Final devoicing and voicing assimilation in Dutch derivation and cliticization

Janet Grijzenhout and Martin Krämer

1. Introduction

In derivational frameworks, final devoicing and voicing assimilation have always been regarded as evidence for rule ordering in Dutch (e.g., Berendsen 1983, Berendsen et al 1984, Zonneveld 1983). In more recent constraint-based approaches, lexical and post-lexical levels have been assumed by, e.g., Booij (1996) to account for some Dutch voicing phenomena. Other linguists propose context-specific faithfulness constraints for a few cases of final devoicing and voicing assimilation (e.g. Lombardi 1995, 1996, 1999). A unified analysis of all phenomena related to final devoicing and voicing assimilation in Dutch has not been proposed yet. In this paper, we will first point out the various problems rule-based approaches encounter when all relevant facts are taken into consideration. We will then suggest an analysis that uses the Correspondence version of Optimality Theory (McCarthy & Prince 1995) and that does not assume different levels (Kiparsky 1998), nor Output-Output constraints (Benua 1995), nor a device such as 'Sympathy' (McCarthy 1998).

Our analysis is based on ideas presented by Booij (1995) and Selkirk (1995) who both suggest that suffixes may differ in their prosodic structure. Some suffixes do not form a Prosodic Word of their own, whereas others do. We argue that clitics in Dutch differ from suffixes in that all suffixes are part of a Prosodic Word, whereas clitics are directly linked to a Phonological Phrase. Because the prosodic structure is distinct, we expect to find differences regarding syllabification (and, consequently, final devoicing) between the two kinds of suffixes and between suffixes and clitics. We will show that this is in fact the case. We will furthermore demonstrate that prosodic structure is also relevant to voicing assimilation. More specifically, it will be shown that it is more important to preserve the underlying voicing specification of a plosive in initial position of a Prosodic Word than to preserve voicing of a plosive that is not initial in a Prosodic Word. We will develop an analysis with (i) Alignment constraints which demand that the edge of certain morphological categories should be aligned with the corresponding edge of a Prosodic Word and (ii) Identity constraints which say that the voicing specification of a segment in onset position of a Prosodic Word should be identical to its input specification.

The structure of this paper is as follows. In section 2, we illustrate the phenomenon of final devoicing and we show how devoicing may be made 'invisible' by voicing assimilation in certain derivations and in compounds. We point out some problems that rule-based derivational accounts encounter with respect to (i) the order of affixation, (ii) progressive voicing assimilation in the case of inflectional endings, and (iii) devoicing of stem-final consonants before clitics. In section 3, we discuss the prosodic structure of stems, suffixes, and clitics in Dutch. In section 4, we present Lombardi's (1995, 1996, 1999) OT-account of progressive and regressive voicing assimilation in Dutch and we point out some problems that this analysis poses for other Dutch data. In section 5, we suggest an alternative analysis which explains more data and in section 6 we present an analysis of devoicing before clitics. Section 7 summarises the discussion.

2. Voicing phenomena and rule-based approaches

In Dutch, voicing is distinctive for obstruents. In some environments, this distinction is neutralised. For instance, all obstruents are voiceless in word-final position. This is illustrated by the examples below, where the voiced plosive /d/ in (1a) and the voiced fricative /z/ in (1c) are realised as voiceless obstruents, i.e. [t] and [s], respectively, in word-final position. The data in the second column in (1b,d) illustrate that there is no intervocalic voicing of obstruents in Dutch:[1,2]

(1) Final devoicing:

a.	/pɑd/	→	[pɑt]	'toad'	/pɑd/	+ ən	→	[pɑdən]	'toads'
b.	/lɑt/	→	[lɑt]	'lath'	/lɑt/	+ ən	→	[lɑtən]	'laths'
c.	/pu:z/	→	[pu:s]	'cat'	/pu:z/	+ ən	→	[pu:zən]	'cats'
d.	/vɔs/	→	[vɔs]	'fox'	/vɔs/	+ ən	→	[vɔsən]	'foxes'

Whether the underlying voicing specification of a stem-final obstruent surfaces or not depends on its position within the word and on the following suffix.

Stem-final obstruents that are underlyingly specified as voiced retain their voicing specification before some vowel-initial suffixes (see 2a,b). They are voiceless before other suffixes (see 3a,b), in compounds (see 4a,b), and before clitics (see 5a,b). In a derivational rule-based approach, it is inferred that final devoicing takes place after suffixation of the former suffixes and before suffixation of the latter suffixes, before

1 All data in this paper are from Berendsen (1983), Booij (1995), and from one of the authors who is a native speaker of Dutch. The phonetic forms in Booij (1995) differ from the intuitions of the author in that Janet Grijzenhout does not have an underlying voiced velar fricative. In contrast to Booij (1995), we will use a length mark ':' after tense vowels, even though we note that there is no consensus in the literature concerning the length of tense vowels in Dutch.

2 In Dutch, syllables with a short (lax) vowel are closed. In the examples in (1a,b,d), the intervocalic obstruent is usually assumed to be ambisyllabic, but this is not a phonetic phenomenon and these obstruents do not have a longer duration than obstruents following long (tense) vowels (see Hulst 1985).

compounding, and before cliticization (Berendsen 1983, Berendsen et al 1984, Zonneveld 1983).

(2) Stem-final obstruents before suffixes with Schwa[3]

a.	/xe:v/$_V$ + -er$_N$	→	['xe:.vər]	'give'	→'giver'
b.	/dɔnz/$_N$ + -ig$_A$	→	['dɔn.zəx]	'down'	→'fluffy'

(3) Stem-final obstruents before suffixes with a full vowel

a.	/xɔud/$_N$	→	xɔut + -achtig$_A$	→	['xɔut.ˌɑx.təx]	'gold' →'gold-like'
b.	/di:v/$_N$	→	di:f + -achtig$_A$	→	['di:f.ˌɑx.təx]	'thief' →'thievish'

(4) Stem-final obstruents before vowel-initial stems in compounds

a.	/xɔud/$_N$	→	xɔut + ader$_N$	→	['xɔut.ˌa:.dər]	'gold' →'gold-vein'
b.	/le:v/$_V$	→	le:f + eenheid$_N$	→	['le:f.ˌe:n.hɛit]	'live' →'family unit'

(5) Stem-final obstruents before clitics

a.	/ba:d/$_V$	→	ba:t + 'r	→	['ba:tər]	'bathe' →'bathe her'
b.	/xe:v/$_V$	→	xe:f + 'm	→	['xe:fəm]	'give' →'give him'

As is clear from examples (2a-b) and (3a-b), we can distinguish two types of suffixes, viz., (i) those in which stem-final obstruents may be resyllabified as onsets and (ii) those which trigger devoicing of a stem-final obstruent. We can also distinguish different types of suffixes on the basis of stress behaviour. The problem is that the suffixes that pattern together with respect to resyllabification are not necessarily part of the same class when we consider stress assignment.

