interview

c. 1121 s'en rappe0312lait l'autre0452 fois alor0412s que1121 il0411 en a parlé

[sɑ̃ ʁaplɛ lot fwa alɔʁ kə il ɑ̃na paʁle]

'Remembered the other time although he talked about it'

Speaker 85amg1, free conversation

The first group of exceptions is the realization of the schwa before a pause or hesitation, as in (147a). These schwas can be considered to be phrase-final and therefore not within the scope of this thesis. (147b) is an example of schwa before *h aspiré* : a word starting with a vowel, but which behaves as though there were a consonant present in front of it. The special behavior of *h aspiré*-words such as *huit* [ɥit] 'eight' is an interesting topic, but will be not be considered here as it is outside of the main subject of the thesis. Finally, schwa may be realized at the end of fixed expressions such as *parce que* [paskə] 'because' and, as in (147c), *alors que* [alɔʁkə] 'although'. In these cases, the vowel is not sensitive to deletion at all, and can therefore be considered to be the full vowel [œ], which does not alternate.

The list in (146) thus gives the complete inventory of possible codes for the alternation types we are looking for, with the exception of schwas in consecutive syllables, as we cannot specify in the third digit that the preceding vowel should be a schwa. As pointed out before, the consecutive schwa syllable context is a combination of other contexts and is mainly found in sentences with multiple clitics. Codes 011*x* and 111*x* allow to search for clitics preceded by an open syllable, and are thus the closest possible to this deletion context.

In order to be sure that a search of the codes is carried out through the whole corpus, and in order not to depend on the PFC website search engine whose performance could not be checked upon, the transcripts of our 49 speakers were copied into three text files per survey, one for every recording type. We then carried out a search for every item with the search and replace function of Microsoft Word[35], which gives the exact amount of replacements after they have been carried out. The coding of schwas was randomly checked in order to verify if the schwas were well coded and if the

35 Microsoft ® Word™ 2002, 10.6775.6735, SP 3.

programme had counted exactly the instances we aimed to investigate. The following section presents the results of these searches.

4.5 Results

4.5.1 Word-internal cluster

The tables below show the number of contexts after word-internal cluster where deletion (code 0322) or no deletion (1322) was found, for the formal (read-aloud text) and the informal (guided interview + free conversation) settings, respectively. If the transcribers were hesitant on the status of a schwa, it was coded 2322.

(148) Deletion in the word-internal cluster context

a. Formal

Point d'enquête	*Dijon*	*Brécey*	*Brunoy*	*Paris*	*Treize-Vts.*	***Total***
Absent	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (8.3%)	0 (0.0%)	**1 (2.0%)**
Present	8 (100%)	10 (90.9%)	10 (100%)	11 (91.7%)	8 (100%)	**47 (95.9%)**
Unclear	0 (0%)	1 (9.1%)	0 (0%)	0 (0%)	0 (0%)	**1 (2.0%)**
Total	**8**	**11**	**10**	**12**	**8**	**49**

b. Informal

Point d'enquête	*Dijon*	*Brécey*	*Brunoy*	*Paris*	*Treize-Vents*	***Total***
Absent	2 (14.3%)	6 (37.5%)	85 (68.5%)	13 (36.1%)	7 (21.2%)	**113 (50.7%)**
Present	12 (85.7%)	10 (62.5%)	39 (31.5%)	23 (63.9%)	25 (75.8%)	**109 (48.9%)**
Unclear	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (3.0%)	**1 (0.4%)**
Total	**14**	**16**	**124**	**36**	**33**	**223**

The relatively low numbers for most surveys show that schwa deletion is quite rare word-internally, after a cluster. In general deletion is not allowed, especially in formal contexts. In the read-aloud text, there was one word-internal schwa present, viz. in the word *gouvernement.* This schwa was omitted only once, viz. by speaker 75ccm2.

In informal style, all occurrences of word-internal schwa had to be checked manually in order to exclude instances that follow a tautosyllabic cluster, as these do not fit our definition of schwa. The following table lists the figures excluding these non-alternating vowels:

(149) Deletion in word-internal cluster context, informal style, excluding vowels following a complex onset.

Point d'enquête	*Dijon*	*Brécey*	*Brunoy*	*Paris*	*Treize-Vts.*	***Total***
Absent	2 (18,2%)	6 (40.0%)	85 (78.0%)	7 (26.9%)	7 (25.0%)	**107 (56.6%)**
Present	9 (81.8%)	9 (60.0%)	24 (22.0%)	19 (73.1%)	20 (71.4%)	**81 (42.9%)**
Unclear	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (3.6%)	**1 (0.6%)**
Total	**11**	**15**	**109**	**26**	**28**	**189**

As expected, the elimination of non-alternating vowels changed only the number of instances of no deletion, except in 6 cases in the Paris-Centre corpus. These were six repetitions of *quart(e)-vingts* by speaker 75cgn1. It seems that this speaker has stored this item as [katvɛ̃] in his lexicon, and that it therefore contains no [ə] sound at all. There are no other cases contradicting our prediction that vowels preceded by a complex onset do not alternate.

Removing the stable vowels from our table slightly changes the picture. More than half of the cases seem to present deletion of schwa after two consonants, which is contrary to what might be expected considering the existing literature on schwa deletion. However, it is especially the Brunoy corpus that is influencing the relatively large number of deletions. Unlike in the other *points d'enquête*, here, there seems to be a much clearer preference for deletion instead of conservation, and the number of instances of post-cluster word-internal schwa are fairly high. However, 81, i.e. 95.3%, of schwas coded 0322 in this corpus were found in *parce que* 'because'. The form *parce que* can be claimed to be lexicalized as [pask(ə)], as it almost never occurs with a schwa between [s] and [k] (and the [ʁ] hardly being pronounced). Its presence in the Brunoy corpus seems overwhelming, but in the transcriptions of the other *points d'enquête* the absence of schwa in *parce que* has often been coded 0312 (following a simplex consonant), 0352 (following metathesis), or 0452 (metathesis, and treating *parce que* as two separate words), codes representing a realization [pask(ə)]. Leaving out all 89 instances of *parce que* out of all counts, the following picture is obtained:

(150) Deletion in word-internal cluster context, informal style, excluding vowels following a complex onset (except *parce que*).

Point d'enquête	*Dijon*	*Brécey*	*Brunoy*	*Paris*	*Treize-Vts.*	***Total***
Absent	2 (18,2%)	6 (40.0%)	5 (18.5%)	3 (13.6%)	4 (16.0%)	**20 (20.0%)**
Present	9 (81.8%)	9 (60.0%)	22 (81.5%)	19 (86.4%)	20 (80.0%)	**79 (79.0%)**
Unclear	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (4.0%)	**1 (1.0%)**
Total	**11**	**15**	**27**	**22**	**25**	**100**

The number of deletion cases is reduced to 20%, a proportion much more in line with the predictions in the literature. Focusing on these examples of schwa deletion, let us now consider their typology. The following table gives an overview of deletion cases in informal style.

(151)	*Speaker(s)*	*Token*	*Group*
a.	50ajm1	*revenu*	I
b.	91adb1	*devenait*	I
c.	85agm1	*parleront*	II
d.	91amb1	*regarderas*	II
e.	75cab1, 91aal1	*justement*	II
f.	91adb1	*exactement*	II
g.	75ccm1	*appartement*	III
h.	85apr1	*garde-forestier* (2x)	IV
i.	85apr1	*porte-monnaie*	IV

The examples in (151) can be sorted into four groups. First, (151ab) are cases of consecutive schwa syllables, which will be discussed in section 4.5.3 below. Second, forms (151cdef) are morphologically complex, and contain a schwa at the morpheme boundary, which is deleted only in these two cases. Third, *appartement* is the only true example of word-internal schwa deletion. Finally, examples (151hi) are compounds, which may be considered to consist of two separate words, the first ending in a vowel which is not a schwa under our definition, and which has more deletion possibilities than schwa. With the exception of certain morpheme boundaries (group II), then, we can conclude that word-internally, deletion is excluded after a cluster (see also Dell 1973:231 for a discussion of schwa deletion in future tense forms like (151c), which Dell considers to be optional after consonant clusters).

Now consider the 109 cases of retention of schwa in informal speech. Examples are given below, showing that the cases of non deletion roughly pattern identically to the deleted schwas.

(152)	*Speaker(s)*	*Token*	*Group*
a.	50apb1	*marteler*	0
b.	91aal2	*orphelinat*	0
c.	21amb1	*devenu*	I
d.	50atv1, 75ccb1, 85amg1,…	*revenu*	I
		revenir, revenait, revenaient, revenus, …	
e.	75cgn1	*monterai*	II
f.	85asl1	*forgeron*	II
g.	21acl1, 50ajp1, 75cab1, …	*justement*	II
		correctement, directement (2x), exactement (2x), strictement, …	
h.	21aml1, 50apb1, 85ajg1, …	*département*	III
i.	75ccm1	*appartement*	III
j.	85amm1	*quelquefois*	IV

Examples like (152ab) are rare: these cannot be labeled as belonging to any of our groups, and are therefore the only proper cases of schwa conservation after a cluster. Again, most of the spontaneous speech data are of type II: morphologically complex, and most frequently ending in the adverbial suffix *-ment*. Other recurrent cases are words in which the schwa in the first syllable is deleted, and in which consequently the second is retained, as it is preceded by a newly formed consonant cluster: (152cd). Examples of the types III and IV are as rare as they were within the group of deletion cases, with only *appartement* and *département* being frequent words, resembling type II words ending in *–ment* and maybe therefore treated like these adverbs. As pointed out above, in 36 cases in formal style, i.e. in realizations of the word *gouvernement* [guvɛʁnəmɑ̃] 'gouvernment', schwa was generally maintained as in (152g) with only one exception.

Comparing the segments surrounding deleted and conserved schwas, little can be said on the differences between these in terms of distinctive features. First, there are too few examples of deletion, and second, after a cluster like [ʁt], deletion (*appartement*) as well as conservation (*département*) are found. However, deletion seems to be excluded after two obstruents, as the group of adverbs ending in *-ctement* shows. We will come back to the issue of featural identity of surrounding consonants when treating clitic schwa below.

This section has shown that schwa within the word is often morphological: it serves to connect morphemes such as *–ment* and the future suffix to the stem, or to connect the two parts of a compound word. In this context, schwa seems to be in a true alternation: it may be retained, as claimed by the literature, and which is almost always the case, but there is also a possibility of deleting it, if the consonantal environment is not too difficult to realize without the support of a vowel. Even rarer are the examples of schwa following a morpheme-internal cluster, in which it is retained throughout.

4.5.2 Initial Syllables

4.5.2.1 Word-initial non Phrase-initial Syllables

Chapter 3 demonstrated that in the literature, a difference is made between schwa syllables that are word-initial and those that are phrase-initial. This section will therefore first explore deletion in word-initial syllables that were not phrase-initial. As shown in section 4.4, this means searching for codes *x*112, *x*122, *x*212, and *x*222. Note again that a 2 in third position can also imply that the vowel coded follows a tautosyllabic cluster, as in e.g. *brebis*. However, as in the preceding section, these vowels were filtered out, as they did not alternate, and we therefore do not consider them to be schwa.

The read-aloud text contains the following instances of word-initial schwas in non-clitics[36]:

(153) a. ses che1212mise0411s en soie
b. est en re1212vanche0412 très inquiet
c. ne1112 cesse0412 de1122 baisser de1212puis les élections

Unfortunately, there were no cases of schwa preceded by a consonant cluster (code *x*222), so that for formal non-clitics, only the distribution of deletion after a single consonant could be tested. This yielded the following result:

[36] In the last line, the word *seraient* occurs after a pause. Its schwa is sometimes coded 1212, but at other times 1232. This example was therefore excluded from our counts.

(154) Schwa in formal, word-initial, non-phrase-initial syllables (excluding clitics): code 0212 vs. 1212.

Point d'enquête	*Dijon*	*Brécey*	*Brunoy*[37]	*Paris*	*Treize-Vts.*	***Total***
Absent	0 (0.0%)	0 (0.0%)	1 (3.4%)	0 (0.0%)	1 (5.9%)	**2 (1.4%)**
Present	24 (100%)	33 (100%)	28 (96.6%)	36 (100%)	16 (94.1%)	**137 (98.6%)**
Unclear	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	**0 (0.0%)**
Total	**24**	**33**	**29**	**36**	**17**[38]	**139**

As this table shows, deletion is excluded in this context in formal style. However, it is allowed in clitics in the same style, although rare and almost exclusively after a single consonant ("Preceding V"), as shown in (155). In this table, for every survey, the column to the left represents the V#C_ context, whereas to the right, alternations in C#C_ context are presented.

(155) Schwa in formal, non-phrase-initial clitics: codes 0112 and 0122 vs. 1112 and 1122.

Point d'enquête	*Dijon*		*Brécey*		*Brunoy*		*Paris*		*Treize-Vents*		***Total***
Preceding	V	C	V	C	V	C	V	C	V	C	
Absent	16	0	20	2	10	1	47	0	8	1	**105**
%	*8,2*	*0,0*	*8,1*	*1,1*	*4,8*	*0,6*	*16,7*	*0,0*	*4,3*	*0,8*	*5,4*
Present	179	125	227	172	197	172	235	214	178	132	**1,831**
%	*91,8*	*100*	91.9	98.9	94.7	99.4	83.3	100	95.7	99.2	*94.5*
Unclear	0	0	0	0	1	0	0	0	0	0	**1**
Total	**195**	**125**	**247**	**174**	**207**	**179**	**282**	**214**	**186**	**133**	**1,937**

The interviews and free conversations show a completely different picture. As is clear from a comparison of tables (154) and (156), contrary to formal reading style, informal speech allows for schwas to be absent, and after a single consonant, they frequently are (rates from 64 to 86%). In case of a (heterosyllabic) consonant cluster, which is rarer, deletion is still disfavored (deletion rates up to 9%).

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[37] One instance of *depuis* was coded 1232, speaker 91abd1 inserting a pause before it.

[38] The first schwa of *chemise* was not always coded in the Treize-Vents survey.

(156) Schwa in informal non phrase-initial non-clitics : codes 0212 and 0222 vs. 1212 and 1222.

Point d'enquête	*Dijon*		*Brécey*		*Brunoy*		*Paris*		*Treize-Vts.*		***Total***
Preceding	V	C	V	C	V	C	V	C	V	C	
Absent	55	0	110	3	104	10	74	3	76	2	**437**
%	*68.8*	*0.0*	*71.0*	*6.7*	*64.2*	*14.3*	*63.8*	*8.6*	*86.4*	*4.3*	*54.3*
Present	25	7	45	42	57	60	42	32	12	45	**367**
%	*31.3*	*100*	*29.0*	*93.3*	*35.2*	*85.7*	*36.2*	*91.4*	*13.6*	*95.7*	*45.6*
Uncertain	0	0	0	0	0	0	0	0	0	0	**0**
Total	**80**	**7**	**155**	**45**	**162**	**70**	**116**	**35**	**88**	**47**	**805**

Note the strange behavior of the Dijon corpus, which only has seven occurrences of code *x*222, while another survey with eight subjects, Treize-Vents, has forty-five. This is partly due to the fact that in Dijon, for speaker 21acl1, there are almost no free conversation data, and that for some speakers these conversations have not been entirely coded. However, as exclusion of Dijon did not seem to greatly influence the percentage of deletion, we decided to give this *point d'enquête* the benefit of the doubt.

The possibilities of omission increase when schwa is the vowel in a clitic: as table (157) shows, absence and presence of schwa are balanced between the V and C columns, absence being preferred after a single consonant (deletion rates from 65 to 77%) and presence after a cluster (rates from 14 to 26%).

(157) Schwa in informal non phrase-initial clitics : codes 0112 and 0122 vs. 1112 and 1122.

Point d'enquête	*Dijon*		*Brécey*		*Brunoy*		*Paris*		*Treize-Vts.*		***Total***
Preceding	V	C	V	C	V	C	V	C	V	C	
Absent	298	20	458	51	428	61	441	38	192	34	**2,021**
%	*77.2*	*15.0*	*71.2*	*21.3*	*72.3*	*20.7*	*68.2*	*13.8*	*64.9*	*25.8*	*55.6*
Present	88	113	184	188	164	233	206	237	104	98	**1,615**
%	22.8	*85.0*	*28.6*	*78.7*	*27.7*	*79.3*	*31.8*	*86.2*	*35.1*	*74.2*	*44.4*
Uncertain	0	0	1	0	0	0	0	0	0	0	**1**
Total	**386**	**133**	**643**	**239**	**592**	**294**	**647**	**275**	**296**	**132**	**3,637**

Table (158) collapses the two preceding ones into one generic overview for all *points d'enquête*, distinguishing between clitics and polysyllabic words on the one hand, and between simplex consonants and clusters as a preceding context on the other.

(158)

	Formal		*Informal*	
	C_	CC_	C_	CC_
Clitics	9.0%	0.5%	70.9%	19.0%
Polysyllabic	1.4%	no data	69.8%	8.8%

As (158) shows, in formal style, deletion is almost only, and still marginally, allowed in clitics, on the condition that schwa is not preceded by a consonant cluster. This condition is also valid for informal speech, albeit less strict: deletion is possible after a cluster. After a simplex consonant, contrary to what happens on the formal style level, deletion takes place in the vast majority of cases. Thus, both the factors clitic/non clitic and simplex consonant/cluster play a role in initial schwa deletion, but the effect of the number of preceding segments is stronger than that of the morphological status of the word, although deletion after two consonants is easier in clitics than in polysyllabic words. The latter observation is not statistically relevant however, as it concerns only a limited number of cases. A typology of these, together with some examples, is given below.

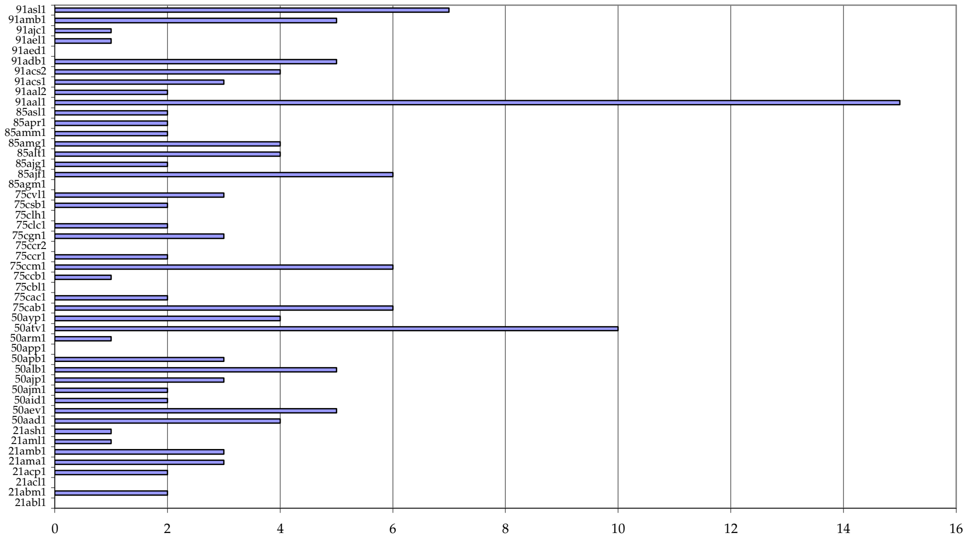
(159)

a.	*petit(e)(s)*	voilà j'avais quand même0411 une0412 p$\boxed{e0222}$tite0412 vie euh	75csb1
b.	*sera, ferait,* etc.	La finale0412 s$\boxed{e0222}$ra faite0411 avant Fontaine0312bleau	50arm1
c.	*re-*	D'ailleur0411s il0412 r$\boxed{e0222}$tourne0412 dans une0411 autre0422 boite0414	91abm1
d.	exceptions	- Oui on peut jouer avec0412 c$\boxed{e0222}$la	50apb1
		- je0112 me1122 suis toujour0412s d$\boxed{e0222}$mandé d'ailleur0412s	75csb1
		- elle0411 avait l'habitude0411 elle0452 v$\boxed{e0222}$nait	85asb1

The word *petit* is very frequently realized without its first vowel, which might be a reason to suppose it is lexically /pti/ for a large number of speakers. A parallel assumption seems reasonable for part of the paradigm (future and conditional forms) of the verbs *être* 'to be' and *faire* 'to make'. Third, verbs starting with the prefix *re-*, meaning 'again', frequently have the vowel of this first syllable unpronounced. Finally, (159d) lists all remaining cases of schwa deletion after a cluster, which are very frequent words (a pronoun and two verbs).

In clitics, there is a much greater amount of alternating vowels, as shown by the tables above. Surprisingly, omission of the vowel seems possible here even when it is preceded by two consonants. However, this is not always allowed. The following graph shows the distribution of deletions after a cluster between speakers.

(160) Number of post-cluster deletions per speaker



As the graph shows, there are speakers who do not delete after a cluster at all, whereas others omit schwa in this context more than six times in the recorded six minutes of speech. However, this amount of variation is not surprising, as schwa seems to be subject to a lot of inter-speaker variation, and because we are dealing with a limited number of cases. Consider for example the variation in deletion after one single consonant, which is even greater, as the number of cases per speaker is larger (varying from 15 to about 75 deletions). This makes it easier to understand why there is so much intra-speaker variation in the case of post-cluster deletion: schwa/zero alternations in clitics are subject to a lot of differences among speakers in general.

One might suppose (as it is sometimes put forward in the literature) that it is the possibility to realize the surrounding consonants as one cluster that influences a speaker's "decision" whether or not to realize the vowel. In what follows, it will be investigated whether the featural identity of the surrounding consonants determines the deletion of schwa.

While searching for code 0122 (deletion of schwa in a monosyllabic word, preceded by a cluster), the underlying cluster (i.e. before voicing assimilation) was noted down. The following example demonstrates the way this coding took place:

(161) *donc je peux* [dɔ̃kʃpø] → kʒp

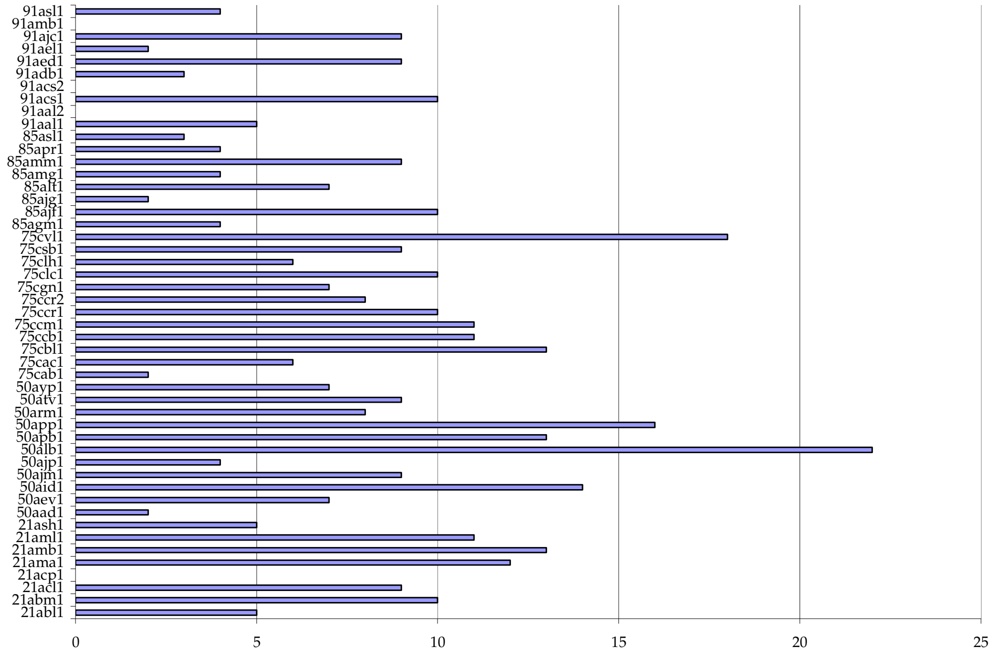
Although the actual realization of the cluster surrounding the deleted schwa in (161) is [kʃp], it is listed as [kʒp], because voicing assimilation between [ʒ] and [p] is not taken into consideration. Consonants originating from deletion in multiple clitics were excluded, in order to keep the group under investigation homogenous. Appendix C provides a complete list of the resulting clusters.

The inventory in Appendix C clearly demonstrates that the observation *"il faut des fricatives"* (Rialland 1986:216) is correct: 90% of clusters resulting from schwa deletion contain at least one fricative, if it is assumed that the French r-sound is part of this group of segments. Another explication for the frequent deletion after [ʁ] might be that, as pointed out by Hansen (1994), among others, it is a very weak segment in French, and therefore, it can be poorly perceptible at the end of words, which might cause phonetic simplification of clusters starting with it. These may easily be reduced to two member clusters, [ʁ] being almost inaudible (cf. also the very frequent *parce que* pronounced [paskə], cited above).

The other 10% of deletion clusters contain [l] as their first constituent. However, the explanation for this should not be sought in the fact that the liquids [l] and [ʁ] pattern together, but rather that in these clusters, word-final [l] is hardly realized, like in the pronunciation [ivœl] instead of [ilvœl] for *ils veulent* 'they want'. Indeed, this cluster simplification process proved to be operative in the consonantal groups under discussion.

In order to consider these facts in the right perspective, let us now compare the data on deleted schwa with those on its conserved counterpart. Table (2) in Appendix C lists the clusters in which deletion did not take place in the clitic context (code 1122). This table excludes groups of four consonants, as it seems logical that these do not lose their intermediate vowel. The following graph shows the distribution of the cases among speakers.

(162) Number of conserved schwas per speaker



The number of instances of code 1122 varies more than that of 0122. However, in general, graphs (160) and (162) show that the speakers for whom there was little data on post-cluster deletion are not among those who present the most instances on conservation either.

A comparison between tables (1) and (2) in Appendix C provides a more detailed picture of deletion possibilities. As table (2) also contains clusters with a fricative, these are subject to variation, which can be intra-speaker as well as inter-speaker. Consider for example the cluster [ʁks] as realized in free conversation by speaker 75csb1: whereas schwa is pronounced in (163a), it is omitted in (163b).

(163) a. Et que1112 le1112 mec0411 il0411 a fait passer son entretien par0411 une0412 stagiaire0412 c'est sûr0412 que1122 ça va re0212tomber sur0412 la gueule0412 du stagiaire0413

b. Donc0411 en fait0412 je0122 me1122 suis sentie hyper0412 bien et en sortant je0112 me1122 suis dit 'tu es trop conne0412' parce0352 que1422 je0112 suis sûre0412 que0122 c'était trop un test0423.

For this reason, it cannot be claimed that there are absolute conditions in which a schwa is *always* deleted. However, constraints can be formulated on clusters which allow for deletion, not assuming that if these are satisfied, the speaker actually deletes the vowel, but only that (s)he has the possibility of doing so.

In clusters of which two members form a geminate, deletion is generally avoided. Although geminates are part of French phonology as they often arise through elision (*il avait* 'he had' vs. *il l'avait* 'he had it), they seem to need the support of a following vowel, and schwa is thus pronounced, e.g. *période de chômage* [peʁjoddəʃomaʒ] by speaker 75cac1.

Striking differences between the two tables in appendix C are the presence of initial [f] in table (2), and the large quantity of clusters starting with [s] in which deletion did not take place. Although these segments are both fricatives, they do not seem to favor deletion in our corpus. The absence of [f] in table (1) can be explained for by its relatively low frequency at word end. The positive influence of [s] on deletion seems to be limited to the second and third position: the fricative is used as a release for the plosives it is surrounded by. This is even more apparent for the voiced fricatives [v], [z], and [ʒ], which seem to need a release vowel when occurring in word-final position: whereas there are only 6 clusters starting with these consonants in table (1), table (2) contains 24 cases, where less than three times as much would be expected (considering that there are 2.8 times as much instances of code 1122 than there are of 0122). These facts seem to support the Sonority Sequencing Principle proposed by Côté (2000): the middle segment of the cluster has the highest sonority.

Thus far, the results are the following: unlike it has been assumed in the literature, deletion of schwa is possible even when this causes a group of three consonants to arise. However, as already pointed out by Rialland, there is a limit to this: not all groups of consonants allow for deletion. The liquids [l] and [ʁ] facilitate cluster simplification as they are often pronounced weakly at the end of the word. Moreover, fricatives, in second and third position of the cluster, help the speaker realize the cluster, and therefore are necessary for post-cluster schwa to surface as zero. On the other hand, the presence of fricatives or word-final liquids does not guarantee deletion. Rather, if the conditions for deletion are met, a speaker has a choice of whether or not to omit the vowel. What exactly determines this decision is a matter we leave open for feature research.

4.5.2.2 Phrase-initial Syllables

To round up this section, let us turn to phrase-initial schwas. For this specific kind of initial schwa, the deletion facts in formal, polysyllabic words are as follows:

(164) Schwa in formal phrase-initial non clitics: code 0232 vs. 1232

Point d'enquête	*Dijon*	*Brécey*	*Brunoy*	*Paris*	*Treize-Vents*	***Total***
Absence	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	**0 (0.0%)**
Presence	7 (100%)	4 (100%)	11 (100%)	1 (100%)	1 (100%)	**24 (100%)**
Uncertain	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	**0 (0.0%)**
Total	**7**	**4**	**11**	**1**	**1**	**24**

The results from table (164) seem surprising: even though every speaker read the same text aloud, the number of instances per survey does not seem to correspond to (a multiple of) the number of speakers in that survey. E.g., Paris has only one instance, whereas with 12 speakers in the survey, we would also expect 12 instances. This is because the only case of post-pausal schwa in polysyllables is the word *seraient* in the following phrase (cf. fn. 5):

(165) Beaulieu préfère0411 être0421 inconnue et tranquille0413 plutôt que1112 de1112 se1112 trouver au centre1422 d'une0412 bataille0412 politique0413 dont, par0412 la télévision, **se1232raient** témoins des millions d'électeur0413s. (speaker 21abm1)

As the case of speaker 21abm1 shows, if the subject does not realize a pause before *seraient*, the schwa is coded *x*232. This explains for the "gaps" in the totals. In the Brunoy corpus, there is one realization of *depuis* before which a pause is inserted (speaker 91adb1). If schwa was coded phrase-initially, it was realized: there were no instances of code 0232 in the read-aloud text. For clitics, deletion rates remain at zero, as the following table shows:

(166) Schwa in formal phrase-initial clitics: code 0132 vs. 1132

Point d'enquête	*Dijon*	*Brécey*	*Brunoy*	*Paris*	*Treize-Vents*	***Total***
Absence	0 (0.0%)	0(0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	**0 (0.0%)**
Presence	60 (100%)	80 (100%)	104 (100%)	94 (100%)	46 (100%)	**384 (100%)**
Uncertain	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	**0 (0.0%)**
Total	**60**	**80**	**104**	**94**	**46**	**384**

Again, the number of cases per survey is not a multiple of its speakers. This is yet again due to the fact that the phrasing of the text is different from speaker to speaker, and that therefore pauses tend to vary. Furthermore, the number of clitics in the text being larger than the number of words starting with a schwa syllable, the variation between speakers is greater. However, the picture remains clear: in phrase-initial syllables, deletion is excluded in formal style.

In informal speech, the (rare) phrase-initial polysyllables also do not tend to lose their schwa, as shown below.

(167) Schwa in informal phrase-initial non clitics: code 0232 vs. 1232

Point d'enquête	*Dijon*	*Brécey*	*Brunoy*	*Paris*	*Vendée*	***Total***
Absence	0 (0.0%)	0 (0.0%)	6 (30.0%)	0 (0.0%)	1 (50.0%)	**7 (9.1%)**
Presence	3 (100%)	3 (100%)	14 (70.0%)	3 (100%)	1 (50.0%)	**24 (90.9%)**
Uncertain	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	**0 (0.0%)**
Total	**3**	**3**	**20**	**3**	**2**	**31**

Apparently, for the Brunoy corpus, the transcribers paid much more attention to the coding of pauses than for the other surveys, as more codes of the form *x3xx* seem to be present throughout. Let us take a closer look at the cases of absence of schwa in the first syllable after a pause.

(168) a. C$\boxed{e0232}$lui-là ça aurait pu êt0452re le1122 Sénégal0414 (speaker 91aal2)

b. C$\boxed{e0232}$lui-là […] Ce0232lui-là c'est un farfouille0412 merde0423. (speaker 91asl1)

c. certaine0312ment un courant euh qui j'espère0414, s$\boxed{e0232}$ra pas qu'un courant d'air0414 (speaker 91adb1)

d. D$\boxed{e0232}$mandez à votre0422 maman elle0412 vous raconte0312ra (speaker 91asl1)

e. La j'ai été V.R.P. si tu veux V.R.P., r$\boxed{e0232}$présentant V.R.P et après chef0412 d/, chef0412 de1122 re0212présentant (speaker 91aal2)

The word *celui* (examples (168ab)) is very frequently reduced to [sɥi] in fast speech, and it is therefore not surprising that this sometimes happens when the word is phrase-initial. The same comment could be made for (168cd). Finally, explaining for (168e), it should be pointed out that speaker 91aal2, having been a *représentant V.R.P.,* has used this word so often that it has lost the schwa in its first syllable, for the same reason as the habitants of Besançon call their city [bzɑ̃sɔ̃] and not [bœzɑ̃sɔ̃] like the rest of their fellow countrymen.[39]

The only "true" cases of deletion in phrase-initial syllables are the informal clitics, in which absence of schwa is quite possible, as shown below.

39 Bernard Laks, personal communication.

(169) Schwa in informal phrase-initial clitics: code 0132 vs. 1132

Point d'enquête	*Dijon*	*Brécey*	*Brunoy*	*Paris*	*Treize-Vts.*	***Total***
Absence	21 (72.4%)	11 (18.6%)	136 (47.2%)	35 (43.8%)	22 (53.7%)	**225 (45.3%)**
Presence	8 (27.6%)	48 (81.4%)	152 (52.8%)	45 (56.3%)	18 (43.9%)	**271 (54.5%)**
Uncertain	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (2.4%)	**1 (0.2%)**
Total	**29**	**59**	**288**	**80**	**41**	**497**

Again, the Brunoy corpus has an extraordinary amount of pauses, and this time, the Dijon corpus presents the inverse picture: only 29 initial schwa syllables were found. Of course, the difference in number between clitics and polysyllabic words is to be explained for by the fact that clitics are very frequent in phrase-initial position. Consider for example the number of phrases in everyday speech starting out with *Je..* 'I'.

In sum, the difference between clitics and polysyllabic words does not play a role in word-initial syllables. As expected, considering the fact that French does not have word-based stress and that phonological processes such as *liaison* and *élision* take place through (non-existent) word-boundaries, the only important factor for the deletion of word-initial schwa is consonantal environment: deletion is more frequent when the vowel is preceded by only one consonant. As phrase-initial schwas can maximally be preceded by one consonant, this difference does not play a role in their alternation. Here, the important factor is clitic/non clitic: deletion is for more frequent in initial clitics than in polysyllabic words, but it should be kept in mind that clitics are simply a lot more frequent phrase initially than other words.

4.5.3 Consecutive Syllables

Our third and final deletion context is a combination of the two preceding ones: schwas in consecutive syllables. To test the behavior of these in formal speech, the read-aloud text only offers two instances:

(170) a. Il a le sentiment de se trouver dans une impasse impossible.
[sɑtimɑ̃d(ə)s(ə)tʁuve]
b. Beaulieu préfère être inconnue et tranquille plutôt que de se trouver au centre d'une bataille politique [plytok(ə)d(ə)s(ə)tʁuve]

In both cases, all schwas were pronounced, with the following exceptions:

(171) a. 75clh1 *d(e) se trouver*
b. 85ash1 *de s(e) trouver*
c. 85asg1 *qu(e) de se trouver*
d. 85ajg1 *que d(e) se trouver*
e. 50aid1 *que [de] se trouver*

These examples can be considered slips of the tongue, especially in the case of three consecutive schwa syllables, which, as we will see further on, are almost never pronounced with three realized schwas in casual speech, but which should be in formal, read-aloud speech if the subject intends to read "carefully".

In informal style, a lot more variation is expected to occur. In order to test this, the following formulae were used to search for deletion possibilities:

(172) a. clitic + clitic e*a*112 ?e*b*1*c*2
b. clitic + polysyllabic word e*a*112 ?e*b*2*c*2
c. first two syllables of polysyllabic word e*a*212?e*b*3*c*2

In (172), *a* is the status of the first schwa, *b* that of the second: both can be either 0 (not realized) or 1 (realized). *c,* the third digit in the code of the second schwa, equals 1 if *a* = 1, because in this case the second schwa is preceded by a vowel (i.e. the first schwa), and 2 if *a* = 0. Keeping the third digit of the first code to 1 avoided counting schwas that were maintained because of a preceding cluster, or deleted because of the phrase-initial position of their syllable. This yielded the following results for two consecutive clitics:

(173) Consecutive schwa syllables in informal speech: clitic + clitic

Point d'enquête	*Dijon*	*Brécey*	*Brunoy*	*Paris*	*Treize-Vts*	***Total***
a = 0, *b* = 0	4 (16.0%)	4 (9.5%)	5 (14.3%)	2 (4.1%)	2 (11.8%)	**17 (10.1%)**
a = 0, *b* = 1	11 (44.0%)	18 (42.9%)	16 (45.7%)	29 (59.2%)	12 (70.6%)	**86 (51.2%)**
a = 1, *b* = 0	8 (32.0%)	16 (38.1%)	9 (25.7%)	12 (24.5%)	3 (17.6%)	**48 (26.6%)**
a = 1, *b* = 1	2 (8.0%)	4 (9.5%)	5 (14.3%)	6 (12.2%)	0 (0.0%)	**17 (10.1%)**
Total	**25**	**42**	**35**	**49**	**17**	**168**

The table shows that if two clitics are involved, there is a slight tendency to reduce the first one and not the second. That is, the general idea present in the literature that deletion takes place from left to right, deleting schwas after one consonant and conserving them after two, is confirmed in our data. In the following tables, which concern a combination of clitic and polysyllabic word, and deletion possibilities within one word, the distribution remains the same.

(174) a. Consecutive schwa syllables in informal speech: clitic + polysyllabic word

Point d'enquête	*Dijon*	*Brécey*	*Brunoy*	*Paris*	*Treize-Vents*	***Total***
a = 0, *b* = 0	2 (25.0%)	0 (0.0%)	2 (22.2%)	0 (0.0%)	0 (0.0%)	**4 (9.5%)**
a = 0, *b* = 1	2 (25.0%)	16 (94.1%)	7 (77.8%)	2 (28.6%)	0 (0.0%)	**27 (64.3%)**
a = 1, *b* = 0	3 (37.5%)	1 (5.9%)	0 (0.0%)	2 (28.6%)	1 (100%)	**7 (16.7%)**
a = 1, *b* = 1	1 (12.5%)	0 (0.0%)	0 (0.0%)	3 (42.9%)	0 (0.0%)	**4 (9.5%)**
Total	**8**	**17**	**9**	**7**	**1**	**42**

b. Consecutive schwa syllables in informal speech: polysyllabic words

Point d'enquête	*Dijon*	*Brécey*	*Brunoy*	*Paris*	*Treize-Vents*	***Total***
a = 0, *b* = 0	0 (0.0%)	1 (11.1%)	1 (8.3%)	0 (0.0%)	0 (0.0%)	**2 (4.8%)**
a = 0, *b* = 1	1 (20.0%)	4 (44.4%)	6 (50.0%)	6 (66.7%)	5 (71.4%)	**22 (52.4%)**
a = 1, *b* = 0	1 (20.0%)	4 (44.4%)	4 (33.3%)	2 (22.2%)	1 (14.3%)	**12 (28.6%)**
a = 1, *b* = 1	3 (60.0%)	0 (0.0%)	1 (8.3%)	1 (11.1%)	1 (14.3%)	**6 (14.3%)**
Total	**5**	**9**	**12**	**9**	**7**	**42**

Most of the cases in (174a) are of the type clitic + *re*: *je revenais, ça me revient* etc. The particular weakness of initial *re-* is well documented in the literature (Hansen 1994, De Jong & Hietbrink 1994). (174b) represents cases like *revenue* and *devenu,* already mentioned in section 4.5.2 when discussing initial schwa syllables. Below are some examples, one for each *point d'enquête.*

(175) a. 21acl1 de1112 foyer quoi en général0412 tu te1112 re0212trouve0411s avec0412 des adolescents à problème0412s

b. 50ayp1 Ben je1112 re0212par0411s au travail0413

c. 75acr1 ben oui moi ce1112 se0212rait le0112 latin si je0112 le1122 re0212passais

d. 85ajf1 C'est le1112 re0212tard qu'on a pris de1212puis quelque1422s années

e. 91acj1 On me1112 de0212mandait de0112 ve1222nir0413

As in the case of post-cluster schwa, the preference to reduce the first or the second syllable does not seem to be determined by the segmental identity of the surrounding consonants. Again, the difference between clitics and polysyllabic words did not prove to influence deletion.

4.6 Laboratory Data

4.6.1 Introduction

In this section, we will discuss two experimental approaches to French schwa, Rialland (1986) and Fougeron & Steriade (1997), which we already briefly presented in chapter 3. Both of these papers, which are based on laboratory recordings, conclude that after schwa has been deleted, the surrounding consonants do not form clusters identical to underlying clusters containing the same consonants. In other words, after schwa has been deleted, *de rôle* [d(ə)ʁol] is not pronounced in the same way as *drôle* [dʁol].

If this is correct, then analyses of schwa deletion based on the possibility of resyllabifying consonants after deletion has taken place (e.g. Anderson 1982) cannot be correct: if the consonants do not get resyllabified, there is no reason for schwa's deletion to be dependent on resyllabification possibilities. Therefore, Rialland's and Fougeron & Steriade's contributions are essential to a good comprehension of the process of schwa deletion. In this section, we will verify whether our own corpus data support their findings.

4.6.2 Rialland (1986)

By means of examining minimal pairs, Rialland (1986) shows that resyllabification does not take place after schwa deletion. As mentioned in chapter 3, this was done comparing sentences like the following:

(176)	a.	*Le bas retrouvé hier*	[ləbaʁtʁuvejɛʁ]	
	b.	*Le bar trouvé hier*	[ləbaʁtʁuvejɛʁ]	(Rialland 1986:195)

The informal pronunciation of (95b) contains the same string of segments as that of (95a). If we were to assume that both examples were syllabified in the same way in the phonological component of the grammar, they would be predicted to behave phonetically alike. Rialland shows that this is not the case, because the [ʁ] in (95a) is stronger than the one in (95b), and because [a] in *bar* is lengthened before tautosyllabic [ʁ] in (95b), and in (95a) it is not (Rialland 1986:196). On the basis of these results, Rialland states that the [ʁ] in *retrouvé* is not syllabified into the preceding coda, but rather, that, although schwa is deleted, the syllables of the initial structure are preserved.

4.6.3 Fougeron & Steriade (1997)

Fougeron & Steriade conduct two experiments focusing on the production and the perception of [dʁ] and [kl] clusters in French. They use the following stimuli for the [dʁ] case (deletion of a schwa is symbolized by apostrophes):

(177) a. Il n'a pas de rôle,..
b. Il n'a pas d'rôle,..
c. Il n'est pas drôle,..
d. Il voit l'jade rose,..

…, en c'moment

(Fougeron & Steriade 1997:937)

Among the four stimuli, (177a) is the only one to contain a realized [ə]. In (177b), schwa is deleted, and in the resyllabification model, the structure of the [dʁ] would be identical to that in (177c). Finally, in (177d), the [dʁ] cluster is split up between two words.

Fougeron & Steriade's first experiment, which focusses on the production part of the stimuli, shows that "[d] in "*d'rôle*" and in "*de rôle*" has significantly greater linguopalatal contact, a longer lingual occlusion and is less subject to lenition than [d] in "*drôle*" or "*jade rose*" (Fougeron & Steriade 1997:938). Like Rialland, they thus find that there is a difference in the way underlying clusters and clusters resulting from schwa deletion are produced. However, whereas Rialland concentrated mainly on the effects on *r*, Fougeron & Steriade focussed on the preceding obstruent.