In Dutch underived words, main stress is assigned to one of the three last syllables in the word. Stress is assigned to the antepenultimate syllable if the penultimate syllable is open and the ultimate one is closed (see 6a).[4] If the final syllable is 'superheavy', i.e., if it ends in a long vowel plus a consonant (-VVC) or a short vowel plus two consonants (-VCC), main stress is assigned to the ultimate syllable (see 6b,c).

(6) Stress assignment with a penultimate open syllable and an ultimate closed syllable

a.	lexikon	['lɛk.si:.kɔn]	'lexicon'
b.	abrikoos	[a:.bri:.'ko:s]	'apricot'
c.	president	[pre:.si:.'dɛnt]	'president'

In all other cases, main stress is usually assigned to the penultimate syllable:

(7) Stress assignment in other cases

a.	pyjama	[pi:.'ja:.ma:]	'pyjamas'
b.	Alaska	[a:.'lɑs.ka:]	'Alaska'
c.	elektron	[e:.'lɛk.trɔn]	'electron'

3 The subscripts 'A', 'N', 'V' indicate the morphosyntactic category of the stems and suffixes in question. Syllable boundaries are indicated by a dot. We will discuss syllabification of forms with clitics (as in 5a-b) in more detail in section 6 below.

4 In addition to the regular (predictable) pattern, Dutch allows irregular stress assignment in some words (e.g. pelotón, celébes, amérika, ólifant). For a more detailed analysis of Dutch regular and irregular stress patterns, we refer to Booij (1995) and Trommelen & Zonneveld (1989).

With respect to stress assignment, Trommelen & Zonneveld (1989) distinguish three types of suffixes in Dutch: one type changes the stress pattern of the base, another type requires stress to be assigned to the immediately preceding syllable, and the third type does not cause a stress shift in the base. Most suffixes belong to the first type. They conform to regular patterns of stress assignment. In the output of (8a), for instance, main stress is assigned to the antepenultimate syllable, because the final syllable is closed and the penultimate syllable is open (cf. 6a). In accordance with the rules of regular stress assignment, main stress is assigned to the final syllables in (8b) and (8c), because they are super heavy (cf. 6b,c):

(8) Class I derivation

a.	aː.noː.'niːm	+ us_N	→	[aː.'noː.niː.mʏs]	'anonymous writer'
b.	proː.'dʏkt	+ $ie/v/_A$	→	[proː.dʏk.'tiːf]	'productive'
c.	proː.dʏk.'tiːf	+ $iteit_N$	→	[proː.dʏk.tiː.viː.'tɛit]	'productivity'

Some adjectival suffixes require that the main stress of the word be located on the syllable preceding the suffix. Examples are *-(e)lijk* [ələk] and *-ig* [əx]:

(9) Class II derivation

a.	'hɛr.tɔx	+ -elijk	→	[hɛr.'toː.xə.lək]	'ducal'
b.	doːt	+ -elijk	→	['doː.də.lək]	'deadly'
c.	sxɑn.'daːl	+ -ig	→	[sxɑn.'daː.ləx]	'scandalous'
d.	lɛif	+ -ig	→	['lɛi.vəx]	'corpulent'

Suffixes of type three do not affect the position of the main stress of the word they are attached to. Examples are the nominalising suffixes *-aard, -dom, -heid, -ling* and *-schap* and the adjectival suffixes *-achtig*, *-baar*, and *-loos*. Main stress is on the first syllable in the words in (10a-c) below, irrespective of the form of the penultimate or ultimate syllable:

(10) Class III derivation

a.	'hɛr.tɔx	+ -dom	→	['hɛr.tɔɣ.ˌdɔm]	'duchy'
b.	'tʊɛi.fəl	+ -achtig	→	['tʊɛi.fəl.ˌɑx.təx]	'doubtful'
c.	'sxaː.dyʊ	+ -loos	→	['sxaː.dyʊ.ˌloːs]	'without a shadow'

Trommelen & Zonneveld (1989) assume that inflectional endings and the diminutive suffix belong to the third type, because they do not affect the stress-pattern of the words they are associated to (see 11a) and they may follow derivational suffixes (see 11b,c):

(11) Diminutive suffix and inflectional endings

a.	'hɛr.tɔx	+ -/jə/		→	['hɛr.tɔx.jə]	'little duke'
b.	roːd	+ -/ɑxtəx/	+ -/ər/	→	['roːt.ˌɑx.tə.xər]	'more reddish'
c.	vɛif	+ -/lɪŋ/	+ -/ən/	→	['vɛif.ˌlɪŋ.ən]	'quintuplets (pl.)'

On the basis of the observations concerning stress assignment, Trommelen & Zonneveld (1989: 192, 200) propose to organise the lexicon in at least three different levels. This model of the lexicon poses a problem for devoicing phenomena. It presupposes that syllabification only applies at early levels, but not at the level where class III affixation, inflection, and compounding take place. Resyllabification of a stem-final

obstruent is indeed attested in words derived by suffixes of the first two types, i.e. suffixes that conform to rules of regular stress assignment (see 8) and suffixes that require main stress before the suffix in question (see 9). Obstruents before schwa-initial suffixes of type three and before inflectional endings are also resyllabified and surface as onsets (see 12). Before suffixes of the third type that have a full vowel, however, stem-final obstruents are not resyllabified and they are voiceless (see 13).

(12) Inflection

a.	/ro:d/	+ -er	→	['ro:.dər]	'redder'
b.	/le:v/	+ -en	→	['le:.vən]	'(we) live'

(13) Class III derivation

a.	/ro:d/			+ -achtig	→	*[ro:.dɑx.təx]	
b.	/ro:d/	→	/ro:t/	+ -achtig	→	[ro:t.ɑx.təx]	'reddish'
c.	/vɛiv/			+ -ling	→	*[vɛi.vlɪŋ]	
d.	/vɛiv/	→	/vɛif/	+ -ling	→	[vɛif.lɪŋ]	'quintuplets'

Examples (12a,b) illustrate that resyllabification takes place in the case of inflectional endings, so that the stem-final consonant surfaces as an onset. Examples (13b,d) and (4a,b), respectively, illustrate that resyllabification does not take place in the case of other class III affixes and in the case of compound formation. It is thus questionable that inflection belongs to the same level as other class III suffixation and compounding.