In their second experiment, they used the [padʁol] sequences obtained in the production experiment and asked the listeners whether they were part of the sentence *il n'a pas d'rôle en ce moment* or of the sentence *il n'est pas drôle en c'moment*. Although the listeners generally claimed they could not hear the difference, the stimuli were recognized above chance level, whereas the probability of a correct identification was rather low (Fougeron & Steriade 1997:938). The correctly identified stimuli all had longer linguopalatal contact and duration of [d], and Fougeron & Steriade therefore conclude that these cues, which are not phonological in French, nevertheless permit to recognize the *d'r* sequences as opposed to underlying [dʁ] clusters.

4.6.4 Resyllabification and the PFC Corpus

The results presented above emanate from speech laboratories, and are therefore not necessarily representative of informal speech. Unlike the speakers in the PFC corpus' guided interview and free conversation recordings, "speakers in experiments perform less natural tasks, since they have to read aloud sentences, often in some pre-agreed format" (Ernestus 2000:82). For these reasons, these speakers remain conscious of the fact that they are being recorded, and will therefore tend to monitor their speech more carefully than they would in informal speech. Furthermore, the style level of monitored speech might be higher, as people often feel that they should speak "carefully" when recorded. Even though part of the disturbing effect of studio recordings of monitored speech can be eliminated by having speakers discuss informal topics with another speaker, as did Ernestus in her survey of informal Dutch, the effect of the studio might still influence them, in spite of undoubtedly useful measures that can be taken to prevent this:

(178) Microphones […] were placed right in front of the speakers, at a distance of 25 cm. Next to each microphone there was a potted plant, whose function was to take the speakers' minds off the microphones, and to make the room somewhat less austere, which was necessary, as the poor lightning, the foam rubber on the walls, and the grid on the floor gave the room a gloomy atmosphere. (Ernestus 2000:98)

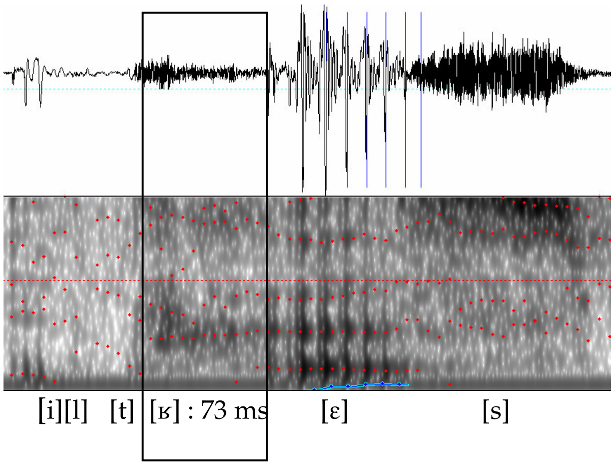
For these reasons, we think that a studio atmosphere will always influence the speakers' attitude. We therefore decided to verify Rialland's and Fougeron & Steriade's results in the PFC corpus, in which subjects where mostly recorded in the privacy of their own home, having conversations with acquaintances.

However, repeating Fougeron & Steriade's production experiment turned out to be impossible, as it is based on linguopalatal contact, which was not measured during the PFC recordings. Testing the perception of minimal pairs of the type *pas d'rôle ~ pas drôle* is nevertheless quite possible, if instead of studio recordings, we present parts of the corpus to listeners. However, none of the pairs used by Fougeron and Steriade were present in our sample of the PFC corpus.

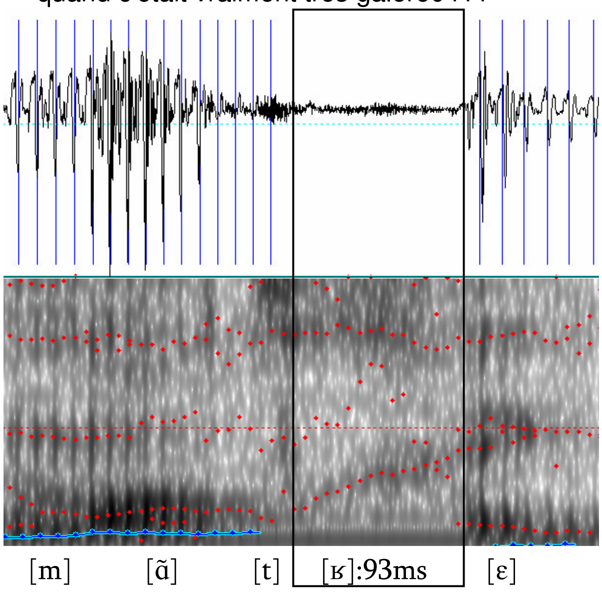
Turning to Rialland's experiments, we tried to find *bar trouvé* ~ *bas r(e)trouvé*-like pairs in our data. Although we were not able to find these, we did encounter some pairs of the type *il va traverser* ~ *il va t(e) renverser*, where Rialland found that the [ʁ] was stronger and longer in the second member of the pair than in the first one. The following examples show the difference between *tr* and *t(e)r* for speakers 21abl1, 50ajp1, and 85amg1. All four samples are from free conversation recordings.

(179) Speaker 21abl1, free conversation

a. Il te0112 reste0452 mille0412 balle0413s.

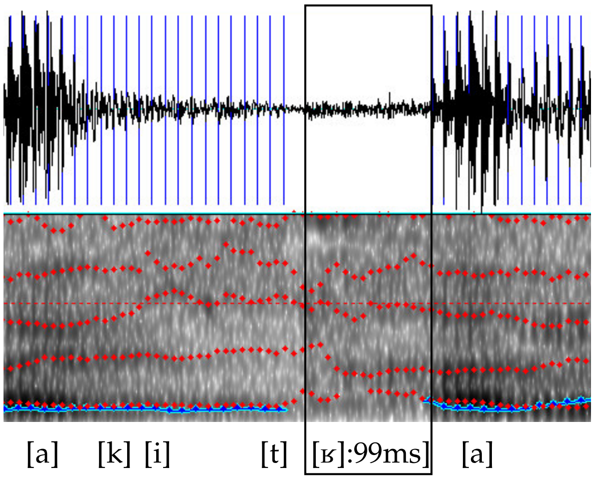


b. quand c'était vraiment très galère0411

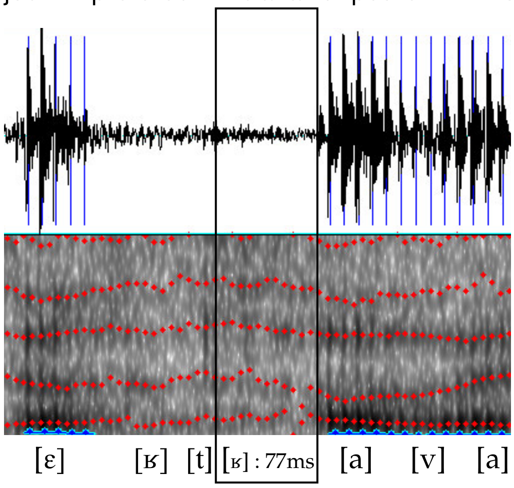


(180) Speaker 51ajp1, free conversation

a. 'ben tu es sûr0412 que1122 c'est pas ton papa qui te0112 ramène0412

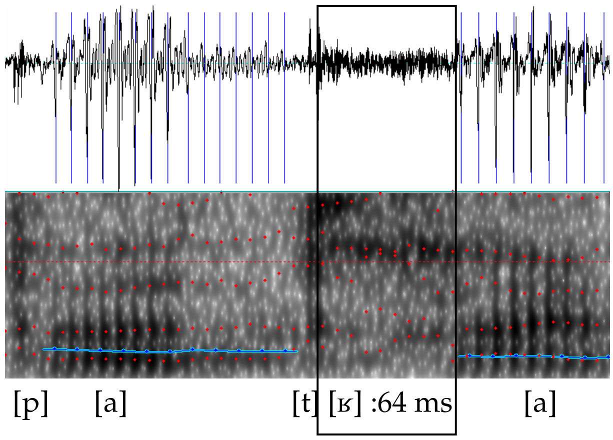


b. je0112 préfère0412 travailler pour0412 l'instant

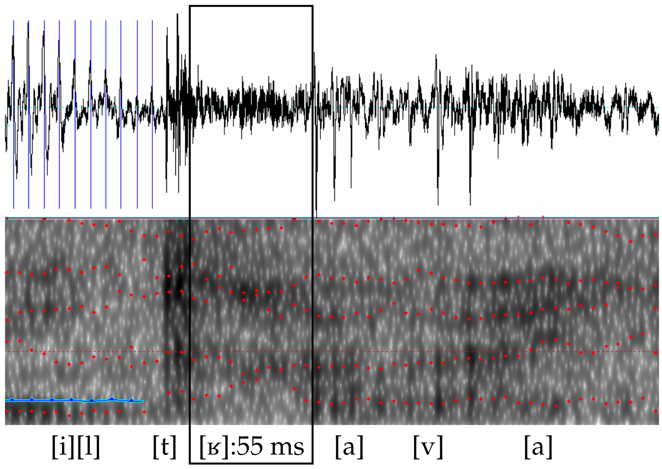


(181) Speaker 85amg1, free conversation

a. mais faudrait que0112 papa te0112 raconte0312rait ça



b. Non il0411 était en Allemagne0411 il0412 travaillait



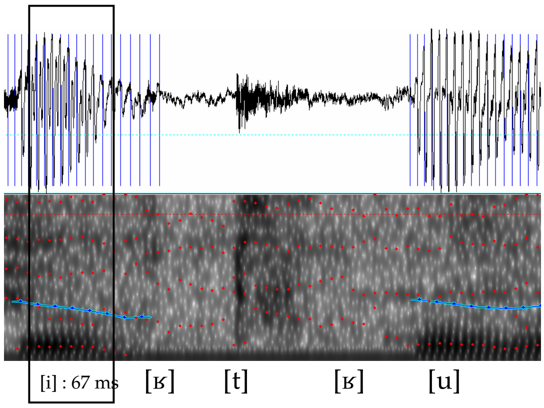
For speaker 21abl1, (179ab) show that [ʁ] is not necessarily longer in *t(e)r* than in *tr*, but it is stronger, as the darker areas in the spectrogram clearly show. The length difference is present for the other two speakers, whereas both differences seem to occur in the data for speaker 85agm1. In our data then, as well as in Rialland's, the difference between an underlying cluster and a cluster in which a schwa has been deleted is acoustically present in the [ʁ] sound following the deleted vowel. However, note that unlike Rialland, we do not have exact minimal pairs to our disposal, as these did not occur in the corpus.

As mentioned before, a difference between the two structures has important consequences for the way schwa deletion has to be modeled. If *t(e)r* is not like *tr*, an account which explains for the possibility of schwa deletion by the fact that the surrounding consonants can resyllabify into correct coda and onset clusters fails: *t(e)r* does not become a *tr* onset cluster, but continues to sound phonetically distinct. In our view then, underlying clusters are different from clusters resulting from schwa deletion, and somehow, this has to be encoded into a model describing the latter consonant groups.

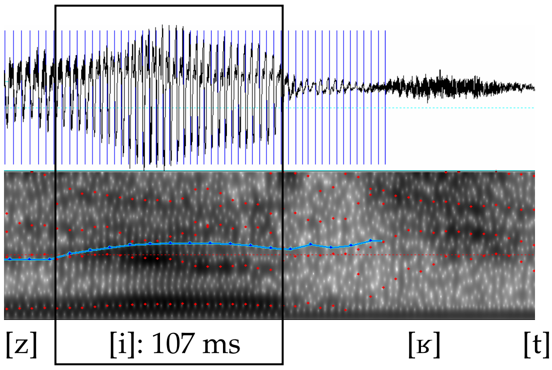
In order to test if the two types of clusters are also perceived differently, we might cut out the sequences [tʁɛ] from (179) and [tʁa] from (180) and (181) and, along the lines of Fougeron & Steriade, ask native speakers of French if they were part of the phrases with or without an omitted schwa. However, speaker 21abl1 pronounced [tʁe] instead of [tʁɛ] in (179b). This is caused by a fairly common closing of the open vowel [ɛ] to [e] in open syllables. As [e] never occurs in closed syllables, the sequence [tʁe] can only come from *très galère* [tʁe.ga.lɛʁ] and not from *te reste* [tʁɛst]. This would lead our listeners to select the correct stimulus on "wrong" grounds. The two sequences [t][ʁ] in speaker 50ajp1 might be different because of the presence of a preceding vowel in the *papa qui te ramène* but not in *je prèfère travailler*. In the last pair, the phonological context was not alike either. In *il travallait*, the [tʁa] sequence is followed by a [v], which is anticipated, and therefore changes the color of the preceding vowel. It might also have an influence on [ʁ], so that we cannot be sure if there is a minimal pair: the influence of anticipation cannot be excluded. Repetition of Fougeron & Steriade's perception experiments therefore turned out to be impossible, given the absence of true minimal pairs in our sample of the corpus.

Although we were also not able to contrastively test the production of [ʁ] before a deleted schwa, as we did not find pairs of the type *bar trouvé ~ bas r(e)trouvé*, we did find three instances of *retrouvé* in which schwa was deleted in the first syllable. In (182), the [i] preceding the resulting cluster [ʁtʁ] is compared to an [i] before a coda [ʁ] in the speech of the same subject.

(182) a. Je0132 me1122 suis re0212trouvée dans un groupe1414 euh
(speaker 21aml1, free conversation)

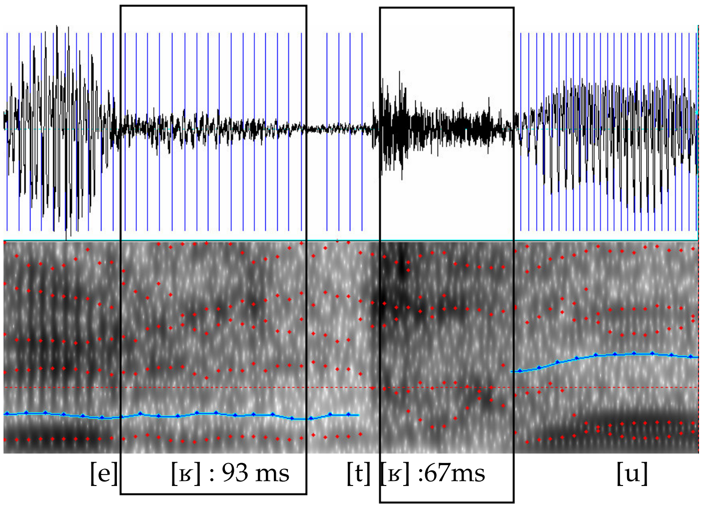


b. Tiens, comme loisir, tu peux mettre jardinage euh, si tu veux.
(Speaker 21aml1, guided interview)

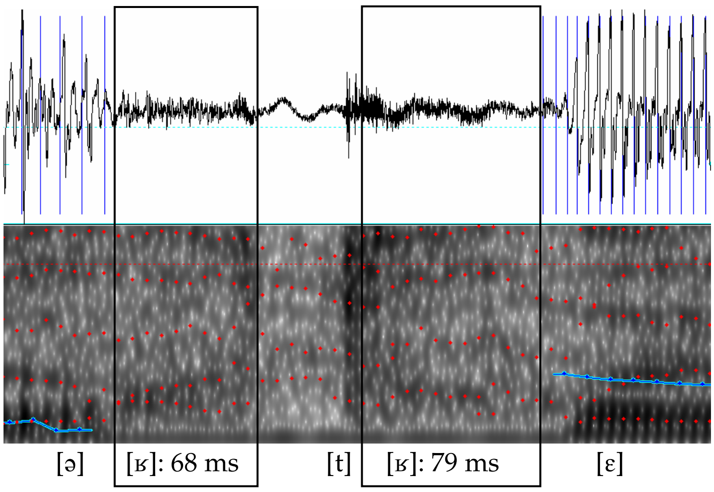


As shown in (182b), [i] lengthens before tautosyllabic [ʁ], as did [a] in *bar trouvé*. Like [a] in Rialland's instance of *bas r(e)trouvé*, this was not the case for [i] in *je me suis retrouvé*, in (182a). [i] in (182b) is 60% longer than in (182a). This confirms Rialland's findings. For the two other instances of *r(e)trouvé*, we were not able to find minimal pairs such as the one in (182). This is easily explained for by the fact that the vowels they contain before [ʁ], viz. [e] in (183a) and schwa in (183b), do not occur in closed syllables in French: both [ə] and [e] are replaced by [ɛ] if their syllable contains a coda. This is demonstrated for [e] by verbs like *espérer* [ɛ.spe.ʁe] 'to hope', which change the [e] in their root into [ɛ] when it ends op in a closed syllable (*tu espères* [ty ɛspɛʁ] 'you (sg.) hope'). Therefore, it is expected that no minimal pairs of the type [e.ʁ.tʁu] ~ [eʁ.tʁu] or [ə.ʁ.tru] ~ [əʁ.tʁu] occur.

(183) a. je0132 les ai re0212trouvés quand même0414 (speaker 85amg1, free conversation)



b. en général0412 tu te1112 re0212trouve0411s avec0412 [ʁtʁuɛk] des adolescents à problème0412s (speaker 21acl1, guided interview)



The two examples show a clear inter-speaker difference: in speaker 85amg1's realization, the first [ʁ] is longer than the second, and for speaker 21acl1, we find the inverse situation. In (183b), the two consonants do not seem substantially different from each other, and if different, it is the second [ʁ] that seems longer and stronger. Thus, our data do not conform Rialland's finding that [ʁ] *preceding* a deleted schwa is stronger than the same consonant as a member of a cluster. Rather, as shown above, the difference between *bas retrouvé* and *bar trouvé* type constructions is in the length of the vowel that precedes [ʁ].

4.7 Discussion and Conclusion

As we have seen in section 4.5, schwa does not arise in non-initial syllables of a monomorphemic word, as it almost uniquely occurs at morpheme boundaries. This fact has already been noticed by Côté (2000), who distinguishes between schwas at morpheme and word boundaries, which in her view are epenthetic, and word-internal schwas, which are only found in initial syllables, and which she claims to be underlying. These categories are confirmed by our data: the only word-internal schwas we found were situated next to a morphological boundary, mostly either before the suffix -*ment*, or before the future endings (cf. Côté 2000:82). One might wonder if the word-internal schwa-type vowels, which hardly alternate, are the same type of segment as boundary schwas, which display a lot more free variation. However, the word does not seem to represent a linguistic domain in the proper sense of the word in French, as phonological processes like voicing assimilation, *liaison* and elision take place across word boundaries. Therefore, it would be surprising for segments that are word-internal to behave differently from identical segments closer to the beginning of the word domain.

As we would expect following this line of thought, the distinction clitic/polysyllabic word did not turn out to be useful for our purposes: there was no difference between schwa in a clitic or in the first syllable of a polysyllabic word as far as deletion possibilities within the phrase were concerned. For the phrase-initial position, this distinction could be made, but this is probably due to the relatively high frequency of clitics in this position. The similarity between clitic schwa and schwa in polysyllabic words became even more clear when consecutive schwa syllables were taken into account: regardless of its clitic or non-clitic identity, it is preferably the first schwa in a row that is deleted.

As the literature suggests, the preceding consonants do influence the behavior of schwa. Schwas of the boundary type generally do not delete when preceded by two consonants, except if the surrounding consonants can form an articulatorily acceptable group, which is not necessarily syllabifiable in terms of core syllables. That is, a group of three consonants may arise, unlike what is claimed in the vast majority of existing accounts, especially when the first of these is [l] or [ʁ], or when a fricative is present in order to facilitate articulation. However, even if these conditions are met, the actual realization of schwa remains an individual "choice" of the speaker.

Although minimal pairs were hard to find, the PFC corpus also turned out to be an interesting testing ground for the findings of the laboratory experiments cited in chapter 3. Like Rialland and Fougeron & Steriade, we found that underlying clusters and clusters after schwa deletion do not sound identical. Particularly, a vowel preceding a tautosyllabic [ʁ] is much longer than a similar vowel preceding [ʁ] as an onset of a syllable in which schwa has been deleted. This clearly contradicts analyses in which the possibility of deleting schwa is *determined* by the possibility of its onset to be resyllabified as the coda of the preceding syllable.

The interaction between various tendencies, viz. lexical influences, phonotactic constraints, and boundary effects, make of French schwa an ideal domain for the interactive constraints of Optimality Theory. On the other hand, the fact that the syllable present before deletion remains intact after the process has taken place, forms an important challenge for a theory that is based on a one-level evaluation of constraints. But, before we can start designing a descriptive OT model of French schwa deletion, a proper representation for the different empty vowel types is needed. For this reason, the following two chapters will first discuss the Dutch vowel reduction process and its result, the reduction vowel (RV). Together with a description and representation of this RV, chapter 7 will then provide an analysis of French schwa/zero alternations.

5 The Dutch Stress Debate

Le néerlandais n'est pas une langue, c'est un rhume.
[Dutch is not a language, it is a cold.]

Jacques Brel

5.1 Introduction

After having discussed French schwa/zero alternations in the three preceding chapters, we will now turn to the second major topic of this thesis, *viz*. Dutch vowel reduction. As was the case for French, our first chapter on Dutch will provide a survey of the existing literature on the subject.

In Dutch, the syllable bearing primary stress is distinguished by the others notably by its higher pitch and longer duration (Van Heuven & Menert 1996). The second most prominent syllable in the word is the one with secondary stress. The vowels of virtually all other syllables are subject to vowel reduction. For this reason, in order to understand and to be able to correctly describe the reduction process, one should have a clear picture of the Dutch stress system in mind.

It is exactly here that the shoe pinches. Just like schwa seems to be the most popular subject among French phonologists, the stress system is apparently the favorite playground of those studying Dutch linguistics. The most important difference between the two domains of research is that in the case of Dutch, the differences in opinion do not concern the data, as these are mostly unanimously agreed upon, but rather the way they can be accounted for. Moreover, although a vast amount of data and accounts is available on primary stress, the descriptions of secondary stress and, consequently, its relation to vowel reduction, are much less abundant.

As we will show, three possible ways of accounting for secondary stress are available, and the description of vowel reduction changes along with the stress model adopted. Furthermore, an important question in the debate on stress which directly concerns reduction is whether primary and secondary stress should be treated alike, at the same level of the phonological derivation. It is only after having found the answer to this question that we can wonder at what point reduction comes into play.

This chapter is organized as follows. Section 5.2 will introduce the Dutch stress facts, concentrating on a few discussions which are central to the debate. In section 5.3, the relation between stress and reduction will be investigated, and as in chapter 3, we will focus on the differences between the various accounts at our disposal. Finally, in section 5.4, we will propose our conclusions.

5.2 Stress

5.2.1 Introduction

A large amount of literature has been devoted to Dutch stress, especially in the 1980s and 1990s. In this section, we will give an outline of the developments in this domain in the past three decades. Instead of providing a chronological overview, this time, we will focus on two main issues in the debate that are relevant to our purposes. In 5.2.2, we will discuss a topic which is directly related to the modelling of stress, and with respect to which Dutch seems to occupy an extraordinary position in the typology of the world's languages, viz. vowel length. Section 5.2.3 will be devoted to primary stress, and discuss the various regular, irregular, and excluded patterns, and how to account for them in OT. Finally, section 5.2.4 will focus on secondary stress.

5.2.2 Vowel length

The phonological status of vowel length in Dutch divides the analyses of Dutch stress into two groups. The first group claims that the vowel chart of Dutch can be divided into two halfs: short vs. long vowels, whereas the second group believes that there is a primarily a tense-lax distinction in vowels, and that the short-long distinction is derived from that. In order to clarify the positions of these two groups of scholars, we will start out by giving a short overview of syllable weight theory. A typology of the syllable is given below.

(184) a. light (open) | b. heavy (long vowel) | c. light (closed) | d. heavy (closed)

As shown in (184), there are two syllable (σ) types: open (CV) and closed (CVC) syllables; (184ab) vs. (184cd). Another subdivision is the one into light and heavy syllables: (184ac) vs. (184bd). The difference between the latter two syllable types, a difference in syllable quantity, plays a role in the stress systems of the so-called quantity-sensitive languages. In these languages, heavy syllables tend to attract stress.

The difference between heavy and light syllables is determined by the composition of the last part of the syllable (syllable rhyme), consisting of nucleus and coda. The onset consonant does not play a role in the light-heavy distinction. This difference in status between onset and rhyme constituents is indicated by the absence or presence of morae (μ, cf. Hayes 1989). (184a) shows this difference: the (onset) consonant in the syllable does not have a mora, while the vowel does. This syllable is light, because it contains only one mora. However, if the vowel is long, as in (184b), it bears two moras, and as an effect of this, the syllable is heavy and thus attracts stress in a quantity-sensitive language. In quantity-insensitive languages, long vowels behave exactly like short vowels, and both are treated alike by stress rules.

For CVC syllables, there are two possibilities in quantity-sensitive languages. First, the coda consonant does not "count" as a mora, and therefore, if the vowel is short, the syllable has only one mora and is treated as light. Second, in languages which have so-called *weight-by-position*, the coda consonant does have a mora, which makes the syllable heavy. The different possibilities for languages are summarized in (185).

(185) Typology of quantity-sensitivity

<table>
<tr><td rowspan="2">Quantity insensitive
light: *CV, CVV, CVC*
heavy: *none*</td><td>Quantity sensitive, no weight by position
light: *CV, CVC*
heavy: *CVV*</td></tr>
<tr><td>Quantity sensitive, weight by position
light: *CV*
heavy: *CVV, CVC*</td></tr>
</table>

How does Dutch fit into this typology? As Gussenhoven (2007:1) shows, it does not. The language has weight by position, and is therefore quantity-sensitive. However, the Dutch long vowels do not seem to attract stress, and consequently must be treated as light. In Dutch, then, CV and CVV are light, whereas only CVC is heavy.

This problem has led many scholars (see Van Oostendorp 2000 for an overview) to believe that the length distinction for Dutch vowels is actually one of tense versus lax. The fact that the non-high tense vowels are (measurably) longer is simply deduced from their tenseness. This means that the distinction lax-tense is the basic distinction that is made, and that the difference short-long is a secondary one: lax vowels are never long (except in loan words), and tense vowels are never short (except the high vowels /i/, /u/ and /y/).

Among the analyses of Dutch stress proposed in the past three decades, Kager (1989), Trommelen and Zonneveld (1989) and Nouveau (1994) support the length analysis, whereas more recent proposals, such as Van Oostendorp (1995, 2000) and Gussenhoven (2003, 2007), advocate the tense/lax analysis. The former approaches have as an advantage that they provide an explanation for the fact that the lax/short vowels never occur in an open syllable. According to these scholars, the Dutch syllable is minimally bimoraic, and therefore, if there is no coda consonant, the nucleus should contain at least two moras, i.e. a long vowel. This fact is explained for in the tense-lax models by the existence of a constraint demanding that lax vowels be followed by a tautosyllabic consonant. Such a constraint is phonetically grounded and its functioning can easily be demonstrated in a number of other languages, as shown by Van Oostendorp (2000:45ff).

A problem related to this discussion is the existence of final stress-attracting superheavy syllables in Dutch. In the short/long systems, these are of the form CVVC: they contain a long vowel followed by a consonant, that is one slot more than heavy syllables. In a tense/lax system, the difference heavy/superheavy is a lot more difficult to make, because there is no straightforward explanation for the fact that a lax vowel followed by a consonant forms a heavy, and a tense vowel followed by a consonant a superheavy syllable. The problem can be resolved by assuming the final consonant of the superheavy forms a syllable of its own, and that the two final syllables then form a foot together (cf. e.g. Van Oostendorp 2000).

As we have seen, the tense/lax accounts have as a major advantage the possibility to classify Dutch as an unexceptional quantity-sensitive language with weight by position. A second advantage is the following: they explain for the fact that long vowels in loanwords do seem to attract stress. In a vowel length model, the metrical weight of these vowels as opposed to the long vowels that are treated as light has to be stipulated in some way. In a model based on the presence or absence of the feature lax, the truly long vowels are simply the only ones that underlyingly bear two morae, whereas the length of the tense vowels is simply inserted by a phonological (Gussenhoven) or phonetic (Van Oostendorp) implementation rule or constraint. These advantages lead us to opt for this interpretation of the Dutch vowel system in this thesis.

After having discussed the Dutch vowel system, which is a central to the stress system, we will now present the “core” Dutch stress facts, dividing them up into patterns with different frequencies of occurrence.

5.2.3 Primary Stress

5.2.3.1. Introduction

The Dutch stress system is mixed: on the one hand, stress is limited to a restricted number of three syllables counting from the right word edge; on the other hand, within this three-syllable-window, stress can be on any syllable, provided that certain conditions are met. Therefore, stress in Dutch is never entirely predictable. However, it is possible to formulate so-called major generalizations (cf. Kager 1989, Nouveau 1994) that are never violated, such as the three-syllable-window. Next, a number of minor generalizations can account for the fact that within the limits of the major generalizations, some patterns occur more frequently then others. The major generalizations for Dutch primary stress are given below:

(186) Major generalizations for Dutch primary stress (Kager 1989, Nouveau 1994).

a. Primary stress occurs on any of the last three syllables of a word.

σ	σ	σ	σ
	antepenultimate	penultimate	ultimate

b. If the penultimate syllable is closed, stress cannot be on the antepenultimate syllable.

σ	σ	σ heavy	σ
	antepenultimate	penultimate	ultimate

c. [ə] is never stressed.

Although these major generalizations are respected by the vast majority of Dutch underived words, they are violated in a small number of heavily marked cases, to be referred to as exceptions. These are mostly geographical names (e.g. *Hindeloopen* [ˈhɪn.də.lo.pə(n)] 'town name', violating (186a)) or historical compounds (e.g. *triatlon* [ˈtri.ɑt.lɔn] 'thriathlon', violating (186b)).

Minor generalizations split up the Dutch lexicon into two groups of words: words with the dominant stress pattern (obeying these rules) and words with a recessive pattern (disobeying them). (187) lists a number of minor generalizations.

(187) Some minor generalizations for Dutch primary stress (Kager 1989, Nouveau 1994)
   a. Final superheavy syllables (CVVC or CVCC) are stressed.
   b. Final diphtongs are stressed.
   c. In –VC final words, stress is on the antepenult if available and possible considering (186b).

At this point, the reader will have found that Dutch stress is an ideal domain for a constraint-based theory like OT (cf. Nouveau 1994:186). There are a number of generalizations that are (almost) never violated; these can be translated into undominated constraints. Other generalizations can be violated, and must therefore be accounted for by dominated constraints. Reranking of these constraints or the assumption of underlying foot structure can account for the occurrence of violable minor generalizations. However, as will be demonstrated in the remainder of this section, some properties of Dutch stress are difficultly accounted for in a strictly parallel approach.

5.2.3.2. Nouveau (1994)

Nouveau provides the first OT account of the Dutch (primary) stress system. She proposes to distinguish between three types of words: type A words, which confirm to both (186) and (187), type B words, which obey the major and part of the minor generalizations, and type C words, which are even more marked, but still in line with (186). For every syllabic composition of a word, there is a most frequent pattern, a less frequent pattern, and a third pattern which has an exceptional status. As Nouveau (1994:42ff) shows, these three patterns can be represented in metrical theory by means of marking: exceptional words (type C) are more marked than words with the second pattern (type B), which in turn are more marked than regular (type A) words. An example is given in (188). For words ending in three open syllables, the unmarked pattern is penultimate stress, followed by antepenultimate and final stress (Nouveau 1994:25).

(188)	Type A	Type B	Type C
	(no marking)	(1 marking)	(2 markings)
	pyjama	*Panama*	*chocola*
	[piˈjama]	[ˈpanama]	[ʃokoˈla]
	'pajamas'	'id.'	'chocolate'

(Nouveau 1994:43)

In line with the results of her experiments, Nouveau abandons the grid-only model with lexical markings and proposes a new account within OT. The different types of words are now accounted for by reranking of constraints: the more radical the reranking, the more marked the prosodic structure (Nouveau 1994:211). The constraints and constraint hierarchy needed to account for Dutch stress are given below.

(189) a. Constraints used to account for Dutch stress (Nouveau 1994:186ff).

EDGEMOST	The right edge of a word must coincide with the head syllable.
FTBIN	Feet are binary on syllables or moras.
LX ≈ PR	The lexical word equals a prosodic word, i.e. monosyllabic words have to be footed.
NONFIN1	Final syllables may not be stressed.
NONFIN2	Final feet may not be stressed.
RHTYPE=T	Feet are trochees, i.e. strong-weak rather than weak-strong.
WSP	Weight-to-Stress Principle: heavy syllables must be in the strong position of a foot.

b. Constraint hierarchy for Dutch stress (Nouveau 1994:189ff):
LX ≈ PR, RHTYPE=T, FTBIN » NONFIN1 » WSP » EDGEMOST » NONFIN2

The undominated constraints assure that monosyllabic words are footed (LX ≈ PR), that Dutch has trochaic (i.e., strong-weak) feet (RHTYPE=T), and that feet are binary (FTBIN). The next constraint is NONFIN1 which prohibits stress on the final syllable. NONFIN1 dominates the Weight-to-Stress-Principle (WSP), according to which heavy syllables (in Nouveau's account, syllables with long vowels and closed syllables) should be stressed. The lowest ranked constraint in the hierarchy is NONFIN2, which prevents the stressed foot from being final.

In words with three open syllables, this hierarchy predicts penultimate stress, as shown in (190) for *pyjama* (type A):

(190) The stress pattern of *pyjama* (cf. Nouveau 1994:190)

/pijama/	LX≈PR	RHTYPE=T	FTBIN	NONFIN1	WSP	EDGEMOST	NONFIN2
a. ˈ(pi.ja) ma						σσ!	
☞ b. piˈ(ja.ma)						σ	*
c. ˈ(pi.ja)(ma)			*!			σσ	
d. (pi.ja)ˈ(ma)			*!	*			*
e. (piˈja)(ma)		*!	*			σ	

The first candidate violates EDGEMOST twice, because the primary stressed syllable is separated from the right word edge by two other syllables. Candidate (190c) contains a monomoraic foot, and is therefore ruled out by FTBIN. This is also the case for candidate (190d), which moreover contains a final main stressed syllable and foot, and therefore violates both NONFIN1 and NONFIN2. The last candidate is ruled out by the foot type constraint as it contains an iambic (weak-strong) foot. Thus, candidate (190a), with penultimate stress, is the optimal candidate.

The pattern of type B words is obtained by reranking EDGEMOST with NONFIN2. This is a change of order with the group of positional constraints, and therefore considered a minor change (Nouveau 1994:197).

(191) The stress pattern of *Panama* (cf. Nouveau 1994:198)

/panama/	LX≈PR	RHTYPE=T	FTBIN	NONFIN1	WSP	NONFIN2	EDGEMOST
☞ a. ˈ(pa.na) ma							σσ
b. paˈ(na.ma)						*!	σ
c. (pa.na)ˈ(ma)			*!	*		*	

In order to derive the type C word *chocola,* with final stress, two adjustments have to be made in the hierarchy for type A. As we can see, candidates (190d) and (191c), which have a stress pattern comparable to that of *chocola*, are ruled out by FTBIN and NONFIN1. Both of these constraints therefore have to be reranked below EDGEMOST, so that [ʃokoˈla] comes out as the optimal candidate, as shown in (192).

(192) Tableau for *chocola* (Nouveau 1994:200)

/ʃokola/	Lx ≈ PR	RhType=T	WSP	Edgemost	FtBin	NonFin1	NonFin2
a. ˈ(ʃoko)la				σ!σ			
☞ b. (ʃoko)ˈ(la)					*	*	*
c. ʃoˈ(kola)				σ!			

Thus, for the various types of words, the following rankings are established:

(193) Type A Lx ≈ PR » RhType=T » FtBin » NonFin1 » WSP » Edgemost » NonFin2
Type B Lx ≈ PR » RhType=T » FtBin » NonFin1 » WSP » NonFin2 » Edgemost
Type C Lx ≈ PR » RhType=T » WSP » Edgemost » FtBin » NonFin1 » NonFin2

5.2.3.3 Van Oostendorp (1997a)

In a review of Nouveau (1994), Van Oostendorp argues that the various constraint rankings proposed are arbitrary: why should a reranking of two given constraints be possible, and another, similar, reranking be excluded (Van Oostendorp 1997a:143)? According to Van Oostendorp, there is only one constraint ranking for the whole Dutch lexicon, and marked forms are input to Gen with underlying prosodic material (Van Oostendorp 1997a:133)[40].

If an underlying foot (pa.na) is assumed, stress in *Panama* ([ˈpa.na.ma], type B) can be obtained with a constraint hierarchy similar to that of type A. In addition to the constraints proposed by Nouveau, MaxIO-Foot is inserted in order to preserve underlying feet in the output. Van Oostendorp's tableau for *Panama* is given below (constraint names were translated into English).

[40] Note that Van Oostendorp (1997b) argues in *favor* of constraint rerankings in order to account for style levels. These will be discussed in chapter 7.

(194) Tableau for *Panama* (Van Oostendorp 1997a:148)

/(pana)ma/	RhType=T	NonFin1	WSP	MaxIO-Ft	Edgemost
☞ a. ˈ(pana)ma					σσ
b. (pana)ˈ(ma)	*!	*			
c. paˈ(nama)				*!	σ

For type C words, Van Oostendorp includes an extra, catalectic consonant in the input. A catalectic element is an empty segment, i.e. a vowel or consonant without phonetic content. In the case of *chocola*, an empty C is added at the end of the word, forming a syllable of its own. Two extra constraints are assumed to play a role, one that prohibits empty elements (which we will call *Empty here) and one that demands preservation of any underlying catalectic element present in the input (MaxIO-Cat). These two contradictory constraints are ranked as follows: *Empty » MaxIO-Cat, but placed at the very bottom of the hierarchy, so that catalectic elements are never present in the output, except when other constraints (such as MaxIO-Ft) impose their presence. The effect of this for *chocola* is shown in (195).

(195) Tableau for *chocola* (cf. Van Oostendorp 1997a:149)

/(ʃoko)laC/	FtBin	NonFin1	WSP	MaxIO-Ft	Edgemost	*Empty	MaxIO-Ct
a. ˈ(ʃoko)la.C					σσ!σ	*	
b. ˈ(ʃoko)la					σσ!		*
☞ c. (ʃoko)ˈ(la.C)					σ	*	
d. ʃoˈ(kola.C)	*!			*	σσ	*	
e. ʃoˈ(kola)C				*!	σσ[41]	*	
f. ʃoˈ(kola)				*!	σ		*
g. (ʃoko)ˈ(la)	*!	*					*

Candidate (195d) contains a trisyllabic foot, and is therefore eliminated by the undominated FootBin constraint. A candidate comparable to (195c) but

41 In the original tableau, this candidate has one extra violation of Edgemost, which seems incorrect.

without the final catalectic syllable, which we added as (195g), would be ruled out in the same way. Next, (195ef) are excluded by PARSE-FT, which prohibits the deletion of the initial underlying foot. Compared to the two other remaining candidates, (195c) has the advantage of having main stress closer to the right edge of the word, and is therefore, by the effect of EDGEMOST, chosen as the optimal candidate.

5.2.3.4 Gussenhoven (2003)

Gussenhoven provides an alternative way to account for the different stress patterns in Dutch, which like van Oostendorp (1997) is based on underlying feet. The ranking for type A words resembles that proposed by Nouveau and Van Oostendorp, as (196) demonstrates:

(196) Tableau for *pyjama* (cf. Gussenhoven 2003:3, *Agatha*)

/pi.ja.ma/	FOOTBIN	NOCLASH	NONFIN1	MAINFTRIGHT
a. ˈ(pi:.ja)(ma:)				*!
b. (pi:.ja)ˈ(ma:)			*!	
☞ c. piˈ(ja:.ma)				
d. (pi:)ˈ(ja:.ma)		*!		
e. ˈ(pi:.ja.ma)	*!			

As an effect of the Stress-to-Weight principle, the non-high vowels of Dutch are lengthened in stressed position, and thus bimoraic in Gussenhoven's model. This explains why only candidate (196e) has a violation of FOOTBIN ("feet are neither monomoraic nor trisyllabic", Gussenhoven 2003:3), as (196ab) contain bimoraic feet: [a:] has two moras assigned to it. Candidate (196d) is eliminated because it contains two adjacent heads (which are in a stress clash), whereas (196b) has a final stressed syllable not tolerated by NONFINALITY1. The choice between the two remaining candidates (196a) and (196c) is made by MAINFOOTRIGHT, which demands for the right edge of the word to coincide with the right edge of a strong foot, i.e. the foot bearing main stress.

In line with Van Oostendorp (1997a), the difference between type A and type B words is made by assuming an underlying foot for type B words. A constraint against deletion of this foot (FAITHFOOT, rendered here as MAXIO-FT to be able to compare this account with Van Oostendorp's) is inserted above NONFINALITY1. (197) demonstrates the working of this ranking for *Panama*.

(197) Tableau for *Panama* (cf. Gussenhoven 2003:6, *Canada*)

/pa.na(ma)/	FTBIN	NOCLASH	MAXIO-FOOT	NONFIN1	MAINFTRT
☞ a. ˈ(pa:na)(ma:)					*
b. paˈ(na:.ma)			*!		
c. ˈ(pa)(na:.ma)		*!	*		*
d. (pa:na)ˈ(ma:)				*!	

The candidate with penultimate stress, (197b), is now eliminated because it is obtained by deleting the underlying foot. The choice is then limited to candidates which respect this footing, with a preference for (197a) where the main stress foot is not final.

For type C words, not only an underlying foot is needed, but also the marking of this foot as the head foot, or foot bearing main stress. The input for *chocola* then is /ʃokoˈ(la)/, which is evaluated as follows:

(198) Tableau for *chocola* (cf. Gussenhoven 2003:6)

/ʃo.koˈ(la)/	FTBIN	NOCLASH	MAXIO-FOOT	NONFIN1	MAINFTRIGHT
☞ a.ˈ(ʃo:ko)(la:)			*!		*
b. ʃoˈ(ko:la)			*!		
c. ˈ(ʃo)(ko:.la)		*!	*		
d.(ʃo:ko)ˈ(la:)				*	

Now, the candidate which was optimal in (197) has a crucial violation of MAXIO-FT, which in Gussenhoven's case demands not only that the underlying foot be conserved, but also that it maintain its main foot identity. Therefore, (198d) wins, even though it violates NONFINALITY1.

5.2.3.5 Conclusion

In sum, we have shown that there are three different ways to deal with the different patterns and their frequency in the Dutch stress system. A first solution is the reranking of constraints, where the number of rerankings needed reflects the likeliness of occurrence of a given pattern. Second, it can be claimed that words belonging to the set of non-default patterns contain and underlying foot. The difference between irregular patterns and exceptions can then be made either by assuming that the latter contain a catalectic consonant, or by assigning main stress to the underlying foot in the input.

5.2.4 Secondary Stress

Contrary to primary stress, secondary stress in Dutch has not been given much attention in the literature. It is mostly discussed either along with primary stress, or in a small, separate section. The question whether Dutch secondary stress is quantity-sensitive is a central issue in the debate. At first sight, secondary stress feet seem to be created from the left word boundary onwards:

(199)	a.	*gordijn* 'curtain'	xɔrˈ(dɛɪn)
	b.	*automaat* 'machine'	ˌ(au.to)ˈ(maːt)
	c.	*emancipatie* 'emancipation'	ˌ(e.mɑn)siˈ(paː.si)
	d.	*onomatopee* 'id.'	ˌ(o.no)ˌ(ma.to)ˈ(peː)
			(cf. Kager 1989:277)

As shown by the last example in (199), Dutch secondary stress displays an alternating pattern of stressed and unstressed syllables, starting from the left word edge. In general, it is placed on peripheral syllables (((199bcd)), an effect which has been called the Hammock Principle (Van Zonneveld 1985).

As (199a) shows, clash is avoided: the first syllable does not receive secondary stress when it is situated right next to the primary stressed syllable. In words with two syllables before main stress, like *automaat*, secondary stress lands on the first syllable. If there are three syllables before the final foot, as in (199c), the third syllable is not stressed, also to prevent a stress clash from occurring.