Alternatively, it could be argued that inflectional endings belong to a level on which the phonology is organised in such a way that resyllabification is ordered before final devoicing. Other class III suffixes and compounds may be said to belong to a later level on which resyllabification no longer applies, so that final devoicing may apply to stem-final obstruents. However, in this way, we predict that inflectional endings are attached prior to class III affixation and we incorrectly exclude the possibility that class III affixes may precede inflectional endings, as is the case in examples (11b,c) above.

So far, we have demonstrated that level ordering does not help to explain the different behaviour of suffixes with respect to obstruent devoicing. In our view, the solution to this problem lies in the different prosodic structure of suffixes which trigger resyllabification and suffixes before which we find final devoicing. This will be the topic of section 3. Before we discuss our solution to this problem, we will first consider a related phenomenon in Dutch which poses an interesting problem for rule ordering, viz. voicing assimilation. Final devoicing is often obscured by voicing assimilation and this has been explained in rule-based analyses by a specific ordering of rules for final devoicing and rules for voicing assimilation. Consider in this respect that some class III suffixes which begin in a voiced obstruent trigger voicing assimilation. In most cases, voicing assimilation is regressive and as a result, a stem-final obstruent is voiced before these suffixes (see 14a,b):[5]

5 A rule of regressive voicing assimilation is formulated in Berendsen (1983) as follows:
[–son] → [αvoice] / --- (#) [–son, αvoice]

(14) Regressive voicing assimilation

a.	/e:t/	+ -baar →	['e:d.ba:r]	'edible'
b.	/ʋɑs/	+ -baar →	['ʋɑz.ba:r]	'washable'

Progressive voicing assimilation occurs when the right member of a cluster is a fricative, i.e. the fricative assimilates to the obstruent on its left:[6]

(15) Progressive voicing assimilation

/ʋɛrk/	+ -zaam →	['ʋɛrk.sa:m]	'active; effective'

In clusters with a fricative as the second member, voicing assimilation interacts with final devoicing, i.e. devoicing takes place before progressive voicing assimilation:

(16) Final devoicing and progressive voicing assimilation

a.	/vri:nd/ →	/vri:nt/	+ -schap →	['vri:nt.sxɑp]	'friendship'
b.	/ra:d/ →	/ra:t/	+ -zaam →	['ra:t.sa:m]	'advisable'

The data in (14) illustrate that devoicing may not take place after regressive voicing assimilation and the data in (16) illustrate that devoicing must take place before progressive assimilation. The order of rules must thus be that final devoicing applies first and that progressive assimilation precedes regressive assimilation.

Voicing assimilation is also attested in compounds and across (grammatical) word boundaries. In cases where the second obstruent in a cluster is a stop, regressive voicing assimilation takes place:

(17) Regressive voicing assimilation

a.	/klɑp/	+ /dør/	→	['klɑb.dør]	'swing-door'
b.	/stɔf/	+ /duk/	→	['stɔv.duk]	'duster'
c.	/hɑnd/	+ /pɑlm/	→	['hɑnt.pɑlm]	'palm'
d.	/sto:v/	+ /pe:r/	→	['sto:f.pe:r]	'stewing-pear'
e.	/klɑp do:r də mo:lən/		→	[klɑb do:r də mo:lə]	'a slap by the windmill'

If the second obstruent in a cluster is a fricative, we find progressive voicing assimilation:

(18) Progressive voicing assimilation

a.	/sla:p/	+ /zɑk/	→	['sla:p.sɑk]	'sleeping-bag'
b.	/dɑk/	+ /vɛnstər/	→	['dɑk.fɛn.stər]	'dormer'
c.	/ɑs/	+ /vɑt/	→	['ɑs.fɑt]	'dustbin'
d.	/klɑp vɑn də mo:lən/		→	[klɑp fɑn də mo:lə]	'a slap of the windmill'

Final devoicing has to precede progressive voicing assimilation:

(19) Final devoicing and progressive voicing assimilation

a.	/rɔnd/ →/rɔnt/	+ /va:rd/ →	['rɔnt.fa:rt]	'cruise'
b.	/xra:v/ →/xra:f/	+ /zʏxt/ →	['xra:f.sʏxt]	'digging urge'

The order of rule application in the case of compounds and at the postlexical level is thus the same as the order of rule application for class III derivation. A problem arises when we consider voicing assimilation and the past tense affix *-de*. This suffix has an

6 A rule of progressive voicing assimilation is characterised in Berendsen (1983) as follows:
[–son, +cont] → [–voice] / [–voice] (#) ---

initial voiced stop (see 20a) which, according to the rule of regressive voicing assimilation, should trigger voicing of stem-final obstruents. This prediction is not borne out by the facts. Voiceless stem-final obstruents are not voiced before the inflectional ending *-de*. Instead, after voiceless stem-final obstruents, the morpheme *-de* is pronounced with voiceless [t]:[7]

(20) Progressive assimilation with inflectional *-de*

a.	zwaai	+ -de→zwaaide	[zʋa:j.də]	'wave', 'waved'
b.	stop	+ -de→stopte	[stɔp.tə] /*[stɔb.də]	'stop', 'stopped'
c.	maf	+ -de→mafte	[mɑf.tə]/*[mɑv.də]	'snooze', 'snoozed'
d.	tob	+ -de→tobde	[tɔb.də]	'drudge', 'drudged'
e.	stoov	+ -de→stoofde	[sto:v.də]	'stew', 'stewed'

Another problem concerns devoicing of stem-final obstruents before clitics. In (21a) we find an instance of a clitic with an initial voiced plosive. According to the rule-ordering established above, one might expect that a preceding obstruent is voiced due to voicing assimilation (see the last two columns in 22). This is not the case for all speakers, however:[8]

(21) No regressive assimilation with clitics

a.	kan	+ die→kan-die	[kɑndi:]	'can he'
b.	vond	+ die→vontie	[vɔnti] / *[vɔnddi]	'found he'
c.	of	+ die→of-tie	[ɔfti] / *[ɔvdi]	'whether he'

Below, we illustrate that the rule-order suggested in the literature (e.g., Berendsen 1983, Zonneveld 1983) makes the wrong predictions for the past-tense suffix *-de* and the clitic *die*:

(22)

	stop-de	vond-die	of-die
Final devoicing		t	
⇓			
progressive ass.			
⇓			
regressive ass.	*b d	*d d	*v d

In summary, we found that the level ordering that can be established on the basis of stress assignment does not help to explain the different behaviour of inflectional suf-

7 Zonneveld (1983) proposes that the past tense suffix actually begins in a voiced fricative /ð/ (which is not a phoneme in Dutch). After the rules of final devoicing, progressive assimilation, and regressive assimilation have applied, the resulting voiced or voiceless fricative is transformed into a plosive. Booij (1995:61-64) proposes that the underlying initial stop of the past tense suffix is unspecified for [voice]. He furthermore assumes a phonological rule that spreads the Laryngeal node from a preceding vowel or consonant to this stop. In section 5 below, we present an alternative analysis that assumes neither an underlying voiced fricative nor underspecification.