(199c) also shows that in the case of secondary stress, there is no weight-by-position: the second syllable [mɑn] is closed, but not stressed. However, for some speakers, variation is possible as far as quantity-sensitivity is concerned, and closed syllables can attract stress (cf. Kager 1989:290). (200a) shows this for *emancipatie*.

(200)	a.	*emancipatie* 'emancipation'		
		ˌ(e.mɑn)siˈ(paːsi)	~	e.ˌ(mɑn.si)ˈ(paːsi)
	b.	*kaleidoscoop* 'kaleidoscope'		
		ˌ(ka.lɛɪ)doˈ(skoːp)	~	kaˌ(lɛɪ.do)ˈ(skoːp)

Furthermore, it is possible for syllables with an underlying long vowel or a diphthong to attract secondary stress, as shown in (200b). Kager (1989:280) argues that there is "a clear tendancy" towards the first variant, but that the second pattern "is well possible". Booij (1995:106) confirms the marginality of cases like (200), and provides counterexamples such as *tuberculose* [tybɛrkylozə] 'tuberculosis', where secondary stress can only be initial, even though the second syllable is closed.

Instead of treating separately the various models of secondary stress and their implications for vowel reduction, in the next section, discussion of these will be combined, as they are often closely linked.

5.3 The Relation between Stress and Vowel Reduction

5.3.1 Introduction

Having described primary and secondary stress in Dutch in the previous section, we are now able to start discussing the vowel reduction process in this language, which is directly associated with prosody by all scholars (e.g. Kager 1989, Booij 1999, Van Oostendorp 2000). The following definition is provided by Booij:

(201) Vowel reduction is the phenomenon that an underlyingly full vowel is optionally realized as schwa in unstressed syllables. (Booij 1999:130)

We will take this description of the process as a starting point, treating four problematic aspects of it in more detail.

First, the use of the term "schwa" in (201) is problematic with respect to the definition of this vowel proposed in chapter 2. In Dutch, we are clearly not dealing with a vowel that alternates with zero. As chapter 2 limited the term of "schwa" to the alternating instances of [ə], when discussing the result of the Dutch vowel reduction process, the word "schwa" will be replaced by the phonetic transcription [ə] or by the descriptive expression "Reduction Vowel" (henceforth RV).

An important aspect of reduction that is not mentioned in definition (201) is the featural identity of the target vowel. Booij (1981, 1999) and Kager (1989) each propose a hierarchy that seems to exist with respect to the reduction possibilities for the various full vowels that reduce:

(202)		a.	Kager (1989)	b.	Booij (1999)
	easily reduced		/e/		/e, ɪ/
	↓		/a/		/a, ɑ/
			/o/, /ø/		/o, ɔ/
			/i/		/i/
	hardly reduceable		/u, y/		/y, u, ø/

These hierarchies are almost identical, with the exception of the place of /ø/ and the absence or presence of the lax vowels /ɪ, ɑ, ɔ/. The latter are not mentioned by Kager, probably because they mostly occur in closed syllables, in which vowels are more difficultly reduced. This points into the direction of another reduction hierarchy: in addition to the different possibilities for reduction according to *segmental identity* of the vowel, there is also a different likelihood of occurrence of the phenomenon according to its *structural position*. Moreover, not only does the reducibility of a vowel depend on the structure of its syllable, but also on the position of that syllable within the prosodic structure: "[r]eduction is even easier when the vowel is in interstress position" (Booij 1999:130). Thus, as argued, among others, by Kager, vowel reduction is a "window into (Dutch) metrical structure" (Kager 1989:275): reducibility of a vowel indicates that it is in a prosodically weak position. Consider for instance the example *banaan* [banan] 'banana', which can be pronounced in three or four ways:

(203)			
	a.	banan	formal
	b.	bɑnan	informal: laxing
	c.	bənan	informal: reduction to [ə]
	d.	?bnan	informal: deletion

Deletion as in (203d) cannot take place in this example according to Kager, but might take place in words in which the consonantal group arising after deletion of the vowel is easier to pronounce than [bn]. It is also more likely to occur in words with two ore more syllables before main stress, as forms like [fonloxi] for *fonologie* [fonoloxi] 'phonology' show. Although the application of the three processes might seem a clear case of a gliding scale from formal to highly informal, at the same time showing that reduction, laxing, and deletion depend on style level, it is pointed out by Kager (1989:305) and Booij (1999:136) that laxing (or, in their accounts based on vowel length, shortening) has a slightly different context of occurrence from that of reduction to the RV: whereas reduction occurs in all syllables which do not bear primary or secondary stress, laxing occurs in initial syllables only, if these are not primarily stressed. This is illustrated below.

(204)

		Formal	Vowel laxing	Vowel reduction
a.	*politiek*	[ˌpo.li.ˈtik]	[ˌpɔ.li.ˈtik]	[ˌpo.lə.ˈtik]
b.	*paradijs*	[ˌpa.ra.ˈdɛɪs]	[ˌpɑ.ra.ˈdɛɪs]	[ˌpa.rə.ˈdɛɪs]
c.	*directeur*	[ˌdi.rɛk.ˈtør]	?[ˌdɪ.rɛk.ˈtør]	?[ˌdi.rək.ˈtør]
d.	*politie*	[po.ˌli.tsi]	[pɔ.ˌli.tsi]	[pə.ˌli.tsi]

(cf. Kager 1989, Booij 1999)

As (204) shows, the two processes do not occur in the same context: whereas vowel laxing targets initial syllables whether stressed or unstressed, the vowel of initial syllables is only reduced when unstressed, as in (204d). Although the two processes seem of the same kind (as shown by example (204c) where according to our intuition they seem to have to either apply at the same time ([ˌdi.rɛk.ˈtør]), or not to apply at all), their conditioning is different. Vowel reduction seems a better indicator for prosodic structure, as contrary to laxing, which can target syllables with secondary stress under the only condition that they be initial, it occurs in purely weak positions only.

A fourth and final aspect of reduction we will treat here is the prosodic position of the reduced syllable. As already pointed out, the process targets prosodically weak syllables, but it does not treat all of these alike. This is shown by the difference in reduction possibilities between the second and third syllable in words with three syllables before main stress:

(205) Reduced forms of *fonologie* 'phonology' (cf. Booij 1981:148; 1995:133, Kager 1989:313, Van Oostendorp 2000:147)

a. [ˌfonələˈxi]
b. [ˌfonəloˈxi]
c. *[ˌfonoləˈxi]

Booij (1981,1999), Kager (1989) and Van Oostendorp (2000) argue that in *fonologie,* [lo] is a stronger syllable than [no]: whereas simultaneous reduction of the two syllables (205a) is possible, and reduction of [no] with retention of [lo] (205b) as well, [lo] cannot be reduced if [no] is not, as in the ungrammatical example (205c). This example clearly demonstrates that the way secondary stress, and thus the prosodic status of syllables preceding main stress, is described, is crucial to determine the modeling of the reduction process[42].

Some more examples, which will serve as a starting point for the discussion in the remainder of this section, will clarify this. Consider the following ways of footing one, two, and three syllables before main stress:

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[42] Note that syllables located near the right edge of the word do not reduce: *cola* [ko.la], *[ko.lə] (cf. Kager 1989:304).

(206)		*tomaat*	*chocola*	*locomotief*
	a.	toˈ(mat)	ˌ(ʃo.ko)ˈ(la)	ˌ(lo.ko)moˈ(tif)
	b.	(to)ˈ(mat)	ˌ(ʃo.ko)ˈ(la)	ˌ(lo.ko)(mo)ˈ(tif)
	c.	toˈ(mat)	ˌ(ʃo.ko)ˈ(la)	ˌ(lo.ko.mo)ˈ(tif)

When confronted with the reduced forms [təmat], [ʃok(ə)la], and [lok(ə)motif], one can describe the context of reduction in three ways according to the footing. If footing method (206a) is selected, reduction occurs in the weak position of a binary foot in *chocola* and *locomotief* ([ko]), and may also (but more difficultly) occur in a stray (i.e. unfooted) syllable in *tomaat* and *locomotief* ([mo]). It is then expected that [to] in *tomaat* reduces just as difficultly as [mo] in *locomotief*. Footings (206b) require a similar description, except that for [to] and [mo] reduction has to be allowed in the head of a foot, provided that it does not bear (primary or secondary) stress. Finally, if ternary feet are allowed in secondary stress, one arrives at situation (206c), where the description of reduction becomes problematic: it targets the middle rather than the rightmost syllable in ternary foot, whereas in binary feet, the vowel of the rightmost syllable reduces just as easily as that in the middle position of ternary feet. Moreover, whether or not the first syllable of *tomaat* is footed, in (206c), it remains in a position which is structurally different from that of [ko] in *chocola* or [mo] in *locomotief*. However, with all three structures, a description of the vowel reduction process is possible. Therefore, reduction alone does not allow us to decide which of the three is the correct one. On the other hand, in order to arrive at a correct definition of the process, we need to determine how Dutch pre-main stress syllables are footed.

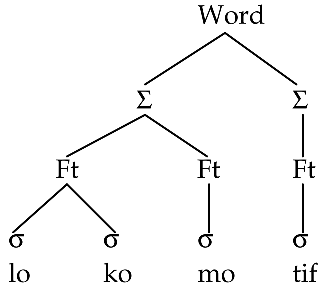
In the remainder of section 5.3, we will first discuss existing accounts on the choice of footing syllables that cannot be incorporated into binary feet such as *to* in *tomaat* and *mo* in *locomotief* (5.3.2). Next, a third option will be considered: ternary feet (5.3.3). Finally, we will focus on the question how primary stress, secondary stress, and vowel reduction have to be ordered in the process of arriving from a lexical input to a concrete phonetic realization: do they all apply to words at the same time, or do they each belong to a different level of a derivation? This will be the topic of section 5.3.4.

5.3.2 Monosyllabic Feet or Stray Syllables?

This section will concentrate on models of secondary stress in which binary feet are used throughout. Consider for example the following structure Van

Oostendorp (2000:148) assumes for words with three syllables before main stress:

(207)



locomotief 'locomotive engine'

In (207), "all syllables are organized into feet, all feet into superfeet, and all superfeet into words" (Van Oostendorp 2000:148). [lo] and [tif] are in strong positions. [lo], which bears secondary stress, is the head of a branching foot, whereas [tif] is the head of a superfoot, and therefore bears primary stress. Syllables [ko] and [mo] are both in weak positions. The structure of the word *locomotief* according to Van Oostendorp is (208a): [mo] being stronger than [ko], it forms a foot by itself (which is unstressed: semi-weak position), whereas [ko] is in the weak position of a binary foot. As Van Oostendorp points out in a footnote, this structure differs from that proposed by Kager ((208b)), because Kager leaves [mo] unfooted.

(208) Possible structures for *locomotief*
- a. ˌ(lo.ko)(mo)ˈ(tif)
- b. ˌ(lo.ko)moˈ(tif)
- c. ˌ(lo.ko.mo)ˈ(tif)

On the basis of the structure in (208a), Van Oostendorp proposes two PROJECT constraints to describe the reduction facts:[43]

(209)	a.	PROJECT (V, Ft_2)	N° dominates a vocalic node → N'' heads a branching foot.
	b.	PROJECT (V, Ft)	N° dominates a vocalic node → N'' heads a foot.

(Van Oostendorp 2000:149)

Constraint (209a) excludes full vowels outside of the head position of bisyllabic feet, whereas PROJECT (V, Ft) bans the RV from all foot heads. The effect of both constraints is countered by PARSE-FEATURE, which demands that all features present in the input be present in the output. As reducing a

[43] Van Oostendorp (1997b:219) replaces PROJECT-FT and PROJECT-FT_2 by REDUCE-2 and REDUCE-1, respectively.

full vowel in Van Oostendorp's view means suppressing its features, the result is a violation of PARSE-FEATURE. Assuming that the constraints in (209) are in a fixed ranking PROJECT (V, Ft) » PROJECT (V, Ft_2), they can be ranked with the PARSE constraint in the following three ways, which each represent a style of speech according to Van Oostendorp:

(210) Tableaux for formal (a), semi-formal (b) and informal (c) realizations of *fonologie* 'phonology' (Van Oostendorp 2000:151)

a.

/fonoloxi/	PARSE-FEATURE	PROJECT (V, Ft)	PROJECT (V, Ft_2)
☞ (fo.no)(lo)(xi)		*	**
(fo.nə)(lo)(xi)	*!		*
(fo.no)(lə)(xi)	*!	*	*
(fo.nə)(lə)(xi)	*!*		

b.

/fonoloxi/	PROJECT (V, Ft)	PARSE-FEATURE	PROJECT (V, Ft_2)
(fo.no)(lo)(xi)	*!		**
☞ (fo.nə)(lo)(xi)		*	*
(fo.no)(lə)(xi)	*!	*	*
(fo.nə)(lə)(xi)		**!	

c.

/fonoloxi/	PROJECT (V, Ft)	PROJECT (V, Ft_2)	PARSE-FEATURE
(fo.no)(lo)(xi)	*!	**	
(fo.nə)(lo)(xi)		*!	*
(fo.no)(lə)(xi)	*!	*	*
☞ (fo.nə)(lə)(xi)			**

In (210a), where PARSE-FEATURE dominates both the PROJECT constraints, the form in which all full vowels keep their features is selected as optimal. If the PARSE constraint is ranked in between, the candidate in which only the vowel in weak position has been reduced comes out as optimal, as shown in (210b). Finally, in (210c), where both PROJECT (V, Ft) and PROJECT V, Ft_2) are ranked above PARSE-FEATURE, the candidate in which both weak and semi-weak vowels are reduced wins.[44]

Thus, the difference between weak and semi-weak positions is made by having the constraints refer to the difference between branching and non-branching feet: vowels in the weak position of a branching foot violate both constraints, and the third syllable of words like *locomotief* only violates PROJECT (V, Ft_2). This model could be adapted to account for structure (208b), where the semi-weak syllable is stray instead of forming a foot by itself. The reason why Van Oostendorp adopts (208a) is simply that in the formalism of projection constraints "it is impossible to refer to the difference between a weak and a stray position in the appropriate way" (Van Oostendorp 2000:148): as the constraints refer to the difference between syllables belonging to two types of feet, they cannot be used to make a difference between and unfooted syllable and one that is in the weak position of a foot.

On the other hand, in Van Oostendorp's model, *mo* is the head of a foot, and it is difficult to understand why a head would reduce, if a monosyllabic main stress foot ([fo.no.lo.ˈ(xi)]) remains intact. Moreover, if this third syllable before main stress is footed, this has consequences for processes other than reduction, as will be demonstrated in the following chapter.

Another problem with incorporating syllables like *mo* in *locomotief* into a foot of their own is that one would expect the same thing to happen with a single pre-main stress syllable, such as *ba* in *banaan:* (ba)(nan). Identical behavior of these syllables with respect to reduction is then predicted. However, as Gussenhoven shows, "Dutch initial syllables do not form monosyllabic feet" (Gussenhoven 1993:63), because in the Chanted Call, unlike other foot heads, they do not impose a new pitch level. We will come back to this in chapter 6. On the other hand, we cannot be sure if Van Oostendorp intends to incorporate syllables like *ba* into a monosyllabic foot, as the working of the reduction hierarchy is not demonstrated for *banaan*-type words. Such a footing can simply be excluded by a constraint CLASH, which excludes the syllable with secondary stress [ba] from being next to primary stressed [nan].

Although the advantages of his model with respect to one in which the third syllable before main stress is not footed are not discussed, Van Oostendorp

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[44] Note that reducing the vowel in the main stress foot is implicitly assumed to be impossible: violation of the constraint PROJECT-FT_2 by this vowel is not counted in the tableaux. If it would be, a candidate [fo.nə.lə.xə] would be optimal in semi-formal and informal styles.

correctly points out that it is difficult to distinguish between weak and semi-weak positions in a model where three pre-main stress syllables are grouped into one ternary foot. "Yet even in this case we could for instance refer to a difference between foot-internal and foot-final positions" (Van Oostendorp 2000:149). However, as we already pointed out in section 5.3.1, although this distinction is helpful for cases like *locomotief*, it is not for *chocola*-type words: *chocola* has a foot-final syllable *co* which behaves like the foot-internal *co* in *locomotief*, and thus reduces much more easily than the foot-final syllable of the ternary foot.

This section has shown that the choice between a stray syllable and a monosyllabic foot for the third syllable before main stress entails a choice between two models of vowel reduction. Therefore, if we were to adopt a stress model with binary feet only, either of the two options must be chosen in order to arrive at a descriptive model of the reduction process. In the next section, another solution will be considered, viz. ternary feet.

5.3.3 Binary or Ternary Feet?

Rietveld et al. (2004) discuss a series of experiments in which they establish differences of duration between vowels in various prosodic positions. Nonsense words were constructed with vowels [i, a], and consonants [k, s, m]. These were pronounced in carrier phrases by four subjects. Thus, a complete picture of the duration of vowels in eleven prosodic patterns was achieved. Among these patterns, four types will retain our attention here:

(211)	a.	locomoˈtief	(x . .)ˈ(x)	
	b.	pacifiˈcatie	(x . .)ˈ(x .)	
	c.	piˈraat	. ˈ(x)	
	d.	piˈano	. ˈ(x .)	(cf. Rietveld et al. 2004:354)

As shown in (211ab), Rietveld et al. propose a ternary foot for three pre-main stress syllables, and leave an initial unstressed syllable unfooted. The prosodic status of the third syllable in such a ternary foot is by definition identical to that of the second one: a weak syllable in a polysyllabic foot. Its duration is thus expected to be roughly identical to that of the second one, but different from that of the first syllables in (211cd), which are unfooted.

Unfortunately, in their statistical analysis of the duration facts, Rietveld et al. do not directly compare the duration of the third syllable in words of the types (211ab) to that of stray syllables, as in types (211cd), nor do they compare it to that of the second syllable in the same type of words. However, the duration averages they report on seem to indicate that the third syllable in (211ab) is in fact more similar to the second syllable in the same words than to the first one in (211cd). Part of the table of results is reproduced in (212) below.

(212) a.		lo	co	mo	ˈtief		
	/i/	69	57	**61**	90		
		/a/	81	52	**58**	135	
b.		pa	ci	fi	ˈca	tie	
	/i/	68	56	**61**	77	63	
		/a/	81	52	**55**	120	55
c.		pi	ˈraat				
	/i/	88	100				
		/a/	84	90			
d.		pi	ˈa	no			
	/i/	76	91	85			
		/a/	72	84	80		

(Rietveld et al. 2004:361, emphasis ours)

The duration of the syllables in bold differs more from that of the stray syllables (average difference 21.75 ms) than from that of the second syllable in the same word (average difference 4.00 ms). These figures might lead us to conclude that Dutch has ternary feet, at least for secondary stress. This has serious consequences for the description of Dutch stress as discussed in the present chapter. For example, let us consider the account proposed by Gussenhoven (2007) in which a constraint FOOTBIN is assumed in order to prevent ternary feet from occurring in the case of words ending in three light syllables.

(213) *Agatha* 'first name' (cf. Gussenhoven 2007:10 and 14)

/axata/	FOOTBIN	NOCLASH	ALIGN-HEAD-R	PARSE-σ
☞a. aˈ(xaː.ta)				*
b. (aː)ˈ(xaː.ta)		*!		
c. ˈ(aː.xa)(taː)			σ!	
d. ˈ(aː.xa.ta)	*!			

The two alternatives to the optimal candidate (213a) are ruled out by NOCLASH, preventing two stressed syllables to occur next to each other, and

ALIGN-HEAD-R, preventing the main stress foot from not being final, respectively. The constraint PARSE-σ, demanding that all syllables be parsed into feet, is crucially ranked below FOOTBIN, as it would prefer (213d) over (213a). Now, consider tableau (214), which evaluates a word with three syllables preceding main stress according to Gussenhoven's constraint ranking.

(214) *pacificatie* 'pacification'

/pasifikasi/	FOOTBIN	NOCLASH	ALIGN-HD-R	PARSE-σ
☞ a. (paː.si)fiˈ(kaː.si)				*
☹ b. (paː.si.fi)ˈ(kaː.si)	*!			
c. pa.si.fiˈ(kaː.si)				**!*

As expected, the constraint ranking now excludes candidate (214b) because of its ternary foot. The only way to obtain (214b) as the optimal candidate would be to rerank FOOTBIN with PARSE-σ. However, this would cause ternary feet to be the optimal outcome for *Agatha*-type words: (213d) would be optimal in tableau (213).

The difference between the two words is that in *Agatha*, the ternary foot would have primary stress, whereas in *pacificatie*, it would bear secondary stress. Therefore, the solution to the problem might be to treat primary and secondary stress separately, with a different constraint ranking for each of them. Another indication pointing in this direction is the fact that, as Gussenhoven argues, Dutch only has weight-by-position as far as main stress is concerned. This is demonstrated in (215).

(215) *armada* (id.) (cf. Gussenhoven 2007:12)

/ɑrmada/	FOOTBIN	WSP/SWP	NOCLASH	ALIGN-HEAD-R	PARSE-σ
☞ a. µ ɑrˈ(maː.da)					*
b. µµ ɑr ˈ(maː.da)		*!			*
c. µµ (ɑr)ˈ(maː.da)			*!		
d. µµˈ(ɑr.maː)(da)				*!	

If the first syllable in *armada* would be analyzed as bimoraic, as in (215b), the candidates with stress on the prefinal syllable would be ruled out because of the fact that a heavy syllable is not footed (as in (215b)), or when it is footed, that it causes clash (as in (215c)) or that the foot with main stress is not located at the right word edge (as in (215d)). Therefore, according to Gussenhoven, the only possible solution is to assume that "closed word-initial pre-stress syllables are monomoraic in Dutch" (Gussenhoven 2007:12). As in his view the constraint demanding for coda consonants to count as a mora, WEIGHT-BY-POSITION (WbP) does not play a role outside of the main stress syllable, Gussenhoven proposes to split up this constraint:

(216)	a.	WbP:	A coda consonant projects a mora.
	b.	WbP'	From the main stress onward, a coda consonant projects a mora.

This difference in the functioning of WbP also helps to describe the difference in quantity-sensitivity between main and secondary stress as discussed in section 5.2.4. These quantity differences between the two types of stress seem to call for a different description of stress assignment in the case of secondary stress.

As we have seen, Gussenhoven's analysis cannot account for ternary feet in secondary stress, unless we treat this type of prominence on a different level from that of primary stress. In this case, the distinction WbP ~ WbP' would not have to be made anymore, as on the secondary stress level, we can simply rank the WbP constraint low. A similar, level-based approach, replacing split-up constraints, has been proposed for Latin by Jacobs (2003).

An alternative solution would be to split up the FOOTBIN constraint as well. However, this would produce another very specific constraint which targets only main stress feet (FOOTBIN': main stress feet are binary). In fact, the creation of "prime"-constraints seems a way to circumvent the problem: confronted with the fact that different constraint rankings are needed for primary and secondary stress, we do not simply propose two rankings, but create two separate constraints which are ranked differently. This solution seems to be designed to stick to strictly parallel evaluation of constraints, in a situation where the need for different levels is obvious. In the next section, we will discuss an experiment proposed by Ernestus & Neijt which seems to point in the opposite direction.

5.3.4 (Main) Stress First

Thus far, we have demonstrated that vowel reduction takes place in weak and semi-weak positions, that is, in the dependent syllables of polysyllabic feet or in stray positions, according to the model adopted. It does not occur in the rightmost part of the word: reduction of vowels in final syllables is excluded, not only if they belong to the main stress foot (e.g. *cola* (ko.la)), but also if this is not the case (e.g. *Canada* *[ka.na.də]).

As shown above, Gussenhoven (2007) needs two constraints, WbP, and WbP', in order to account for the fact that, unlike primary stress, secondary stress is not sensitive to the presence of coda consonants. These facts seem to point into the direction of a clear distinction between primary and secondary stress, the latter being subject to much more variation (cf. *caleidoscoop* cases), and triggering reduction. However, as we will demonstrate in this section, Gussenhoven is not the only author arguing for one single, parallel treatment of both types of prominence in Dutch.

Kager (1989:283ff) provides an overview of rule-based accounts available on Dutch secondary stress, and divides them into two groups, *viz.* Main Stress First analyses and Stress First analyses. The Main Stress First analyses first determine the syllable with primary stress, and afterwards assign secondary stress with an alternating pattern (e.g. Booij 1981). Stress First analyses assign both stress types at the same time, and afterwards apply an end rule to attribute primary stress at the right edge of the word (e.g. Neijt and Zonneveld 1982). Both ways of accounting for the Dutch system support the claim that primary and secondary stress should be dealt with in separate ways: either by singling out primary stress, or by applying secondary stress after the attribution of primary stress.

Van der Hulst (1999:72) argues that "the assignment of primary accent does not depend on prior exhaustive footing", and that therefore, Main Stress First analyses cannot be correct: if main stress simply selects the rightmost foot from a word that is already entirely parsed into feet, one would expect for syllables to be parsed into feet as much as possible. That is, for a word with four syllables, a parsing (σσ)(σσ) would be preferred over σ(σσ)σ, and therefore, penultimate stress over antepenultimate. According to Van der Hulst then, this is not the case. Furthermore, he argues that languages such as Dutch and English where primary stress is quantity-sensitive and secondary stress is not (entirely), provide evidence for an independent footing process for secondary stress.

An experimental contribution to the debate is provided by Ernestus & Neijt (forthcoming), who counter Van der Hulst's assumption for Dutch. They conducted various experiments in order to establish whether the number of syllables in a word plays a role in stress assignment in English, German, and Dutch. For Dutch, they ran statistical analyses on the CELEX lexical database, and found that for words with a closed final syllable, there is a significant difference in the location of primary stress between words with three syllables and those with four syllables. This finding was confirmed by a paper-and-pencil experiment with nonsense words. A number of stressing possibilities for trisyllabic and quadrasyllabic words with a final closed syllable are given in (217):

(217) Theoretically possible stress patterns in Dutch three- and four-syllable words, in which the final syllable is closed.

	Three syllables	Four syllables
a.	ˌ(σσ) ˈ(σ)	ˌ(σσ)σˈ(σ)
b.	ˌ(σσ) ˈ(σ)	ˌ(σσ)ˈ(σσ)

The situation in (217a) is the one expected by the Main Stress First accounts: the final closed syllable receives primary stress because it is heavy, and secondary stress is established by constructing binary feet from the left word edge. (217b) is the situation Ernestus & Neijt found: in quadrasyllabic words, primary stress on the penultimate syllable is preferred over stressing of the final closed syllable. Thus, contrary to what is claimed by Van der Hulst, Ernestus & Neijt argue that primary stress does depend on prior exhaustive footing:

(218) [...] the position of primary stress depends on the positions of secondary stresses. The observed effect of word length thus calls into question the assumption that the location of primary stress is independent of the location of secondary stresses. Our results support the claim by Gussenhoven (in press) [cited as Gussenhoven 2007 in this thesis, TG] that primary stress cannot be satisfactorily described if the section of the word before the primary stress is ignored. (Ernestus & Neijt forthcoming:37)

At first sight, Ernestus and Neijt's data show that, when assigning primary stress, exhaustive parsing is preferred over parsing a heavy syllable as a head of a foot. At the first (or, the only) level, the footing of the word is not limited to a single foot at the right edge, as the choice between parsing the final closed syllable as a monosyllabic foot and including it into a binary foot seems to be determined by the footing of other syllables within the word.

The (main) stress first debate is relevant to our discussion of vowel reduction, because if primary and secondary stress are assigned on different levels, it would be possible to assume vowel reduction takes place at yet another moment in the derivation. Alternatively, reduction can be claimed to take place on the phonetic realization level together with secondary stress. However, if both footings were done at the same time, as Ernestus & Neijt and Gussenhoven argue, then this forms no argument to assume a different level for reduction.

5.3.5 Conclusion

Three important factors that determine vowel reduction were introduced in section 5.3.1: the identity of the vowel, its structural position (both in the syllable and in the foot) and style level. In order to incorporate these aspects into our definition of the phenomenon, definition (201) should be modified to the following one:

(219) Vowel reduction is the phenomenon by which an underlyingly full vowel, depending on its featural identity and the structure of its syllable, is optionally realized as [ə] in prosodically weak syllables in informal speech.

It is now apparent from the definition of vowel reduction that stress plays an important role in our understanding of the process. Therefore, before an account of it can be proposed, as sections 5.3.2 through 5.3.4 demonstrated, it has to be determined (a) how pre-main stress syllables are footed, and (b) at which level of the phonology of Dutch the assignment of primary and secondary stress take place.

5.4 Conclusion

The existing accounts of Dutch stress essentially concentrate on main stress. As far as the major issues are concerned, we adopted a lax/tense-based vowel system and a constraint-based approach. For secondary stress, the literature is less abundant. However, it has been shown by various authors that feet bearing secondary stress are constructed in a different way than primary stress feet. The question of how to resolve this problem in a unified model of Dutch stress is of direct relevance to the conditioning of vowel reduction, as this process takes place in prosodically weak positions.

More specifically, a choice needs to be made between three models: (a) a model in which ternary feet are assigned to three syllables before main stress; (b) a model in which in these words, the third syllable is left unfooted; (c) a model similar to (b), but which incorporates the stray syllable into a monosyllabic foot. In order to select the correct model, the footing of pre-main stress syllables needs to be verified.

Moreover, in order to arrive at a correct description of vowel reduction, the status of secondary stress needs to be established: are we dealing with feet which are created at the same level as the primary stressed foot? If the answer is no, then it would not be surprising if a separate level on which vowels are reduced were to be assumed.

Both the questions of *how* and *when* non-main stress feet are created will be treated in the next chapter, in which prosodically based segmental processes other than vowel reduction will be used to arrive at the answers.

6 Experimental and Corpus-based Approaches to Dutch Vowel Reduction

Laboratoire. Même si on ne trouve rien, on renifle l'odeur de la vérité qui se cache. [Laboratory. Even when one finds nothing, one breathes the sent of the truth hiding.]

Jean Rostand, *Carnet d'un biologiste*

6.1 Introduction

In the preceding chapter, an answer to Q2 (the conditioning factor) was established for vowel reduction: it occurs in prosodically weak syllables. However, as demonstrated, the exact status of the foot, and more precisely, that of feet that are not primarily stressed, is unclear in Dutch. The present chapter aims to find more exact answers to both Q1 (description of the process) and Q2, this time choosing the approach of experiments and corpus research.

The chapter will start out with finding answers to Q1: what exactly is vowel reduction? As we have seen in the preceding chapter, there are four types of possible realizations of a Dutch vowel in informal speech: fully realized, reduced to a lax vowel, reduced to [ə], and fully deleted. In section 6.2, we will introduce a large corpus of Dutch spontaneous speech, the Corpus Gesproken Nederlands, which will allow investigation into the frequency of occurrence of these possibilities in section 6.3. A set of words with three syllables before main stress (i.e., of the type *locomotief*) will be used as a testing ground.

With a better picture of reduction in mind, we can turn to its conditioning in search of answers to Q2. As demonstrated in chapter 5, two choices have to be made here: one between binary and ternary feet, and one between monosyllabic feet and leaving syllables stray. This is done by means of experiments based on o-coloring and pre-r-lengthening: before [r], Dutch mid vowels are centered and high vowels are lengthened, but these processes are limited by foot structure conditions. The suggested effects can be used as a diagnostic tool to establish whether pre-main stress syllables belong to one and the same foot or not. These experiments, in which again, words of the *locomotief* type are crucial, are described in section 6.4.

Sections 6.5 and 6.6 will address the question whether stress and reduction require separate levels. First, section 6.5 will try and determine whether after complete deletion new feet are built on the remaining vowels. Then, in section 6.6, repeating Ernestus and Neijt's experiments on a corpus of spontaneous speech, we will investigate if their conclusion that primary and secondary stressed feet are established at the same level of derivation is justified, or, even if so, independent evidence for the existence of multiple levels exists.

In section 6.7, the results of this chapter will be summarized and answers to both Q1 and Q2 will be supplied for Dutch vowel reduction.

6.2 The Corpus Gesproken Nederlands

6.2.1 Introduction

The *Corpus Gesproken Nederlands* ('Spoken Dutch Corpus', henceforth CGN) is the first large corpus of spoken Dutch ever collected. Up till the 1990s, the only substantial corpora consisted of written texts only. The CGN project ran from 1998 to 2003 at the Universities of Nijmegen and Ghent, aiming "to compile a 10-million-word corpus that will constitute a plausible sample of contemporary Dutch as spoken in Flanders and the Netherlands" (Oostdijk 2000:1). Of the realized 9,000,000 word corpus, about one third of the data was collected in Flanders (approximately 3,3 million words), the other two thirds, which interest us, in the Netherlands (about 5,6 millions words). The corpus is composed of the following data types, the numbers in the right column representing the number of words recorded in the Netherlands for every part:

(220)	a.	Spontaneous face-to-face conversations	1,747,789
	b.	Interviews with teachers of Dutch	249,879
	c.	Telephone conversations (recorded by switchboard)	743,537
	d.	Telephone conversation (recorded on MD)	510,204
	e.	Business negociations (simulated)	136,461
	f.	Interviews, discussions, debates (broadcast)	539,561

g.	Discussions, debates, meetings (non-broadcast)	221,509
h.	Lessons recorded in classroom	299,973
i.	Sports commentary (broadcast)	130,377
j.	News reports (broadcast)	90,866
k.	News (broadcast)	285,298
l.	Commentaries, columns, reviews (broadcast)	80,167
m.	Ceremonious speeches, sermons	5,565
n.	Lectures, seminars	61,834
o.	Read aloud text	551,624
	Total	5,654,644

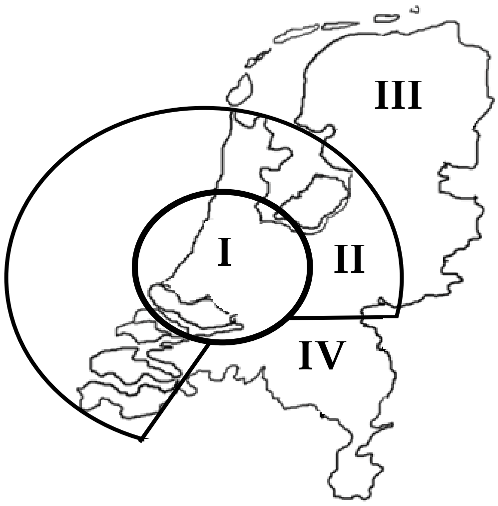
All of these were transcribed in Dutch orthography, and an automatic broad phonetic transcription was generated with text-to-speech software. For the so-called core part of the data, approximately 1,000,000 words, the latter was verified manually. Also, the corpus was enriched with lexical, syntactic, and prosodic information.

Appendix D contains a list of subjects of whom data were used in the experiments to be described in this chapter. Unfortunately, there were no lists of subjects available per component, and in order not to have to list all of the 4,235 speakers who participated in the CGN, we selected those of whom data was used for our purposes. The table in the appendix contains all sociolinguistic parameters used in chapter 4 for the PFC corpus, applied to the CGN. In the remainder of this section, we will treat these variables in more detail.

6.2.2 Diatopic Variation

The variants typically considered "Standard" Dutch are spoken in the west of the Netherlands, in the area surrounding what is called the "*Randstad*": a conglomeration of the cities Amsterdam, Rotterdam, The Hague, and Utrecht. This region is indicated with the number I in the map below.

(221) Map of the Netherlands, representing the regional varieties distinguished in the CGN



In the area around the *Randstad*, indicated by II on the map, a variant of Dutch is spoken that is not recognized by speakers as typical for a specific region. The speech of areas III and IV is often judged typical, especially by those originating from other parts of the Netherlands. In Appendix D, we indicated the region every speaker was born in, as well as the part of the country in which (s)he resided when the survey was conducted. The overall distribution of the speakers among the various regions was as follows:

(222) Regional distribution of CGN speakers

Region	*I*	*II*	*III*	*IV*	*Other*	*Unknown*
Number of speakers born	36	19	12	16	5	25
Number of speakers residing	37	28	8	13	0	27

As shown, the majority of speakers are from the western part of the country (regions I and II), and a minority from the peripheral regions III and IV, with a slight preference for the south. Region III being the part of the country with the lowest number of inhabitants per square kilometer, the distribution is fairly normal. As reduction possibilities might differ according to the region the speaker is from, we will have to take the diatopic variable into account when describing the variation in processes in section 6.3.

6.2.3 Diastratic Variation

As for the PFC corpus, we applied De Jong's (1988) age classification to the CGN. As the records only mentioned birth dates, in order to obtain the speakers' ages, we assume that all surveys took place in 2000 (about half-way in the corpus collection period). For groups I (age less than 30 years old), II (between 30 and 50 years old), and III (50 years and older), the distribution was as follows.

(223) Age of CGN speakers in 2000

Age category	*I*	*II*	*III*	*Unknown*
	<30	*30-50*	*>50*	
Number of speakers	19	44	37	13

Unlike the PFC corpus then, the CGN does not contain a great number of young speakers. On the contrary, the group of speakers under 30 seems relatively small. This means that the number of reductions found might be smaller than actually present in speech, as younger people tend to reduce more easily (in general, produce more casual speech, Labov 2001:101 ff).

On the other hand, only 41 out of 112 speakers, i.e. 37%, of the speakers are female. Recall that women's speech is usually more careful than that of men, which might mean that the corpus contains an extra amount of reduced forms. Besides age, then, sex is a factor that has to be taken into account when describing our CGN data. If there is less reduction than expected, this is probably due to the relatively high age of the speakers, and if there is more, this might be attributed to the majority of men. Therefore, age and sex of the speakers in our corpus seem to balance each other with respect to the effect on the processes under investigation.

The final factor to be described is social class. Again, we used Mullineaux and Blanc's (1982) scale originally used for the Orléans corpus, and translated the categories used in the CGN metadata files in the following way:

(224) Socio-economic stratification: Mullineaux and Blanc vs. CGN.

Classification in CGN metadata		*Mullineaux & Blanc/De Jong*
occ1	occupation requiring higher level of education (doctor, lawyer, etc.)	I-II

occ2	occupation requiring middle level of education (teacher, journalist, etc	II
occ3	occupation requiring lower level of education (mechanic, teacher nursery school, bank employee, etc.)	III-IV
occ5	holding no job, attending school	III
occ4	occupation not requiring any level of education (garbage collector, cleaning lady, taxi driver, etc.)	V
occ7	holding no job; housewife	V

The table shows that the categories are far from being parallel: categories III and IV from the Orléans corpus are classified together as occ3 in the CGN, and Orléans category II is distributed among occ1 and occ2 in the Dutch Corpus. As was done for PFC, we classified students (occ5 in the CGN) into group III. The distribution according to our categories I through V is now as follows:

(225) Distribution of CGN speakers according to the categories from the Orléans corpus

social class	*I*	*I-II*	*II*	*III*	*III-IV*	*IV*	*V*	*unknown*
number of speakers	no data	20	60	14	11	no data	7	1

Although it is hard to draw conclusions from this table as the number of speakers between two categories is rather large, it is clear that there are more people in the higher classes I and II than in the middle class categories III and IV. Therefore, the CGN speakers seem higher educated than the PFC participants. This is partly due to the fact that almost half of our CGN data were broadcast. Note however that the part of category V is also larger than for PFC.

6.2.4 Diaphasic Variation

In order to obtain a realistic impression of informal speech, components a, c, and d from table (220), i.e. face-to-face and telephone conversations, seem the most relevant types. These seem to form a homogenous group, only differing from each other by the fact that during a telephone conversation, one cannot see each other and therefore one has to express oneself without making use of signs, nods, etc. The recordings for the face-to-face conversations were made at the speaker's homes, or at special settings, such as shops, restaurants, etc. Component (220b), the only other more or less spontaneous speech material, contains interviews with teachers of Dutch, which are more formal: besides the fact that they were conscious of the fact that they were being interviewed, the speakers are also professionals in the domain of careful speech in the language they teach at school. The data from this part of the corpus were therefore not used in our survey.

For 177.127 words in component (220a) and 201.141 in (220c), the broad phonetic transcription made with automatic transcription software was manually checked. Unfortunately, this was not done for component (220d), which does not belong to the core part of the corpus. We therefore eliminated this component from our experiments.

The automatically generated phonetic transcription of the core corpus was given to transcribers, who were asked to modify the transcript if they were sure it was wrong. This led to approximately 20% of the automatic transcripts being corrected (Oostdijk 2000). Only phonemic differences between sounds were encoded. In the case at hand this means that a change of vowel is only encoded when the vowel is entirely laxed (e.g. [a] → [ɑ]), fully reduced to [ə], or entirely deleted.

Formal, but spontaneous speech seems best represented by components containing speech from formal situations, but which is not read. These conditions are best met by conditions (220f) (broadcast interviews, discussions, and debates), (220g) (same, but not broadcast) and (220h) (lessons). Sport commentaries might be too informal, whereas broadcast columns, speeches, and lectures are often read aloud. For a total of 126,184 words in parts (220fgh), a verified phonetic transcription is available. Unfortunately, this is a considerably smaller subcorpus than the one used for informal situations, but including other, slightly different components into our survey would make this less representative of formal but unread speech. As in the case of PFC then, percentages will have to be used instead of absolute figures.

Thus, the two sets of components (220ac) vs. (220fgh) seem well suited for a first exploration of the phenomenon of vowel reduction. Table (226) summarizes the part of the CGN that will be used in the remainder of the chapter.

(226) Components of the CGN studied

formal components	*words in verified phonetic transcription*
f. interviews, discussions, debates (broadcast)	75,106
g. Discussions, debates, meetings (non-broadcast)	25,117
h. Lessons recorded in classroom	25,961

informal components	*words in verified phonetic transcription*
a. spontaneous face-to-face conversations	106,182
c. telephone conversations (switchboard)	201,141

6.3 What is Vowel Reduction? A CGN-based Approach

6.3.1 Introduction

The experiment to be described in this section aims to provide a clearer picture of the Dutch vowel reduction processes, based on corpus data instead of intuitions. As pointed out in chapter 4, the typical difference between these two types of data collection is that in corpus data, we can make counts and therefore establish the likeliness of occurrence of a given linguistic phenomenon. Moreover, unlike PFC which contained only read speech as a representative of formal style, CGN offers a possibility to check our findings against spontaneous formal talk. Thus, the corpus allows checking the actual ratio of occurrence for each of the reduction processes of Dutch, laxing, reduction, and deletion, in informal speech, and confronting these findings with formal speech facts. Finally, the hierarchies proposed by Booij and Kager for the various vowels of Dutch can be verified on the basis of CGN data.

6.3.2 Method

Please do recall from chapter 5 the four transcripts of the word *banaan* 'banana' that are repeated below, and which show the various reduction possibilities for the vowel /a/.

(227)	a.	banan	formal
	b.	bɑnan	informal: laxing
	c.	bənan	informal: reduction
	d.	ˀbnan	informal: deletion

It is the phonemic differences between the examples in (227) that were encoded in the corpus. COREX, the exploration software designed for the corpus, contains a regular expression search function which can be used to search for these in the phonetic transcripts. It contains the following options for replacing concrete sounds:

(228)	a.	\v	all vowels	g.	\c	all consonants
	b.	\A	short vowels	h.	\e	nasals
	c.	\a	long vowels	i.	\p	plosives
	d.	\@	[ə]	j.	\f	fricatives
	e.	\y	diphtongs	k.	\r	sonorants
	f.	\o	long vowels			

These strings can be grouped into syllables. Dutch syllables can be of the following types, of which the right-hand column gives a transcript according to (228).