8 The data below are taken from the literature (Berendsen 1983, Booij 1995), but there is a great degree of variety among speakers of Dutch with respect to these forms. We assume with Berendsen (1983:29) coherency for the data in the sense that they may occur in one speaker/hearer.

fixes and other class III suffixes with respect to final devoicing. Furthermore, we showed that the order of rules that is needed to explain examples with some class III suffixes, compounds, and the behaviour of consonant clusters across word boundaries does not explain forms which are built by the suffix *-de* and forms which involve clitics.

3. The prosodic structure of affixes

To explain the different behaviour of suffixes with respect to final devoicing, voicing assimilation, and stress in Dutch and to explain phonological phenomena which may or may not apply in different morphosyntactic environments in other languages, Booij (1995:111 ff.) and Selkirk (1995) make the following suggestion. In their view, there are different categories of suffixes which may be prosodified differently. The first category consists of suffixes that do not form a Prosodic Word of their own. Following Selkirk (1995), we will refer to these suffixes as 'internal suffixes', because they become part of a larger prosodic unit, i.e., the Prosodic Word. The second category consists of suffixes that form a Prosodic Word of their own and that have an internal stress pattern. In this respect, they resemble morphological stems. From now on, these suffixes will be referred to as 'semisuffixes'. The prosodic structure of semisuffixes ensures that stem-final obstruents are not resyllabified as onsets of the suffix-initial syllable (23b).[9] Selkirk (1995) proposes that the morphosyntactic word structure for all suffixes is the same (23a), but the prosodic word structure may be different (23b).[10] We illustrate this idea by representing the morphosyntactic word structure and the prosodic word structure for the examples *roder* 'redder' (see 12a) and *roodachtig* 'reddish' (13b), respectively:

(23) a. Morphosyntactic word structure

b. Prosodic word structure

'internal affix' 'semisuffix'

(ro:.dər)$_{\omega}$ (ro:t)$_{\omega}$ (ɑxtəx)$_{\omega}$

9 In the remainder of this paper, we will use round brackets as boundary markers for the prosodic categories 'Prosodic Word' (PWd) and 'Phonological Phrase' (PPh). Also, the symbol 'ω' denotes 'Prosodic Word'.

10 Following Selkirk (1995:440), 'Lex' (lexical word) designates a morphosyntactic word belonging to a lexical category, i.e., N^0, V^0, or A^0.

We assume in the remainder of this paper that semisuffixes have the same status as stems underlyingly. Under this assumption, prosodic structure will be assigned by the grammar (i.e., stems and semisuffixes will both get their prosodic word structure by the grammar).[11]

In (24b) it is shown that an underlyingly voiced obstruent (/v/) is realised as such when it surfaces in onset position. In (24c), the fricative is also in front of a vowel-initial suffix (i.e. a semisuffix), but in this case, it does not resyllabify as an onset. Due to the fact that it finds itself in a Prosodic Word-final position, it is voiceless:

(24)	a.	die/v/		→(di:f)$_{\omega}$	'thief'
	b.	die/v/	+ -en	→('di:.vən)$_{\omega}$	'thieves'
	c.	die/v/	+ -achtig	→('di:f)$_{\omega}$ (ˌɑx.təx)$_{\omega}$	'thievish'

The challenge is to account for the fact that a stem-final obstruent may resyllabify before some vowel-initial suffixes, but not before other ones. In section 2, we argued that a derivational account for final devoicing has serious shortcomings. In the remainder of this paper, we will first discuss and criticise a previous constraint-based non-derivational account and, subsequently, we will present our own proposal.

4. Lombardi's OT-account of final devoicing and voicing assimilation

A recent explanation for part of the Dutch data is found in Lombardi (1995, 1996, 1999). She defends the position that there is no feature specification [–voice]. In her view, voicing in obstruents is expressed by the presence of a Laryngeal node. To account for devoicing, Lombardi (1996) proposes a constraint which prohibits segments with features for voicing (i.e., *LAR). This markedness constraint interacts with faithfulness constraints which say that underlying featural specifications should remain the same. One group of familiar faithfulness constraints are the so-called "Identity constraints" introduced by McCarthy & Prince (1995) which say that a segment in the output should have the same value for a particular feature as the corresponding segment in the input:

(25) **IDENT(F)** (McCarthy & Prince 1995:264):[12]
Let α be a segment in S_1 and β be any correspondent of α in S_2.
If α is [γF] then β is [γF]. (Correspondent segments are identical in feature F.)

11 The fact that semisuffixes never occur in isolation, even though they are stems, according to our view, can be explained by their semantically 'defective' content. They bear grammatical information, but no conceptual information. The linear order of 'real' stems and semisuffixes (e.g., a noun precedes a semisuffix and not the other way around) can be derived from the same principle that governs the order within real compounds ('right-hand head rule'). Since semisuffixes are derivational affixes, they determine the categorial status of the construction they belong to and this makes them syntactic/semantic heads.

12 A list of the constraints used in this paper is given in the appendix.

Lombardi (1996, 1999) points out that it is usually more important to be faithful to onset laryngeal specifications than to coda - or elsewhere - specifications. She proposes to limit the scope of Identity constraints by so-called 'positional requirements' to ensure that obstruents in onset positions do not devoice. For example, the identity constraint in (26) requires that the underlying value for the feature [voice] of an obstruent surfaces as such if it is realised in onset position:

(26) **IDENTONSET(Laryngeal)** (IDOnsLar): Onsets should be faithful to underlying laryngeal specification.