(229)

Type	*Description*	*COREX*
A	open syllable with no onset	\v
B	open syllable with simplex onset	\c\v
C	open syllable with complex onset	\c\c\v
D	closed syllable with no onset and simplex coda	\v\c
E	closed syllable with simplex onset and simplex coda	\c\v\c
F	closed syllable with complex onset and simplex coda	\c\c\v\c
G	closed syllable with simplex onset and complex coda	\c\A\c\c
H	closed syllable with a complex onset and a complex coda	\c\c\A\c\c

I	closed syllable with no onset and a simplex coda, containing a long vowel	\a\c
J	closed syllable with simplex onset and simplex coda, containing a long vowel	\c\a\c
K	closed syllable with complex onset and simplex coda, containing a long vowel	\c\c\a\c
L	closed syllable with no onset and a complex coda, containing a long vowel	\a\c\c
M	closed syllable with simplex onset and a complex coda, containing a long vowel	\c\a\c\c
N	closed syllable with complex onset and coda, containing a long vowel	\c\c\a\c\c
O	closed syllable with no onset and a simplex coda, containing a diphthong	\y\c
P	closed syllable with simplex onset and coda, containing a diphthong	\c\y\c
Q	closed syllable with a complex onset and a simplex coda, containing a diphthong	\c\y\c\c

The experiment concentrated on vowels in prosodically weak positions. In order to keep the context of the phenomenon studied constant, the focus was on words ending in a superheavy syllable, bearing final stress, which was the case for the vast majority of these items, in accordance with the minor generalizations discussed in chapter 5. The transcription of the vowel in the penultimate syllable was examined. This syllable was only considered when it was open, as reduction is more difficult in closed syllables. We decided not to take bisyllabic words like *banaan* into account because the syllable *ba* in which reduction takes place is also necessarily the initial syllable, and effects which are specific to this first syllable might influence our results. Moreover, we preferred testing a vowel in interstress position over that of a “stray” syllable: the third syllable of three before main stress. Therefore, only trisyllabic words, or more specifically, nouns, were taken into account, considering the fact that monomorphemic quadrasyllabic words are quite rare. Thus, limiting ourselves to a very strict phonological context allows us to exclude all kinds of external influences on reduction possibilities. (230a) shows the configuration of the words under consideration, and (230b) lists the syllable types involved.

(230) a. Syllabic configuration of the words used as indicators for vowel reduction

#	ˌσ	σ	ˈσ	#
	open or closed	open	superheavy	

b. Possible syllable types in each of the three positions

first syllable	*second syllable*	*third syllable*
A	A	G
B	B	H
C	C	I
D		J
E		K
F		L
		M
		N
		O
		P
		Q

Types G through Q, which are superheavy syllables, do not occur elsewhere than in the last syllable of a word, which is why we excluded them from the first two syllables.

Unfortunately, the COREX program does not support the syllable boundary as a unit, so that we can not distinguish between e.g. a sequence of an open syllable followed by a syllable with a complex onset, and a sequence of a closed syllable with a simplex coda followed by a syllable with a simplex onset: both BC (CV.CCV) and EB (CVC.CV) are encoded as \c\v\c\c\v. This eliminates a great part of the 198 (6 x 3 x 11) logically possible combinations. These are further restricted by the fact that when searching for strings starting with \v, one also finds words that begin with a consonant, but which contain the search terms. For this reason, syllables with and syllables without an onset at the beginning of the word could not be distinguished, which reduces the possibilities for the first syllable to types A and D. A final restriction is the impossibility of having two vowels next to each other, which for instance eliminates the sequence AD: *VVC. If all of these considerations are taken into account, 28 possible strings remain to be entered into the COREX search engine, which are listed in table (1) in Appendix E.

In order to be sure that the vowels were correctly transcribed, the transcription was randomly checked in the corpus sound files. These checks did not reveal any errors, so we assumed that in general, the transcripts were reliable.

6.3.3 Results

A complete overview of results of the COREX query is given in tables (2) through (7) in appendix E, which list all words that fit into template (230a), grouped according to style level (formal/informal) and reduction process that took place in the second syllable (none/laxing/reduction). Deletion did not occur in the trisyllabic words under investigation. The table below lists the number of times the phenomena occurred in the informal part of the corpus. The numbers in parentheses represent the number of different words that displayed the processes, that is, if a given lexical entry (type) occurred multiple times (tokens), it was counted every time for the number in the second column, but only once for the number in the third column.

(231)	*Phenomenon*	*Number of occurrences*		*Examples*
		tokens	*types*	
	conservation	32	20	*advocaat* [ɑtfokat], *instituut* [ɪnstityt]
	laxing	9	7	*apparaat* ɑpɑrat]], *microfoon* [mikrɔfon]
	reduction to [ə]	27	14	*saxofoon* [sɑksəfon],*formulier*[fɔrməlir]

As shown, laxing is more rare than reduction to [ə]. One might wonder if a laxed vowel is not an intermediate stage between a full vowel and [ə]. This idea is corroborated by the case of *apparaat* 'machine', which is realized twice as [ɑpɑrat] by speaker N01141, but also once as [ɑpərat] by the same subject. Furthermore, the cases of laxing we found took place in the second syllable, whereas, as demonstrated in chapter 5, according to Booij (1999) and others it only takes place in word-initial syllables. On the other hand, laxing of the type described by Booij even takes place in cases where the vowel in the second syllable was fully retained, such as in *halogeen* [hɑloɣen] 'halogen' and *kwaliteit* [kwɑlitɛɪt] 'quality'. Therefore, the laxing found in the CGN is of two types: first, the type that takes place in the first syllable of polysyllabic words and to which we will come back in our discussion below, and second, an intermediate stage between vowel conservation and reduction to [ə], which occurs in the second syllable of (230a) type words, the context under investigation here, which for this reason is conditioned exactly like "full" reduction.

Interestingly, the high vowels, which are claimed to be highly resistant to reduction in the literature, did reduce in our corpus, albeit in highly frequent words such as *politiek* [politik → polətik] 'politics' and *formulier* [fɔrmylir → fɔrməlir], or in words often used by the speaker as they concern his or her daily occupation: *machinist* [maʃinɪst] → mɑʃənɪst] 'engineer' by speaker N08078 who is a spokesman for the national railway company.

As mentioned before, deletion did not occur in our set of trisyllabic words. However, while searching for these, we came across a number of words of four and more syllables, in which deletion turned out to be quite frequent. A few examples are given below:

(232)		*Spelling*	*Full form*	*Reduced form*	*Speaker*
	a.	*alcoholist* 'alcoholic'	/ɑlkoholɪst/	[ɑlkolɪst]	N01073
	b.	*materiaal* 'material'	/materijal/	[mɑtrijal]	N08021 and others
	c.	*origineel* 'original'	/oriʒinel/	[ɔʃinel]	N08019
	d.	*universiteit* 'university'	/yniversitɛɪt/	[yniverstɛɪt]	N08025
				[ynivɛstɛɪt]	N08019

Although (232a) might be an accidental fast release, the other three examples are cases of very frequent words. (232d) is extremely frequent throughout, probably because it was the university that collected the corpus data. If deletion occurs, then, it takes place in words of more than three syllables, typically targeting the second syllable, which therefore seems to be in a weaker position than the third, which is also unstressed but not deleted. In general, deletion appears to take place in the weak positions of binary feet, as (232d) show for the fourth syllable before main stress.

In formal style, as expected, the number of reductions is considerably lower, as shown in the table below. The absolute number of occurrences of reduction in the second syllable of trisyllabic words is higher, but this is comprehensible as words with three syllables and more occur more often in formal than in informal speech. Relatively, however, the percentage of reductions on the total amount of vowels in the context at hand is 28.7%, versus 39.7% in informal speech.

(233)

Phenomenon	Number of occurrences		Examples
	tokens	types	
conservation	77	34	*advocaat* [ɑtfokat], *instituut* [ɪnstityt]
laxing	5	4	*dialect* [dijɑlɛkt], *journalist* [ʒurnɑlɪst]
reduction to [ə]	33	16	*paragraaf* [pɑrəgraf], *officier*[ɔfəsir]

Note that the reduction rate is still quite high, especially in light of the hypothesis advanced in the literature that the process is excluded in formal style (cf. e.g. Van Oostendorp 2000:151). In particular, the trisyllabic words of component h, the lessons, display a surprising behavior: there is only one instance of a conserved vowel in this part of the corpus, viz. *structureel* [strʏktyrel] 'structural'. However, even when excluding component h, one is left with a considerable amount of reduction in frequent words, which means that the formal state of affairs as described in the literature only refers to read aloud texts. These and other considerations will be discussed in more detail in the following section.

6.3.4 Analysis and Discussion

Kager (1989:303) proposes the reduction hierarchy below for the Dutch vowel system, only differing from that proposed by Booij (1999) by the position of /ø/, which did not occur in our corpus' reduced syllables:

(234)
a. /e/
b. /a/
c. /o, ø/
d. /i/
e. /u, y/

According to Kager, "only /e/ and /a/ are regularly reducing, /o/ and /i/ reduce only in very informal speech, whereas /y/, /u/, and /ø/ hardly reduce at all" (Kager 1989:303). Our results partly confirm to his hierarchy. Although high vowels, and particularly /y/ in frequent words such as *formulier* [fɔrmylir] 'form' seem to be able to reduce, both in our data and in Kager's hierarchy, high vowels and rounded vowels reduce with more difficulty than others (cf. also Booij 1981). Thus, in general, our corpus data do not contradict Kager and Booij's observations.

The consequent realization of reduced forms of a given lexical item seems to indicate that the process is not applied to every lexical item over and over again, but rather, that it forms an intrinsic property of lexical items.

It looks almost as if every word has an informal pronunciation stored with it, which is linked to the formal pronunciation, as both realizations are recognized as belonging to one particular item. However, the relation between the two surface forms can still be subject to further research: to what extent is it possible for a given formal realization to have a particular informal counterpart? This relation seems to be determined by the prosodic structure of the word.

In the case of words in which laxing takes place in the first syllable, there is important evidence to assume that this is not a reduction process in the sense of this thesis. First, it can take place in initial syllables which bear secondary stress, such as [kwɑ] in *kwaliteit* 'quality' [kwɑlitɛ͡ɪt][45]. Second, for some speakers, the full form as indicated in the dictionary is hardly possible, and the form with a lax vowel (especially [ɑ]) in the initial syllable is used throughout. The author of this thesis, realizing that he should not apply introspection after arguing that it cannot be a useful instrument in linguistic research, still feels that a pronunciation [banan] as proposed by Kager and, for instance, the Van Dale dictionary (although in the latter, [bɑnan] is indicated as a second possibility) is impossible in his speech. Intuitively, it seems like all [a] vowels in the initial syllable are automatically laxed, even though the syllable is open. This conclusion is confirmed by the CGN data under consideration. The vowel [a] only occurs in an open initial syllable of a trisyllabic word in the following case:

(235)	*Arabist*	[arabɪst]	component c, speaker N08017

It is not surprising that this speaker is from region I: laxing in the initial syllable might be a regional phenomenon, which occurs everywhere in the Netherlands, except in the *Randstad* area. Independent of the way this variation is analyzed, the contrast of lax versus tense vowels in initial syllables does not seem to concern the subject of this thesis, as speakers tend to have one of the vowels, and not to vary them according to speech rate or style.

In our corpus, conservation of the vowel and reduction to [ə] largely outnumber the cases of laxing and complete deletion. For this reason, vowel reduction rather than laxing, which moreover exists in the two types just described, and deletion, which is limited to words of four syllables and more, is linked to the prosodic structure of Dutch. In the following sections, we will try and establish how this link can be described.

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[45] Although this does not seem to be the case for all speakers: one of the members of the manuscript committee pointed out to us that an increasing number of speakers say [kwaːlitɛ͡ɪt], including a fellow linguist and newscasters.

6.4 O-coloring and Pre-r Lengthening

6.4.1 Introduction

As demonstrated in chapter 5, the footing of Dutch pre-main stress syllables has been described in the following three ways:

(236)		*tomaat*	*chocola*	*locomotief*	
	a.	toˈ(mat)	ˌ(ʃo.ko)ˈ(la)	ˌ(lo.ko)moˈ(tif)	(cf. Kager 1989)
	b.	(to)ˈ(mat)	ˌ(ʃo.ko)ˈ(la)	ˌ(lo.ko)(mo)ˈ(tif)	(cf. Van Oostendorp 2000)
	c.	toˈ(mat)	ˌ(ʃo.ko)ˈ(la)	ˌ(lo.ko.mo)ˈ(tif)	(cf. Rietveld et al. 2004)

In this section, we will focus on *locomotief*-type words, as these have a different footing for each of the three models proposed. By means of two processes triggered by [r] and conditioned by the prosodic structure, we will try and determine if the third syllable in these words is unfooted, footed in a monosyllabic foot, or incorporated in a ternary foot.

As had already been remarked by Donders (1870), who claims the mid vowels can only be well heard when they are followed by [r], and more recently by 't Hart (1969), Gussenhoven (1993), and Van Oostendorp (2000), Dutch [r] affects the vowels preceding it: high and mid vowels are lengthened, and mid vowels are in addition colored. For these reasons, [i] in *pier* [piːr] 'worm' is longer than that in *piek* [pik] 'summit', and [o] in *koor* [koᵊr] 'choir' sounds differently from that in *koop* [kop] 'purchase'. These processes, like vowel reduction, are claimed to be conditioned by foot structure: coloring does not take place when the vowel and [r] are in two different feet, and lengthening only occurs when the vowel is in the same foot as [r]. Therefore, both phenomena seem ideally suited to test footing independently of vowel reduction. The following subsections will treat coloring and lengthening in more detail, and describe the experiments conducted.

6.4.2 O-coloring

6.4.2.1 Introduction

Gussenhoven & Jacobs (1998:252) give examples of mid vowel centralization before [r] in Dutch. Some of these examples are copied below.

(237)	a.	[meᵊr]	'more'
	b.	[meeˈrɛɪzən]	'with-travel' (= 'to accompany')

As in (237a), the mid vowels [e, ø, o] are colored by the following [r] if followed by [r] in the same phonological word. Carlos Gussenhoven (p.c.) hypothesizes this coloring process to take place whenever [o] occurs in front of [r], except when [o] and [r] are in two different feet, as is clearly the case in (237b). Thus, as an indicator for foot structure, the centralization of mid vowels could help determine the way pre-main stress syllables are footed. In particular, in *locomotief*-type words, if the mid vowel is placed at the end of the third syllable, and the [r] at the beginning of the fourth, the following predictions are made:

(238)	a.	ˌ(σσ) σ ˈ(σ)	coloring
	b.	ˌ(σσσ) ˈ(σ)	no coloring
	c.	ˌ(σσ)(σ)ˈ(σ)	no coloring

In (238a) the primary stress syllable and the one that precedes it are not in two different feet, so the coloring process is expected to take place. If the structure of four syllable words with final stress is that of (238bc), however, no coloring is predicted to occur.

The mid vowel to be used in the experiment would preferably be [o], because it seems to us that for this vowel, the difference between the original [o] and the centralized/colored version [oᵊ] is the best perceptible to Dutch speakers.

6.4.2.2 Method

The test items can be grouped according to the number of syllables and the expected prosodic structure, as shown in (239) below. Possible test words are given in (239a). All of these words, except *categorie*, are morphologically complex, ending in suffixes *–aat* or *–iek*. We were not able to find more underived words of the type needed.

(239) a. test condition:
three syllables before main stress

categorie
monitoraat
metaforiek
elaboraat
revisoraat
electoraat
directoraat

b. two syllables preceding main stress
NO COLORING
perforatie
diorama
decoratie
laborante
honorarium
panorama

c. one syllable preceding main stress
COLORING
moraal
koraal
orakel
oratie
gorilla
forens
oranje

d. fillers
NO COLORING
hegemonie
kosmopoliet
dermatoloog
anakoloet
homeopaat
pedagogiek
telefonie
filosofie

Following Gussenhoven's assumption that coloring does not occur when [o] and [r] are in two different feet, we would expect it to affect the words in (239c), where [o] is not footed, but not those in (239b), where [o] and [r] are in two different feet, nor the fillers which do not contain [r] in the given context at all. The results for the test words in (239a) can than be compared to those from (239c) on the one hand, and (239bd) on the other. If the third syllable is not footed, (239a) items are expected to behave exactly like (239c) words.

Measuring coloring of a vowel is rather difficult, because it results in other formants for his vowel in a spectrogram, which should be compared to the original F1 and F2 in a similar context. Moreover, separating the realization of the vowel from that of a following liquid is cumbersome. Therefore, we decided to base the experiment on speakers' intuitions rather than on actual realizations.

All items were thus presented on paper (in normal Dutch spelling) to 25 students of French literature and linguistics at the Radboud University Nijmegen. The subjects were explained the difference between the two types of [o] by means of the following set of examples.

(240)

	A	B
	koop	koor
	telefoon	oren
	girorekening	quorum

Next, they were asked to indicate if the underlined [o] vowel in the test words belonged to type A (without coloring) or B (with coloring) in Dutch pronunciation. Full instructions in Dutch can be found in appendix F. The subjects were not rewarded for their effort.

6.4.2.3 Results

The results of two subjects had to be discarded, as one of them indicated not to understand the difference between the types A and B, and the other one was not a native speaker of Dutch. The results for remaining subjects are schematized below:

(241) Number of subjects opting for non-colored vowel (A) versus colored vowel (B).

	A	B		A	B
a. test words			b. two syllables preceding main stress		
categorie	1	22	*perforatie*	4	19
monitoraat	4	19	*diorama*	17	6
metaforiek	4	19	*decoratie*	3	20
elaboraat	3	20	*laborante*	3	20
revisoraat	1	22	*honorarium*	12	11
electoraat	1	22	*panorama*	6	17
directoraat	3	20			
Total	17	144	Total	39	93
Average	2,4	20,6	Average	7,5	15,5
c. one syllable preceding main stress			d. fillers		
moraal	3	20	*hegemonie*	21	2
koraal	7	16	*kosmopoliet*	19	4
orakel	2	21	*dermatoloog*	19	4
oratie	0	23	*anakoloet*	20	3
gorilla	6	17	*homeopaat*	19	4
forens	6	17	*pedagogiek*	22	1
oranje	7	16	*telefonie*	18	5
			filosofie	20	3
Total	31	130	Total	158	26
Average	4,4	18,6	Average	19,8	3,3

As shown in the table, coloring occurs in our test group (241a). It is however impossible to draw conclusions from this fact, as our subjects seem to automatically apply o-coloring to every [o] which is followed by [r]. Thus, there appears to be a preference for the B-type, colored, vowel even when this vowel and the following [r] are in two different feet as in (241b). There is a significant difference between (241b) and (241c) (T (22)= -2.87, p = .009), the proportions of A and B being clearly different (coding A as 0 and B as 1, average for (241b) = .68, sd = .23. For (241c), average = .81, sd = .19). However, when applying a repeated measures ANOVA, including (241a) and (241d) and taking into account the number of possible comparisons (Bonferroni), a p-value of .054 is found. This means that if we compare the four groups, (241b), where coloring was to expected be excluded, and (241c), where it should have been abundant, do not differ significantly[46].

6.4.2.4 Analysis and Discussion

Contrary to what we expected, the difference between [or] occurring in two different feet and the same sequence elsewhere is very poorly present in our subjects' linguistic intuitions. If this is the case, nothing can be said about the foot structure of our test group, because subjects think they perceive coloring both if the vowel and [r] are in two different feet, and if they are not.

The poor results of the experiment as reported thus far could be due to the fact that the subjects identified the test words with words having a similar meaning or segmental structure, but with a different foot structure. For instance, the status of [o] in *metafoor* [me.ta.foᵊr] 'metaphor' might influence the judgment of the [o] in the derived test word *metaforiek*. Furthermore, words in the category "two syllables before main stress" were hard to find, which resulted in rather rare (*diorama*) or morphologically complex (*laborante*) test items.

For these reasons, we decided to repeat the experiment with nonsense words, which could more easily be shaped the way we desired. An extra category was created to test whether [o] is also colored when it is in the same foot as [r]. We constructed 30 test words, by using the consonants [p, b, t, d, k, n, s] and vowels [i, a, o, u]. The items can be grouped according to the number of syllables and the expected prosodic structure, as shown in (242). First, a group of six words of the form $\sigma\sigma\underline{\sigma}\,^{\text{ˈ}}(\sigma\sigma)$ was created ((242a)). The underlined syllable contained [o], whereas the syllable following it, in this case the syllable bearing primary stress, started with [r]. In order to guarantee stress on the penultimate syllable, this syllable was always closed,

[46] Frans van der Slik (p.c.)

whereas the others were open (closed penult restriction, see chapter 5). Next, three groups of words were constructed ((242bcd)) to which the first group was to be compared. These have the forms $\sigma^{ˈ}(\underline{\sigma}\sigma)$, where [o] and [r] are in the same foot ((242b)), $\sigma\underline{\sigma}^{ˈ}(\sigma\sigma)$, where [o] is in the second syllable instead of the third ((242c)), and $\underline{\sigma}^{ˈ}(\sigma\sigma)$, where it is in the first ((242d)). In both (242c) and (242d), the syllable containing [o] precedes the main stress foot, which starts by [r], as was the case for (242a). Finally, the six fillers in (242e) were included in which [o] was directly followed by another consonant than [r].] Stress was not indicated in the words because they were all constructed in such a way that it could only be in one syllable (obeying both major and minor generalizations).

(242) Test items as used in a second o-coloring experiment

a.	test words	b.	[o] and [r] in same foot COLORING
	Dobakorosta		*Satori*
	Kitunorinti		*Tukora*
	Padilorunta		*Badoru*
	Bakitoraski		*Kiboro*
	Tobukoristu		*Tikori*
	Pokutorasku		*Katoru*
c.	two syllables before main stress NO COLORING	d.	one syllable before main stress COLORING
	Kunorindi		*Oroski*
	Sitoraski		*Poristu*
	Batoronta		*Soranki*
	Sikoristu		*Borinda*
	Tuborinti		*Torusko*
	Pisoranku		*Korindi*
e.	fillers NO COLORING		
	Blikodinti		
	Odarindi		
	Sibokunka		
	Katonarunpa		
	Posuski		
	Takolinta		

We presented these words to a test group of 12 subjects. The instructions were identical to those provided for the initial experiment, except that we had to explain for the nonsense words. To the latter goal, we had the subjects assume the words were town names in an African language (full instructions in Dutch can be found in Appendix G).

Unfortunately, replacing existing words by nonsense words did not improve our test results. On the contrary, in group (242c), where coloring is supposed to be excluded due to the fact that [o] and [r] are in two different feet, it occurred in 85% of the cases. Although o-coloring might be a valid indicator for foot structure for part of the native speakers of Dutch, e.g. from other parts of the country, it appeared not to be for most of the subjects we tested. As the difference between (242c) and (242d) turned out to be inexistent according to their judgments, we were not able to establish as which of these two groups the group of words in (242a) behaves. This leaves us with no choice other than to abandon o-coloring as an indicator for foot structure: it seems that, according to subjects' judgments, every [o] that is followed by [r] is perceived as colored, regardless of the prosodic structure.[47]

6.4.3 Pre-r Lengthening

6.4.3.1 Introduction

Gussenhoven (1993:47ff.) describes the process of lengthening that occurs in Dutch high vowels before [r]. Interestingly, unlike [r]-coloring, this process only takes place if the tense vowel and [r] occur in the same foot. Some of the examples provided by Gussenhoven are copied in (243).

(243)	a.	*Olivier*	ˈ(oli)(vi:r)	'Oliver'
	b.	*sloerie*	ˈ(slu:ri)	'slut'
	c.	*piraat*	piˈ(ra:t)	'pirate'
			*pi:(ra:t)	
	d.	*admiraal*	(atmi)ˈ(ra:l)	'admiral'
			*(atmi:)ˈ(ra:l)	(Gussenhoven 1993:48)

Note that [i] and [u] lengthen if [r] is in the same foot (as in (243ab)), but fail to do so if the high vowel is not footed ((243c)) or if the segments are in two different feet, as shown by (243d). (243a) demonstrates that main stress is not a factor in this lengthening process: [i] also lengthens before [r] in a foot that does not bear main stress.

[47] In future research, one might try having one subject pronounce the items from the experiments, and check the actual perception of coloring in these by other speakers.

As seemed to be the case for o-coloring, the process of pre-r-lengthening could be used as an indicator for the occurrence of vowels and [r] in the same foot. Thus, a production experiment can be designed in which the duration of the high vowel is measured in three positions:

(244)	a.	ˈ(x .) i]$_{\sigma}$ $_{\sigma}$[r	LENGTHENING		
	b.	(x .) ˈ(x .) i]$_{\sigma\sigma}$[r	NO LENGHTENING		
	c.	1. (x .) . ˈ(x) i]$_{\sigma}$ $_{\sigma}$[r	2. (x .) (.) ˈ(x) i]$_{\sigma\sigma}$[r	3.	(x . .) ˈ(x) i]$_{\sigma\sigma}$[r
		NO LENGTHENING	NO LENGTHENING	LENGTHENING	

In (244a), the high vowel, symbolized by [i], is expected to lengthen, whereas in (244b), it is not, [i] and [r] being in two different feet. In the case of three pre-main stress syllables, either [i] does not lengthen, and we expect the structure in (244c.1) or that in (244c.2), and thus a binary foot, or it does, in which case structure (244c.3) is predicted, with a ternary foot.

6.4.3.2 Method

Three base words and three suffixes were used to construct a set of 12 stimuli listed in (245). The underlined syllable contains the high vowel that was measured. Words with two to five syllables were obtained. Some of these are neologisms, but their meaning is assumed to be straightforward for all speakers of Dutch, since we suffixed proper names (as indicated by the initial capital) with very frequent suffixes, comparable to '-ism', and '–ian' in English.

(245)	Base			
	a.	*Arthur*	ˈ($\underline{\sigma}\sigma$)	id.
	b.	*Sapir*	ˈ($\underline{\sigma}\sigma$)	id.
	c.	*Epicurus*	($\sigma\sigma$)ˈ($\underline{\sigma}\sigma$)	id.
	Base + *-isme*			
	d.	*Arthurisme*	($\sigma\underline{\sigma}$)ˈ($\sigma\sigma$)	'Arthurism'
	e.	*Sapirisme*	($\sigma\underline{\sigma}$)ˈ($\sigma\sigma$)'	'Sapirism'
	f.	*Epicurisme*	($\sigma\sigma$)$\underline{\sigma}$ˈ($\sigma\sigma$), ($\sigma\sigma$)($\underline{\sigma}$)ˈ($\sigma\sigma$), or ($\sigma\sigma\underline{\sigma}$)ˈ($\sigma\sigma$)	'Epicurism'
	Base + *-iaans*			
	g.	*Arthuriaans*	($\sigma\underline{\sigma}$)σˈ(σ), ($\sigma\sigma$)($\underline{\sigma}$)ˈ($\sigma\sigma$), or ($\sigma\underline{\sigma}\sigma$)ˈ($\sigma$)	'Arthurian'

h.	*Sapiriaans*	$(\sigma\underline{\sigma})\sigma^{\prime}(\sigma)$, $(\sigma\sigma)(\underline{\sigma})^{\prime}(\sigma\sigma)$, or $(\sigma\underline{\sigma}\sigma)^{\prime}(\sigma)$	'Sapirian'
i.	*Epicuriaans*	$(\sigma\sigma)(\underline{\sigma}\sigma)^{\prime}(\sigma)$	'Epicurian'[48]

Gussenhoven predicts that (245ab) are longer than (245de), because in the former cases, the high vowel and [r] are in the same foot, where as in the latter, they are not. The important items for our purposes are (245gh)[49]. Depending on their prosodic configuration, the length of the measured high vowels in these items can either be lengthened as in (245abc) or short as in (245de). Note hat the length of the vowels might be reduced as a result of the number of syllables, just as the length of the stressed syllable is reduced when the number of unstressed syllables is augmented (Nooteboom 1972, Rietveld et al. 2004), which might make the comparison of (245gh) to (245ab) difficult.

The stimuli were integrated into a carrier phrase, in which focus was on the final word. Thus, we obtained an out of focus realization of stimuli, and avoided lengthening effects that occur in focus position (cf. Sluijter & Van Heuven 1996:2475, Waals 1999:18). The carrier phrase was varied, both to avoid boring the subjects and to help them place the focus on the right word. Also to the latter goal, *en niet …* 'and not ..' was added, followed by a verb contrasting with the verb in focus. (246) shows the possible forms of the phrase.

(246)

		gefluisterd 'whispered'		*gefluisterd*
Ik heb	"[stimilus]"	*geroepen* 'called'	*en niet*	*geroepen*
'I have'		*gezegd* 'said'	'and not'	*gehoord*
		gelezen 'read'		'heard'

Thirty-two subjects were recruited for the reading task. They read the resulting 384 (12 x 32)[3] phrases aloud, which were shown to them one by one in an on-screen presentation controlled by a time clock. Subjects were recorded with a Labtec® microphone on a regular PC, and the results were subsequently analyzed with PRAAT by two independent transcribers.

On the basis of measured vowel length, the following comparisons were made:

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48 The original experiment further contained *Arthurianisme, Sapirianisme,* and *Epicurianisme*, which we omitted later on because in these words, length of the vowels is likely to be heavily influenced by the exceptional length of the words.

49 In (245f), lengthening does not allow us to choose any of the three footing options, because in none of these, [y] and [r] occur in the same foot: [r] is the onset of the main stress syllable here.

(247)		*comparison*	*expected length of test vowel*
	a.	1. (245a) vs. (245d)	(245a) > (245d)
		2. (245b) vs. (245e)	(245b) > (245e)
		3. (245c) vs. (245f)	(245c) > (245f)
	b.	1. (245g) vs. (245d)	bisyllabic foot: (245g) = (245d)
			trisyllabic foot: (245g) > (245d)
		2. (245h) vs. (245e)	bisyllabic foot: (245h) = (245e)
			trisyllabic foot: (245h) > (245e)

The comparisons in (247a) were made in order to verify Gussenhoven's assumption on lengthening of high vowel before [r] in the same foot. The crucial comparisons are those in (247b).

As already shown in (247), two hypotheses were considered. According to the first hypothesis, in (245gh) the first two syllables are grouped together; according to the second hypothesis, the first three syllables are grouped together in these examples. The consequences of the two hypotheses for the expected outcome of comparisons (247b) are represented in (248).

(248)		Hypothesis I	Hypothesis II
		same	*different*
		(σσ)σˈ(σ… /(σσ)(σ)ˈ(σ…	(σσσ)ˈ(σ….
(247b)	*Arthurisme/Sapirisme*	(σ$\underline{\sigma}$)ˈ(σσ)	(σ$\underline{\sigma}$)ˈ(σσ)
	Arthuriaans/Sapiriaans	(σ$\underline{\sigma}$)σˈ(σ) / (σσ)σˈ(σ)	(σ$\underline{\sigma}$σ)ˈ(σ)

6.4.3.3 Results

By means of the statistical package SPSS 12.0.1, we analyzed the duration of the vowels for the relevant stimuli, performing Student's t-test to check if the difference between the mean durations for a given vowel in a stimulus differed significantly from that of the vowel in the stimulus it is compared to. This yielded the following results.

(249)		*comparison*	*result* *df*	*t*	*p*	*significance (5% level)*
	a.	1. Arthur ~ Arthurisme	60	1.877	.065	not significant
		2. Sapir ~ Sapirisme	60	3.537	.001	significant
		3. Epicurus ~ Epicurisme	59	6.030	.000	significant
	b.	1. Arthuriaans ~ Arthurisme	59	1.235	.222	not significant
		2. Sapiriaans ~ Sapirisme	57	1.784	.080	not significant

6.4.3.4 Analysis and Discussion

As shown in (249), the results are all in line with Hypothesis I, except for the difference between *Arthur* and *Arthurisme.* In this case, the expected difference in length between the vowel [i] in both words was not significant. It was so in the other comparisons (249a), so that one could suppose that at least lengthening of [i] can be used to test the grouping of syllables into feet.

However, the fact that the pair (249a3) shows a significant result is likely to be due that in *Epicurus*, stress is on the syllable [ky], which automatically lengthens this vowel. Therefore, the length of the [y] in this word is likely to be superior to that in *Epicurisme* [epikyˈrɪsmə], where it is not stressed. This pair can therefore not be used to establish the length difference, as the exterior factor of main stress influences vowel length here.

A similar effect seems to take place in the pair (249a2). Although in the proper name Sapir, stress should be on the first syllable, 12 out of 32 subjects, unfamiliar with this early twentieth century linguist, pronounced [saˈpir] instead of [ˈsapir]. However, if we omit these subjects from our statistics, we get the same result: the difference between the two test vowels is still significant: t= 1.877, p = .001. We can therefore conclude that, although there is no significant effect for the vowel [y] in *Arthur ~ Arthurisme*, there is lengthening of [i] before [r] in the same foot, which in the case of (248a) is that bearing main stress.

Turning now to the pair that is most relevant for our purposes, viz. *Sapiriaans ~ Sapirisme,* we see that the lengths of the two vowels do not differ significantly. Therefore, as predicted by hypothesis I, they must be footed identically: (sapi)ˈ(rɪsmə) and (sapi)riˈ(ans) or (sapi)(ri)ˈ(ans).[50] On the basis of these two pairs, we can conclude that hypothesis I must be true, and that three syllables before main stress are footed as (σσ)σˈσ or (σσ)(σ)ˈσ, and not as (σσσ)ˈσ.

However, a critical note is in order: we can now only draw conclusions on the basis of the lengthening of [i]. Furthermore, note that it was not possible to compare words of identical length, so that the shorter [i] in *Sapirisme* might also be due to the fact that this words simple has more syllables that *Sapir*. The length of the words cannot be kept constant, because we need words with different numbers of syllables before main stress in order to compare the different footings: a word with an identical number of

[50] There is also no such effect for *Sapiriaans ~ Sapirianisme*. Even though we might expect the second vowel in *Sapirianisme* to be shorter than that in *Sapiriaans,* as the former word is two syllables longer than the latter, the length difference is not significant.

open syllables preceding the main stress foot will be footed identically. Finally, as the lengthening process only occurred for [i] in *Sapir*, we are not sure if the lengthening process is not simply limited to the primary stress foot.

In sum, the results of this experimental study, although partly significant, are not very convincing. They seem to point in the direction of a binary foot pattern.

6.5 Chanted Call

6.5.1 Introduction

In the preceding section, experiments were conducted in order to determine in which way pre-main stress syllables are footed. In this and the following section, focus is moved to the place of this footing, and that of vowel reduction, in the derivation from lexical input to phonetic output. It will be attempted to find independent motivation for the existence of multiple levels.

In this section, we will investigate if vowel reduction in some way influences the process of footing. More precisely, the question will be examined if footing takes place again once vowel reduction, in an extreme case, has removed a vowel from its syllable. For example, if in *locomotief*, the second syllable loses its vowel, and the word is pronounced [lokmotif], is it still footed (lok)mo(tif)/(lok)(mo)(tif), or is there a process of refooting, which changes the structure into (lokmo)(tif)?[51] The Chanted Call, presented by Gussenhoven (1993) will be used here to establish the structure of word with a deleted vowel. Before turning to the experiment needed for our own purposes, let us first introduce the Chanted Call and discuss the way Gussenhoven proceeds to reveal the structure of post-main stress syllables.

Gussenhoven (1993) investigates Dutch stress patterns by means of a number of phenomena that are conditioned by foot structure. One of these is the Chanted Call, an intonation contour that occurs when a subject calls out someone's name. In Dutch, there is a change of pitch level in the Chanted Call at the start of every new foot. Furthermore, the final syllable receives a boundary tone. An example is given below.

[51] Note that if ternary feet are assumed, the structure does not change after vowel deletion, because with or without refooting, (lokmo)(tif) is obtained.

(250) *Annemieke* 'first name'

(ɑn. nə) (miː. kə)

As shown in (250), the syllable [miː], as the first syllable in the second foot, gets a higher pitch level then the preceding two syllables which are grouped into one foot. [kə] has the lowest pitch level because it attracts the boundary tone.

The Chanted Call is thus directly linked to the prosodic structure. As such, it is an ideal testing ground to establish how syllables are footed in Dutch. The goal of Gussenhoven's experiments is to establish which of the patterns is correct in the pairs (251a) and (251b).

(251) a.	*harnas* 'suit of armour'	b.	*almanak* 'almanac'	
	1. ˈ(hɑr)(nɑs)		1.	ˈ(ɑl.ma) (nɑk)
	2. ˈ(hɑr.nɑs)		2.	ˈ(ɑl.ma)nɑk

Adding the diminutive suffix to words in order for it to attract the boundary tone, Gussenhoven is able to detect the beginning of a foot by a change of tone in the Chanted Call. As [har] and [nas] on the one hand, and [ma] and [nak] on the other are not on the same tone level, the patterns on the first row are the correct ones. I.e., "words with the main stress on the penult end in disyllabic feet" (Gussenhoven 1993:47; example (251a.2)). Moreover, it is shown that "[w]ords with the main stress located on the third syllable from the end have a final monosyllabic foot" (Gussenhoven 19993:47; example (251b.1)).

As indicated above, the Chanted Call will be used here to establish the structure of words with a deleted vowel. An example is given below.

(252) *Reduction of* sigaret *'cigarette'.*

a.	ˌ(si xa)	ˈ(rɛt)	→	b.	si	x	rɛt
				1.	(si	x)	(rɛt)
				2.	si	(x	rɛt)

When vowel deletion takes place in the case of *sigaret*, it is possible that the original foot structure is conserved (252b.1). Alternatively, the remaining sequence [sixrɛt] is partly or entirely reparsed into syllables and consequently into feet, which would yield a structure comparable to that of [piˈraat] 'pirate', where the first syllable is not footed (252b.2). The Chanted Call is an ideal instrument to investigate whether the structure of (252b.1) or (252b.2) is the foot structure of the reduced form of *sigaret*, as it marks the beginning of a foot by a change in tone.

6.5.2 Method

As we have seen, a new pitch level starts at the beginning of every foot. It goes without saying that every word also starts with a new pitch level. Therefore, in order to check if the syllable [si] is at the beginning of a foot, a prefix should be added to the word *sigaret*, such as *nep-* [nɛp] 'fake' or *rot-* [rɔt] 'rotten'. If a change of pitch then occurs in [si], it is still footed as before the reduction (as in (252b.1)). The absence of a pitch change would point into the direction of structure (252b.2). In order to get a complete picture of word structure, the diminutive suffix *–je* can be added. Thus, as the final boundary is attracted by the suffix as in Gussenhoven's experiments. The test word then is *nepsig(a)retje* [nɛpsiɣrɛtjə], for which the two possible Chanted Call patterns are visualized in (253).

(253) Chanted Call pitch levels for *nepsigaretje*

a.

nɛp si ɣrɛt je

b.

nɛp si ɣrɛt je

Pattern (253a) is similar to that of a compound word like *si-toon* [ˈsiˌtoːn] 'si-tone'. Both parts of the compound are stressed, and therefore receive two different pitch levels. On the other hand, in a word like *citroen* [siˈtrun] 'lemon', the first syllable is unstressed and unfooted, and its Chanted Call is therefore comparable to that in (253b). If these two words are augmented with the same suffixes as our reduced form *sigaretje*, the patterns in (254) are obtained, which are identical to those in (253).

(254) *Chanted Call pitch levels for* nep-si-toontje *(a) and* nepcitroentje *(b).*

a.

nɛp si toːn tje

b.

nɛp si trun tje

In the Chanted Call experiment in this thesis, we asked our subjects to choose between patterns (253a) and (253b). Stimuli were obtained by pasting the [nɛpsi] parts of (254a) and (254b) into the reduced form of *nepsigaretje*.

For the recording of the stimuli, one linguistically trained speaker was asked to produce the Chanted Call forms of *nepcitroentje, nep-si-toontje* and *nepsigaretje*. In the case of *nepsigaretje,* the full, unreduced, form was recorded, because the speaker did not tend to delete or reduce the weak vowel in words like *sigaretje* in his normal speech. During the recordings, the speaker practiced the Chanted Call intonation by augmenting the length of the words step by step, e.g.: *toontje! si-toontje! nep-si-toontje!* Moreover, he was asked to produce similar forms starting with [nɛpɑs]: *nepasperge* [nɛpɑspɛrʒə] 'fake asparagus', *nepasbakje* [nɛpɑzbɑkjə] 'fake ashtray' and *neasp(i)rientje* [nɛpɑsp(i)rintjə] 'fake aspirin tablet', of which the foot structure corresponds to *nepcitroentje, nep-si-toontje,* and *nepsigaretje*, respectively.

Subjects were recruited among students and (not linguistically trained) colleagues at the department of Romance Languages at the Radboud University Nijmegen. Three types of stimuli were created. First, three training stimuli were obtained. Using PRAAT, we manipulated three short words the speaker used to familiarize himself with the Chanted Call. Thus, for each of the words, we obtained two versions: the original version and the version with a manipulated pitch contour. Next, the longer stimuli were numbered as in (255). In the cases of stimuli *si*3B and *as*3B, we cut out the vowel in the weak position, [a] in the case of *–garetje* and [i] in the case of -*pirientje*.

(255) *Numeration of stimuli*

si	A	B	*as*	A	B
1.	*nepci*	*troentje*	1.	*nepas*	*perge*
2.	*nepsi*	*toontje*	2.	*nepas*	*bakje*
3.	*nepsi*	*gretje*	3.	*nepas*	*prientje*

The different chunks shown in (255) were then cut out and stored in different files. Afterwards, they were put together to make up the sequence of stimuli in (256). Cutting was done through zero crossings in order to avoid clicking sounds and intensity of the various chunks was scaled with PRAAT (new average intensity 70dB).

(256) *Stimuli in Chanted Call experiment*

a.	bakje	man.	vs.	org.		training stimuli
b.	citroentje	org.	vs.	man.		training stimuli
c.	asbakje	org.	vs.	man.		training stimuli
d.	*as* 1A	1B	vs.	2A	1B	

e.	*si*	1A	3B	2A	3B
f.	*si*	1A	2B	2A	2B
g.	*as*	3A	3B	1A	3B
h.	*si*	2A	1B	1A	1B
i.	*si*	2A	3B	3A	3B
j.	*as*	2A	3B	3A	3B
k.	*si*	3A	3B	1A	3B

As mentioned above, (256abc) were training sequences, meant to help the listener to get used to differences in intonation patterns. In each of these three cases, we manipulated the intonation contour of the word with PRAAT, and presented this version (man.) together with the original (org.) to the listeners.

(256d-k) make up the core part of the experiment. These were constructed in a different way: they consist of two repetitions of two versions of a word, each made up by two chunks from (255). Each sequence (256a-k) was played twice in a row. Subjects were asked to indicate on a sheet of paper which of the two versions was the better one, or, more specifically, the one that sounded more naturally. A copy of the instructions presented to them can be found in Appendix H. Three options were offered: both versions are equally well-formed, the first one (A) is better than the second one (B), or B is better than A.

An example will clarify the exact test situation. Stimulus (256h), for instance, consisted of the first part of *nep-si-toontje*, together with the second part of *nepcitroentje* (2A 1B)(version A). Next, the sequence 1A 1B (i.e., the first and the second part of *nepcitroentje*) was presented to the subject (version B). Version A and B were played another time to facilitate the listener's choice.

6.5.3 Results

The three subjects recruited for a pilot test found the task extremely difficult. They complained of not hearing the difference between the stimuli at all, even for the training words (256abc) in which the speech signal was manipulated in order to make them sound different from each other. The subjects did not know what factors to take into account when making a decision, and therefore turned to factors we did not control, such as pitch of the first syllable, and length of the vowels. Although the subjects indicated to be familiar with the Chanted Call, they were not able to provide judgments on correctness of the pattern when confronted with two options.

6.5.4 Analysis and Discussion

As the three subjects were not able to hear any difference between the pairs of stimuli, and because of the fact that even trained linguists whom we asked to listen to them could not, we decided not to persist in using the speech material of our speaker for the experiment. Apparently, the different pitch levels were hard to recognize. This could also be due to the fact that the level of *si* in *nepsig(a)retje* is different from that of *ci* in *nepcitroentje*, but also from that of *si* in *nep-si-toontje*. Average F_0 for these levels in our stimuli is shown below.

(257) *Average pitch level in Hertz for the various stimuli produced twice by one linguistically trained speaker. Values were obtained using* P*RAAT's manipulation option, setting maximum pitch to 300 Hz.*

a.	*nepci*	*troen*	*tje*
	nepas	*per*	*ge*
	219	139	106

b.	*nep*	*si*	*toon*	*tje*
	nep	*as*	*bak*	*je*
	230	165	130	109

c.	*nep*	*siga*	*re*	*the*
	nep	*aspi*	*rien*	*tje*
	228	191	139	106

As can be seen in (257), the pitch level also varies according to the number of syllables the speaker is planning to produce. Also, there is a tendency to start with a higher pitch as soon as the number of pitch levels to produce on one word increases.

We considered recruiting more speakers for the production of the stimuli, but abandoned this idea because of two reasons. First, a speaker using the exact same Chanted Call as the one described in Gussenhoven (1993) was hard to find. Second, it turned out to be even more difficult to come across subjects willing to shout words like 'little fake cigarette' out loud as if they were dogs' names. In the one speaker we succeeded to persuade, there was no difference in pitch levels for [nɛpsi] between *nepcitroentje* and *nep-si-toontje*.

Another option would be to copy the desired pitch levels onto the stimuli *nepsig'retje* and *nepasp'rientje*.[52] However, the difference between the various options (the original without the vowel, first with the original pitch level, then with that of *nepcitroentje* and finally with that of *nep-si-toontje*) remained very poorly perceptible, even to ourselves. Moreover, the result sounded less natural than the chunks we used for the pilot experiment. Thus, using the Chanted Call for a production or perception experiment proved highly difficult, if not impossible.

The Chanted Call experiment described in this section did not help us to establish if a separate level is required to incorporate reduction. However, the existence of such a level can be indirectly motivated: as we have demonstrated in chapter 5, the difference in importance of the weight-by-position constraint can only be described in a strictly parallel model by assuming this constraint to be split into two (cf. Gussenhoven 2007). As argued, this seems to point into the direction of multiple levels. In the next section, an experiment we conducted in order to find out if both stress types should be treated at one and the same level is described.

6.6 Main Stress First? [53]

6.6.1 Introduction

Chapter 5 showed that there are various reasons to assume that primary and secondary stress feet are not formed at the same level of the phonological derivation. If this is indeed not the case, then it would not be surprising for vowel deletion to take place at yet another level. As we mentioned in section 5.3.4, Ernestus & Neijt (forthcoming) argue against this assumption. In their article, it is shown that there is a difference in stress patterns between trisyllabic and quadrasyllabic words of which the last syllable is closed. According to Ernestus & Neijt, this means that there is a tendency towards exhaustive parsing (contra Van der Hulst 1999): in the CELEX database of the

[52] The author is greatly indebted to Joop Kerkhoff who proposed and attempted this.
[53] Part of the results of this section were published earlier as Geerts (2007).

Dutch lexicon, (217b) is preferred over (217a), although one would expect the final heavy syllable to attract the head position of a foot, regardless of the number of syllables.

(258)		Three syllables	Four syllables
	a.	$_{\shortmid}(\sigma\sigma)\ ^{\shortmid}(\sigma)$	$_{\shortmid}(\sigma\sigma)\sigma^{\shortmid}(\sigma)$
	b.	$_{\shortmid}(\sigma\sigma)\ ^{\shortmid}(\sigma)$	$_{\shortmid}(\sigma\sigma)^{\shortmid}(\sigma\sigma)$
	c.	$_{\shortmid}(\sigma\sigma)\ ^{\shortmid}(\sigma)$	$\sigma_{\shortmid}(\sigma\sigma)^{\shortmid}(\sigma)$

It is argued that as the complete parsing of the word seems to play a role, the initial secondary stress foot should be present at the level where primary stress is determined: both should be created at the same level of derivation. Note that what would be expected considering the minor generalizations as formulated by Kager and Nouveau, is penultimate stress:

(259) Some minor generalizations for Dutch primary stress
(Kager 1989, Nouveau 1994)
- a. Final superheavy syllables (CVVC or CVCC) are stressed.
- b. Final diphtongs are stressed.
- c. In –VC final words, stress is on the antepenult if available and possible considering the heavy penult restriction.

According to (187c), if the penultimate syllable is open, and the final syllable is closed, penultimate stress is expected to occur in both words with four and those with three syllables. This stress pattern, which does not produce exhaustive parsing for quadrasyllabic words as shown in (217c), would plead against Ernestus and Neijt's hypothesis.

In the corpus part of their research, Ernestus and Neijt used the CELEX database, which contains 381,292 Dutch word forms from well-known dictionaries such as Van Dale[54]. As in this thesis, we do not wish to use data other than from actual every-day speech, we decided to check Ernestus and Neijt's findings in the CGN corpus described in section 6.2.

6.6.2 Method

In the CELEX database, out of 9,861 monomorphemic Dutch words, 837 contained three or more syllables, of which 135 ended in a closed syllable. Of

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[54] More information on the CELEX lexical database can be found at http://www.ru.nl/celex.

these 135 words, 53.0 %of quadrasyllabic words had penultimate stress, versus only 7.6% of trisyllabic words (Ernestus & Neijt forthcoming:9)

By means of the COREX program, we searched the CGN for trisyllabic and quadrasyllabic words, of which the last syllable was closed and the other ones open. Next, we selected the non-derived words. The following table shows the counts we made.

(260)	Number of syllables	Stress: final	penultimate	antepenultimate
	3	132	17	30
	4	39	15	20

As predicted by Ernestus & Neijt, the number of trisyllabic words bearing final stress is by far superior to that of stress-final quadrasyllabic words: the distribution is significant ($\chi^2(2)=11.026$, $p < .001$). In our corpus, the effect observed by Ernestus & Neijt therefore also seems to be present. However, note that the proportion of penultimate stress is the lowest in quadrasyllabic words.

However, in order to get a clear picture, words with a predictable stress pattern need to be excluded from the counts. Therefore, words ending in a superheavy syllable (which attracts stress) and words containing a syllable with [ə] as its nucleus (repelling stress) cannot be counted; Ernestus & Neijt considered these as a separate group in their statistical CART analysis, distinguishing between syllables containing [ə], open, closed, and superheavy syllables. As theirs, our conclusions should only be based on the distinction closed/open. Examples of final superheavies are given in (261ab), whereas (261c) contains an example of a [ə]-syllable.

(261)	a.	*-aal*	*federaal, kapitaal, materiaal, …*
	b.	*-ment*	*document, experiment, monument,…*
	c.	*-er*	*jenever, theater, helikopter, …*

Leaving endings like these out, we are left with the following words:

(262)	trisyllabic	final	*compromis, hagedis, parallel, peloton, protocol, parasol*
		penultimate	*notaris, salaris,* trisyllabic words from (263)
		antepenultimate	*baritone, horizon, marathon, stadion,* trisyllables from (263)
	quadrasyllabic	final	*ammoniak, kameleon*
		penultimate	*eucalyptus, cellulitis,* quadrisyllabic words from (263)
		antepenultimate	*catalogus, linoleum, normaliter, proficiat,* quadrasyllables from (263)

Five groups of endings can be distinguished which seem to impose a penultimate ((263abc)) or a penultimate ((263de)) stress pattern:

(263)	a.	*-aris*	*commissaris, functionaries, missionaris, notaris, salaris, titularis*
	b.	*-or*	*detector, dictator, instigator, professor, promotor, radiator, rollator, senator*
	c.	*-um*	*atheneum, curiosum, decorum, jubileum, lyceum, museum, referendum, universum*
	d.	*-ium*	*opium, podium, uranium, adagium, curriculum, decennium, symposium, …*
	e.	*-icus*	*medicus, politicus, academicus, historicus, satirius*

After eliminating words with a predictable stress pattern, we obtained less significant results, which will be discussed below.

6.6.3 Results

Unlike in Ernestus & Neijt's counts, the number of types left after eliminating superheavies and [ə]-syllables is rather limited, as shown in (262) and (263). The following table summarizes the number of tokens left per stress pattern.

(264)

Stress	3 syllables	4 syllables
final	124	39
superheavy	*110*	*37*
schwa	-	-
fixed ending	*5*	*0*
other	*9*	*2*
penultimate	11	15
superheavy	*0*	*0*
schwa	*5*	*2*
fixed ending	*6*	*11*
other	*0*	*2*
antepenultimate	30	20
superheavy	*9*	*0*
schwa	-	-
fixed ending	*17*	*14*
other	*4*	*6*

If only totals are considered, there is a significant distribution ($\chi^2(2)= 14.376$, $p \leq .001$: the groeps of words in the table have a different location of stress. However, if the predictable cases are excluded, that is, if we only count the words listed as “other”, the number of words per structure is not 5 or more in 80% of the cases, which means that the χ^2 test cannot be used.

However, none of the trisyllabic words has penultimate stress, except for the cases of final schwa syllables or fixed endings. The latter are more frequent within the category of quadrasyllabic words, where there are also two words, viz. *eucalyptus* ‘id.’ and *cellulitis* ‘cellulite’, which have penultimate stress without containing a superheavy syllable, schwa, or suffix. Unfortunately, there are just as many cases (*ammoniak* ‘ammonia’ and *kameleon* ‘cameleon’) where words with four syllables have final stress under the exact same circumstances. Moreover, these two cases sound a lot less exotic to the Dutch ear, whereas the two other ones are botanic and medical terms.

The rareness of monomorphemic quadrasyllabic words is another salient result. If we exclude words ending in superheavy and [ə]-syllables and words that obey patterns (i.e. ending in *–aris, -tor,* or *–um*), we are left with *ammoniak, kameleon* with final, and *eucalyptus, cellulitis* with penultimate stress. Antepenulimate stress occurs in the following four words:

(265)	a.	*linoleum*	[li.ˈno.le.ʏm], [li.no.ˈle.ʏm]	‘linoleum’
	b.	*catalogus*	[ka.ˈta.lo.xʏs], [ka.ta.ˈlo.xʏs]	‘catalogue’
	c.	*normaliter*	[nɔr.ˈma.li.tɛr], [nɔr.ma.ˈli.tər]	‘normally’
	d.	*proficiat*	[pro.ˈfi.si.ɑt]	‘Congratulations.’

As shown above, these words obey a minor generalisation, and counter Ernestus & Neijt’s hypothesis.

6.6.4 Analysis and Discussion

The only conclusion that can safely be drawn from (264) is that the preference for final stress in trisyllabic words ending in a consonant is very strong: all 9 of these have stress on their final syllable.

Interestingly, however, searching the corpus, we found that a large part of the monomorphemic nouns consisting of more than two syllables are organized into groups with similar endings and similar stress placement. This gives us an important clue as to how the Dutch lexicon is organized: it seems as though, instead of applying stress rules to words, one simply copies patterns to words with a similar syllabic and phonemic structure.

This assumption seems to be contradicted by the words in (265abc), where stress seems to be regularized to penultimate stress. If Dutch stress were only determined by lexical considerations, it would be hard to understand why this regularization takes place. However, in the case of

(265c), the vowel in the final syllable is even reduced, as instead of Latin loanword, *normaliter* is seen as ending in *liter* [litər] 'litre'. *Linoleum* might have its stress shifted by analogy with frequent words such as *museum* [myˈze.ʏm] 'id.' which also have penultimate stress. If one adds the fact that *catalogus* might be interpreted as a compound of *cata* and *logus*, and considering similar words (*katapult*, *catamaran*, etc.) with a different pattern, a stress shift is not surprising.

In sum, the results from the CGN corpus partly confirm Ernestus & Neijt's conclusions: in words with three syllables where the final one is closed, there is a tendency towards final stress. However, this is the pattern that we would expect for both trisyllabic and quadrasyllabic words, and it is therefore the latter that are crucial to both Ernestus & Neijt's and to our analysis. Unfortunately, for quadrasyllabic words, there was no significant result in the CGN data, as these not only turned out to be rare, but also seemed to prefer antepenultimate stress, as expected considering the minor generalizations formulated by Kager and Nouveau.

The influence of the lexicon on the Dutch stress data seems to blur our results: as a great number of word endings produce identical stress patterns, corpus research is necessarily fixed to a limited set of words. If lexical effects influence the results of a corpus study, they are likely to also influence the language learner who is confronted with a large amount of Dutch speech. Therefore, although Ernestus & Neijt are right in assuming that stress in quadrasyllabic words ending in a closed syllable is penultimate rather than final, this effect is more likely to be caused by similar words in the lexicon than by exhaustive parsing.

The results Ernestus & Neijt obtained searching the CELEX corpus could not be confirmed by the CGN data. Although paper-and-pencil tests conducted by Ernestus & Neijt seem to point into the direction of exhaustive parsing and thus confirm the effect of the length of the word, the fact that we were unable to corroborate these findings in a large corpus of spontaneous speech is very problematic. Of course, not finding that the number of syllables influences the position of main stress does not necessarily imply that multiple levels are needed, but makes the argument in favor of the one-level approach questionable. For this reason, we are still unsure whether to adopt a multiple or single level approach to Dutch stress.

6.7 Conclusion

The first, orientating, experiment presented in this chapter showed that vowel reduction is the most frequent of the three vowel changing processes in Dutch informal speech. The results of this experiment support the answers to Q1 found in the literature. Moreover, the process of laxing was divided up into two categories: first, the lax vowel can be an intermediate stage between a full vowel and the RV; second, it can be the result of a process taking place in word-initial syllables, which seems to be of another type than reduction, and much less dependent on speech style. On the other hand, the most rigorous reduction process, deletion, was generally limited to words of at least four syllables. Finally, reduction was shown to take place both in informal and in formal speech, albeit more frequently in the former than in the latter.

Next, in search of an answer to Q2, two experiments were conducted to establish the foot structure of words with three open syllables preceding main stress. Both of these were quite unsuccessful: o-coloring did not prove to be foot-based, and pre-r lengthening only worked for [i] in a limited set of cases. For these reasons, testing the footing of pre-main stress syllables turned out to be difficult, if not impossible.

When confronted which such poor testing possibilities, one must ask oneself if the phenomenon in question is in fact present in the linguistic competence of speakers: if there is no way researchers can demonstrate a process is at work, how does the language learning child detect it? For three syllables preceding main stress, it is safe to assume that the syllable bearing secondary stress is the most stable, and that the syllable following it is the most likely to have its vowel reduced, but there is nothing more we can say about linguistic structure here. Both a ternary and a binary foot can be used to explain for the facts at hand, and the language learner is left with a choice whether to adopt either of these possibilities.

From the point of view of reduction, a choice between the three models discussed can easily be made. As we have demonstrated, if three pre-main stress syllables are grouped into a ternary foot, a unified description of the reduction context becomes difficult, as in this foot, the middle syllable is expected to reduce, whereas in two pre main stress syllables, the rightmost one has its vowel reduced. Within the two models with strictly binary feet, the footing of stray syllables leads to monosyllabic feet, which are not necessarily heads, and if they are not, they may be reduced. A solution without this footing seems more logical: vowels reduce if they are outside the head of a foot, viz. either in the dependent syllable of a bisyllabic foot, or in stray position.

The second corpus study conducted in this chapter showed that primary and secondary stress in Dutch are not necessarily determined at the same level of derivation: quadrasyllabic words, which were used by Ernestus & Neijt (forthcoming) to show that exhaustive parsing is active, turned out to be very rare. The Chanted Call was not a helpful instrument to determine if multiple levels are needed to describe the stress/reduction phenomenon either: perception and production of this intonational pattern turned out to be cumbersome.

Thus, the question whether levels are needed remains open, at least, as far as empirical evidence is concerned. As shown by the theoretical issues discussed in chapter 5, however, in order to treat both stresses at one and the same level, two constraints WBP were needed, and in order to be able to adopt ternary feet for secondary stress, two constraints FOOTBIN are necessary as well. If we adopt two different levels, one for primary, and one for secondary stress, and use binary foot throughout, this can easily be accounted for. Next, if the two stress types take place at two different levels, it would not be shocking if vowel reduction did as well.

Another argument pleads in favor of such an analysis. As shown by the experiments in this chapter, speakers are often not aware of processes such as lengthening and coloring, which can however be shown to take place empirically. Grouping phenomena such as these, on which speakers have no intuitions, might be considered to take place at a separate, post-lexical, level. It seems logical for vowel reduction to take place at this level because, when confronted with a reduced transcript of a given word they just pronounced, speakers of Dutch often react with surprise or even shock: “I never say that!”

Taking into account the factors discussed here, we will provide an integral analysis of Dutch vowel reduction in the following chapter, aiming to explain for and to describe both fast speech phenomena under discussion.

7 An OT Account of Fast Speech Phonology

Ce qu'on peut expliquer de plusieurs manières ne mérite d'être expliqué d'aucune.
[What can be explained in various ways deserves to be explained in none.]

Voltaire, *Le siècle de Louis XIV*

7.1 Introduction

This chapter forms the third and final part of the thesis, in which we will search for a model to describe the two fast speech phenomena treated in the five preceding chapters. The results of our corpus and studio experiments will be taken into account in order to not only provide a new theoretical framework, but also to use actual fast speech data to support the choices made.

As already demonstrated in chapter 1, an [ə]-type vowel plays a central role in both languages under consideration, being the result of vowel reduction in one, and the starting point for alternation with zero in the other. However, as chapters 2 through 6 have clearly shown, the entity labeled "schwa" behaves differently in Dutch then it does in French. Therefore, the exact phonological structure of this segment will have to be determined before analyzing fast speech. This will be done in section 7.2. Section 7.3 forms the core part of this chapter and aims to propose an analysis of both vowel reduction and schwa/zero alternations. These processes will be described with the same set of theoretical instruments, and a formal account of them will also have to explain for the apparent differences between the two languages. Next, in section 7.4, the model is confronted with the existing theories on linguistic variation, testing which of these is best suited to describe the processes at hand. The final section rounds up the chapter and the thesis, providing the conclusion of both.

7.2 On the Status of Schwa and the Reduction Vowel

7.2.1 French Schwa

Below is our definition of French schwa as established in chapter 2:

(266) Definition: *Standard French schwa is a word-internal or clitic-final instance of [ə] or [œ] that can be changed into zero in informal speech without a change of meaning.*

As demonstrated in that chapter, different types of this vowel behave in different ways. This claim was supported by the findings in chapter 4, which are summarized below.

(267) a. Word-internal schwa is very rare outside of the initial syllable, and conserved in most cases.
b. Clitic schwa does not behave differently from schwa in initial syllables of polysyllabic words.
c. Schwa in phrase-initial syllables deletes more easily.
d. Deletion of schwa is influenced by surrounding consonants, but there is no resyllabification.

As word-internal schwa is rare and because of its low frequency and relatively high probability of following a cluster, it is almost always conserved. However, this does not seem a reason to assume a different status for this vowel, as its relative stability seems due to its position rather than to its phonological status. The same holds true for "clitic" and "initial" schwa: schwa in clitics is particularly unstable because of the high frequency of occurrence of these monosyllabic words, and schwa in phrase-initial syllables deletes more easily than elsewhere because of the distance to phrase-final stress. The typology proposed in chapter 2 ("morphemic", "clitic", and "initial" schwa) therefore does not seem to reflect differences in phonological status.

Partly following Anderson (1982), Noske (1992), Van Oostendorp (2000), and others, we therefore propose an autosegmental representation of schwa, in which it is an empty vocalic node (or root node) without features. The underlyingly featureless status of schwa explains why it is the only vowel which can freely alternate with zero in French. If schwa is realized on surface level, then the default features have been assigned to it. These are the features of the central vowel, as they are the least marked (Koopmans-van

Beinum 1980, Flemming 2001). Strangely enough, as pointed out in chapter 2, in French, the unmarked features often comprise [round], as the segment is realized as [œ] in most dialects. It is "curious" (in the words of Van Oostendorp 2000:231) that an empty vowel bares this marked feature. However, this becomes clearer once the French vowel triangle is considered:

(268) Vowel triangle of French

front					*back*
i	y			u	*high*
e	ø		o		
ɛ		(ə)	ɔ		
	ɑ				*low*

All French front unrounded vowels have a rounded counterpart: /i/ corresponds to /y/, /e/ to /ø/, and /ɛ/ to (underlying) /œ/. However, the back vowels are always rounded. Thus, rounding occurs on all non front vowels, with the exception of the low vowel /a/[55]: when lowering the lower jaw to articulate this segment, lip rounding becomes more difficult. Rounding of schwa might therefore be caused by the fact that everything that is not front is automatically rounded. If this is true, than the feature [round] is rather an effect of the articulatory phonetic realization, than the result of a phonological process.

If schwa is realized, then, it has the default features of a central vowel assigned to it on the phonetic implementation level. If it is not, the empty root node remains empty, but present in the surface structure, so that processes like spreading of features from consonants can take place. This accounts for the compensatory lengthening effects from Rialland's (1986) experiments and the corpus data on this subject in chapter 4. However, if we assume that [ə] is an empty vowel both in French and in Dutch, we have to explain for the fact that in the first language, it may surface as empty, but in the latter, this is not allowed. This can be done by assuming that in Dutch, constraints against empty root nodes on the surface are highly ranked. On the other hand, although in Dutch, all roots are then automatically filled, in French, they do not all remain empty: only root nodes that have been marked as realized should have the default features assigned to them. These can be distinguished from the unrealized vowels by the presence or absence of the vocalic node, as we will argue in section 7.3.2.

The other types of vowels, which are labeled "schwa" in the literature, but which we excluded from our definition of schwa because they

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[55] And with the exception of /ɑ/ which is slowly disappearing from the system, and furthermore sometimes informally realized as rounded [ɔ]: *je ne sais pas* [ʃsɛpɔ].

behave quite differently from it, also differ in the phonological underlying status attributed to them in this thesis. The full vowel /œ/, which is often called "non-alternating schwa", simply has a full representation comprising vocalic features such as [round]. On the other hand, the word-final schwa-like segment does not alternate with zero in the same way schwa does, as it is most frequently omitted, and therefore should be less specified than schwa. In fact, as it almost never surfaces in Standard French except to break up clusters starting with a complex coda (in cases already cited in chapter 2 and repeated below), we propose that it is not present in the underlying structure, and therefore a pure case of insertion.

(269)	a.	*un film français*	[œ̃filmfʁɑ̃sɛ], [œ̃filməfʁɑ̃sɛ] 'a French film'
	b.	*un contexte pénible*	[œ̃kɔ̃tɛkstpenibl], [œ̃kɔ̃tɛkstəpenibl] 'a difficult context'

The possibility of inserting a vowel (which is usually automatically the least marked of the system and therefore, in the case of French, [ə]/[œ]) might seem problematic as it might imply that vowels can be inserted anywhere. However, as pointed out by, among others, Féry (2001), French often has complex consonant clusters word-finally, which can even be onset-type obstruent-liquid clusters such as [tʁ] in e.g. *autre, quatre,* etc. As the following word might also start with an onset cluster, the word-internal context seems unique as far as the number and identity of surrounding consonants is concerned. Therefore, it is safe to assume that allowing insertion in clusters of four consonants will restrict the occurrence of non-underlying [ə] in surface representations to word-final positions.[56]

An alternative analysis of schwa can be presented in Government Phonology. Recall from chapters 1 and 2 that the empty vowel plays a central role in this theoretical framework, especially in CVCV-phonology as proposed by, among others, Scheer (1999, 2000). As demonstrated in chapter

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[56] Evidence for the presence of final /ə/ seems to be provided by *verlan,* a secret language mostly used by young people, in which the syllables of bisyllabic words are inversed (*metro* → *tromé*). Monosyllabic words ending in a consonant seem to have a underlying final schwa, because *sac* becomes [kœs] and *femme* ends up as [mœf] (Joaquim Brandão de Carvalho, p.c.). However, as Weinberger & Lefkowitz (1991:45) argue, this could also be caused by the insertion of a default vowel at the end of the word. Pleading in favor of a separate rule for these words seems reasonable, as, even if one assumes they end in an underlying schwa and are thus bisyllabic, they do not behave exactly like bisyllabic words (as *sac* does not become [kœsa], which would be expected if its underlying form were /sa.kə/).

2, this model allows explaining for schwa deletion after one consonant, and its conservation after two:

```
(270) a.   C V C V C V C V C V
               | | |   | | |
               s u v   n i r
                     PG

      b.   C V C V C V C V C V C V
               | | |   | | | | |
               p a r   v ə n i r
                     PG      PG
```

In (64a), the empty nucleus alter [v] is properly governed by [i] and therefore not realized, whereas in (64b), its realization as schwa is obligatory as it is needed to properly govern the empty nucleus present within the cluster [rv].

Government principles alone are in principle incapable of accounting for segmental differences in clusters. As we have demonstrated in chapter 4, the featural identity of the surrounding consonants determines the possibilities of omitting a schwa, a factor that could never be expressed by Proper Government. The notion of charm (cf. e.g. Charette 1991) could be used here: stops and non-strident fricatives have negative charm, vowels are positive, and liquids do not have charm at all. Charm is normally used to account for the fact that in clusters, the liquid (without charm) follows the stop (with negative charm) and not the other way round: segments with charm can govern charmless consonants.

Even if using charm, one would be able to describe the facts of French, there are still three other reasons why we will not adopt a GP analysis here. First, in GP, and more specifically in the CVCV-variant, words are assumed to start and with empty CV and to end in CV as well. The empty vowel at the beginning of the word needs to be properly governed, as shown below (cf. Scheer 2000:125).

```
(271)      C V C V C V C V C V
           | |     |   | | |
           l a     s ə m ɛ n
                 PG      PG
```

However, the final V in this example remains empty, although it is not properly governed. This is accounted for by mere stipulation: "un noyau peut rester phonétiquement nul si […] il est final (parametrisé)"(Scheer 2000:118). The different status of these two seemingly identical empty vowels therefore remains problematic.

Second, as shown in chapter 4, schwas in two consecutive syllables are able to delete if the consonant cluster that results is still pronounceable. This phenomenon cannot be accounted for within GP, as Proper Government can only explain for one of them deleting, or both being realized. The assumption that a governed segment cannot govern is the vary basis of the GP accounts, and therefore cannot be easily modified.

Third, a GP-account is unable to explain for schwa deletion in Dutch, as this implies loss of all elements in a weak prosodic position. Prosody has not yet been incorporated into Government Phonology, and seems almost incompatible with it, because the syllable, the intermediate constituent between feet and segments, does not exist in the theory.

Although these apparent shortcomings might be repaired in a modified version of GP, we will not attempt to do this here. Instead, an autosegmental OT model will be adopted, not because we feel that GP is intrinsically incapable of accounting for French and Dutch empty vowels, but because OT and autosegmental phonology can do so without major adaptations.

7.2.2 Dutch RV

For Dutch, as demonstrated in chapter 2, Van Oostendorp (2000) distinguishes between three types of schwa: *r*-schwa (the Reduction Vowel, RV), *e*-schwa (the vowel inserted into clusters), and *u*-schwa (the vowel present in underlying structure). Although the behavior and specific properties of these different "schwas" are described in different chapters by the author, their phonological representation is identical: an empty root node. Following Van Oostendorp, we assume that Dutch vowel reduction is the elimination of vocalic features in weak positions of feet, and that therefore, as in French, what surfaces as [ə] is an underlyingly empty nucleus with the default features of a central vowel attached to it. For Dutch, it does not matter whether we suppose the vocalic node to be present or not. Assuming it is always there accounts for the fact that empty vowels in Dutch are always "filled" in with features, whereas in French only schwas marked as realized are: in both languages, only the vocalic node can receive default featural material.

Insertion of the empty vowel also does not take place under the same circumstances as in French. Whereas in the latter language, as we have seen, it is optionally inserted word-finally to break up a four-member clustered formed by the final consonants of the first word and the onset of the second, in Dutch, [ə] may show up in the middle of coda clusters, as shown by the following examples.

(272)	a.	*kerk*	[kɛrək]	'church'	
	b.	*film*	[fɪləm]	'film'	vs. French *film* [filmə] *français*

Van Oostendorp (2000:235ff.) argues that this difference between the two languages can be explained by the fact that in Dutch, alignment of features with word boundaries is more important than in French: ALIGN » CONNECT (N', lax), whereas for French, the ranking is the other way round, disallowing [ə] in closed syllables because it does not have the feature [lax]. As the explanation seems reasonable, and as the insertion of vowels is not the topic of the thesis, we will not treat this issue in more detail here.

In Dutch, as we have seen, underlying [ə]-vowels cannot be deleted as in French. It is therefore impossible to realize the empty nucleus without the default features of the central vowel attached to it. This can be accounted for by assuming that in Dutch, the empty vowel is a root node with a vocalic node, which, as in French, is obligatorily filled with the default features.

Table (273) gives a complete typology of schwa-type vowels for both languages under consideration, and compares the various types to those proposed in Noske and Van Oostendorp.

(273)

Type in this thesis		*Example*	*Van Oostendorp*	*Noske*
0	Non-alternating	*grenouille* [gʁœnuj]	U-schwa	
I	Morphemic schwa	*porte-monnaie* [pɔʁtəmɔne]	U-schwa	C
II	Clitic schwa	*je veux* [ʒəvø]	U-schwa	A, E
III	Initial schwa	*regarder* [ʁəgaʁde]	U-schwa	E
IV^{a}	Epenthetic vowel	*film français* [filməfʁɑ̃sɛ]	E-schwa	D
IV^{b}		*kerk* [kɛrək]	E-schwa	F
V	Reduction vowel	*banaan* [bənan]	R-schwa	

Type 0 is left entirely out of consideration, because in our view, we are dealing with a full vowel here. As we argued in chapter 2, only types I through III are cases of French schwa according to our definition. In Dutch, the label of "schwa" is applied to various types of the central vowel which do not alternate, but which are claimed to be cases of a featureless vowel. These are types IV and V, which, in order to avoid confusion, will not be called "schwa" in our typology.

For French, unlike Van Oostendorp who treats types I, II and III as one single category, we have made a clear-cut subdivision of "schwa" into three positional types, making a distinction between clitic schwa and initial schwa in addition to Noske's type C-E distinction. For Dutch, adding additional types to the Van Oostendorp typology seems unnecessary. All "U-schwas" of Dutch could be treated as type 0, whereas E-schwas and R-schwas represent types IV^{b} and V, respectively.

As vowel types I, II, III, and V have the same phonological representation in our account, viz. an empty vowel without features attached to it, they form a homogenous group, of which the following section aims to propose an analysis.

7.3 Schwa/Zero Alternations and Vowel Reduction in Optimality Theory

7.3.1 Introduction

The common causative factor that must be at the basis of the two fast speech phenomena analyzed in this section is the speaker's wish to reduce articulatory effort. A constraint similar to LAZY, proposed by Kirchner (2001) to account for lenition processes, can be used to describe the trigger behind reduction processes:

(274)	NO-EFFORT	The output is produced with the least effort possible for the speaker.

The effects of this generic constraint are of course limited by PARSE or MAX-IO constraints, of which the ranking differs according to the language. The common goal of these faithfulness constraints would be to reduce the efforts of the listener. When listening to the output of a given lexical item, one is after all best helped by a faithful rendering of the input. For example, in both Dutch and French, NO-EFFORT is not usually satisfied by the dropping of consonants. Therefore, a constraint of the type MAX-IO -CONSONANT, demanding that every consonant that is present in the input be present in the output, is fairly high-ranked. However, cluster simplification of the type *expliquer* [ɛksplike] > [ɛsplike] does occur, and therefore, a specific constraint against clusters, which is ranked above MAX-IO-CONSONANT, might be needed. This is the case for yet another reason, as we will argue further on.

Traditionally, the effects of the NO-EFFORT constraint are translated into those of various, more specific, markedness constraints. For instance, the fact that French omits (empty) vowels is described by Tranel (1999,2000) by means of SYLLABLE ECONOMY: "less is better" (Tranel 2000:273). Noske (1996) expresses this with the constraint MONOSYLLABICITY, whereas Van Oostendorp uses *[-cons] as a trigger for the deletion of schwa.

(275)	a.	SYLLABLE ECONOMY	A form should contain as few syllables as possible (Tranel 2000:273)
	b.	MONOSYLLABICITY	Forms should be monosyllabic (Noske 1996:500)
	b.	*[-cons]	Ban on vocalic roots (Van Oostendorp 2000:254)

Although the constraints in (275) do not seem to represent a uniform tendency in the world's languages, and might surprise those studying first language acquisition, it should be noted that the effects of a constraint are seldom visible at surface level throughout. For example, even though the existence of Max-IO, the ban on deletion, has been attested by numerous authors, to our knowledge there is no language where deletion processes do not occur. Therefore, following Van Oostendorp, we propose the constraint below as the trigger behind the fast speech reduction and deletion processes:

(276) *VOWEL The output contains no vowels.

The following two subsections will each discuss one of the two fast speech phenomena, integrating the *VOWEL constraint into language-specific constraint rankings.

7.3.2 French Schwa/Zero Alternations

As a first attempt to formulate an analysis of French schwa, one can take as a central assumption that a realized schwa is a case of insertion of a standard set of features on the root node, in order to avoid complicated consonants. The constraint could be formulated in terms of a Sonority Sequencing

Principle such as the one proposed by Tranel (1999, 2000) and cited by Côté (2000) as we have seen in chapter 3. Basing ourselves on the results in chapter 4, we propose to modify this principle to the following:

(277) *Sonority Sequencing Principle (SSP)* (modified)
The middle member of a three-member cluster exceeds the other two in sonority.

Of course, this is only a rough formulation of the principle, and a simplification of facts, since the possible clusters after schwa deletion display a lot of variation. In particular, as shown in chapter 4, more complex clusters are allowed at the beginning of the phrase. Note furthermore that the constraint is formulated in a highly language-specific way. As the analysis here is not intended to predict all individual and context-bound variation, nor to describe the French situation with respect to that in other languages, but rather to explain for the interaction between various forces of influence, we will not attempt an exact formulation of a complex cluster constraint here.

A constraint against the violation of the SSP is provisionally defined in (278a). The other two constraints in (278) then have to dominate the *CLUSTER constraint, because otherwise, in order to satisfy it full vowels could be inserted (avoided by a high ranking of constraints against the insertion of non-standard vocalic features (278b)), or one or more members of the consonant clusters could be deleted (avoided by a high ranking of the constraint against deletion (278c)).

(278)	a.	*CLUSTER	Consonantal features of a given type may not be adjacent.
	b.	DEP-IO-FEATURE	Features present in the output must be present in the input.
	c.	MAX-IO	Segments present in the input must be present in the output.

If the French situation is compared to Dutch, which does not have schwa/zero alternations, but where on the other hand, full deletion of vowels is possible without compensatory effects, it seems reasonable to assume that in the latter language, empty vowels may be deleted, whereas in the former, they are always conserved. This difference can be described by having MAX-IO at the top of the hierarchy, so that deletion is absolutely banned.

Constraint (278b) must be ranked above a more specific constraint against the insertion of the standard vocalic features (say, DEP-IO-

STANDARDVOC) in order for insertion of schwa's features to be preferred over that of the other, full, vowels. If the constraint against clusters is inserted into the hierarchy above the DEP-IO constraints, but below MAX-IO, the hierarchy in (279a) is obtained, which can account for schwa/zero alternations even without the *VOWEL constraint. This is shown for schwa within a complicated cluster (*de traverser)* and between two simplex consonants (*de taper*) in (279b) and (279c), respectively.

(279) a. MAX-IO » * CLUSTER » DEP-IO-FEATURE » DEP-IO-STANDARDVOC

b.

/dVtʁavɛʁse/	MAX-IO	*CLUSTER	DEP-IO-LOW	DEP-IO-STVOC
1. datʁavɛʁse			*!	*
☞ 2. dətʁavɛʁse				*
3. dVtʁavɛʁse		*!		
4. dVtavɛʁse	*!			
5. dtʁavɛʁse	*!			

c.

/dVtape/	MAX-IO	*CLUSTER	DEP-IO-LOW	DEP-IO-STVOC
1. datape			*!	*
2. dətape				*!
☞ 3. dVtape				
4. dtape	*!			

In tableau (279b), the last two candidates, in which the empty vowel (symbolized by V) or a consonant have been deleted, are eliminated by MAX-IO. Next, the constraint against neighbouring consonantal features causes a fatal exception for (279b3), in which the cluster [dtʁ], where the most sonorous segment [ʁ] is in the middle, is not separated by vocalic features. The decision between the first two candidates is made by the constraint DEP-IO-LOW, which rules out candidate (279b1) because the feature [low] of /a/ has been inserted. Realization of schwa is therefore (correctly) predicted in the case of a three-member cluster of which two or more consonants are prevented from occurring next to each other by the *CLUSTER constraint.

Tableau (279c) shows that if this constraint is not violated by the cluster that occurs when the empty vowel is not realized, the candidate with the empty vowel on surface level wins. That is, not inserting the standard features is preferred over doing so, because this entails avoiding a violation of DEP-IO-STANDARDVOC.

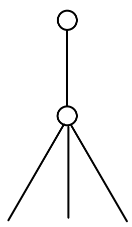
A number of objections could be raised against this approach. First, whereas (279a) represents a grammar of informal speech, how can the ranking for a more formal speech style, in which schwas like the one in *de̲ taper* are realized? As candidate (279c3) violates none of the constraints mentioned, another constraint will be needed to insure that candidate (279c2) wins in formal speech conditions. This could be a constraint against empty vowels, or a constraint that demands featural content. Both solutions would entail ranking this constraint above DEP-IO-STANDARDVOC, in order to rule (279c3) out in favor of (279c2).

The second drawback of the model concerns the constraint DEP-IO-STANDARDVOC itself: it refers to "standard" vocalic features. However, as we have shown, in French, when schwa is realized, it is often rounded. Therefore, if we assume that all of schwa's surface features are inserted when the decision to realize it is made, the feature [round], which is highly marked in the phonology of the world's languages, would have to be added as well. This seems to call for an insertion of the standard features on a separate, i.e. phonetic implementation, level.

The third and by far most important problem with the account proposed is that the constraint intended as the motor of the reduction processes in fast speech, *VOWEL, does not play a role here. Therefore, the possibility of accounting for similar phenomena such as Dutch vowel reduction seems to be lost.

Taking the constraint *VOWEL as the starting point for a new analysis, it is important to realize that this constraint bans all three parts of the vocalic element, and can therefore be contradicted by three markedness constrains militating against deletion of these. This is schematized below.

(280)



root node	MAX-IO-ROOT
vocalic node	MAX-IO-VOCALIC
features	MAX-IO-[low], MAX-IO-[round], etc.

As the constraint targets these three components, it can be decomposed itself into *ROOT, *VOCALIC and *FEATURE.

In this analysis, to be based on deletion rather than on insertion, it is assumed as argued before that an underlying [ə] in French contains a root node and a vocalic (V-place) node, but no features. These features are not inserted by the phonology (as in our first proposition), but by phonetic implementation (cf. Van Oostendorp 2000), and only if the vocalic element has a V-place node. "Deleted" [ə] therefore does not have this node, but is still a root node (MAX-IO-ROOT being highly ranked as argued above), because features from other segments can spread to it, again in phonetic implementation.

Full vowels have to be saved from deletion, as only underlying empty vowels are allowed to not surface in French. This can be done by having the constraint against deletion of features dominate *VOWEL. Thus far, the ranking obtained is the following:

(281) MAX-IO-FEATURE, MAX-IO-ROOT » *VOWEL » MAX-IO-VOCALIC

This ranking has the effect of deleting schwas throughout. As we have seen, deletion is limited by the clusters obtained, so that the constraint against undesired clusters *CLUSTER has to be ranked above *VOWEL. Also, features may not be inserted to prevent empty vowels to be "saved" from deletion by adding featural material (i.e. changing an empty vowel into a full one). This asks for a constraint like DEP-IO-FEATURE, as discussed above, to be added, again outranking *VOWEL. These observations yield the ranking below.

(282) MAX-IO-FT, MAX-IO-ROOT, *CLUSTER, DEP-IO-FT » *VOWEL » MAX-IO-VOCALIC

Adding an output with a vocalic node (symbolized by an underlined V) to the candidate set, the following tableaux evaluate the examples *de traverser* and *de taper* again. Furthermore, a candidate with a reduced full vowel, (283a7), was added to the first tableau to show why reduction of full vowels is not allowed by the ranking in (282).

(283) a.

/dVtʁavɛʁse/	Max-IO-Ft	Max-IO-Root	*Cluster	Dep-IO-Ft	*Vowel	Max-IO-Voc
1. datʁavɛʁse				*!	****	
2. dətʁavɛʁse				*!	****	
☞ 3. dV̲tʁavɛʁse					****	
4. dVtʁavɛʁse			*!		****	*
5. dVtavɛʁse	*!	*			****	*
6. dtʁavɛʁse		*!	*		***	*
7. dV̲tʁavəʁse	*!				****	

b.

/dVtape/	Max-IO-Ft	Max-IO-Root	*Cluster	Dep-IO-Ft	*Vowel	Max-IO-Voc
1. datape				*!	***	
2. dətape				*!	***	
☞ 3. dV̲tape					***	
☹ 4. dVtape					***	*!
5. dtape		*!			**	

In tableau (283a), all candidates but one are ruled out by the undominated constraints. The last candidate, where the full vowel [a] has been reduced, and candidate (283a5) both violate Max-IO-Feature, as they omit the features of a vowel or those of a consonant, respectively. The latter candidate also violates Max-IO-Root, as a whole segment has been deleted, just like in (283a6). Finally, the candidates where features have been inserted, either those of a full vowel as in (283a1) or the "standard" features as in (283a2), are eliminated by Dep-IO-Feature. After evaluation of the undominated constraints, then, the candidate with an empty vocalic node is selected as optimal.

In tableau (283b), the candidate without the vocalic node is the desired optimal output. However, the empty vocalic node is preferred by the hierarchy, this time because candidate (283b4) has an additional violation of Max-IO-Vocalic. Thus, conservation of schwa is predicted. As shown below, this problem can be solved by decomposing the constraint *VOWEL into its three components *ROOT, *VOCALIC, and *FEATURE. The ranking of these three is of no importance here. Note that in the tableau, we have counted every vowel which has a set of features as one violation of the *FEATURE constraint, whereas in reality of course, *FEATURE is violated by every feature that occurs on a vowel. The actual number of violations will therefore be more than indicated in the tableau.

(284)

/dVtape/	MAX-IO-FT/ROOT	*CLUSTER	DEP-IO-FT	*ROOT	*VOCALIC	*FEATURE	MAX-IO-VOC
1. datape			*!	***	***	***	
2. dətape			*!	***	***	***	
3. dV̲tape				***	***!	**	
☞ 4. dVtape				***	**	**	*
5. dtape	*!			**	**	**	

The candidate with a vocalic node on the empty vowel has one extra violation of *VOCALIC, and is therefore eliminated. This yields the correct result for the deletion context: a vowel without a vocalic node, to which no default features can be attached in the phonetic implementation. For tableau (283a), decomposing the *VOWEL constraint into its three components makes no changes into the outcome, because all undesired candidates have been eliminated before this constraint is taken into consideration. This difference between the tableaux is determined by the constraint against given clusters, just as the choice between realizing schwa or deleting it is determined by the surrounding consonants.

Following Van Oostendorp (2000:153), it will be assumed here that more formal styles of speech can be derived by a higher ranking of faithfulness constraints. Thus, in formal speech, the markedness constraints, and in particular, the constraint *VOWEL, are ranked lower. Most importantly, *VOWEL will rank below the constraint MAX-IO-VOCALIC, so that retention of the vocalic node for underlying root nodes is obligatory and all schwas will be pronounced, as shown in the following tableau for *de taper*.

(285)

/dVtape/	MAX-IO-FT/ROOT	*CLUSTER	DEP-IO-FT	MAX-IO-VOC	*ROOT	*VOCALIC	*FEATURE
1. datape			*!		***	***	***
2. dətape			*!		***	***	***
☞ 3. dV̲tape					***	***	**
4. dVtape				*!	***	**	**
5. dtape	*!				**	**	**

Of course, this is a simplification of the facts, because even in formal speech, schwas may be deleted. The grammar in (285) represents French read-aloud speech, as present in the formal part of the PFC corpus. Actual spontaneous formal speech will be somewhere in between the two rankings established, and present variation triggered by rhythmic factors. We will come back to this issue in our discussion of variation in OT.

7.3.3 Dutch Vowel Reduction

The analysis proposed for French, with a central role for a constraint against vowels and their three parts, may be used to develop an account for Dutch vowel reduction. The first difference between the two languages is that, unlike in French, in Dutch, vowels may be completely deleted in quadrasyllabic words. Examples are given below.