According to Lombardi (1996), Dutch only allows a laryngeal specification (i.e., voicing in obstruents) in onsets. This is guaranteed in her analysis by the ranking IDONSLAR >> *LAR >> IDENTLAR:

(27) <daad> 'deed'

	Input: /da:d/	IDONSLAR	*LAR	IDENTLAR
a.	[da:d]		**!	
b.	[ta:t]	*!		**
c. ☞	[da:t]		*	*

Lombardi suggests that assimilation can be attributed to a constraint which she calls AGREE that requires adjacent obstruents to have the same value for voicing:

(28) **AGREE**: Obstruent clusters should agree in voicing.

In a cluster of two obstruents where one of the obstruents appears in onset position, the obstruent in onset position will be faithful to its underlying voicing specification at the cost of the preservation of the underlying voicing specification of its lefthand neighbour. This is ensured in Lombardi's analysis by ranking IDONSLAR above the markedness constraint on voiced obstruents (*LAR):

(29) /kɑs/ + /buk/ <kasboek> 'cash-book' according to Lombardi (1996, 1999)

	Input: /kɑs/ + /buk/	AGREE	IDONSLAR	*LAR	IDENTLAR
a. ☞	[kɑz.buk]			**	*
b.	[kɑs.puk]		*!		*
c.	[kɑs.buk]	*!		*	

However, examples with fricatives as second members of consonant sequences (see 15, 16, 18, and 19 above) show that voicing is not always preserved in onsets. In Lombardi's analysis, the postobstruent fricative voicing constraint given in (30) is assumed to capture the fact that the identity constraint for onsets (IDONSLAR) may be overruled in the case of fricatives:

(30) Postobstruent Fricative Voicing constraint (**FRICVOICE**): * [–son] [–son]
[+cont]
[+voice]

Lombardi acknowledges that this constraint is not very elegant and in section 5 we will propose an analysis which does not use this constraint.

In the following tableau, Lombardi's analysis is exemplified for a case where it works properly. Ranking FRICVOICE and AGREE above IDONSLAR will give the correct output for a case where the input consists of a voiced plosive followed by a voiced fricative:

(31) /ra:d/ + /za:m/ <raadzaam> 'advisable' according to Lombardi (1996, 1999)

	Input: /ra:d/ + /za:m/	FRICVOICE	AGREE	IDONSLAR	*LAR	IDENTLAR
a.	[ra:d.za:m]	*!			**	
b.	[ra:t.za:m]	*!	*		*	*
c.	[ra:d.sa:m]		*!	*	*	*
d. ☞	[ra:t.sa:m]			*		**

Lombardi (1996, 1999) is not concerned with inflection and clitics and her proposal does not exhaustively explain the Dutch facts. This is demonstrated in the tableaux below. The little skull and crossbones (☠) marks the winning candidates according to Lombardi's grammar and the sad smiley (☹) marks the actual outputs of the Dutch grammar.

(32) <klapte> 'clapped', following Lombardi's analysis

	Input: /klɑp/ +/ də/	FRICVOICE	AGREE	IDONSLAR	*LAR	IDENTLAR
a. ☠	[klɑbdə]				**	*
b. ☹	[klɑptə]			*!		*
c.	[klɑbtə]		*!	*	*	**
d.	[klɑpdə]		*!		*	

(33) <mafte> 'snoozed', following Lombardi's analysis

	Input: /mɑf/ + /də/	FRICVOICE	AGREE	IDONSLAR	*LAR	IDENTLAR
a. ☠	[mɑvdə]				**	*
b. ☹	[mɑftə]			*!		*
c.	[mɑvtə]		*!	*	*	**
d.	[mɑfdə]		*!		*	

(34) <gaf-tie> 'gave he', following Lombardi's analysis

	Input: /xɑv/ + /di/	FRICVOICE	AGREE	IDONSLAR	*LAR	IDENTLAR
a.☠	[xɑvdi]				**	
b.☹	[xɑfti]			*!		**
c.	[xɑvti]		*!	*	*	*
d.	[xɑfdi]		*!		*	*

These data will be accounted for by us in the following sections.

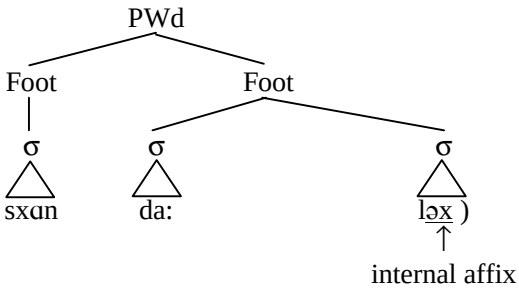
5. Prosodic structure and voicing assimilation

Combinations of a stem plus an internal suffix form one domain for stress assignment and, hence, one Prosodic Word. We attribute this to the requirement that a Prosodic Word must correspond to a lexical word (stem + suffix). Selkirk (1995:445) formulates such a type of constraint in terms of Generalized Alignment (McCarthy & Prince 1993):

(35) **ALIGNR PWD:** Align the right edge of every Prosodic Word with the right edge of some lexical word (N, V, or A).

The prosodic structure in (36) for a form like *schandalig* [sxɑn.'da:.ləx] 'scandalous' illustrates that the Prosodic Word is right aligned with a lexical word (here an adjective) and that internal suffixes are part of a Prosodic Word:

(36)



In this paper, we defend the view that final devoicing may be formulated as a locally restricted markedness constraint against voicing in obstruents. In particular, we will argue in favour of a context-free constraint against voicing in obstruents (37a) and in favour of a specific constraint against voicing in obstruents at the end of a Prosodic Word (31b).[13]

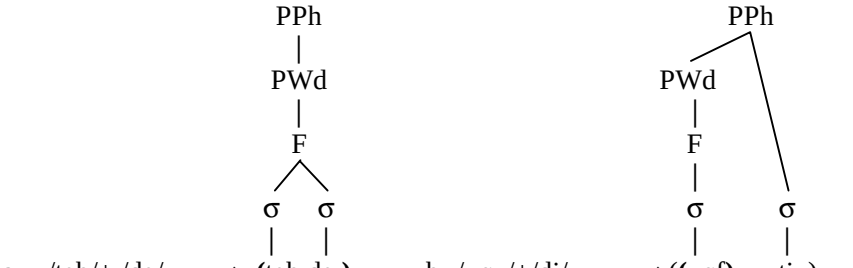
(37) a. Markedness: ***[+voice]**
i.e., obstruents are voiceless.

b. Positional markedness: ***[+voice])ω**
i.e., Prosodic Word-final obstruents are voiceless.

We will show shortly, that the fact that devoicing of obstruents is obviously ignored within the Prosodic Word (see 38a), but not across a Prosodic Word boundary (see 38b) can be attributed to the different ranking of (37a) and (37b) with respect to Identity constraints.

13 Note that it is not necessary to assume a positional markedness constraint on final devoicing which makes reference to the domain of the syllable, i.e., *[+voice])σ, or a local conjunction like {NOCODA & *[+voice]}. (Such constraints are proposed by, for instance, Ito & Mester 1998 and Féry 1998 for German, and by Krämer, to appear, for Breton).

(38)



a. /tɔb/+ /də/$_{\text{Affix}}$ → **(**tɔb.də **)**$_{\text{PWd}}$ b. /xɑv/+/di/$_{\text{Clitic}}$ →**((**xɑf**)**$_{\text{PWd}}$ ti)$_{\text{PPh}}$
'drudge' +past→ 'drudged' 'gave' + 'he' → 'gave he'

In (38a), the constraint *[+voice])$_{\omega}$ is vacuous and the underlying voicing specification of both the stem-final obstruent and the affix-initial obstruent is unaltered. In (38b), *[+voice])$_{\omega}$ plays an important role, since the underlying voicing specifications of both obstruents are lost in order to comply with this constraint. The following tableau illustrates that the three constraints ONSET (i.e. syllables should have an onset), ALIGNR PWD, and *[+voice])$_{\omega}$ give the correct output for the verbal stem /xe:v/ 'give' and the nominalizing affix -/ər/:

(39) /xe:v/ + -/ər/ <gever> 'someone who gives'

	Input: xe:v$_{\text{Stem}}$ + ər$_{\text{Affix}}$	ALIGNR PWD	* [+voice])$_{\omega}$	ONSET
a.	[(xe:v) .ər]	*!	*	*
b.	[(xe:f) .ər]	*!		*
c.	[(xe:).vər]	*!		
d. ☞	[(xe: .vər)]			
e.	[(xe:v. ər)]			*!

( ) = Prosodic Word boundaries; [] = lexical boundaries

Candidate (39a) violates *[+voice])$_{\omega}$, because the Prosodic Word-final obstruent [v] is not voiceless. In candidates (39a,b,c), the right edge of the Prosodic Word is not the right edge of a lexical word in violation of ALIGNR PWD. Candidates (39a,b,e) violate ONSET. Candidate (39d) does not violate any of the three constraints mentioned above and it is thus the winner or the 'optimal' candidate.

Below we show a tableau for a lexical word which consists of a stem followed by two internal affixes. The constraint requiring that a lexical word must correspond to one Prosodic Word (ALIGNR PWD) is violated in (40a,b) because the only Prosodic Word is not at the right edge of a lexical word. The winning candidate (40d) has an onset and, hence, one violation less than (40c):

(40) /pro:dʏkt/ + -/i:v/ + -/itɛit/ <productiviteit> 'productivity'

	Input: pro:dʏkt$_{Stem}$ + i:v$_{Affix}$ + itɛit$_{Affix}$	ALIGNR PWD	*[+voice])$_{ω}$	ONSET
a.	[(pro:dʏkt).i:.vitɛit]	*!		*
b.	[(pro:dʏk.ti:v).i.tɛit]	*!	*	*
c.	[(pro:dʏk.ti:f.i.tɛit)]			*!
d. ☞	[(pro:dʏk.ti:.vi.tɛit)]			

We still have to account for the fact that stem-final obstruents are voiceless before the so-called 'semisuffixes' and in compounds. Stem-final obstruents cannot be onsets of semisuffixes due to the fact that the latter form a Prosodic Word of their own. Recall that, in section 3, we assumed that these suffixes behave like stems. The constraint that ensures that morphological stems (and semisuffixes) form an independent Prosodic Word domain is a morphology/prosody Alignment constraint which says that the left edge of a stem (or a semisuffix) coincides with the left edge of a Prosodic Word:

(41) **ALIGNL STEM:** Align the left edge of every stem with the left edge of some Prosodic Word.

In tableau (42), ALIGNL STEM is violated in candidates a-d, because the left edge of the semisuffix -/ɑxtəx/ does not coincide with the left edge of a Prosodic Word in these candidates. The constraint ALIGNL STEM must be ranked higher than ALIGNR PWD, because it incurs a fatal violation in candidate (d) below. Candidates (e) and (f) violate ALIGNR PWD. Candidate (e) violates *[+voice])$_{ω}$ as well and candidate (f) wins, even though it violates ONSET (which must, hence, be ranked below *[+voice])$_{ω}$).

(42) /di:v/ + -/ɑxtəx/ <diefachtig> 'thievish'

	Input: div$_{Stem}$ + ɑxtəx$_{Semisuffix}$	ALIGNL STEM	ALIGNR PWD	*[+voice])$_{ω}$	ONSET
a.	[(di:v). ɑx.təx]	*!	*	*	*
b.	[(di:f). ɑx.təx]	*!	*		*
c.	[(di:).(vɑx.təx)]	*!	*		
d.	[(di:.vɑx.təx)]	*!			
e.	[(di:v).(ɑx.təx)]		*	*!	*
f. ☞	[(di:f) .(ɑx.təx)]		*		*

Now consider the situation where both an internal affix and a semisuffix are involved. The constraints proposed in this section account for final devoicing before semisuffixes as well as for the fact that final obstruents of semisuffixes may be onsets of internal affixes. In candidate (43d) below, the violation of ALIGNL STEM is fatal, and candidate (43f) wins, even though it violates ALIGNR PWD once.