(286) a. *alcoholist* 'alcoholic' [ɑlkoholɪst] → [ɑlkolɪst]
b. *initiatief* 'initiative' [iniʃatif] → [inʃatif]

As pointed out in chapter 6, this seems to happen only in words of more than three syllables, eliminating the second syllable rather than the third. The greater prominence of this third syllable as compared to the second has also been remarked for vowel reduction as well, as chapters 5 and 6 have demonstrated.

If the first three syllables of quadrasyllabic words bearing final stress are considered to form a ternary foot, describing the fact that the middle one reduces easier than the third one is rather problematic. One could assume that there is some edge effect, favoring deletion of features or entire vowels in syllables that are not adjacent to foot boundaries. However, this does not explain for the following reduction facts:

(287)	a.	*automaat*	‘machine’	[ɑ͡utomat] > [ɑ͡utəmat]
	b.	*microfoon*	‘microphone’	[mikrofon] > [mikrəfon]

As shown, vowels in the second syllables of trisyllabic words with final stress are easily reduced. These words can only be parsed as ˌ(ɑ͡u.to)ˈ(mat), the second syllable being next to the right edge of the initial foot. This shows that the position preceding the right foot boundary does not save vowels from reduction. On the other hand, considering the process of complete vowel deletion, it could be claimed that this is not allowed in the rightmost syllable of a foot: ˌ (mɑ.xɑ)ˈ(zɛ͡ɪn) and ˌ(o.riʒi)ˈ(nel) cannot become mɑxˈ(zɛ͡ɪn) and ˌ(o.riʒ)ˈ(nel). This is contradicted by the following counterexamples, used during our experiments in chapter 6, in which the second syllable of a pre-main stress binary foot deletes:

(288)	a.	*sigaretje*	‘little cigaret’	[(si.xa)(rɛ.tjə)] > [sixrɛtjə]
	b.	*aspirientje*	‘little aspirin tablet’	[(ɑs.pi)(rin.tjə)] > [ɑsprintjə]

These cases show that if the onset of the deleted vowel and the onset of the following vowel together form an obstruent-liquid cluster, deletion is very well possible. Although these are marginal cases, which are unattested in the CGN, they represent a logical type of deletion as obstruent-liquid consonant clusters are formed after deletion of the vowel.

If binary feet are taken to be the only possible prosodic configuration for Dutch, the description of vowel deletion and reduction becomes considerably easier. Consider the following examples with final stress from the CGN:

(289)		*Type*	*Example*	*Reduction*	*Deletion*
	a.	2 syllables	*manier* mɑˈ(nir)	[mənir]	n/a
	b.	3 syllables	*magazijn* ˌ(mɑ.xɑ)ˈ(zɛ͡ɪn)	[mɑxəzɛ͡ɪn]	n/a
	c.	4 syllables	*origineel* ˌ(o.ri)ʒiˈ(nel)	n/a	ˌ[ɔrʒiˈnel]

Deletion seems to take place only in the weak position of a binary foot, and most frequently (as we found no examples of the contrary in the CGN) if there are at least three syllables preceding main stress (with the exception of cases like (288ab)). Deletion of the second syllable in quadrasyllabic words creates an alternating rhythm: secondary stressed syllable – unstressed syllable – syllable bearing main stress. This seems to be a preferred rhythmic pattern in Dutch (cf. also Neijt 2006).

In Dutch, therefore, the constraint family against the realization of vowels is contradicted by constraints demanding vowels be realized in strong positions of feet and if they are unfooted. These are formalized as in (290ab).

(290)	a.	MAX-IO-FEAT-FOOTHEAD	Features in the head of a foot in the output should be identical to those of corresponding segments in the input.
	b.	MAX-IO-FEAT-UNFOOTED	Features in syllables that are not parsed into feet in the output should be identical to those of corresponding segments in the input.
	c.	MAX-IO-FEAT-FOOTWEAK	Features in the weak position of a foot in the output should be identical to those of corresponding segments in the input.

(290c) protects vowels in prosodically weak positions, and must therefore be ranked below the markedness constraints mentioned. Note that the constraints refer to foot structure. This means that this prosodic parsing has to be done *before* reduction takes place, i.e. prosodic parsing has to take place on another level than vowel reduction, which is exactly what we would expect since the fast speech process takes the prosodic structure as a starting point.

However, as argued before, this contradicts the original, strictly parallel, basis of OT. Of course, we could take the status of the syllable in the output as a basis for evaluation of the constraints. That is, e.g. MAX-IO-FEAT-UNFOOTED refers to a vowel in a syllable that is unfooted in the output. Still, this solution misses the actual point in the Dutch reduction process: it is based on a foot that is already there. Consider the following example.

(291)		*serial*	*parallel*
	input	/iniʃɑtif/	/iniʃɑtif/
	a.	(ini)ʃɑ(tif)	
	b.	(in)ʃɑ(tif)	
	output	(inʃɑ)tif	(inʃɑ)(tif)

Deletion of vowel in the weak position of a foot in (291b), followed by refooting to a bisyllabic foot in the output can be easily explained by a serial account in which first the footing takes place (lexical level), and then deletion and refooting (postlexical level). It is a lot less straightforward how and why we should arrive directly from an input /iniʃɑtif/ to an output (inʃɑ)(tif): a vowel is deleted because it is in a weak position, but this is the case neither in the underlying, nor in the surface form. We will come back to this issue below.

The analysis to be proposed here functions essentially like Van Oostendorp's (2000:150ff) constraints that ensure the relation between stress and the retention of features, described in chapter 5. The constraints this author uses and the rankings he proposes for the three different style levels described are repeated below for convenience.

(292) a. PARSE-FEATURE — A feature has to be parsed into a segment.
b. PROJECT (*V*, Ft_2) — N° dominates a vocalic node → N'' heads a branching foot.
c. PROJECT (*V*, Ft) — N° dominates a vocalic node → N'' heads a foot.
(Van Oostendorp 2000:149)

(293) Tableaux for formal (a), semi-formal (b) and informal (c) realizations of *fonologie* 'phonology' (Van Oostendorp 2000:151)

a.

/fonoloxi/	PARSE-FEATURE	PROJECT (*V*, Ft)	PROJECT (*V*, Ft_2)
☞ (fo.no)(lo)(xi)		*	**
(fo.nə)(lo)(xi)	*!		*
(fo.no)(lə)(xi)	*!	*	*
(fo.nə)(lə)(xi)	*!*		

b.

/fonoloxi/	PROJECT (*V*, FT)	PARSE-FEATURE	PROJECT (*V*, FT_2)
(fo.no)(lo)(xi)	*!		**
☞ (fo.nə)(lo)(xi)		*	*
(fo.no)(lə)(xi)	*!	*	*
(fo.nə)(lə)(xi)		**!	

c.

/fonoloxi/	PROJECT (*V*, FT)	PROJECT (*V*, FT_2	PARSE-FEATURE
(fo.no)(lo)(xi)	*!	**	
(fo.nə)(lo)(xi)		*!	*
(fo.no)(lə)(xi)	*!	*	*
☞ (fo.nə)(lə)(xi)			**

As shown, the constraint PARSE-FEATURE, which demands realization of underlying features, can be combined in three ways with the obligatory ranking PROJECT (*V*, FT) » PROJECT (*V*, FT_2). These three rankings exactly correspond to the three style levels described.

For similar reasons, the constraints in (290) are obligatorily ranked as follows: (290a) » (290b) » (290c). A constraint MAX-IO-ROOT is needed on top of our hierarchy to prevent deletion from occurring in most speech styles. In Van Oostendorp's description, no deletion is allowed in any of the three styles. Outputs with a deleted segment are not included in the candidate sets. Considering the fact that a candidate which deletes a vowel would always come out as optimal because it avoids one violation of the foot-based markedness constraints, MAX-IO-ROOT must in this case be on top of this hierarchy, together with the constraint MAX-IO-FEAT-FOOTHEAD. The constraint against the realization of vocalic features can be ranked into our hierarchy in the following ways to obtain the three speech styles:

(294) Tableaux for formal (a), semi-formal (b) and informal (c) realizations of *locomotief* 'locomotive'

a.	/lokomotif/	MAX-IO-FOOTHEAD	MAX-IO ROOT	MAX-IO-UNFOOTED	MAX-IO-FOOTWEAK	*FEATURE
	☞ (lo.ko) mo (tif)					****
	(lo.kə) mo (tif)				*!	***
	(loko) mə (tif)			*!		***
	(lo.kə) mə (tif)			*!	*	**
	(lə.kə) mə (tif)	*!		*	*	*
	(lo.kəm)(tif)		*!		*	***

b. /lokomotif/	Max-IO-FootHead	Max-IO Root	Max-IO-Unfooted	*Feature	Max-IO-FootWeak
(lo.ko) mo (tif)				****!	
☞ (lo.kə) mo (tif)				***	*
(loko) mə (tif)			*!	***	
(lo.kə) mə (tif)			*!	**	*
(lə.kə) mə (tif)	*!		*	*	*
(lo.kəm)(tif)		*!		***	*

c. /lokomotif/	Max-IO-FootHead	Max-IO Root	*Feature	Max-IO-Unfooted	Max-IO-FootWeak
(lo.ko)mo(tif)			***!*		
(lo.kə)mo(tif)			***!		*
(loko)mə(tif)			***!	*	
☞ (lo.kə)mə(tif)			**	*	*
(lə.kə)mə(tif)	*!		*	*	*
(lo.kəm)(tif)		*!	***		*

The hierarchy and constraints have the same effect as those proposed by Van Oostendorp: in formal style, no reduction takes place; in semi-formal style, only reduction in weak positions of feet is allowed; and in informal speech, vowels are reduced in both weak and "stray" positions. The only difference thus far is that in Van Oostendorp's account, a faithfulness constraint that bans deletion of features is placed into a hierarchy of two constraints that demand that featural material be linked to prosodically strong positions, and that in our account the problem is approached the other way round: a constraint against features is inserted into a hierarchy of constraints linking faithfulness to stress.

However, as we have learned from data from the CGN corpus in chapter 6, the state of affairs in (294a), where no features are deleted, is rare, even in formal speech. That is, the situation is similar to French where the most formal hierarchy is not possible in non read speech. An analysis of spontaneous Dutch would therefore ideally be limited to rankings (294bc).

On the other hand, as shown above, there is a possibility of deleting vowels altogether in informal speech. This only happens in the third syllable of quadrasyllabic, stress-final words such as the case *locomotief* at hand. Apparently, the structure with a syllable that is not parsed into a foot is disfavored in very fast speech, because, as demonstrated above, deletion does not occur in all trisyllabic words with final stress: *magazijn* *[mɑx.sɛ͡ɪn]. This can best be expressed by means of a PARSE-SYLLABLE constraint, which ranks above the constraint against deletion of rootnodes in the new style level to be described, but low, i.e. below MAX-IO-ROOT in the other grammars just described.

(295) PARSE-SYLLABLE Syllables are parsed into feet.

In order for the grammar not to find a solution in just parsing the syllable (mo) in locomotief into a monosyllabic foot, the constraint against monomoraic feet, or, alternatively, the one avoiding adjacent feet heads, must be highly ranked. These constraints, which were already discussed in chapter 5, are repeated below.

(296) a. FOOTBINARITY Feet contain minimally two syllables.
b. NOCLASH Foot heads are not adjacent.

As we have seen in chapter 5, both constraints rank on top of the hierarchy needed to derive Dutch stress, and therefore their dominating PARSE-SYLLABLE is not surprising. The following tableau shows the outcome for /lokomotif/in this fourth, very informal style.

(297)

/lokomotif/	FOOTBIN	PARSE-σ	MAX-IO-ROOT	*FEAT	MAX-IO-UNFOOTED
a.(lo.kə)mo(tif)		*!		***	
b. (lo.kə)(mo)(tif)	*!			**	
f. (lok.mo)(tif)			*	***!	
☞ g. (lok.mə)(tif)			*	**	
h. (lo.kəm)(tif)			*	**	*!
i. lok(tif)		*!		**	

Note that, as pointed out before, it is *not* [o] in the unparsed syllable (mo) that is deleted, but rather the vowel in the weak position of a binary foot, so that *loco* and *mo* can be parsed together into one binary foot. This fact cannot be described in a strictly parallel way, because the difference between the second and the third syllable is based upon their footing: *co* is weaker than *mo*, *because* it is in the weak position of a binary foot. Therefore, the deletion process can only take place *after* syllables have been parsed into feet. The tableau thus presents a simplified picture: what actually happens is that the *position* of the third syllable is deleted, but that the *vowel* of the *second* syllable disappears, as this is the least protected by the MAX-IO constraints.

The Dutch vowel reduction process takes place in weak positions of feet, which presupposes the presence of feet *before* the actual changing of vowels into [ə] takes place. Then, as we have seen for French, default features are filled in in phonetic implementation in order to realize the empty vowel. These facts require three levels, or three different grammars:

(298)		*Level*	*Phenomena to be explained*
	a.	Lexicon	Stress (at least primary)
	b.	Intermediate	Vowel reduction (secondary stress?)
	c.	Surface	Reduced vowel realization, deletion

As chapter 5 has demonstrated, and chapter 6 aimed to test, it is unclear whether primary and secondary stress should be treated at the same level. However, it is obvious that vowel reduction, which takes place on an intermediate level between phonetic realization and the lexicon, refers to both primary and secondary stressed feet.

The following table summarizes the rankings proposed for the various speech styles thus far.

(299)		*Style level*	*Style level Van Oostendorp*	*Ranking*
	a.	Read text	Formal	MAX-IO-FOOTHEAD » MAX-IO-ROOT » MAX-IO-UNFOOTED » MAX-IO-FOOTWEAK » $\boxed{\text{*ROOT » *FEATURE}}$
	b.	Formal	Semi-formal	MAX-IO-FOOTHEAD » MAX-IO-ROOT » MAX-IO-UNFOOTED » $\boxed{\text{*ROOT » *FEATURE}}$ » MAX-IO-FOOTWEAK
	c.	Semi-formal	Informal	MAX-IO-FOOTHEAD » MAX-IO-ROOT » $\boxed{\text{*ROOT » *FEATURE}}$ » MAX-IO-UNFOOTED » MAX-IO-FOOTWEAK

d.	Informal	n/a	MAX-IO-FOOTHEAD, $\boxed{\text{PARSE SYLLABLE}}$ » MAX-IO-ROOT » $\boxed{\text{*FEATURE}}$ » MAX-IO-UNFOOTED » MAX-IO-FOOTWEAK

Our model makes a strong prediction: the initial unfooted syllable of trisyllabic words with stress on the penultimate syllable, and the same syllable in bisyllabic words with final stress, is expected to behave exactly like the third syllable in stress-final quadrasyllabic words with respect to reduction. In other words, *ba* in *banaan* should reduce as the same syllable in *acrobatiek*, that is, not as easily as the second syllable in the same word does.

(300) a. *banaan* ba ˈ(nan) 'banana'
b. *acrobatiek* ˌ(a.kro) ba ˈ(tiek) 'acrobatics'

Unfortunately, there is no evidence available to support or contradict this claim: in their measurements of vowel length we discussed in chapter 5, Rietveld et al. (2004) did not compare the duration of the initial unfooted syllable to that of the third syllable in what they consider the trisyllabic foot preceding main stress in stress-final quadrasyllabic words. Such a comparison would be hard to make in any case, because the word length effect (words of two versus four syllables) cannot be neglected here.

In our own corpus data, only trisyllabic words were considered in chapter 6, in which the vowel tested was in the weak position of a binary foot. These data, listed in appendix E, could be compared to similar data for the initial syllable in bisyllabic words with final stress. In order to make this comparison, we searched for the string \v\c\a\c\ in the CGN phonetic transcripts. This yielded a list of words similar to *banaan*, which is provided in Appendix I. In these tables, the categories "conservation" and "laxing" have been collapsed into one, "unreduced", so that four lists are given: conservation (1) and reduction (2) in informal style, and in formal style (3 and 4, respectively). The results from appendices E and I are contrasted below.

(301)

Appendix	*E: weak position of binary foot*	*I: initial unfooted syllable*
Reduction in informal style	27 out of 68 cases (39.7%)	29 out of 91 cases (31.9%)
Reduction in formal style	33 out of 115 cases (28.7%)	27 out of 102 cases (26.5%)

As the table shows, the two positions behave surprisingly alike, and the initial pre-stress syllable does not seem more resistant to reduction than the weak position of a binary foot. However, as we have seen in chapter 6, full deletion of vowels only takes place in the latter position. This, and the fact that the initial syllable cannot be in the same structural environment as the syllable following secondary stress by the mere fact of its initial position, leads us to suppose that another force must be at work here.

The most important drawback of having a fully articulated vowel in a syllable preceding main stress is that the vowel baring main stress is not aligned with the left edge of the word. Moreover, the beginning of the foot does not correspond to the beginning of the word, as *ˌ(ba)ˈ(nan) is avoided for reasons of clash avoidance (cf. Gussenhoven 2007). The solution that is chosen is to reduce (and not delete) the first vowel of the world, so that the vocalic features of the second vowel are closer to the word edge. This can be explained as the effect of an ALIGN constraint which demands that the features of the vowel with main stress be adjacent to beginning of the word.

(302) ALIGN-LEFT {V-FEATURES, MAIN-FT, WORD}
The features of the vowel with main stress are adjacent to the left word edge.

This constraint can then be ranked below or above MAX-IO-UNFOOTED in order to obtain retention or reduction of the first vowel. Unlike the other two markedness constraints, it cannot rank above MAX-IO-ROOT, however, so that a pronunciation *[bnan] is ruled out for *banaan*.

(303) Tableaux for *banaan*, in semi-formal (a) and informal (b) styles.

a.

/bɑ(nan)/	NOCLASH	MAX-IO-FOOTHEAD	MAX-IO ROOT	MAX-IO-UNFOOTED	ALIGN-L	*FEATURE
☞ bɑ (nan)					*	**
(bɑ)(nan)	*!				*	**
bə(nan)				*!		*
(bnan)			*!			*

b.	/bɑ(nan)/	NOCLASH	MAX-IO-FOOTHEAD	MAX-IO ROOT	ALIGN-L	*FEATURE	MAX-IO-UNFOOTED
	bɑ (nan)				*!	**	
	(bɑ)(nan)	*!			*	**	
	☞ bə(nan)					*	*
	(bnan)			*!		*	

In the two grammars proposed, the ALIGN constraint is ranked above the *FEATURE constraint, and the two are kept next to each other as they are both markedness constraints to be reranked with markedness condiditions. For formal style, the same output as in (303a) is generated, as the constraint MAX-IO-FOOTWEAK does not play a role for bisyllabic stress-final words: there is no syllable in the weak position of a foot.

In informal speech, the rankings established up to this point predict that the initial syllable of *banaan* type words is as likely to delete as the second syllable in e.g. *initiatief*, as it forms an unparsed syllable, and therefore a violation of PARSE-SYLLABLE. The following table shows the unattested outcome [bnan].

(304)	/bɑ(nan)/	FOOTBIN	PARSE-σ	MAX-IO-ROOT	ALIGN-L	*FEATURE	MAX-IO-UNFOOTED
	a. bɑ(nan)	*	*!		*	**	
	b. ☹ bə(nan)	*	*!			*	*
	c. ☞ (bnan)	*		*		*	

However, note that *[bn] is an impossible onset in Dutch. The constraint against these clusters has a different formulation then the one proposed for French above, as deletion is very well possible inside the word: unlike in French, resyllabification does take place in Dutch. *Locomotief* is thus syllabified [lok.mə.tif] when it has its weakest syllable reduced, so that the impossible onset cluster [km] is avoided. The assumption that it is the impossibility for consonants to combine into word onsets that stops the following nucleus from deleting in words like *banaan* is confirmed by the data in appendix I: in almost all $C_1VC_2VC_3$ words, C_1 and C_2 together form an unpronounceable cluster. A first group of exceptions are [pl] in *piloot*, [st] in *citaat*, [sx] in *sigaar*, which are all separated by [i] which is hardly reducible and thus difficultly deletable as well. Next, [pn], which is marginal and only occurs in loanwords starting with *pneu-*, also seems excluded. A final counterexample, and the only true one in our view is [kn], which is a possible onset of Dutch (cf. *knie* [kni] 'knee'), but which is typologically marked (e.g. excluded in English). With this unique exception than, it can safely be assumed that deletion of the nucleus in the word-initial syllable in very informal speech is avoided because of a cluster constraint.

Having established the various rankings needed to describe the different speech styles, we can turn to the question whether speakers of Dutch clearly distinguish between the three grammars (299bcd), or, rather, that they tend to switch between the styles according to speech rate or other grammar-external factors. The latter option is more convincing if one considers the CGN data, in which speakers sometimes delete vowels (informal style), but not throughout. Similarly, a given word may contain a reduced vowel at a given time, but be fully realized five minutes later by the same speaker. The ways to formalize this in OT will be discussed in the following section.

7.4 Variation in Optimality Theory

7.4.1 Introduction

In strictly parallel OT (as in the original version proposal by Prince & Smolensky 1993), the only way to express variation is to have multiple candidates result from a given constraint ranking, as shown in (305).

(305) A tie between two candidates

a. /Input/	CONSTRAINT 1	CONSTRAINT 2	CONSTRAINT 3
☞ Candidate 1		*	**
Candidate 2	*!		
☞ Candidate 3		*	**

b. /Input/	CONSTRAINT 1	CONSTRAINT 2	CONSTRAINT 3
☞ Candidate 1		**	**
Candidate 2	*!		
☞ Candidate 3		*	***

In (305a), as candidates 1 and 3 have the exact same number of violations for constraints 2 and 3, they are judged equally "optimal" by EVAL. The chances for such a situation arising are quite small, because this tableau being a simplification of the facts, for two candidates to both be judged as optimal, they would have to have the precisely as many violations for every ranked constraint. A more frequent situation is the one in (305b), where constraints 2 and 3 are not ranked. Due to this absence of ranking, candidates 1 and 3, which have an equal number of violations for the two constraints *together*, are both optimal. This is a way in which free variation could be accounted for in OT. Consider for example the following tableau from Noske (1996).

(306) *tu devenais* 'you became' (Noske 1996:502)

/ty#dV+vVn+ɛ/	PARSE-SEGMENT	NO CODA	MONO-SYLLABICITY
☞ a. .ty.də.və.nɛ.			***
☞ b. .ty.dəv.nɛ.		*	**
☞ c. .tyd.və.nɛ.		*	**
d. tyd.v<n>ɛ	*!	*	*
e. .tyd.<v>nɛ.	*!	*	*
f. .ty<d>v.nɛ.	*!	*	*

Candidates (306def) try to obey an invisible syllable structure constraint, according to which an onset [vn] is excluded, by omitting consonants from their surface structure. These are eliminated by the faithfulness constraint PARSE-SEGMENT. (306abc) are all judged optimal, having an equal number of violations of the two unranked constraints NO CODA and MONOSYLLABICITY. Thus, according to Noske, these are the three possible pronunciations of the phrase *tu devenais*. Note that these are all equally possible in Noske's account: nothing prevents us from choosing formal [tydəvənɛ] instead of informal [tydəvnɛ], nor is there any preference for either of the informal candidates (306b) and (306c): variation is predicted to be absolutely free. However, the chances of this actually occurring are quite small. In the case at hand, we would expect (306a) to be optimal read-aloud text, and the two other forms to be selected in more informal speech styles.

In what follows, we will discuss different views on how to incorporate variation into Optimality Theory, and in particular, into our account of fast speech phonology in French and Dutch. Sections 7.4.2 through 7.4.5 will pass in review Van Oostendorp (1997b), Anttila (1997), Hayes (2000) and Boersma & Hayes (2001), respectively.

7.4.2 Van Oostendorp (1997b)

A first possible solution to account for variation according to style level is proposed by Van Oostendorp (1995, 1997b, 2000) for Dutch vowel reduction: every style level has a different ranking, assuming that in formal speech, faithfulness constraints are ranked higher than in the other grammars. This is the solution adopted thus far in this thesis: e.g. for French, there were two possibilities, one with the MAX-IO-VOCALIC constraint ranked above *VOWEL, and one where the latter outranks the former.

However, when every reranking of constraints is a possible grammar, and the number of constraints that can be reranked increases, the question of how to limit the number of these immediately comes to mind, especially as the three different rankings established for Dutch are only part of the inventory of possible rankings of eight constraints (as these can theoretically be ordered in 8! = 40,320 ways)

As chapter 5 showed, this question is also raised by Van Oostendorp (1997a), commenting on Nouveau (1994), who treats the different possibilities for stressing Dutch words as different grammars. According to Van Oostendorp, the existence of some grammars and the absence of others have to be explained for. Van Oostendorp (1997b), discussing various cases of social variation within OT, treats the Dutch reduction case from Van Oostendorp (1995) again, this time stating that the division into exactly three style levels is arbitrary, and that "[t]here seems to be little reason to make exactly this distinction and not to distinguish e.g. two style levels or four." (Van Oostendorp 1997b:221). However, limits are imposed by obligatory rankings: "PARSE-[+high] always dominates the wellformedness constraints, which in turn always dominate the constraint PARSE-[+front]" (Van Oostendorp 1997b:221). The fixed ranking of faithfulness constraints and that of markedness constraints can then interact. This yields the ranking possibilities in (307). (308) lists the consequences of each ranking for the examples *plezier* 'pleasure', *fataal* 'fatal', *fonologie* 'phonology', and *bizar* 'bizarre' from Van Oostendorp (1997b).

(307)

a. PARSE-[+high] » PARSE-[+rnd] » PARSE-[+low]» REDUCE-2 » REDUCE-1 » PARSE-[+front]
b. PARSE-[+high] » PARSE-[+rnd]» REDUCE-2 » PARSE-[+low] » REDUCE-1 » PARSE-[+front]
c. PARSE-[+high] » PARSE-[+rnd] » REDUCE-2 » REDUCE-1 » PARSE-[+low]» Parse-[+front]
d. PARSE-[+high] » REDUCE-2 » PARSE-[+rnd] » PARSE-[+low] » REDUCE-1 » PARSE-[+front]
e. PARSE-[+high] » REDUCE-2 » PARSE-[+rnd]» REDUCE-1 » PARSE-[+low] » PARSE-[+front]
f. PARSE-[+high] » REDUCE-2 » REDUCE-1 » PARSE-[+rnd] » PARSE-[+low] » PARSE-[+front]

(308)

	[e]	[a]	[o]	[i]
a.	pləzir	fatal	fonoloɣi	bizɑr
b.	pləzir	fətal	fonoloɣi	bizɑr
c.	plәzir	fətal	fonoloɣi	bizɑr
d.	pləzir	fatal	fonəloɣi	bizɑr
e.	pləzir	fətal	fonəloɣi	bizɑr
f.	pləzir	fətal	fonələɣi	bizɑr

Rankings (307aef) represent Van Oostendorp's rankings for formal, semi-formal and informal style, respectively. Styles (307bcd) are equally logically possible.

In addition to the rankings established in the preceding section, there are also more possible grammars using our constraint set and its ranking limitations. Recall that these were that MAX-IO-FOOTWEAK should be on top of the hierarchy, that the MAX-IO constraints are in a fixed ranking just as the markedness constraints *ROOT and *FEATURE, and that *ROOT may never outrank MAX-IO-ROOT, because otherwise, the candidate with the lowest amount of vowels simply wins. The constraint PARSE-SYLLABLE is less limited in its rankings, but like *FEATURE and *ROOT, can only rank between MAX-IO-FOOTHEAD and MAX-IO-FOOTWEAK. The constraint ALIGN can be ranked either above or below *FEATURE, but we did not investigate these possibilities here, as ALIGN only plays a role in words with a single unfooted syllable before main stress such as *banaan* and *pyjama*, and including it would simply double the number of grammars under consideration, without changing the results for words with more than two syllables, which we will take as a testing ground further on. These considerations yield the following possible hierarchies:

(309)

I. MAX-IO-FTHD » PARSE-σ » MAX-IO-RT » *ROOT » *FEAT » MAX-IO-UNFTD » MAX-IO-FTWK
II. MAX-IO-FTHD » PARSE-σ » MAX-IO-RT » *ROOT » MAX-IO-UNFTD » *FEAT » MAX-IO-FTWK
III. MAX-IO-FTHD » PARSE-σ » MAX-IO-RT » MAX-IO-UNFTD » *ROOT » *FEAT » MAX-IO-FTWK
IV. MAX-IO-FTHD » MAX-IO-RT » *ROOT » *FEAT » PARSE-σ » MAX-IO-UNFTD » MAX-IO-FTWK
V. MAX-IO-FTHD » MAX-IO-RT » *ROOT » *FEAT » MAX-IO-UNFTD » PARSE-σ » MAX-IO-FTWK
VI. MAX-IO-FTHD » MAX-IO-RT » *ROOT » PARSE-σ » *FEAT » MAX-IO-UNFTD » MAX-IO-FTWK
VII. MAX-IO-FTHD » MAX-IO-RT » *ROOT » PARSE-σ » MAX-IO-UNFTD » *FEAT » MAX-IO-FTWK
VIII. MAX-IO-FTHD » MAX-IO-RT » *ROOT » MAX-IO-UNFTD » *FEAT » PARSE-σ » MAX-IO-FTWK
IX. MAX-IO-FTHD » MAX-IO-RT » *ROOT » MAX-IO-UNFTD » PARSE-σ » *FEAT » MAX-IO-FTWK
X. MAX-IO-FTHD » MAX-IO-RT » PARSE-σ » *ROOT » *FEAT » MAX-IO-UNFTD » MAX-IO-FTWK

XI. MAX-IO-FTHD » MAX-IO-RT » PARSE-σ » *ROOT » MAX-IO-UNFTD » *FEAT » MAX-IO-FTWK
XII. MAX-IO-FTHD » MAX-IO-RT » PARSE-σ » MAX-IO-UNFTD » *ROOT » *FEAT » MAX-IO-FTWK
XIII. MAX-IO-FTHD » MAX-IO-RT » MAX-IO-UNFTD » *ROOT » *FEAT » PARSE-σ » MAX-IO-FTWK
XIV. MAX-IO-FTHD » MAX-IO-RT » MAX-IO-UNFTD » *ROOT » PARSE-σ » *FEAT » MAX-IO-FTWK
XV. MAX-IO-FTHD » MAX-IO-RT » MAX-IO-UNFTD » PARSE-σ » *ROOT » *FEAT » MAX-IO-FTWK

Note that we did not consider the read text style here, focussing on spontaneous speech only. Regardless of the position of PARSE-SYLLABLE, grammars XII through XV represent the ranking for formal speech and rankings IV, V, VI, X, and XI are semi-formal. For the informal style, where PARSE-SYLLABLE plays an important role, I is the only grammar that corresponds to the ranking discussed in the preceding section. The other rankings, i.e. II, III, VIII, and IX represent intermediate stages.

Each of the fifteen grammars proposed has as an outcome one of the candidates already mentioned. That is, only candidates with a reduced vowel in the weak position of a binary foot, with both this vowel and the one in unfooted position reduced, or with a deleted vowel in the dependent position are generated.

A major disadvantage of this model is that it does not explain for the choice of some grammars to represent styles of speech, while others are not taken into account. No difference is made between an output that is preferred by ten grammars and one that is only generate by one ranking. The following section will discuss a theory according to which the number of times a candidate is judged optimal is linked to its probability.

7.4.3 Anttila (1997)

In Anttila's view, tableau (305b), which we repeat below as (310), and in which constraints 2 and 3 are not ranked, can be decomposed into the two tableaux in (311), which each form a grammar of the language under consideration.

(310) Tie - (305b) repeated

b. /Input/	CONSTRAINT 1	CONSTRAINT 2	CONSTRAINT 3
☞ Candidate 1		**	**
Candidate 2	*!		
☞ Candidate 3		*	***

(311) Decomposition of tableau (310) into two possible rankings

a. /Input/	CONSTRAINT 1	CONSTRAINT 2	CONSTRAINT 3
Candidate 1		**!	**
Candidate 2	*!		
☞ Candidate 3		*	***

b. /Input/	CONSTRAINT 1	CONSTRAINT 3	CONSTRAINT 2
☞ Candidate 1		**	**
Candidate 2	*!		
Candidate 3		***!	*

As (311) shows, the grammar CONSTRAINT 1 » CONSTRAINT 2, CONSTRAINT 3 can be decomposed into two possible grammars, one in which CONSTRAINT 2 dominates CONSTRAINT 3 ((311a)), and in which candidate 3 wins, and another one with the reverse ranking for constraints 2 and 3, and in which the first candidate comes out as optimal, as in (311b). Anttila's model of variation in OT is the following:

(312) a. A candidate is predicted by the grammar iff it wins in some tableau.
b. If a candidate wins in *n* tableaux and *t* is the total number of tableaux, then the candidate's probability of occurrence is *n/t*. (Anttila 1997:48)

For our tableaux, with only the two possibilities in (311), this means that each of the candidates 1 and 3 has a probability of occurrence of ½ = 50%. Let us now consider again tableau (306). As NO CODA and MONOSYLLABICITY can be ranked in two different ways, there are two possible tableaux, which are provided below.

(313) *tu devenais* 'you became' (Noske 1996:502)

a. /ty#dV+vVn+ɛ/	PARSE-SEGMENT	NO CODA	MONO-SYLLABICITY
☞ 1. .ty.də.və.nɛ.			***
2. .ty.dəv.nɛ.		*!	**
3. .tyd.və.nɛ.		*!	**
4. tyd.v<n>ɛ	*!	*	*
5. .tyd.<v>nɛ.	*!	*	*
6. .ty<d>v.nɛ.	*!	*	*

b. /ty#dV+vVn+ɛ/	PARSE-SEGMENT	MONO-SYLLABICITY	NO CODA
1. .ty.də.və.nɛ.		***!	
☞ 2. .ty.dəv.nɛ.		**	*
☞ 3. .tyd.və.nɛ.		**	*
4. tyd.v<n>ɛ	*!	*	*
5. .tyd.<v>nɛ.	*!	*	*
6. .ty<d>v.nɛ.	*!	*	*

In (313a), with NO CODA ranked high, the first candidate comes out as optimal. It therefore has a 50% probability. However, in the other possible tableau, with MONOSYLLABICITY ranked over NO-CODA, both (313b2) and (313b3) are optimal, and therefore these would also have a probability of 50%, together. This way, it is still not clear what the exact probability of these two candidates is: do they each have a 25% chance of appearing on surface level? Calculations based on (312) only work if every grammar produces exactly one candidate.

In order for Anttila's model to work on Noske's tableau, then, we would need an extra constraint which evaluates (313b2) and (313b3) in a different way. This could be a constraint excluding schwa in closed syllables, *əC]σ. However, this constraint simply eliminates candidate (313b2) from the set of optimal candidates, because neither of the two other possible outcomes violates this constraint. As the number of violations of NO CODA and MONOSYLLABICITY is exactly balanced, there is no possible constraint that could decide between (313b2) and (313b3), without excluding one of the two as suboptimal: it would always have one or more violation mark more than the other two candidates. Thus, [ty.dəv.nɛ] would no longer be a possible variant, which cannot be the desired effect.

More interestingly, let us now look at the consequences of Anttila's model for our account of Dutch vowel reduction and deletion. In Appendix J, the input *fonologie* is evaluated according to each of the fifteen possible grammars cited above. The results are summarized below.

(314)	*optimal candidate*	*grammar(s)*	*probability* (=$\frac{\textit{number of grammars}}{15}$ *x 100%*
a.	fonoloxi	-	0%
b.	fonəloxi	VII, VIII, IX, XI,XII, XIII, XIV, XV	53.3%
c.	fonələxi	IV, V, VI, X,	26.7%
d.	fonoləxi	-	
e.	fonləxi	I, II, III	20%

The probability of occurrence of reduction is 80% (when cases with only the vowel in weak position and cases with both the weak and the unparsed vowel reduced are collapsed), whereas deletion is expected to take place 20% of the time. The model thus correctly predicts that deletion is less frequent than reduction, and that if one reduces, it is most often only the vowel in the weak position in the foot. However, the percentage for complete deletion seems relatively high, although it has to be noted that we are only considering quadrisyllabic words here, in which this deletion process just happens to take place (unlike in trisyllabic words for example, where it is rare).

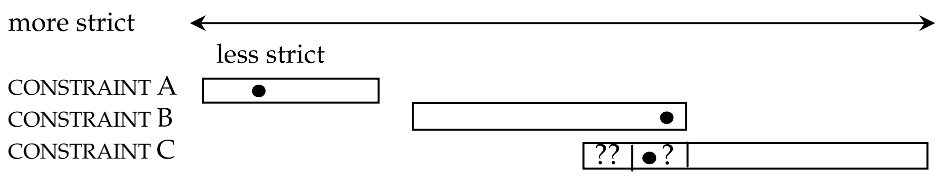
In addition to the fact that the percentages do not exactly correspond to reality, the problem with Antilla's approach is that we are dealing with two phenomena at the same time. The percentages indicate the probability of a form *regardless* of the style level used. Predicting [fonəloxi] in 53.3% of cases means at the same time that speakers of Dutch are claimed to use a formal style about half of the time. This problem becomes even more apparent when French is taken into account: as in our model of schwa/zero alternations, the only possible reranking is that of MAX-IO-VOC with the *VOWEL constraints, only two outputs are possible, a formal and an informal candidate, with a probability of 50% each.

The following sections will discuss two other models of linguistic variation in OT, checking whether these are as exact as Anttila's, and if they allow accounting for the fact that the various forms belong to various speech styles or rates.

7.4.4 Hayes (2000)

Departing from the idea that intuitions of speakers are rather gradient than categorical, Hayes (2000) proposes to replace strict ranking of constraints by a new model, in which constraints can overlap: Gradient Welformedness. Overlap can occur without any restrictions (free variation), but also, constraints can be claimed to be reranked at the cost of the resulting candidate being more or less ill-formed. The following scheme will clarify this approach.

(315) Constraint ranking in Hayes' (2000) model



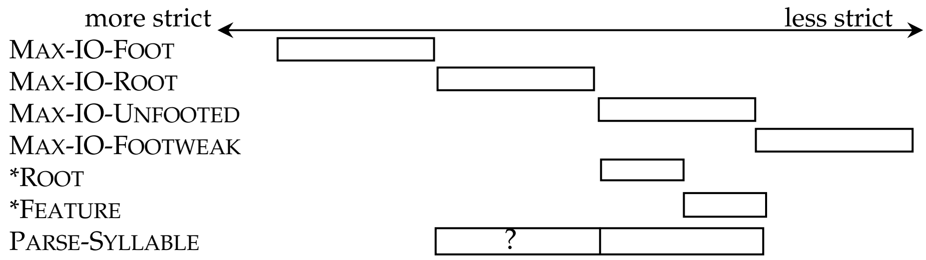
Constraints are represented with "strictness bands": their ranking is in a range of values, which is symbolized by a horizontal line. The exact position that the constraint takes within this strictness band is given by a dot, the so-called selection point. The selection point is "the particular value of strictness taken on by a constraint on a given speaking occasion" (Hayes 2000:89).

In (315), the strictness bands of constraints A and B do not overlap: they are strictly ranked, as was the case in the "classical" OT model, and can be reranked under no circumstances. Whatever strictness of application of these constraints is chosen, and where-ever we place the selection points within the strictness bands of these constraints, A will always outrank B. Constraints B and C do overlap, but B only overlaps the so-called fringes of C. That is, it is only in mildly ill-formed ("?") or considerably ill-formed ("??") cases that C can dominate B. In the case at hand, the selection point in constraint B being below that in C, C outranks B, although the candidate is mildly ill-formed (i.e, the selection point is in the "?" area).

If we compare this proposal to Anttila's, the fringes in Hayes' proposal account for the rarely occurring candidates, which were explained for by the relatively small number of grammars that predicted them in Antilla's account. Instead of having multiple equally possible grammars resulting from the absence of ranking between various constraints, Hayes proposes the possibility of reranking constraints with the cost of the resulting candidate being more or less ill-formed.

The Hayes' model can be applied to the Dutch reduction/deletion grammar in the following way:

(316)



As shown in (316), the MAX-IO-constraints are never reranked, and their strictness bands therefore do not overlap. The same holds for the two markedness constraints *ROOT and *FEATURE, which can be ranked with MAX-IO-FOOTWEAK and therefore together display complete overlap with this constraint. As can be seen, MAX-IO FOOTWEAK can also rank between the two, as in grammars II, VII, VIII, IX, and XI. The fact that reduction is more frequent than deletion can be expressed by giving the constraint PARSE-SYLLABLE, which is responsible for the latter process, a '?'-fringe on its left side, from where it begins to overlap with MAX-IO-ROOT.

However, the analysis seems to run into trouble once the constraint *FEATURE, which prohits realization of a feature, is decomposed into its various components: *[high], *[round], etc. This will first be shown by applying Hayes' model to a different account of Dutch vowel reduction, Van Oostendorp (1997b). As mentioned, Van Oostendorp uses the following constraints to account for the fast speech process:[57]

(317)	a.	PARSE-FEATURE	a feature has to be parsed into a segment
	b.	REDUCE-1	weak and semi-weak positions should be schwa.
	c.	REDUCE-2	weak positions should be schwa.

As pointed out before, Van Oostendorp approaches the problem the other way round: the REDUCE constraints demand reduction, whereas a range of PARSE-FEATURE constraints prevents the various vowels from turning into the RV. Furthermore, the author incorporates a style in which al vowels are fully realized into his description, which he calls "formal", but which we left outside of consideration because of the rareness of fully articulated forms in the CGN. This difference will turn out to be crucial. The simplified version of Van Oostendorp's model can easily be described by means of strictness bands, as demonstrated below.

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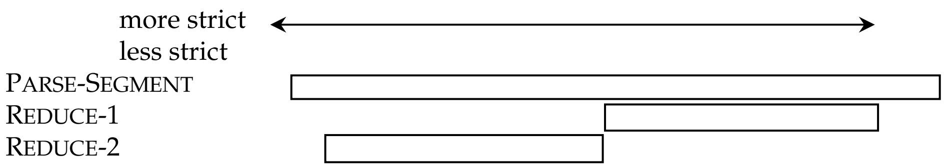
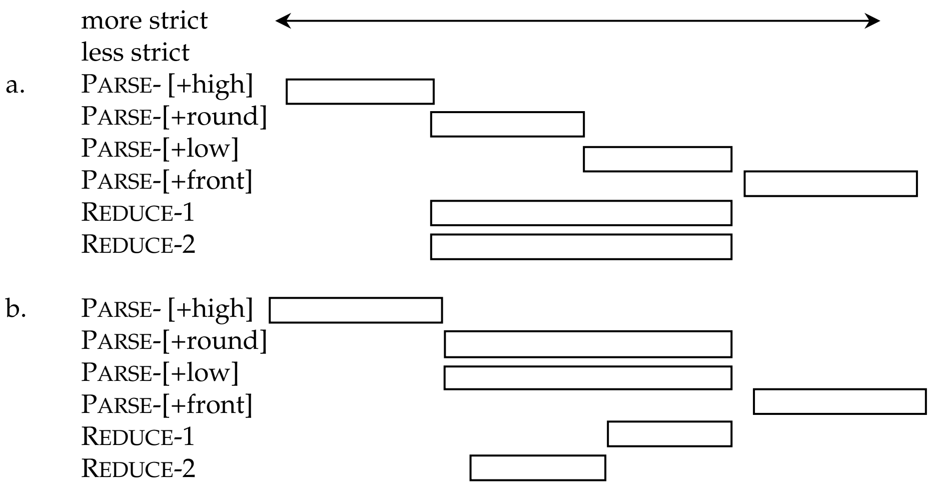
[57] The REDUCE constraints roughly correspond to the PROJECT constraints from Van Oostendorp 1995,2000) we discussed earlier.

(318)



As shown in (318), whereas REDUCE-2 will always outrank REDUCE-1, PARSE-SEGMENT can either outrank both constraints (formal style), be in between (semi-formal style), or be dominated by both of them (informal style). However, if we decompose PARSE-SEGMENT into the various feature-specific constraints it is composed of, it becomes impossible to represent the constraint hierarchy argued for by Van Oostendorp within Hayes' model. This is shown in (319).