(43) /ro:d/ + -/ɑxtəx/ + -/ər/ <roodachtiger> 'more reddish'

	Input: $ro:d_{Stem}$ + $ɑxtəx_{Semisuffix}$ + $ər_{Affix}$	ALIGNL STEM	ALIGNR PWD	*[+voice])$_{ω}$	ONSET
a.	[(ro:d). ɑx.təx .ər]	*!	*	*	**
b.	[(ro:t). ɑx.təx .ər]	*!	*		**
c.	[(ro:t). (ɑx.təx).ər]		**!		**
d.	[(ro:. dɑx. tə. xər)]	*!			
e.	[(ro:t). (ɑx.tə).xər]		**!		*
f.☞	[(ro:t). (ɑx.tə.xər)]		*		*

ALIGNL STEM also ensures that members of a compound form a Prosodic Word of their own:

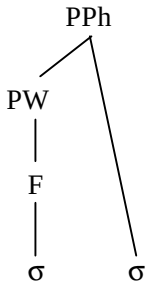
(44) /xɔud/ + /a:dər/ <goudader> 'gold-vein'

	Input: $xɔud_{Stem}$ + $a:dər_{Stem}$	ALIGNL STEM	ALIGNR PWD	*[+voice])$_{ω}$	ONSET
a.	[(xɔud).a:.dər]	*!	*	*	*
b.	[(xɔut). a:.dər]	*!	*		*
c.	[(xɔu).(da:.dər)]	*!	*		
d.	[(xɔu.da:.dər)]	*!			
e.	[(xɔud).(a:.dər)]		*	*!	*
f.☞	[(xɔut) .(a:.dər)]		*		*

This is not the end of the story, however. There is another element with the same surface form as the suffix -/ər/. This element, a reduced form of the pronoun *haar* 'her', is a clitic and it behaves differently. In particular, stem-final obstruents may be voiced before the suffix -/ər/ (see 36d), whereas stem-final obstruents are always voiceless before vowel-initial clitics. We here suggest that this may be attributed to the different prosodic requirements of stems, internal affixes, and clitics. Schwa-initial affixes have to be incorporated into a prosodic structure, whereas the weak forms of personal pronouns are clitics which are not part of a Prosodic Word. Rather, clitics are directly linked to a Phonological Phrase and do not belong to the same Prosodic Word as their hosts:[14]

14 Selkirk (1995) refers to elements which do not belong to a Prosodic Word as 'free' elements. We will discuss the prosodic structure of clitics in more detail in section 6.

(45)



((xe:f)$_{\omega}$ ər)$_{PPh}$ 'give her'

If we assume that the host of a pronominal clitic is a lexical word, the constraint ranking established thus far correctly predicts final devoicing before clitics. The tableau in (46) differs from the one in (39) above in that there is no internal affix involved and a Prosodic Word boundary is not required to the right of the clitic *-ər*. Tableau (46) also illustrates that *[+voice])$_{\omega}$ and ALIGNR PWD may not be violated in the optimal form, whereas ONSET may be violated. ONSET should therefore be ranked below *[+voice])$_{\omega}$ and ALIGNR PWD.

(46) /xe:v/ + /ər/ <geef 'r> 'give her'

	Input: xe:v + ər$_{Clitic}$	ALIGNL STEM	ALIGNR PWD	*[+voice])$_{\omega}$	ONSET
a.	[(xe:v)] .ər			*!	*
b. ☞	[(xe:f)] .ər				*
c.	[(xe:). v] ər		*!		
d.	[(xe: . v] ər)		*!		
e.	[(xe:f] .ər)		*!		*

So far, we have provided a constraint-based account of final devoicing in Dutch. The distinction between internal suffixes and semisuffixes plays a crucial role in our analysis. We propose one Alignment constraint for Prosodic Words and one for stems and semisuffixes, respectively. They are ranked as in (47a):

(47) Constraint Ranking for Dutch
  a. ALIGNL STEM >> ALIGNR PWD >> ONSET
  b. *[+voice])$_{\omega}$ >> ONSET

On the basis of the observation that stem-final obstruents resyllabify before some suffixes but not before others and neither before clitics, we conclude that Dutch distinguishes between internal affixes, semisuffixes, and 'free' clitics. That is to say, stems and semisuffixes have a Prosodic Word boundary at their left-hand side. Internal suffixes may be incorporated into the prosodic structure of their host due to the constraint which says that the right edge of every Prosodic Word coincides with the right edge of a lexical word (ALIGNR PWD). Since clitics are not lexical words, this constraint also says that the right edge of a clitic cannot be the right edge of a Prosodic Word, i.e. clitics do not form a Prosodic Word together with their host and they are directly linked to a higher prosodic category, i.e. the Phonological Phrase.

If the prosodic structures that we have argued for above are correct, the solution to the problem concerning voicing assimilation in the case of inflectional suffixes may become more transparent. The difference between voicing assimilation in the case of two stems or a stem + semisuffix (e.g. [kɑzbuk] and [ra:dza:m], respectively) on the one hand, and voicing assimilation in the case of a stem + internal suffix or a stem + clitic (e.g., [mɑftə] and [xɑfti], respectively), on the other hand lies in the fact that the former cases constitute forms that consist of two Prosodic Words, whereas there is only one Prosodic Word in the latter cases:

(48)		Stem + Stem	Stem + Semisuffix	Stem + Affix	Stem+Clitic
a.	Input	/kɑs/ + /buk/	/ra:d/ + /za:m/	/mɑf/ +/də/	/xɑv/ + /di/
b.	Output	[(kɑz) (buk)]	[(ra:t) (sa:m)]	[(mɑf tə)]	[(xɑf)] ti

We here note that the AGREE constraint as formulated by Lombardi (see section 4 above) is neither a markedness constraint nor a correspondence constraint. As such, it does not belong to any constraint family proposed in the literature. We doubt the necessity of positing a new constraint scheme. Instead, we propose to substitute AGREE by an Identity constraint. Consider in this respect, that assimilation is an identity relation that requires that neighbouring segments look identical in some respect (e.g., with respect to voicing). Following Krämer (1998), who proposes that vowel harmony is best expressed as an identity relation among surface elements, we formulate the constraint which expresses voicing assimilation as follows:

(49) **SURFACE-IDENTITY**[voice] (S-IDENT): Let α be an obstruent in a string and β be any adjacent obstruent in that string. If α is [γvoice] then β is [γvoice]. (Adjacent obstruents are identical in voicing.)

The output form *[(kɑz).(buk)]* 'cash book' in (48b) shows that a plosive in onset position of a Prosodic Word is faithful to its underlying voicing specification. The output forms *[(mɑf.tə)]* 'snoozed' and *[(xɑf)]ti* 'gave he' show that a plosive in the onset of a syllable which is not initial in a Prosodic Word may not be faithful when other conditions are at work (e.g. Prosodic Word-final devoicing). We propose to add another specific positional requirement to Lombardi's Identity constraint in such a way that it does not refer to all syllable onsets, but only onsets of Prosodic Words:

(50) **IDENT PWO**: Onsets of Prosodic Words should be faithful to underlying laryngeal specification.