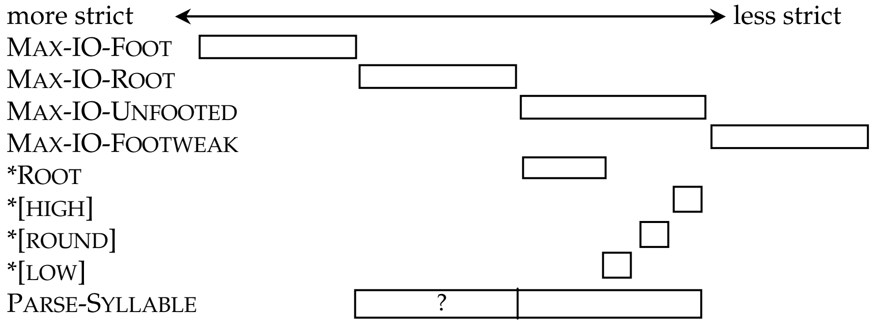
(319)



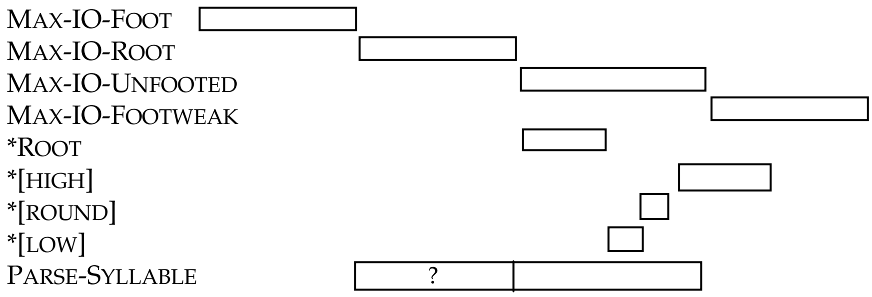
If we assume that the PARSE-constraints cannot overlap, they should be ranked as in (319a). However, the REDUCE-constraints, which are in a fixed ranking and therefore do not overlap, can then no longer be ranked with respect to the PARSE hierarchy in (319a): REDUCE-1 has to be dominated by REDUCE-2, which is impossible if we want both to overlap the middle two PARSE constraints.. Approaching the problem the other way round, by first ranking REDUCE-1 and REDUCE-2, is not a solution either, as shown in (319b). Constraints PARSE-[+round] and PARSE-[+low], which both have to be able to dominate and rank below the REDUCE-constraints, can only be left unranked in this model, which is not Van Oostendorp's intention.

Looking back at (316), it is easily seen that in our model, the *FEATURE-constraint can be decomposed without problems: it only overlaps with MAX-IO-UNFOOTED and PARSE-SYLLABLE, two constraints which are not necessarily ranked with respect to each other. This is shown in (320a).

(320) a.



b.

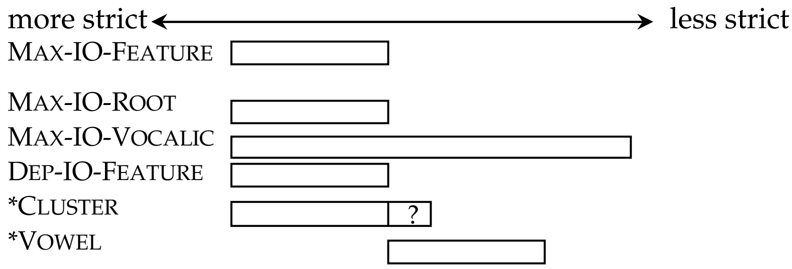


The picture changes if we take into account forms in which all vowels are conserved. In order to arrive at such a grammar, some of the *FEATURE constraints have to be dominated by MAX-IO-FOOTWEAK. As shown in (320b), this can only be obtained by expanding the strictness band of the lowest ranked *FEATURE-constraint to the right. Moving the whole feature to the right is not an option, because then, it can no longer interact with MAX-IO-UNFOOTED, so that low vowels in unfooted positions are predicted to be conserved troughout. If *[low] cannot be integrally moved to the right, the other *FEATURE-constraints cannot overlap with MAX-IO-FOOTWEAK, which would mean only [high] vowels can be conserved in the weak position of a binary foot. This possibility seems perfectly acceptable: if there is a spontaneous speech style in which vowels can be conserved in prosodically weak environments, it is exactly the high vowels which one expects to be saved in Dutch.

The Hayes model elegantly incorporates the type of variation needed in our account of Dutch, and has a major advantage with respect to Antilla (1997): it explains for the form which is preferred at a given moment. The more informal the speech, the less strictly the markedness constraints are respected (i.e. the less attention to perception). Thus, the selection points of the markedness constraints are likely to be below those of faithfulness constraints in fast speech.

Our analysis of French schwa/zero alternations can be translated into the gradient well-formedness model as follows.

(321) a.



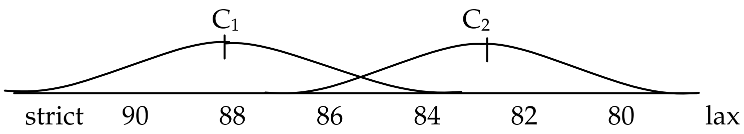
The fringe on the right hand side of the *CLUSTER constraint accounts for the variation that occurs in the clusters that are actually allowed: in marginal cases, the constraint is ranked below *VOWEL so that a vowel is deleted even though this creates an elsewhere impossible group of consonants.

The fact that Max-IO-VOCALIC is either ranked above or beneath all of the *VOWEL constraints at the same time cannot be accounted for unless the latter are considered to be one single constraint: if the strictness bands of *ROOT, *VOCALIC, AND *FEATURE would overlap with that of MAX-IO-VOCALIC, the latter could also be ranked between the first two, or between the last two constraints, which would produce incorrect optimal candidates. This is the only slight inconvenience for this theory of variation thus far, so that we will adopt it to account for the linguistic varieties described in this thesis.

7.4.5 Boersma & Hayes (2001)

Boersma & Hayes (2001) replace the fringed strictness bands by probability distributions ("Stochastic OT"). Constraints are placed on a "continous ranking scale", going from strict to lax, in which they are allowed to overlap as in Hayes' model. However, constraints are claimed to be normally distributed, with a standard deviation fixed at 2.0. That is, it is argued that the mid value of the constraint has the highest probability (68% of possible values is located within one standard deviation from the center), and that this probability diminishes when we approach the constraint's limits. This is schematized below.

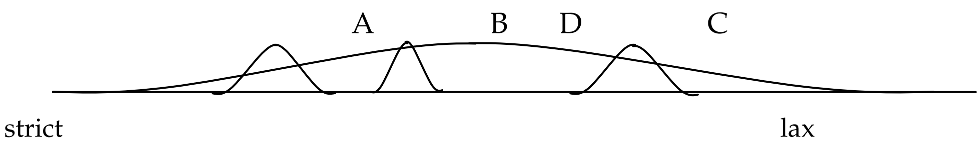
(322) Overlapping ranking distribution (Boersma & Hayes 2001:49)



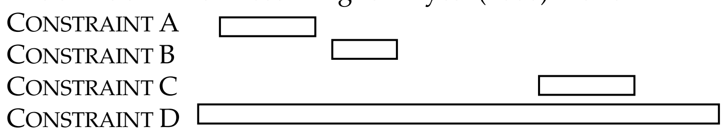
As shown in (322), constraints are distributed in the clock-shaped form of the normal distribution in statistics. In most cases, C_1 will outrank C_2, but the inverse ranking is also possible as shown by the small overlap.

An important difference with Hayes' (2000) model is that stronger predictions are made on possible variations. Whereas in Hayes' account, theoretically, a single constraint could overlap multiple other constraints at the same time, this possibility is eliminated partly in the Boersma & Hayes approach, due to the normal distribution of constraints. A situation like the one below is therefore excluded.

(323) a. Impossible ranking: multiple standard deviations (Boersma & Hayes 2001:50)



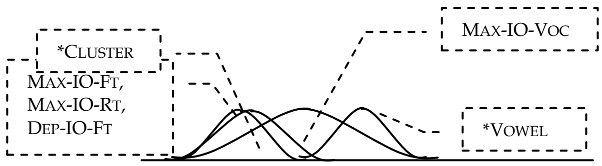
b. The same situation according to Hayes' (2000) model



The situation in (323a) is impossible, because constraints all have the same standard deviation. In order for constraint D to overlap the other constraints in this way, its standard deviation would have to be a lot larger that that of A, B, and C. As shown in (323b), the strictness band of constraint D can overlap those of A, B, and C, and therefore, the situation depicted in (323a) can be correctly represented in Hayes' account. For this reason, Boersma & Hayes' model is a lot more powerful than that of Hayes': it makes stronger predictions on what is a possible grammar.

It is exactly because of these extra predictions that the Boersma & Hayes model cannot be applied to our analysis of fast speech phenomena. As the figure below shows, for French, one constraint entirely overlapping two others is needed. For Dutch, the situation is even more complicated: four markedness constraints have to be covered by PARSE-SYLLABLE and MAX-IO-UNFOOTED. For these reasons, we will not adopt the Boersma & Hayes model here.

(324)



7.4.6 Conclusion

The three models of variation discussed in this section all make predictions on what rerankings of constraints are possible. In Van Oostendorp's model, every two constraints that are not ranked can be ranked in two ways: constraint 1 dominates constraint 2 or the other way round. Both possibilities are then part of a possible grammar. Anttila (1997) makes the additional prediction that a candidate has a probability value that corresponds to the number of grammars it results of. Hayes (2000) and Boersma & Hayes (2001) introduce the notion of overlapping constraints, limiting the possibilities of overlapping largely to neighboring constraints.

With the exception of the last one, all of these models seem to work on our accounts of fast speech phenomena. In particular, Hayes' gradient constraint rankings produce a clear picture that is able to account for all the details in the data: the preference of reduction over deletion in Dutch, and the fact that high vowels may not reduce in the weak position of a binary foot, even in colloquial Dutch. For French, again except for the Boersma & Hayes model, all theories of variation are successful, but that of Hayes' is preferable, as, unlike Anttila's, it does not prodict a probability of exactly 50% for formal speech.

7.5 General Conclusion

In this chapter, we provided an account for two fast speech phenomena: French schwa/zero alternations and Dutch vowel reduction. The trigger of these processes is identical: the desire of the speaker to put less effort into his utterances. This was expressed by means of markedness constraints, which target vowels and their three components: the root, the vocalic node, and the vocalic features.

The effect of these constraints is countered by the two languages in two different ways: in Dutch, vowels with prosodic prominence tend to be preserved, whereas French realizes those which are needed to prevent complicated consonant clusters from occurring. The absence of this prosodic trigger in French can easily be accounted for by the fact that French has no feet, and that therefore, even if the prosodic faithfulness constraints were highly ranked, the language would still allow for deletion everywhere. For French then, a constraint against complicated consonantal groups and one against deletion of features are the brakes on reduction.

Second, empty vowels such as those occurring in French surface forms simply are not allowed in Dutch outputs, just like, say, retroflex consonants are not. This is also reflected in the way vowels are reduced: in French, only deletion of vocalic nodes with no features is possible, whereas Dutch allows for omission of features, or entire vowels only. This difference is accounted for by the different distribution of empty vowels in the two languages, and by the importance of parsing syllables into binary feet in the latter.

The research questions formulated in chapter 1 can now be answered in the following way.

Q1. What exactly happens in fast speech phenomena?

In Dutch, vowel reduction, that is, loss of features, takes place in the weak position of a binary foot (all spontaneous speech styles) and in an unfooted syllable (informal speech styles). Furthermore, a vowel can be deleted, preferably in the weak position mentioned. In French, the vocalic node of a schwa is deleted if this does not yield an unpronounceable consonant cluster. This condition is met especially when the cluster contains a fricative.

Q2. How are fast speech phenomena conditioned?

Dutch vowel reduction is clearly conditioned by the foot. Moreover, as suppression of features can only take place once foot structure has been established, this demands for at least a two-level approach to Dutch phonology. Vowel reduction appears to be the only segmental process by means of which Dutch foot structure can be established, which is why we adopted the binary foot instead of a ternary one, as this allows for a better description of the reduction process.

In French, the syllable is not the conditioning factor, contrary to what has been assumed by numerous authors. The clusters created after schwa deletion need not be sequences of legal codas followed by legal onsets, as deletion in the phrase-initial syllable, but also word-internal deletions from the PFC-corpus clearly show. Furthermore, after deletion of a schwa, the surrounding consonants are not resyllabified, which corroborates the view that onsets and codas cannot be the trigger behind the process, as it does not help them to improve. For these reasons, it seems that it is rather the resulting consonant cluster as a whole that conditions the process of schwa deletion. The exact conditions are still unclear, as they differ per speaker and per speech condition, but it is clear that fricatives have a positive effect, especially when breaking up a cluster of obstruents.

Both processes occur in informal speech, but as corpus data have shown, they also occurring in other spontaneous utterances, albeit less than in truly fast dialogues. Therefore, the so-called fast speech phenomena described in this thesis hopefully contribute to a better understanding of human spoken language in general.

Q3. How can we describe both the answers to Q1 and Q2 in OT?

It was the aim of this chapter to find an answer to this question. If the tendency of the speaker to reduce his effort is seen as the rise of markedness constraints at the cost of faithfulness constraints, Optimality Theory is able to account for both processes at hand. However, the original, strictly parallel, concept of OT cannot describe what exactly happens, as in Dutch, reduction takes place after prosodic parsing, and in French, features like [round] are only filled in and spreading of features only takes place to empty nuclei of which the vocalic node has not been deleted. In the latter case, the problem can be solved by leaving the filling and spreading to phonetic implementation. This could be a solution for Dutch as well, although it would mean that vowel reduction is a case of phonetic implementation, whereas schwa/zero alternations are a phonological process, and the two processes are clearly two examples of effort reduction.

A second challenge for OT is the fact that both processes display variation, depending on style level, but also within one style of speech, spreakers tend to vary the form of the word they use. As shown in the preceding section, this is best explained for by constraints of which the strictness of application may vary, and which display fringes that allow marginal forms to surface. In reality, the ranking of these constraints is of course influenced by rhythmic factors.

The difference in conditioning between the two languages is easily explained for: the constraints protecting stressed vowels do not have an effect in French, because this language has only phrase-final stress. A reduction process can therefore never occur in French. On the other hand, the explanation for the fact that Dutch does not have schwa/zero alternation is less straightforward.

The contribution of this thesis to the linguistic debate lies not only in the answers found to the research questions Q1 through Q3, but also in the way these answers were obtained. For Dutch, like Ernestus (1999), we used a corpus of spontaneous speech, which was in our case not collected especially for the purpose of recording fast speech, but to provide a completely new look at a phenomenon that up to this point had mostly been studied through introspection and laboratory experiments. The same holds true for French, for which we drew on data from a recent and still growing corpus of spontaneous speech collected all over the country. Thus, we hope to have given a new dimension to the theoretical discussion on fast speech.

Appendix A

Below is a list of the subjects from the PFC corpus we used in our survey. Subjects are listed by code name, which is constructed as follows:

2 1 a m a 1

Additional digit to distinguish subjects with identical initials

Subject's initials

Department

Used to distinguish multiple surveys in a single department

#	*Code name*	*Point d'enquête*	*Age* *when survey was conducted*	*Sex*	*Profession*
01	50aad1	Brécey	16	f	student
02	50aev1	Brécey	20	f	student
03	50aid1	Brécey	39	f	service agent
04	50ajm1	Brécey	53	m	insurance
05	50ajp1	Brécey	19	m	student
06	50alb1	Brécey	55	f	teacher
07	50apb1	Brécey	42	m	antiquarian
08	50app1	Brécey	69	f	retired farmer
09	50arm1	Brécey	81	m	retired cattle middleman
10	50atv1	Brécey	42	f	secretary
11	50ayp1	Brécey	43	m	commercial agent
12	21abl1	Dijon	29	m	temporary worker
13	21abm1	Dijon	31	m	graphic designer
14	21acl1	Dijon	25	f	boarding school supervisor
15	21acp1	Dijon	25	f	student
16	21ama1	Dijon	26	m	temporary worker
17	21amb1	Dijon	27	f	free-lance translator
18	21aml1	Dijon	24	f	student
19	21ash1	Dijon	86	f	retired teacher

20	75cab1	Paris Centre	69[58]	f	unknown
21	75cac1	Paris Centre	41[1]	m	unknown
22	75cbl1	Paris Centre	44[1]	f	unknown
23	75ccb1	Paris Centre	25[1]	m	unknown
24	75ccm1	Paris Centre	33[1]	m	unknown
25	75ccr1	Paris Centre	34[1]	f	unknown
26	75ccr2	Paris Centre	56[1]	f	unknown
27	75cgn1	Paris Centre	86	m	retired chemical laboratory manager
28	75clc1	Paris Centre	23[1]	m	unknown
29	75clh1	Paris Centre	64[1]	m	unknown
30	75csb1	Paris Centre	25[1]	f	unknown
31	75cvl1	Paris Centre	25[1]	f	unknown
32	85agm1	Treize Vents	22	m	boat mechanic
33	85ajf1	Treize Vents	45	m	commercial executive
34	85ajg1	Treize Vents	87	m	retired hairdresser
35	85alt1	Treize Vents	39	m	writer/composer
36	85amg1	Treize Vents	62	f	retired hairdresser
37	85amm1	Treize Vents	56	f	ward orderly
38	85apr1	Treize Vents	20	f	waitress
39	85asl1	Treize Vents	59	m	smith
40	91aal1	Brunoy	27	f	PhD student
41	91aal2	Brunoy	73	m	retired concern owner
42	91acs1	Brunoy	22	m	photocopier technician
43	91acs2	Brunoy	49	f	civil servant
44	91adb1	Brunoy	54	m	informatics teacher
45	91aed1	Brunoy	60	f	secondary teacher instructor
46	91ael1	Brunoy	73	f	retired bank employee
47	91ajc1	Brunoy	63	m	informatics manager
48	91amb1	Brunoy	62	m	technician
49	91asl1	Brunoy	64	f	head of book keeping departement

[58] Estimated age: the age of the subject at the time of the survey was not listed, but was calculated assuming the whole survey in Paris took place in 2004, after the subject's birthday.

Appendix B

In the PFC corpus, the following text was read aloud by all subjects:

[0] **Le Premier Ministre ira-t-il à Beaulieu?**

[1] Le village de Beaulieu est en grand émoi.
[2] Le Premier Ministre a en effet décidé de faire étape dans cette commune au cours de sa tournée de la région en fin d'année.
[3] Jusqu'ici les seuls titres de gloire de Beaulieu étaient son vin blanc sec, ses chemises en soie, un champion local de course à pied (Louis Garret), quatrième aux jeux olympiques de Berlin en 1936, et plus récemment, son usine de pâtes italiennes.
[4] Qu'est-ce qui a donc valu à Beaulieu ce grand honneur?
[5] Le hasard, tout bêtement, car le Premier Ministre, lassé des circuits habituels qui tournaient toujours autour des mêmes villes, veut découvrir ce qu'il appelle « la campagne profonde ».
[6] Le maire de Beaulieu – Marc Blanc – est en revanche très inquiet.
[7] La cote du Premier Ministre ne cesse de baisser depuis les élections.
[8] Comment, en plus, éviter les manifestations qui ont eu tendance à se multiplier lors des visites officielles ?
[9] La côte escarpée du Mont Saint-Pierre qui mène au village connaît des barrages chaque fois que les opposants de tous les bords manifestent leur colère.
[10] D'un autre côté, à chaque voyage du Premier Ministre, le gouvernement prend contact avec la préfecture la plus proche et s'assure que tout est fait pour le protéger.
[11] Or, un gros détachement de police, comme on en a vu à Jonquière, et des vérifications d'identité risquent de provoquer une explosion.
[12] Un jeune membre de l'opposition aurait déclaré :
[13] « S'il faut montrer patte blanche pour circuler, nous ne répondons pas de la réaction des gens du pays.
[14] Nous avons le soutien du village entier. »
[15] De plus, quelques articles parus dans La Dépêche du Centre, L'Express, Ouest France et Le Nouvel Observateur indiqueraient que des activistes des communes voisines préparent une journée chaude au Premier Ministre.
[16] Quelques fanatiques auraient même entamé un jeûne prolongé dans l'église de Saint Martinville.
[17] Le sympathique maire de Beaulieu ne sait plus à quel saint se vouer.
[18] Il a le sentiment de se trouver dans une impasse stupide.

[19] Il s'est, en désespoir de cause, décidé à écrire au Premier Ministre pour vérifier si son village était vraiment une étape nécessaire dans la tournée prévue.

[20] Beaulieu préfère être inconnue et tranquille plutôt que de se trouver au centre d'une bataille politique dont, par la télévision, seraient témoins des millions d'électeurs.

Appendix C

For our sample of the PFC corpus, the following tables list the possible and impossible consonantal groups resulting from schwa deletion, respectively.

(325)	*Cluster*	*Token*	*Speaker*
	b(l)ʒkʁw	semble je crois	75cab1
	bʒp	arabe je peux	75ccr1
	ddl	Sud de la	85apr1
	d(ʁ)ʒlɥ	descendre je lui	75cgn1
	dsf	monde se fait	75ccm1
	jsp	soleil se pointe	50atv1
	jʒl	pareil je la	85agm1
	jʒs	travaille je sais	50aev1
	kkʒ	trucs que j'ai	21ama1
	ksk	donc ce qui	91adb1
	kʒf	que je fasse	50aad1
	kʒkʁw	organique je crois	50aad1
	kʒl	donc je les ai	91amb1
	kʒm	donc je m'y suis	50alb1
		donc je m'occupe	91asl1
	kʒn	que je n'avais	50atv1
	kʒsɥ	donc je suis	21amb1 (2x)
			50alb1
			75ccm1
	kʒp	donc je peux	91acs1
		donc je pense	91acs2
	kʒtʁ	que je travaille	85amg1
	ldk	salle de concerts	85apr1
	lls	ils le savent	91aal1
	lmd	elle me disait	91asl1 (2x)
		i(l) me dit (2x)	85ajg1
	(l)mf	elle me fera	91aal1
		elle me fait	91aal1
		il me faisait	91asl1
		qu'il me faut	91aal1
	lmm	elle me mettra	91aal1
	lmʁ	elle me racontait	85alt1
	(l)ms	il me semble (2x)	91acs1
	(l)nl	il ne l'est	91aal1
	lns	elle ne savait	91ael1

lsd	elle se défendait	91asl1
(l)sk	ils se camouflent	91asl1
lsl	elles se laissent	75cab1
(l)sʁgʁ	ils se regroupent	21acp1
(l)st	il se tenait	85amg1
(l)td	il te donnera	91amb1
lʒf	laquelle je finissais	50ajp1
lʒs	s’appelle je sais	75cvl1
lʒsɥ	général je suis	21amb1
msk	même ce qui	21abm1
	même ce qu’on	75cgn1
mʒkʁ	Guillaume je crois	85amm1
	même je crois	75cvl1
mʒl	comme je l’expliquais	50apb1
mʒtʁ	comme je travaille	85amg1
nʒp	copine je pense	50aev1
nʒv	à l’origine je voulais	50ajp1
ʁdb	avoir de baskets	75clc1
ʁdd	chaussure de danse	91aal1
ʁdk	guerre de quatorze	75cab1
ʁdl	bord de la	75cab1
	histoire de la	85alt1
	faire de la	91aal1
	faire de l’écho	50aev1
	lors de la vente	50ayp1
	partir de la	75clc1
ʁdm	avoir de munitions	91amb1
ʁds	dehors de son	75ccb1
	professeur de cet	85alt1
ʁdt	assure de temps	21acp1
ʁkl	alors que le	75csb1
	croire que les	91adb1
	dire que là	91adb1
ʁkm	c’est-à-dire que moi	91acs2
ʁkn	c’est-à-dire que nous	91acs2
ʁkp	ouvert que pendant	85asl1
ʁks	alors que c’est	75cac1
		91aal1
	c’est-à-dire que ces	91acs2
	claire que ça	75ccm1
	dire que c’est	50apb1
		75ccr1
		91aal1
	sûre que c’est	50atv1
		91aal1
	sûre que c’était	75csb1

ʁkv	sûr que vous	91aal1
ʁkʒ	c'est-à-dire que j'ai	85ajf1
	sûr que je l'ai	91aal1
	chaussures que j'ai	91aal1
ʁld	par le département	85ajf1
	sur le débarquement	75cgn1
ʁlkw	sur le coin	91acs1
ʁll	pour le lendemain	21ama1
ʁlm	pour le Ministère (2x)	91aed1
	pour le monde	91amb1
ʁlp	alors le prof	91asl1
ʁls	sur le secteur	75ccm1
	pour le Sénégal	91aal2
ʁlʃ	par le chômage	91amb1
ʁlt	avoir le téléphone	91aal2
	sur le terrain	50ajm1
	sur le Teilleul	50ayp1
ʁmʁ	pour me ramener	50aid1
ʁnp	pour ne pas	21ash1
ʁns	d'ailleurs ne sont plus	50atv1
ʁnʒm	tournes je m'occuperai	85ajg1
ʁsk	contre ce qu'il	85ajf1
	faire ce qu'on	21ama1
	heure ce qui	75cac1
	savoir ce qui	91asl1
ʁsm	voir se monsieur	50alb1
	pour se mettre	91adb1
ʁtʒkʁw	verte je crois	50atv1
ʁʒd	bierre je disais	50ayp1
	grand-père je dis	85amg1
ʁʒkʁw	jours je crois	85asl1
	soir je crois	50ayp1
ʁʒlɥ	alors je lui	91aal1
ʁʒm	anniversaire je m'étais	50arm1
	primaire je m'en souviens	50aad1
	d'ailleurs je me souviens	50ajm1
ʁʒp	alors je peux	85ajfn1
	derrière je pense	50atv1
	encore je pense	50aev1
	grammaire je pense	50aev1
ʁʒsɥ	d'ailleurs je suis	21abm1
ʁʒtʁ	nature je trouve	50atv1
ʁʒv	fort je vais	50alb1
sdm	plus de mille	91ajc1
skl	tandis que là	50aad1
stdl	sud-ouest de la France	75cab1

sʒsɥ	naissance je suis	85alt1
t(ʁ)tk	entre te couper	50aid1
t(ʁ)ʒl	contre je l'ai	50apb1
t(ʁ)ʒs	être je sais	50ajp1
tsk	fait ce qui	75cab1
	fait ce qu'on	85ajf1
tʒp	soixante je pense	50atv1
	sept je pense	75cvl1
tʒs	suite je sais	75ccm1
tʒsɥ	fait je suis	21aml1
	ensuite je suis	50atv1
vʒd	arrive je dis	85amm1
zdt	croise de temps	85agm1
zmʒs	tourisme je sais	50atv1
zsk	entreprise ce qu'elle	85ajf1
ʒdm	âge de ma	75ccm1
ʒʒkʁw	nettoyage je crois	50alb1

(326)	*Cluster*	*Token*	*Speaker*
	bdʃ	robe de chambre	85amm1
	ddb	études de biologie	75cbl1
	ddf	méthode de faire	50aid1
	ddl	demandent de l'expérience	50ajp1
		études de lettres	21amb1
	ddʃ	période de chômage	75cac1
	ddʒ	bande de jeunes	75ccm1
	dkl	attendes que les	75ccm1
	dlm	regardes le marché	21abm1 (2x)
	dtf	baignade te foutre	21abm1
	dtʁ	monde te regarde	50aid1
	dtv	monde te vouvoie	75ccm1
	fdl	meufs de l'autre	75ccb1
	fds	chef de section	91acs1
	fkm	sauf que moi	50aid1
	fdk	impératif de connaître	75cvl1
	fdʒ	prof de gym	50ajm1
	gdp	drogues de prises	50aid1
	jkʒ	fauteuil que j'ai	50alb1
	kdk	trucs de cool	75ccr2
		typique de Cuves	50apb1
	kdl	diététique de l'hôpital	91aal1
		mec de l'E.M.	75cvl1
	kdm	classique de musicien	85alt1
		moques de moi	50atv1

kdn	politique de Napoléon	21ash1
kdʁ	musique de Renaissance	85alt1
kdʃ	mec de chez	75cvl1
kdv	donc de vos	21ash1
	que de vagues	21abm1
kkl	musique que la	75ccb1
kkt	mecs que tu	21abl1
klb	avec le boulot	21amb1
	que le bouquin	21amb1
kld	avec le département	85ajg1
klf	donc le photographe	75ccr2
klk	avec le canton	85ajf1
	avec le car	50atv1
	que le CAPES	21acl1
kll	avec le Lulu	21ama1
	donc le lycée	21acl1
klm	donc le métro	75csb1
klt	avec le temps	85ajf1
klp	donc le père	21aml1
kmp	l'acrylique me plaît	50alb1
knf	mec ne fait	75clc1 (2x)
kss	que ce soit	85agm1
kʒn	donc je n'insiste	50aid1
ldb	salle de bain	50app1 (3x)
		75ccm1
		91asl1 (2x)
ldd	professionnel de dactyolographie	91acs1
ldk	école de commerce	75clh1
		75csb1
		75cvl1 (3x)
	styles de comment	50ayp1
ldl	grammaticale de l'espagnol	75ccr1
	mal de locatifs	85amg1
	Mémorial de la paix	75clh1
	principale de la	85asl1
	salle de la	75ccr2 (2x)
	vénale de l'objet	50apb1
ldm	école de musique	21aml1
	mal de monde	21aml1
		50ayp1
	Nobel de mathématiques	75clh1
	nouvelles de Maria	50arm1
ldp	mal de parler	75cbl1
lds	global de son	21abl1
	rappelle de certaines	91asl1
ldv	agricole de volailles	85ajf1

ldʒ	contrôle de gestion	75cbl1 (2x)
lkd	celles que donnait	75cgn1
lkm	facile que maintenant	50atv1
lks	mal que ça	85ajf1
lls	elle le savait	91acs1
lkt	veulent que tout	85amm1
llp	ils le parlaient	75ccr1 (3x)
(l)lʁ	ils le reçoivent	21amb1
lmd	il me dit	50alb1
(l)mf	il me fallait	50arm1
(l)ms	il me semble	50atv1
lsd	elle se disait	91ael1
ltk	elle te connaîtra	85ajg1
lʒm	l'huile je m'en	50alb1
mdk	réformes de quatre-vingt dix	91aed1
mdl	hommes de là-bas	85amg1
	l'I.U.F.M. de l'école	21acl1
	maximum de leur	50apb1
	problème de l'informatique	91adb1
mdm	problèmes de maintenance	91adb1
mdn	maximum de nourriture	50ajm1
mdʁ	poème de Rimbaud	75ccr1
mds	même de son	21ama1
	système de sécurité	91ajc1
	système de supervision	91ajc1 (2x)
mdt	pommes de terre	75cgn1
	programme de télé	85amm1
mlb	même le B.E.P.	91aal1
	même le bouquin	21amb1
mlp	abîment le pipe	91ajc1
mss	même ce soir	21ama1
ndd	trentaine de disques	85alt1
ndf	copines de fac	75ccr2
ndk	cinquantaine de kilomètres	50apb1
	tunes de côté	85apr1
ndm	personnes de même	75ccm1
ndp	viennent de Pont	50app1
	vingtaine de personnes	75clc1
nds	gamine de seize	91acs1
	origine de cette	50alb1
	une de ses	85ajf1
ndt	semaine de tournée	21ama1
	viennent de toutes les	91aed1
nkm	jeune que ma	91ael1
nks	mélomane que ça	75ccb1
nlt	peine le temps	85amg1

nlw	viennent le weekend	75ccr2
nnl	Hélène ne l'avait	85amm1
ɲdʃ	ligne de chemin	21acl1
ŋdb	holding de Béghin	85ajf1
pdd	groupe de dix	75ccb2
pdl	équipe de l'E.M.	75cvl1
	Europe de l'Est	21abl1
		75ccm1
pdm	groupes de musique	85alt1
pdt	occupe de tout	91aal1
ʁdb	banlieusard de base	21ama1
	l'air de bien	85amm1
	mère de bonne	75ccb2
ʁdd	air de démarrer	50alb1
	air de dire	50app1
	cours de danse	75ccb2 (2x)
	dire de dix-huit	75ccb2
ʁdf	concert de fin	21aml1
	Universitaire de Formation	91aed1
ʁdk	d'onduleur de courant	91ajc1
	heures de cours	21aml1
	pierre de Caen	50aev1
	rupture de contrat	85apr1
	voiture de collection	50ajm1
ʁdl	autour de la	50ajm1
	avoir de la	50arm1
	avoir de l'eau	21abm1
	boulevard de l'Université	21amb1
	boulevard de Strassbourg	21abm1
	concours de l'IUFM	91aed1
	concours de la	75cvl1
	directeur de l'informatique	91ajc1
	faire de l'aquarelle	50alb1
	heure de la	21aml1
	heure de math	75cbl1
	jour de l'école	50aid1
	Ministère de la	91aed1
	originaire de la	50alb1
	par de l'accordéon	50alb1
	secteur de la	75ccm1
	signature de l'armistice	75cab1
	tour de la ville	50aid1
ʁdm	armoire de mariage	50apb1
	belle-sœur de madame	75ccr2
	bord de mer	85alt1
	hauteur de mille	21abl1

	père de ma	21ash1
	sœur de monsieur	75ccr2
	trois-quarts de mon	85ajf1
ʁdn	guerre de nos	21ash1
	demi-heure de Nantes	85ajf1
ʁdp	cœur de Paris	75clh1
	odeur de peinture	50alb1
	finir de passer	50app1
ʁdʁ	extérieur de richesses	85alt1
ʁds	air de sourire	50app1
	autour de soixante	50alb1
	genre de situation	75ccm1 (2x)
	partir de sept	21ama1
ʁdʃ	armure de chevalier	75ccr1
	autour de chez	85ajf1
	heures de chez	21ama1
ʁdt	concerts de temps	81agm1
	contrôleur de télécommunication	91ajc1
	peur de toucher	91adb1
ʁdv	jours de vacances	85amg1
ʁdʒ	master de journalisme	50aev1
	genre de généraliste	75clc1
ʁkd	alors que d'autres	50arm1
	ailleurs que dans	91aed1
ʁkk	savoir que quelqu'un	50apb1
ʁkl	alors que l'opérationnel	75csb1
	dire que le	21ama1
	dire que les	21ama1
		91aed1
	pour que les parents	50aid1
	pour que leur	75cbl1
ʁks	croire que ça	21aml1
	CR que ça	50app1
	alors que si	21aml1
	garantir que c'est	91asl1
	père que ça	91acs1
	sûr que ça va	75csb1
	sûr que c'est	50ajp1
	sûr que sur	50aid1
ʁkʒ	répertoire que j'ai	85alt1
ʁkt	alors que tu	21abm1
	savoir que tu	50apb1
	soir que tu	21ama1
	voir que tu	50app1
ʁkv	c'est-à-dire que vous	75cvl1
ʁkʒ	colocataire que j'avais	21amb1

	dire que j'ai	50atv1
ʁlb	alors le Bocage	21ash1
	par le basket	50ajp1
	par le biais	50apb1
	vers le Bocage	21abm1
ʁld	alors le D.E.S.S.	75cvl1
	avoir le D.N.S.E.P.	21abl1
	genre le département	21aml1
ʁlk	boire le café	50ayp1
	pour le candidat	75cvl1
	pour le concours	75cvl1
	sur le campus	21aml1
	sur le côté	50ayp1 (2x)
	toujours le cas	75cbl1
	voir le comment	50ayp1
	vers le café	21acl1
ʁll	par le lecteur	21amb1
	savoir le latin	75ccr1
	travers le lien	75cac1
ʁlm	dire le mot	50aid1
	faire le mardi	75cbl1
	partir le matin	75cac1
	pour le Ministère	91aed1
	pour le rempaillage	50alb1
	sur le même	75clc1
ʁlp	sur le palier	50app1
	sur le parking	21amb1 (2x)
	sur le plan	50apb1
	vers le parc	21acl1
ʁlʁ	sur le répondeur	50app1
ʁls	heures le soir	85amm1
	morts le soir	21abm1
	pour le saumon	50app1
	sur le secteur	50ayp1
	sur le site	75csb1 (3x)
ʁlt	sur le téléski	50atv1
ʁlw	pour le weekend	50aad1
ʁmk	pour me confirmer	50ajp1
ʁmʃ	venir me chercher	50aid1
ʁns	père ne savait	21ash1
ʁsd	mer se dégage	75clh1
	pour se détendre	75cbl1
ʁsf	stagiaires se font	75csb1
ʁss	clair ce soir	50app1
	cours se sont	75cbl1
ʁtm	pour te moucher	50app1

ʁʒp	dire je parle	75ccr1
ʁʒs	alors je sais	75cvl1
		85amm1
	alors je savais	75cgn1
	jours je sais	50arm1
sdd	plus de difficultés	75cbl1
	plus de dix	75cbl1
	service de diététique	91aal1
sdl	directrice de l'école	91acs1 (2x)
sdm	commerce de marchand	50arm1
	maîtresse de maison	75cgn1
	plus de monde	50ajm1
sdʁ	ambiance de rue	75cac1
sds	espèce de système	75cac1
	face de soi	75cvl1
	naissance de Céline	85amm1
sdʃ	différences de chauffage	50alb1
	plus de chance	50atv1
sdt	office de tourisme	50aev1
	différences de température	50alb1 (2x)
sdv	courses de voiture	75ccb2
	force de votre	75cgn1
	le plus de voix	91aal1
skd	pense que dans	85ajf1
skl	fréquence que les	75ccb2
	pense que la	50ajm1
	pense que les	50ajm1
skm	plus que maintenant	50alb1
	pense que même	75cac1
	pense que non	50apb1
skn	chance que nous	50atv1
sks	ce que ça va	50aev1
	pense que c'est	75clc1
		75ccm1
		91acs1
	pensent que ça	75cvl1
	plus que ça	50alb1
skt	pense que tout	50arm1
	pense que tu	21acl1
		50atv1
skʒ	pense que j'ai	75clc1
	pense que je	50aev1
sss	pense ce soir	50afm1
std	puisse te donner	50apb1
sʒs	ambulance je suppose	50app1
	pense je sais	75cab1

ʃdl	fiche de lecture	21amb1
ʃdʃ	mèches de chaque	50aid1
ʃdp	crèche de Paris	85asl1
tdd	méchante de dire	50arm1
	vente de dix-sept	85apr1
tdk	minutes de cours	21acl1
tdl	retraite de Longvic	21acl1
	suite de la	85asl1
	teintes de l'époque	50alb1
tdm	dix-huit de moyenne	85apr1
	sortes de musique	50alb1
tdn	boîte de nuit	85agm1 (2x)
tds	tête de ceux	75clc1
tdʃ	suite de cheveux	50aad1
tdt	tête de Turc	75csb1
		75cvl1
tks	compte que c'est	75cvl1
	fait que c'est	50alb1
tkt	fait que tu	50apb1
tlb	achètent le bouquin	21amb1
tlt	fait le tissu	50alb1
t(ʁ)kʒ	peut être que je	50aev1
tʒb	fait je bossais	75ccm1
tʒp	sept je pense	75cgn1
tʒs	ensuite je sais	75ccr1
	fait je sais	50aev1
vdf	trouve de former	91aed1
vdk	épreuve de commentaire	75ccr1
vdm	épreuve de math	75ccb2
vks	trouve que ça	75cvl1
	trouve que c'est	21abm1
vlk	enlèves le casque	50aid1 (2x)
zdl	crise de larmes	75ccb1
	phrases de la	21amb1
	chaise de l'autre	50alb1
zdn	prises de notes	21aml1
zds	cause de ça	91ajc1
zdn	chose de Norvège	75cgn1
zdt	prise de tête	21ama1
zkd	chose que du	75clc1
ʒdn	bougent de niveau	75cbl1
ʒds	âge de ses	91acs1
ʒdv	âge de vingt-trois	50apb1
ʒks	privilège que c'est	21ama1
ʒkʒ	âge que j'ai	91acs1
ʒmʁ	je me rappelle	50ajm1

ʒms	je me souviens	50ajm1
ʒnʁ	je ne rencontrais	91ajc1
ʒsv	bizutage se veulent	75clc1
ʒʒs	rouge je sais	50app1

Appendix D

The following table lists sex, age, regions of birth and residence, and occupation for every subject from the CGN from whose speech data was used.

#	*Subject ID*	*Sex*	*Age*	*Region of birth*	*Region of residence*	*Occupation*
001	N00011	male	33	II	II	unkown
002	N00022	female	46	III	II	II
003	N00023	male	27	I	II	III-IV
004	N00034	male	64	IV	II	I-II
005	N00167	male	50	II	II	II
006	N00168	male	61	I	II	II
007	N00171	male	52	I	I	II
008	N00181	male	45	I	I	II
009	N00189	male	48	I	I	II
010	N00204	male	58	I	II	II
011	N00227	male	50	I	I	II
012	N00291	male	47	I	I	II
013	N00327	male	45	I	I	I-II
014	N00339	male	60	I	I	I-II
015	N00340	male	49	III	III	I-II
016	N01001	female	48	Flanders	II	I-II
017	N01011	female	34	II	II	II
018	N01017	male	31	I	I	II
019	N01037	female	19	II	II	III
020	N01038	female	45	II	II	II
021	N01039	male	31	II	II	III-IV
022	N01041	female	20	I	II	III
023	N01059	female	20	IV	I	III
024	N01085	male	30	II	II	II
025	N01123	female	57	I	IV	III-IV
026	N01134	female	30	III	II	II
027	N01140	male	58	III	II	II
028	N01141	female	57	I	II	III-IV
029	N01144	male	29	III	II	III
030	N01152	female	46	IV	IV	III-IV

031	N01155	female	21	IV	IV	V
032	N01168	male	21	II	II	III
033	N03002	male	unknown	unknown	unknown	I-II
034	N03006	male	unknown	unknown	unknown	II
035	N03008	female	52	III	IV	III-IV
036	N03009	female	44	IV	unknown	II
037	N03011	male	54	IV	I	II
038	N03014	male	48	I	unknown	II
039	N03017	male	69	I	I	I-II
040	N03020	male	43	I	I	II
041	N03038	male	48	I	II	II
042	N03040	male	51	unknown	unknown	I-II
043	N03041	male	53	outside NL	IV	II
044	N03042	male	unknown	unknown	unknown	II
045	N03044	male	unknown	unknown	unknown	I-II
046	N03045	male	54	unknown	unknown	I-II
047	N03049	male	52	unknown	I	I-II
048	N03074	male	51	I	I	I-II
049	N03082	male	53	unknown	I	II
050	N03084	male	51	II	II	II
051	N03086	male	54	III	III	II
052	N03089	male	unknown	unknown	I	I-II
053	N03090	male	58	outside NL	I	II
054	N03092	male	unknown	unknown	unknown	II
055	N03115	male	53	I	I	II
056	N03116	male	43	unknown	unknown	I-II
057	N03123	male	52	IV	unknown	II
058	N03128	male	56	unknown	unknown	II
059	N03132	male	57	III	III	II
060	N03144	male	49	I	unknown	II
061	N03163	male	unknown	unknown	unknown	II
062	N03164	male	unknown	unknown	unknown	II
063	N03165	male	44	unknown	unknown	II
064	N03166	male	47	I	unknown	II
065	N03173	male	50	I	I	II
066	N03175	male	38	outside NL	I	II
067	N03211	male	57	unknown	unknown	I-II
068	N03222	female	40	I	I	II
069	N03224	male	61	unknown	unknown	I-II

070	N03228	male	unknown	unknown	unknown	II
071	N03230	female	48	unknown	unknown	II
072	N03240	male	43	unknown	unknown	I-II
073	N03264	male	unknown	unknown	unknown	II
074	N03265	male	71	I	I	I-II
075	N03267	male	31	I	I	II
076	N03268	male	57	I	I	I-II
077	N03269	male	59	unknown	unknown	II
078	N03344	male	unknown	unknown	unknown	II
079	N08007	female	22	IV	I	III
080	N08009	male	23	outside NL	I	III-IV
081	N08010	female	19	II	I	III
082	N08011	female	21	II	I	III
083	N08016	female	30	I	I	II
084	N08017	male	75	IV	I	I-II
085	N08019	female	21	III	II	III-IV
086	N08021	male	39	I	II	V
087	N08022	female	32	III	II	III-IV
088	N08025	female	21	II	I	II
089	N08027	male	22	III	III	III
090	N08050	female	34	II	IV	III-IV
091	N08051	male	38	I	IV	II
092	N08052	female	55	I	II	II
093	N08055	female	73	IV	IV	III-IV
094	N08057	male	27	I	I	II
095	N08072	female	17	IV	IV	III
096	N08078	female	21	II	III	III
097	N08079	female	50	III	III	V
098	N08082	female	48	I	III	II
099	N08083	female	38	I	III	II
100	N08086	female	49	II	II	V
101	N08087	female	26	II	II	V
102	N08110	female	68	II	I	II
103	N08111	female	20	IV	I	III
104	N08112	male	53	IV	IV	II
105	N08113	female	51	IV	IV	II
106	N08136	female	63	II	II	V
107	N08141	male	51	I	I	V
108	N09165	male	32	IV	IV	II
109	N09183	female	44	II	I	II
110	N09196	female	39	IV	IV	II

111	N09197	female	unknown	unknown	unknown	III
112	N09213	male	48	I	I	II
113	N09218	female	unknown	unknown	unknown	III

Appendix E

The following table lists the types of trisyllabic words entered into the COREX search engine during the experiment described in section 6.2.

(1) #	*syllable types*	*segment string*
01	DDG	VCVCAC
02	DEG	VCCVCAC
03	DFG	VCCCVCAC
04	DCH	VCCCAC
05	DDH	VCVCCAC
06	DEH	VCCVCCAC
07	DFH	VCCCVCCAC
08	DDI	VCVCCCAC
09	DEI	VCCVCCCAC
10	DFI	VCCCVCCCAC
11	DDJ	VCVCVCC
12	DEJ	VCCVCVCC
13	DFJ	VCCCVCVCC
14	DDK	VCVCCVCC
15	DEK	VCCVCCVCC
16	DFK	VCCCVCCVCC
17	DDL	VCVCCCVCC
18	DEL	VCCVCCCVCC
19	DFL	VCCCVCCCVCC
20	DDM	VCVCYC
21	DEM	VCCVCYC
22	DFM	VCCCVCYC
23	DDN	VCVCCYC
24	DEN	VCCVCCYC
25	DFN	VCCCVCCYC
26	DDO	VCVCCCYC
27	DEO	VCCVCCCYC
28	DFO	VCCCVCCCYC

Below are three tables that list cases of conservation of the full vowel, laxing, reduction to schwa, and complete deletion, respectively, for the informal speech from CGN components a and c.

(2) Conservation of full vowels in informal speech (CGN components a and c)

case #	*word form*	*example*	*phonetic transcription*	*component*	*subject*
IC01	DBN	*adviseur*	ɑtfisør	c	N08016
IC02					N08082
IC03			ɑtfizør	a	N01017
IC04	DBJ	*advocaat*	atfokat	c	N08007
IC05					N08022
IC06					N08022
IC07	ABG	*Arabist*	arabɪst	c	N08017
IC08	ABH	*assistent*	ɑsistɛnt	a	N01155
IC09	ABJ	*automaat*	otomat	c	N08055
IC10					N08112
IC11	CBJ	*crimineel*	kriminel	a	N01168
IC12	BBG	*dialect*	tijalɛkt	c	N08010
IC13	BBH	*dirigent*	dirixɛnt	c	N08051
IC14					N08051
IC15	DBJ	*esthetiek*	ɛstetik	c	N08057
IC16					N08057
IC17	BBJ	*fenomeen*	fenomen	a	N01059
IC18	BBK	*fotograaf*	fotoɣraf	a	N01152
IC19!	BBJ	*halogeen*	hɑloɣen	a	N01001
IC20	ABJ	*idioot*	idijot	a	N01140
IC21				c	N08009
IC22					N08079
IC23					N08082
IC24	BCJ	*instituut*	ɪnstityt	c	N08025
IC25					N08025
IC26	ABG	*irritant*	iritɑnt	c	N08011
IC27	CBP	*kwaliteit*	kwɑlitɛɪt	c	N08136
IC28	BBJ	*neuroloog*	nørolox	c	N08110
IC29					N08110
IC30	EBJ	*personeel*	pɛrsonel	a	N01037
IC31	FBK	*principieel*	prɪnsipljel	a	N01041
IC32	CBG	*stimulans*	stimylɑns	c	N08027

(3) Laxing of full vowels in informal speech (CGN components a and c)

case #	*word form*	*example*	*phonetic transcription*	*component*	*subject*
IL01	ABJ	*aparaat*	ɑpɑrad	a	N01141
IL02			ɑpɑrat		N01141
IL03	BBG	*dialect*	dijɑlɛkt	c	N08010
IL04	CBJ	*dramatiek*	drɑmɑtik	c	N08087
IL05	BBJ	*favoriet*	fɑvɔrit	c	N08087
IL06	BBP	*magazijn*	mɑɣɑzɛɪn	a	N01039
IL07	BCJ	*microfoon*	mikrɔfon	a	N01001
IL08					N01001
IL09	CBJ	*psycholoog*	psixɔlox	c	N08052

(4) Reduction of full vowels to schwa in informal speech (CGN components a and c)

case #	*word form*	*example*	*phonetic transcription*	*component*	*subject*
IR01	ABQ	*amateurs*	ɑmətørs	a	N01011
IR02	ABJ	*apparaat*	ɑpərat	a	N01039
IR03					N01134
IR04					N01140
IR05					N01141
IR06				c	N08072
IR07	ABJ	*apotheek*	ɑpətek	c	N08086
IR08	EBJ	*formulier*	fɔrməlir	c	N08019
IR09	EBJ	*korporaal*	kɔrpəral	a	N01123
IR10					N01123
IR11	BBP	*magazijn*	mɑɣəzɛɪn	c	N08021
IR12					N08021
IR13	BBG	*machinist*	mɑʃənɪst	c	N08078
IR14	BBM	*passagiers*	pɑsəʒirs	c	N08025
IR15	BCJ	*microfoon*	mikrəfon	a	N01134
IR16					N01144
IR17				c	N08141
IR18	EBJ	*personeel*	pɛrsənel	c	N08050
IR19	BBJ	*politiek*	polətik	c	N08019
IR20	CBJ	*psycholoog*	psixəlox	a	N01085
IR21	EBJ	*saxofoon*	sɑksəfon	a	N01038
IR22				c	N08111
IR23					N08113
IR24					N08113
IR25					N08113
IR26					N08113
IR27	EBJ	*taxateur*	tɑksətør	a	N01134

(5) Conservation of full vowels in formal speech (CGN components f, g, and h)

case #	*word form*	*example*	*phonetic transcription*	*component*	*subject*
FC01	DBP	*adviseur*	ɑdvizør	f	N03163
FC02	DBJ	*advocaat*	ɑtfokat	f	N03175
FC03	DBG	*architect*	ɑrʃitɛkt	f	N03128
FC04					N03175
FC05	DBG	*argument*	ɑrɣymɛnt	g	N00168
FC06					N00340
FC07			ɑrxymɛnt	f	N03166
FC08				g	N00189
FC09					N00189
FC10					N00204
FC11	ECG	*compliment*	kɔmplimɛnt	f	N03222
FC12					N03222
FC13	EBG	*component*	kɔmponɛnt	f	N03222
FC14					N03222
FC15					N03224
FC16					N03269
FC17	EBG	*componist*	kɔmponɪst	f	N03049
FC18					N03050
FC19					N03092
FC20	ECE	*compromis*	kɔmpromɪs	f	N03144
FC21	EBJ	*consulaat*	kɔnsylat	f	N03175
FC22	EBG	*consument*	kɔnzymɛnt	f	N03230
FC23					N03230
FC24	CBJ	*crimineel*	kriminel	g	N00167
FC25	BBQ	*demokraat*	demokrat	f	N03044
FC26	BBJ	*dialoog*	dijalox	f	N00035
FC27	BBQ	*donateurs*	donatørs	f	N03038
FC28	BBJ	*fenomeen*	fenomen	f	N00022
FC29	BBG	*gitarist*	xitarɪst	f	N03268
FC30	DBG	*incident*	ɪnsidɛnd	f	N00327
FC31			ɪnsidɛnt	f	N00327
FC32					N03268
FC33	DCJ	*instituut*	ɪnstityt	f	N03041
FC34					N03042
FC35					N03123
FC36					N03267
FC37				g	N00034
FC38					N00034
FC39	EBG	*journalist*	ʒunalɪst	f	N03115
FC40			ʒurnalɪst	f	N03086

FC41	EBP	*kampioen*	kɑmpijun	f	N03014
FC42	EBJ	*kandidaat*	kɑndidat	f	N03020
FC43					N03040
FC44					N03084
FC45					N03084
FC46	CBP	*kwaliteit*	kwalitɛɪt	f	N03168
FC47	BBJ	*metafoor*	metafor	f	N03090
FC48	BCJ	*microfoon*	mikrofon	f	N03228
FC49	EBJ	*personeel*	pɛrsonel	f	N03009
FC50					N03009
FC51	BBJ	*politiek*	politig	f	N03041
FC52					N03264
FC53			politik	f	N03240
FC54					N03265
FC55	BBJ	*positief*	positif	h	N09196
FC56	CBG	*predicant*	predikɑnt	f	N03211
FC57					N03211
FC58	CBG	*president*	pesidɛnt	f	N03116
FC59			presidɛnt	f	N03128
FC60					N03344
FC61			prezidɛnt	f	N03017
FC62					N03115
FC63					N03116
FC64					N03116
FC65					N03116
FC66					N03116
FC67					N03116
FC68					N03116
FC69					N03264
FC70	BBQ	*republiek*	repyblik	f	N03224
FC71	BEJ	*resultaat*	resʏltat	f	N03049
FC72				g	N00339
FC73					N00339
FC74					N00339
FC75	s+FBJ	*structureel*	strʏktyrel	h	N09196
FC76	BBP	*therapeut*	terapøt	f	N03002
FC77	BBJ	*visioen*	fisijun	f	N03008

(6) Laxing of full vowels in formal speech (CGN components f, g, and h)

case #	*word form*	*example*	*phonetic transcription*	*component*	*subject*
FL01	BBG	*dialect*	dijɑlɛkt	f	N03006
FL02	BBJ	*politiek*	polɪtig	f	N03240
FL03	DBJ	*signatuur*	sɪnjɑtyr	f	N03042
FL04	EBG	*journalist*	ʃunɑlɪst	f	N03011
FL05			ʃurnɑlɪst	f	N03082

(7) Reduction of full vowels to schwa in formal speech (CGN components f, g and h)

case #	*word form*	*example*	*phonetic transcription*	*component*	*subject*
FR01	ABP	*amateur*	ɑmətør	h	N09213
FR02	ABJ	*apparaat*	ɑpərat	f	N03089
FR03	DBJ	*advocaat*	ɑtfəkat	f	N03163
FR04	ABJ	*ecoloog*	ekəlox	f	N00011
FR05	BBJ	*fenomeen*	fenəmen	h	N09196
FR06	DCJ	*instituut*	ɪnstətyt	g	N00291
FR07			isətyt	f	N03042
FR08	BBJ	*katholiek*	kɑtəlik	h	N09196
FR09	BCJ	*microfoon*	mikrəfon	h	N09196
FR10	BCM	*microfoons*	mikrəfons	h	N03074
FR11	BBJ	*negatief*	negətif	h	N09196
FR12	ABJ	*officier*	ɔfəsir	f	N00181
FR13					N03045
FR14				g	N00171
FR15	BBK	*paragraaf*	pɑrəgraf	h	N09165
FR16					N09165
FR17					N09165
FR18					N09165
FR19					N09197
FR20					N09218
FR21					N09218
FR22			pɑrəgrav	h	N09165
FR23	BBJ	*pedagoog*	pedəxox	h	N09183
FR24	EBJ	*personeel*	pɛrsənel	f	N03008
FR25	BBJ	*politiek*	polətik	f	N03144
FR26					N03240
FR27				g	N00227
FR28					N00291

FR29					N00291
FR30					N00291
FR31	EBK	*journalist*	ʃunəlɪst	f	N03175
FR32			ʒurnəlɪst	f	N03132
FR33					N03173

Appendix F

The following are the instructions in Dutch for our first o-colouring experiment.

Experiment: de *o* van het Nederlands

In het Nederlands bestaan 2 verschillende *o*-klanken, die in dit experiment worden aangeduid met A en B. Van elk type volgt hier een aantal voorbeelden:

A	**B**
koop	koor
telefoon	oren

Instructie

Hieronder staan 30 woorden waarin de klinker *o/oo* voorkomt. Aan jou de taak om aan te geven of deze *o*-klank van het type A of van het type B is. De klank waarom het gaat staat steeds onderstreept. Omcirkel de letter van het type van je keuze. Geef altijd een antwoord, ook als je twijfelt.

Alvast bedankt voor je medewerking!

1.	categorie	A	B
2.	girorekening	A	B
3.	moraal	A	B
4.	monitoraat	A	B
5.	perforatie	A	B
6.	metaforiek	A	B
7.	koraal	A	B
8.	hegemonie	A	B
9.	orakel	A	B
10.	monorail	A	B
11.	elaboraat	A	B
12.	kosmopoliet	A	B
13.	dermatoloog	A	B
14.	oratie	A	B
15.	gorilla	A	B
16.	anakoloet	A	B

17.	diorama	A	B
18.	homeopaat	A	B
19.	revisoraat	A	B
20.	decoratie	A	B
21.	pedagogiek	A	B
22.	electoraat	A	B
23.	laborante	A	B
24.	forens	A	B
25.	honorarium	A	B
26.	telefonie	A	B
27.	panorama	A	B
28.	filosofie	A	B
29.	directoraat	A	B
30.	oranje	A	B

Appendix G

The following are the instructions in Dutch for our second o-colouring experiment.

Experiment: de *o* van het Nederlands

In het Nederlands bestaan 2 verschillende *o*-klanken, die in dit experiment worden aangeduid met A en B. Van elk type volgt hier een aantal voorbeelden:

A	**B**
koop	koor
telefoon	oren
girorekening	quorum

Instructie

Hieronder staan 25 plaatsnamen uit een Afrikaanse taal waarin een *o*-klank voorkomt. Aan jou de taak om aan te geven of in de Nederlandse uitspraak van deze namen de *o*-klank van het type A of van het type B is. De klank waarom het om gaat staat steeds onderstreept. Omcirkel de letter van het type van je keuze. Geef altijd een antwoord, ook als je twijfelt.

Alvast bedankt voor je medewerking!

1.	Sikoristu	A	B
2.	Blikodinti	A	B
3.	Badoru	A	B
4.	Korindi	A	B
5.	Padilorunta	A	B
6.	Posuski	A	B
7.	Kunorindi	A	B
8.	Bakitoraski	A	B
9.	Borinda	A	B
10.	Dobakorosta	A	B
11.	Tikori	A	B
12.	Odarindi	A	B
13.	Sitoraski	A	B
14.	Tobukoristu	A	B
15.	Kiboro	A	B
16.	Poristu	A	B
17.	Soranki	A	B
18.	Katonarumpa	A	B
19.	Batoronta	A	B
20.	Kitunorinti	A	B
21.	Satori	A	B
22.	Tukora	A	B
23.	Sibokunka	A	B
24.	Tuborinti	A	B
25.	Oroski	A	B
26.	Pokutorasku	A	B
27.	Katoru	A	B
28.	Pisoranku	A	B
29.	Torusko	A	B
30.	Takolinta	A	B

Appendix H

The following Dutch instructions were used for our Chanted Call experiment.

Zo meteen krijg je 11 woorden te horen. Deze woorden worden door een proefpersoon geroepen, op de manier waarop je normaal roept wanneer je de aandacht van iemand wilt trekken. Het gaat om zelfstandige naamwoorden, waarbij je je kunt voorstellen dat ze de naam zijn van een huisdier, dat door de proefpersoon geroepen wordt om binnen te komen. Sommige woorden komen meerdere keren voor.

Elk woord wordt op twee verschillende manieren uitgesproken, A en B. Jij moet beoordelen of uitspraak A of uitspraak B het meest natuurlijke klinkt, of dat beide even goed zijn. Je hoort steeds een pieptoon, waarna je van één woord uitspraak A en uitspraak B krijgt te horen. Kruis op dit blad het antwoord van je keuze (A, B of beide even goed) aan. Probeer zo veel mogelijk te kiezen voor A of B, en kies alleen voor 'beide even goed' als dit echt het geval is. Vervolgens is er een onderbroken pieptoon, en krijg je A en B nogmaals te horen, zodat je kunt nagaan of je het juiste antwoord hebt ingevuld. Hierna wordt verdergegaan met het volgende woord.

Succes!

	A	B	Beide even goed
1. bakje	☐	☐	☐
2. citroentje	☐	☐	☐
3. asbakje	☐	☐	☐
4. nep-asperge	☐	☐	☐
5. nep-sigaretje	☐	☐	☐
6. nep-si-toontje☐	☐	☐	
7. nep-aspirientje	☐	☐	☐
8. nep-citroentje	☐	☐	☐
9. nep-sigaretje	☐	☐	☐
10. nep-aspirientje	☐	☐	☐
11. nep-sigaretje	☐	☐	☐

Appendix I

The following tables list stress-final bisyllabic words occurring in CGN components a and c, first, without reduction, then, with the first vowel reduced to schwa.

(1) *case #*	*example*	*phonetic transcription*	*component*	*subject*
IU01	*accuut*	ɑkyt	c	N08147
IU02	*atoom*	atom	a	N01134
IU03	*chauffeur*	ʃofør	c	N08021
IU04	*dieet*	dijet	c	N08067
IU05				N08069
IU06				N08087
IU07	*figuur*	fiɣyr	c	N08072
IU08		fixyr	a	N01123
IU09			c	N08009
IU10	*formaat*	fomat	a	N01012
IU11	*humeur*	hymør	c	N08096
IU12	*idool*	idol	c	N08009
IU13	*graniet*	xranit	c	N08019
IU14	*kaneel*	kɑnel	a	N01141
IU15	*klimaat*	klimad	a	N01091
IU16		klimat	a	N01091
IU17	*kritiek*	kritiek	c	N08049
IU18	*kwartier*	kwɑtir	c	N08049
IU19				N08050
IU20				N08142
IU21	*lawaai*	lɑwaj	c	N08005
IU22				N08076
IU23	*limiet*	limit	a	N01058
IU24	*manier*	mɑnir	a	N01030
IU25				N01042
IU26				N01084
IU27				N01085
IU28			c	N05088
IU29				N08009
IU30				N08016
IU31				N08082
IU32				N08145

IU33				N08149
IU34		manix	c	N08070
IU35	*mobiel*	mobil	c	N08025
IU36	*muziek*	mysik	a	N01135
IU37			c	N08001
IU38				N08079
IU39		myzik	a	N01039
IU40				N01078
IU41			c	N08072
IU42	*paniek*	pɑnik	c	N08009
IU43	*papier*	pɑpi	c	N08081
IU44		pɑpir	a	N01005
IU45				N01134
IU46				N01135
IU47				N01138
IU48				N01139
IU49			c	N08107
IU50				N08081
IU51	*profiel*	profil	c	N08056
IU52	*rivier*	rufir	c	N00049
IU53	*sigaar*	siɣar	c	N08024
IU54	*tarief*	tɑrif	c	N08025
IU55	*toneel*	tɑnel	a	N01151
IU56		tonel	a	N01139
IU57				N01151
IU58			c	N08028
IU59				N08029
IU60	*totaal*	total	c	N08096
IU61				N08111
IU62	*toernooi*	tunoj	c	N08139

(2) *case #*	*example*	*phonetic transcription*	*component*	*subject*
IR01	*chauffeur*	ʃəfør	c	N08021
IR02	*figuur*	fəɣyr	c	N08111
IR03	*graniet*	xrənit	c	N08079
IR04	*kabaal*	kəbal	c	N08021
IR05	*kanaal*	kənal	a	N01128
IR06	*kritiek*	krətik	c	N08049
IR07	*kwartier*	kwətir	a	N01140
IR08			c	N08030
IR09				N08019
IR10		kətir	c	N08050
IR11	*lawaai*	ləwaj	a	N00809

IR12			c	N08005
IR13	*manier*	mənir	a	N01031
IR14				N01045
IR15				N01048
IR16				N01083
IR17				N01086
IR18				N01152
IR19				N01159
IR20			c	N08005
IR21				N08017
IR22				N08018
IR23				N08025
IR24				N08032
IR25				N08056
IR26				N08058
IR27				N08079
IR28				N08082
IR29				N08086
IR30				N08088
IR31				N08088
IR32				N08089
IR33				N08096
IR34				N08113
IR35	*minuut*	mənyt	a	N01014
IR36				N01039
IR37			c	N08022
IR38				N08033
IR39				N08070
IR40				N08087
IR41				N08089
IR42				N08096
IR43				N08143
IR44	*muziek*	məsik	c	N08000
IR45		məzik	c	N08051
IR46	*paniek*	pənik	c	N08086
IR47	*papier*	pəpir	a	N01139
IR48			c	N08077
IR49				N08081
IR50				N08082
IR51				N08139
IR52	*persoon*	pəson	a	N01012
IR53				N01126
IR54			c	N08029
IR55				N08136
IR56	*tomaat*	təmaat	c	N08144

IR57	*toneel*	tənel	c	N08028
IR58	*verhaal*	fəhal	c	N08015

The next set of tables list stress-final bisyllabic words occurring in the more formal components f, g, and h, again first without reduction and then with the first vowel reduced to schwa.

(3) *case #*	*example*	*phonetic transcription*	*component*	*subject*
FU01	*figuur*	fiɣyr	f	N03002
FU02				N03221
FU03				N03002
FU04		fixyr	h	N09213
FU05				N09213
FU06	*idool*	idol	f	N00028
FU07				N00022
FU08	*kameel*	kɑmel	h	N09131
FU09	*klimaat*	klimat	f	N03010
FU10	*kritiek*	kritik	f	N00181
FU11			f	N03029
FU12	*kwartier*	kwɑtir	f	N03032
FU13	*lokaal*	lokal	f	N03133
FU14			h	N09074
FU15		lɔkal	h	N09074
FU16	*manier*	manij	f	N00022
FU17		manir	f	N00181
FU18				N03002
FU19			g	N00046
FU20				N00188
FU21				N00189
FU22				N00200
FU23				N00204
FU24			h	N09213
FU25		mɑnir	f	N03002
FU26				N03003
FU27				N03029
FU28				N03041
FU29				N03042
FU30				N03224
FU31				N03268
FU32			g	N00204
FU33			h	N09131
FU34				N09199
FU35				N09223
FU36				N09257

FU37	*muziek*	mysik	f	N03050
FU38				N03198
FU39		myzik	f	N00011
FU40				N03004
FU41				N03006
FU42				N03017
FU43				N03050
FU44				N03091
FU45				N03092
FU46				N03192
FU47		mʏzik	f	N03017
FU48	*natuur*	natyr	f	N00006
FU49				N03004
FU50				N03039
FU51				N03269
FU52		nɑtyr	f	N03269
FU53	*papier*	pɑpir	f	N03086
FU54			h	N09020
FU55				N09257
FU56	*penseel*	pɛsel	h	N09213
FU57	*piloot*	pilot	f	N00181
FU58	*planeet*	plɑnet	h	N09257
FU59	*primaat*	primat	g	N00291
FU60	*profeet*	profet	f	N03008
FU61				N03026
FU62	*riool*	rijol	f	N03269
FU63	*citaat*	sitat	f	N03011
FU64				N03013
FU65				N03131
FU66				N03133
FU67			g	N00189
FU68	*statuut*	statyd	g	N00314
FU69		statyt	g	N00227
FU70		stɑtyt	g	N00227
FU71		stɑtyt	g	N00291
FU72	*tarief*	tarif	g	N00034
FU73		tariv	f	N03228
FU74	*toneel*	tonel	f	N03050

(4) *case #*	*example*	*phonetic transcription*	*component*	*subject*
FR01	*katoen*	kətun	f	N03158
FR02	*manier*	mənir	f	N00028
FR03				N03000

FR04				N03008
FR05				N03020
FR06				N03029
FR07				N03041
FR08				N03042
FR09				N03138
FR10				N03159
FR11				N03236
FR12				N03230
FR13			g	N00168
FR14				N00170
FR15				N00291
FR16				N00321
FR17			h	N09196
FR18				N09199
FR19				N09213
FR20	*minuut*	mənyt	f	N03012
FR21				N03249
FR22			g	N00170
FR23	*muziek*	məzik	f	N00006
FR24				N03092
FR25				N03198
FR26	*penseel*	pəsel	h	N09213
FR27	*persoon*	pəson	f	N00028

Appendix J

The following is an exhaustive list of possible constraint rankings for Dutch vowel reduction.

Grammar I:
MAX-IO-FOOTHEAD » PARSE-σ » MAX-IO-ROOT » *ROOT » *FEATURE » MAX-IO-UNFOOTED » MAX-IO-FOOTWEAK

/fo.no.lo.xi/	MAX-IO-FTHEAD	PARSE-σ	MAX-IO-ROOT	*ROOT	*FEATURE	MAX-IO-UNFTD	MAX-IO-FTWEAK
(fo.no)lo(xi)		*!		****	****		
(fo.nə)lo(xi)		*!		****	***		*
(fo.nə)lə(xi)		*!		****	**	*	*
(fo.no)lə.(xi)		*!		****	***	*	
☞ (fon.lə)(xi)			*	***	**		*

Grammar II:
MAX-IO-FOOTHEAD » PARSE-σ » MAX-IO-ROOT » *ROOT » MAX-IO-UNFOOTED » *FEATURE » MAX-IO-FOOTWEAK

/fo.no.lo.xi/	MAX-IO-FTHEAD	PARSE-σ	MAX-IO-ROOT	*ROOT	MAX-IO-UNFTD	*FEATURE	MAX-IO-FTWEAK
(fo.no)lo(xi)		*!		****		****	
(fo.nə)lo(xi)		*!		****		***	*
(fo.nə)lə(xi)		*!		****	*	**	*
(fo.no)lə.(xi)		*!		****	*	***	
☞ (fon.lə)(xi)			*	**		***	*

Grammar III:

MAX-IO-FOOTHEAD » PARSE-σ » MAX-IO-ROOT » MAX-IO-UNFOOTED » *ROOT » *FEATURE » MAX-IO-FOOTWEAK

/fo.no.lo.xi/	MAX-IO-FTHEAD	PARSE-σ	MAX-IO-ROOT	MAX-IO-UNFTD	*ROOT	*FEATURE	MAX-IO-FTWEAK
(fo.no)lo(xi)		*!			****	****	
(fo.nə)lo(xi)		*!			****	***	*
(fo.nə)lə(xi)		*!		*	****	**	*
(fo.no)lə.(xi)		*!		*	****	***	
☞ (fon.lə)(xi)			*		***	**	*

Grammar IV:

MAX-IO-FOOTHEAD » MAX-IO-ROOT » *ROOT » *FEATURE » PARSE-σ » MAX-IO-UNFOOTED » MAX-IO-FOOTWEAK

/fo.no.lo.xi/	MAX-IO-FTHEAD	MAX-IO-ROOT	*ROOT	*FEATURE	PARSE-σ	MAX-IO-UNFTD	MAX-IO-FTWEAK
(fo.no)lo(xi)			****	***!*	*		
(fo.nə)lo(xi)			****	***!	*		*
☞ (fo.nə)lə(xi)			****	**	*	*	*
(fo.no)lə.(xi)			****	***!	*	*	
(fon.lə)(xi)		*!	***	**			*

Grammar V:

MAX-IO-FOOTHEAD » MAX-IO-ROOT » *ROOT » *FEATURE » MAX-IO-UNFOOTED » PARSE-σ » MAX-IO-FOOTWEAK

/fo.no.lo.xi/	MAX-IO-FTHEAD	MAX-IO-ROOT	*ROOT	*FEATURE	MAX-IO-UNFTD	PARSE-σ	MAX-IO-FTWEAK
(fo.no)lo(xi)			****	***!*		*	
(fo.nə)lo(xi)			****	***!		*	*
☞ (fo.nə)lə(xi)			****	**	*	*	*
(fo.no)lə.(xi)			****	***!	*	*	
(fon.lə)(xi)		*!	***	**			*

Grammar VI:

Max-IO-FootHead » Max-IO-Root » *Root » Parse-σ » *Feature » Max-IO-Unfooted » Max-IO-FootWeak

/fo.no.lo.xi/	Max-IO-FtHead	Max-IO-Root	*Root	Parse-σ	*Feature	Max-IO-UnFtd	Max-IO-FtWeak
(fo.no)lo(xi)			****	*	***!*		
(fo.nə)lo(xi)			****	*	***!		*
☞ (fo.nə)lə(xi)			****	*	**	*	*
(fo.no)lə.(xi)			****	*	***!	*	
(fon.lə)(xi)		*!	***		**		*

Grammar VII:

Max-IO-FootHead » Max-IO-Root » *Root » Parse-σ » Max-IO-Unfooted » *Feature » Max-IO-FootWeak

/fo.no.lo.xi/	Max-IO-FtHead	Max-IO-Root	*Root	Parse-σ	Max-IO-UnFtd	*Feature	Max-IO-FtWeak
(fo.no)lo(xi)			****	*		****!	
☞ (fo.nə)lo(xi)			****	*		***	*
(fo.nə)lə(xi)			****	*	*!	**	*
(fo.no)lə.(xi)			****	*	*!	***	
(fon.lə)(xi)		*!	***			**	*

Grammar VIII:

Max-IO-FootHead » Max-IO-Root » *Root » Max-IO-Unfooted » *Feature » Parse-σ » Max-IO-FootWeak

/fo.no.lo.xi/	Max-IO-FtHead	Max-IO-Root	*Root	Max-IO-UnFtd	*Feature	Parse-σ	Max-IO-FtWeak
(fo.no)lo(xi)			****		****!	*	
☞ (fo.nə)lo(xi)			****		***	*	*
(fo.nə)lə(xi)			****	*!	**	*	*
(fo.no)lə.(xi)			****	*!	***	*	
(fon.lə)(xi)		*!	***		**		*

Grammar IX:

MAX-IO-FOOTHEAD » MAX-IO-ROOT » *ROOT » MAX-IO-UNFOOTED » PARSE-σ » *FEATURE » MAX-IO-FOOTWEAK

/fo.no.lo.xi/	MAX-IO-FTHEAD	MAX-IO-ROOT	*ROOT	MAX-IO-UNFTD	PARSE-σ	*FEATURE	MAX-IO-FTWEAK
(fo.no)lo(xi)			****		*	****!	
☞ (fo.nə)lo(xi)			****		*	***	*
(fo.nə)lə(xi)			****	*!	*	**	*
(fo.no)lə.(xi)			****	*!	*	***	
(fon.lə)(xi)		*!	***			**	*

Grammar X:

MAX-IO-FOOTHEAD » MAX-IO-ROOT » PARSE-σ » *ROOT » *FEATURE » MAX-IO-UNFOOTED » MAX-IO-FOOTWEAK

/fo.no.lo.xi/	MAX-IO-FTHEAD	MAX-IO-ROOT	PARSE-σ	*ROOT	*FEATURE	MAX-IO-UNFTD	MAX-IO-FTWEAK
(fo.no)lo(xi)			*	****	***!*		
(fo.nə)lo(xi)			*	****	***!		*
☞ (fo.nə)lə(xi)			*	****	**	*	*
(fo.no)lə.(xi)			*	****	***!	*	
(fon.lə)(xi)		*!		***	**		*

Grammar XI:

MAX-IO-FOOTHEAD » MAX-IO-ROOT » PARSE-σ » *ROOT » MAX-IO-UNFOOTED » *FEATURE » MAX-IO-FOOTWEAK

/fo.no.lo.xi/	MAX-IO-FTHEAD	MAX-IO-ROOT	PARSE-σ	*ROOT	MAX-IO-UNFTD	*FEATURE	MAX-IO-FTWEAK
(fo.no)lo(xi)			*	****		****!	
☞ (fo.nə)lo(xi)			*	****		***	*
(fo.nə)lə(xi)			*	****	*!	**	*
(fo.no)lə.(xi)			*	****	*!	***	
(fon.lə)(xi)		*!		***		**	*

Grammar XII:

MAX-IO-FOOTHEAD » MAX-IO-ROOT » PARSE-σ » MAX-IO-UNFOOTED » *ROOT » *FEATURE » MAX-IO-FOOTWEAK

/fo.no.lo.xi/	MAX-IO-FTHEAD	MAX-IO-ROOT	PARSE-σ	MAX-IO-UNFTD	*ROOT	*FEATURE	MAX-IO-FTWEAK
(fo.no)lo(xi)			*		****	****!	
☞ (fo.nə)lo(xi)			*		****	***	*
(fo.nə)lə(xi)			*	*!	****	**	*
(fo.no)lə.(xi)			*	*!	****	***	
(fon.lə)(xi)		*!			***	**	*

Grammar XIII:

MAX-IO-FOOTHEAD » MAX-IO-ROOT » MAX-IO-UNFOOTED » *ROOT » *FEATURE » PARSE-σ » MAX-IO-FOOTWEAK

/fo.no.lo.xi/	MAX-IO-FTHEAD	MAX-IO-ROOT	MAX-IO-UNFTD	*ROOT	*FEATURE	PARSE-σ	MAX-IO-FTWEAK
(fo.no)lo(xi)				****	****!	*	
☞ (fo.nə)lo(xi)				****	***	*	*
(fo.nə)lə(xi)			*!	****	**	*	*
(fo.no)lə.(xi)			*!	****	***	*	
(fon.lə)(xi)		*!		***	**		*

Grammar XIV:

MAX-IO-FOOTHEAD » MAX-IO-ROOT » MAX-IO-UNFOOTED » *ROOT » PARSE-σ » *FEATURE » MAX-IO-FOOTWEAK

/fo.no.lo.xi/	MAX-IO-FTHEAD	MAX-IO-ROOT	MAX-IO-UNFTD	*ROOT	PARSE-σ	*FEATURE	MAX-IO-FTWEAK
(fo.no)lo(xi)				****	*	****!	
☞ (fo.nə)lo(xi)				****	*	***	*
(fo.nə)lə(xi)			*!	****	*	**	*
(fo.no)lə.(xi)			*!	****	*	***	
(fon.lə)(xi)		*!		***		**	*

Grammar XV:

MAX-IO-FOOTHEAD » MAX-IO-ROOT » MAX-IO-UNFOOTED » PARSE-σ » *ROOT » *FEATURE » MAX-IO-FOOTWEAK

/fo.no.lo.xi/	MAX-IO-FTHEAD	MAX-IO-ROOT	MAX-IO-UNFTD	PARSE-σ	*ROOT	*FEATURE	MAX-IO-FTWEAK
(fo.no)lo(xi)				*	****	****!	
☞ (fo.nə)lo(xi)				*	****	***	*
(fo.nə)lə(xi)			*!	*	****	**	*
(fo.no)lə.(xi)			*!	*	****	***	
(fon.lə)(xi)		*!			***	**	*

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Samenvatting (Summary in Dutch)

Dit proefschrift heeft als doel de bestaande fonologische analyses, die vaak uitgaan van standaardtaal, aan te vullen met de beschrijving en verklaring van twee verschijnselen uit de snelle spraak, namelijk schwa-deletie in het Frans en klinkerreductie in het Nederlands.

Bij schwa-deletie gaat het om weglating van de stomme e in snelle spraak, zoals in *la ch'mise* voor *la chemise*. Het verschijnsel wordt bepaald door de aan- of afwezigheid van medeklinkers: wordt het medeklinkercluster onuitspreekbaar, of niet meer in te delen in lettergrepen, na weglating van de *e*, dan blijft deze laatste bewaard.

Klinkerreductie behelst het veranderen van een klinker in een stomme e, bijvoorbeeld *locomotief* uitgesproken als *lokemotief* of *lokemetief*. Het proces vindt plaats in klemtoonloze lettergrepen, maar onduidelijk is welke de exacte positie hiervan is in de prosodische structuur.

Een primair probleem bij de beschrijving van de twee fenomenen in kwestie vormen de gegevens. Voor het Frans zijn deze er in overvloed, maar omdat ze vaak voortkomen uit introspectie en selectief kopiëren van data van andere auteurs zijn er veel contradicties en behandelen niet alle analyses dezelfde taalvariant. Voor het Nederlands zijn veel minder gegevens voorradig, en het probleem is hier dan ook niet de tegenstrijdigheid van de data, maar het gebrek aan een volledige inventaris.

Voordat dus kan worden overgegaan tot een analyse van de twee snelle spraakfenomenen, is eerst een inventarisatie van bestaande gegevens nodig, en eventueel uitbreiding met nieuwe data. Bij voorkeur geschiedt dit laatste niet, zoals voorheen vaak gebeurde, door middel van introspectie, maar door het gebruik van corpora, volgens de auteur de enige gerechtvaardigde gegevensbron voor de taalkundige analyse. Hiertoe worden twee corpora aangewend: het corpus *Phonologie du Français Contemporain* (PFC) voor het Frans, en het *Corpus Gesproken Nederlands* (CGN) voor het Nederlands.

In het PFC-corpus werd schwa in drie contexten bekeken: na een consonantcluster woord-intern, in de eerste lettergreep van het woord of de zin, en met een schwa in de voorafgaande lettergreep. Dit levert nieuwe inzichten op in de consonantclusters die mogen ontstaan na deletie van de schwa. De aloude observatie uit de literatuur volgens welke schwa mag wegvallen na één medeklinker en bewaard blijft na twee (*la ch'mise* versus *une chemise*) blijkt te kort door de bocht te zijn: deletie na meerdere medeklinkers is heel goed mogelijk, mits de ontstane groep consonanten goed uit te spreken blijft. Dit laatste kan worden bereikt door bijvoorbeeld een sibilant ([s], [ʃ], [z], [ʒ]) bij voorkeur in het midden van het cluster op te nemen. Verdere generalisaties zijn moeilijk te maken, omdat deletie sterk aan variatie onderhevig is, zowel tussen sprekers als in de spraak van één en dezelfde spreker.

Het CGN laat zien dat klinkerreductie op alle stijlniveaus van de spontane spraak voorkomt, inclusief bijvoorbeeld vrij formele radio-interviews en lessen. Reductie moet onderscheiden worden van *laxing*, waarbij de klinkers (met name de [a]) in de eerste lettergreep veranderen in klinkers met het kenmerk [lax]. Dit proces lijkt een lexicaal fenomeen: een spreker zegt ofwel altijd [banan], ofwel altijd [bɑnan]. Klinkerreductie daarentegen komt voor in prosodisch zwakke lettergrepen, en is afhankelijk van stijlniveau en spreker.

Nadat door corpusonderzoek duidelijk is geworden wat beide fenomenen precies inhouden, kan worden begonnen aan de vraag welke taalkundige factoren eraan ten grondslag liggen. Voor het Frans is helder geconstateerd dat de omringende medeklinkers bepalen of een schwa kan worden weggelaten. Hierbij speelt, in tegenstelling tot wat sommige auteurs aannemen, de lettergreep geen bepalende rol: ook al kunnen de overblijvende medeklinkers niet worden ondergebracht in correcte lettergrepen, dan nog kan deletie plaatsvinden. Bewijs tegen de lettergreephypothese vormen ook eerdere experimentele onderzoeken van o.a. Rialland (1986), in dit proefschrift herhaald op PFC-materiaal, waaruit blijkt dat na deletie van de schwa de lettergrepen van een woord niet opnieuw ingedeeld worden: *le bas r'trouvé* blijft anders klinken dan *le bar trouvé*.

Voor het Nederlands is de situatie minder duidelijk: reductie vindt plaats in onbeklemtoonde lettergrepen, maar hoe moeten we deze precies omschrijven? Hoewel in de literatuur duidelijk is geformuleerd hoe voeten worden gevormd op basis van lettergrepen die hoofdklemtoon hebben, is voor de overige lettergrepen van het woord de prosodische structuur onduidelijk. In het geval van woorden met drie open lettergrepen voor hoofdklemtoon, zoals *locomotief*, is eenvoudig vast te stellen dat de laatste lettergreep een voet vormt, en dat de eerste, die nevenklemtoon heeft, het hoofd van een voet moet zijn, maar de status van de tweede en derde lettergreep varieert van analyse tot analyse. (lo.ko)mo(tif), (lo.ko)(mo)tif en (lo.ko.mo)tif zijn drie mogelijkheden. Welke van de drie de juiste is, is moeilijk tot niet aan te tonen door middel van fonetische experimenten: testen met [o]-verkleuring, verlenging voor de [r] en de *Chanted Call* tonen aan dat sprekers er weinig tot geen intuïties over hebben. De lengte- en toonhoogteverschillen worden niet gehoord, hoewel ze misschien wel onbewust aangebracht worden. Bij gebrek aan bewijs uit experimenten kiest het proefschrift voor de theoretisch meest verantwoorde oplossing: (lo.ko)mo(tif), waarbij de tweede lettergreep zijn klinker gemakkelijker reduceert dan de derde, omdat hij in de zwakke positie van een voet zit, terwijl de derde niet in een voet is ondergebracht.

De segmenten die voortkomen uit klinkerreductie in het Nederlands en uit deletie van de Franse schwa zijn twee verschillende, en daarom wordt het eerste hier aangeduid als "reductieklinker", en bewust niet als schwa. Dat laatste woord is voorbehouden aan de met nul alternerende klinker van het Frans. Verder worden de twee anders formeel gerepresenteerd: waar de Nederlandse reductieklinker alleen de fonetische kenmerken mist, en hierdoor leeg is ten opzichte van de andere klinkers, kan de Franse schwa ook de zogenaamde vocalische knoop missen, en wel als de spreker de keus heeft gemaakt hem niet te realiseren. De zogeheten wortelknoop blijft in dat geval wel bewaard, omdat ook de niet uitgesproken schwa het hoofd van een lettergreep kan zijn.

De twee processen kunnen in de Optimaliteitstheorie (OT) worden beschreven aan de hand van een constraint *KLINKER, die bestaat uit drie delen: voor elk van de bestanddelen van een klinker (wortelknoop, vocalische knoop, fonetische kenmerken) een constraint die realisatie ervan verbiedt. Doordat schwa en de reductieklinker, zoals hierboven geschetst, een andere formele representatie hebben dan de overige klinkers in beide talen, zijn het juist deze segmenten die reageren op de interactie tussen de bestanddelen van *KLINKER en constraints voor het behoud van de verschillende knopen en kenmerken. In het Nederlands zijn de hier relevante constraints gebaseerd op de voetstructuur, en in het Frans op combinaties van medeklinkers. Een klinker verliest zijn kenmerken alleen in de zwakke posities van de prosodische structuur in de eerste taal, en de schwa als klinker zonder kenmerken kan ook zijn vocalische knoop kwijtraken in de tweede, mits de overgebleven medeklinkers een acceptabel cluster vormen.

Blijft het probleem van de variatie: zelfs als aan de voorwaarden hierboven voldaan is, wordt een klinker niet automatisch gereduceerd of een schwa weggelaten. Beide processen zijn afhankelijk van tal van sociolinguïstische factoren, waarvan stijlniveau de belangrijkste is. OT is niet bij uitstek geschikt voor het beschrijven van variatie, omdat een van de kernprincipes is dat er één optimale kandidaat is voor één input. Het model waarin de hier behandelde snelle spraak processen het best beschreven kunnen worden binnen OT is Gradient Welformedness (Hayes 2000). In dit model kan de rangschikking van constraints verschillen naar gelang deze strikt of minder strikt worden toegepast door de spreker.

Door beschrijving en analyse van, literatuurstudie naar, en uitbreiding van gegevens over de Franse schwa en de Nederlandse klinkerreductie hoopt de auteur te hebben bijgedragen aan de theorievorming op het gebied van de snelle en informele spraak.

Curriculum vitæ

Twan Geerts, geboren op 23 mei 1980 in Tilburg, behaalde het diploma gymnasium in 1998, en ging daarna Franse taal- en letterkunde studeren in Nijmegen. Na zijn afstuderen (*cum laude*) in 2002 trad hij als promovendus in dienst van de Nijmeegse letterenfaculteit. Sinds 2004 heeft hij daar ook een dienstverband als docent bij de afdeling Romaanse talen en culturen.