Furthermore, we note that the fricative in onset position of a Prosodic Word is not faithful to its underlying voicing specification in *raadzaam* [ra:tsa:m] 'advisable'. Lombardi (1996) proposes the 'postobstruent fricative voicing constraint' to exclude the outcome *[ra:dza:m]. In the current theoretical framework, there are no restrictions on the way markedness constraints can be formulated and the supposed existence of such a constraint opens the door, for instance, to constraints which require all segments following an obstruent to be a labial nasal, or to be aspirated, etc. Obviously, this is not desirable and we choose not to adopt this constraint in our analysis. Based on the observation that voiced fricatives are more marked than voiced stops, we propose here

that it is more important to preserve an underlying voice specification for stops than for fricatives:[15, 16]

(51) **IDENT STOP** (voice): Let α be a stop in S_1 and β be any correspondent of α in S_2. If α is [γvoice] then β is [γvoice].
(Stops should be faithful to underlying laryngeal specification.)

Combining the two requirements regarding faithfulness to voicing specifications in onset position of Prosodic Words and faithfulness to voicing specifications for stops, we arrive at the following constraint which will be crucial to our analysis:

(52) **IDENT PWOS:** Let α be a stop in S1 and β be any correspondent of α in onset position of a Prosodic Word in S2. If α is [γvoice] then β is [γvoice].
(Stops in onset position of Prosodic Words should be faithful to underlying laryngeal specification.)

With this constraint, we have eliminated the need of an ad hoc constraint like Lombardi's postobstruent fricative voicing constraint. However, it predicts that suffixes with an initial voiced fricative (e.g. *-zaam*) would always be realised with a voiceless obstruent (due to *LAR or *[+voice]). This is not the case (cf. *eenzaam* [e:nza:m]/ *[e:nsa:m] 'lonely'). For this reason, we propose to add a constraint which limits the scope of the constraint *[+voice] to the final position in a Prosodic Word (see 37b repeated here for convenience as 53):

(53) *[+voice])$_\omega$ i.e., Prosodic Word-final obstruents are voiceless.

This constraint and S-IDENT select the winning candidate in (54). The constraint in (52) is vacuous in (54) because there is no Prosodic Word onset stop available, but it is crucial in selecting the winning candidate in cases where the second obstruent in a cluster is a plosive (see 55 and 56 below).

(54) <raadzaam> 'advisable'

	Input: /ra:d/ + /za:m/	S-IDENT	IDENT PWOS	*[+voice])$_\omega$
a.	[(ra:d).(za:m)]			*!
b.	[(ra:t).(za:m)]	*!		
c.	[(ra:d).(sa:m)]	*!		*
d. ☞	[(ra:t).(sa:m)]			

The constraint ranking proposed here adequately accounts for all cases where two consonants are adjacent across a Prosodic Word boundary, i.e. when a stem and a semisuffix are involved (54, 55), in compounds (56, 57) and when a stem and a clitic are involved (58):

15 Instead of the Laryngeal node, we make use of the binary valued feature [±voice], because we find Inkelas' (1994) arguments in favour of this feature convincing. Also, Krämer (to appear) shows on the basis of Breton voicing assimilation that a specification for voicing cannot be privative. However, for the purpose of this paper, nothing crucial hinges on this.

16 IDENT PWOS can be interpreted as the local conjunction (see Smolensky 1993, 1995) of the two more general identity constraints IDENT PWO and IDENT STOP (voice) which are ranked lower than the more specific constraint.

(55) <eetbaar> ‘edible’

	Input: /e:t/ + /ba:r/	S-IDENT	IDENT PWOS	*[+voice])$_{\omega}$
a.☞	[(e:d).(ba:r)]			*
b.	[(e:t).(ba:r)]	*!		
c.	[(e:d).(pa:r)]	*!	*	*
d.	[(e:t).(pa:r)]		*!	

(56) <slaapzak> ‘sleeping bag’

	Input: /sla:p/ + /zɑk/	S-IDENT	IDENT PWOS	*[+voice])$_{\omega}$
a.	[(sla:b).(zɑk)]			*!
b.	[(sla:p).(zɑk)]	*!		
c.	[(sla:b).(sɑk)]	*!		*
d.☞	[(sla:p).(sɑk)]			

(57) <kasboek> ‘cash-book’

	Input: /kɑs/ + /buk/	S-IDENT	IDENT PWOS	*[+voice])$_{\omega}$
a.☞	[(kɑz).(buk)]			*
b.	[(kɑs).(buk)]	*!		
c.	[(kɑz).(puk)]	*!	*	*
d.	[(kɑs).(puk)]		*!	

(58) <gaf-die> ‘gave he’

	Input: /xɑv/ + /di/$_{\text{Clitic}}$	S-IDENT	IDENT PWOS	*[+voice])$_{\omega}$
a.	[(xɑv)].di			*!
b.	[(xɑf)].di	*!		
c.	[(xɑv)].ti	*!		*
d.☞	[(xɑf)].ti			

This constraint ranking explains cases where two consonants in a cluster are separated by a Prosodic Word boundary, but is not sufficient yet to give us the output forms in cases where two obstruents are adjacent within a Prosodic Word. This issue will be addressed now.

Our analysis crucially relies on the assumption that there are different locality requirements on the constraint that rules out voiced obstruents. *[+voice])$_{\omega}$ rules out candidate (58a). In (59a), this constraint is vacuous. If the higher-ranked constraints S-IDENT and IDENT PWOS do not select an optimal output, the form with fewest violations of lower-ranked constraints wins.

(59) <leefde> 'lived'

	Input: /le:v/+ /də/	S-IDENT	IDENT PWOS	*[+voice])$_{\omega}$	*[+voice]	IDENT STOP (voice)	IDENT (voice)
a.☞	[(le:v.də)]				**		
b.	[(le:f.də)]	*!			*		*
c.	[(le:v.tə)]	*!			*	*	*
d.	[(le:f.tə)]					*	**!

In this tableau, it is crucial that *[+voice] is not ranked above IDENT (voice), otherwise (59a) would be less optimal than (59d).

We may now account for cases which are problematic in Lombardi's analysis, viz. cases that involve a stem plus a voiced obstruent initial affix. In the tableaux below, the constraints *[+voice])ω and IDENT PWOS are satisfied vacuously and the candidates that have the fewest violations of the relatively low-ranked constraints *[+voice], IDENTSTOP (voice) and IDENT (voice) wins.

(60) <klapte> 'clapped'

	Input: /klɑp/ + /də/	S-IDENT	IDENT PWOS	*[+voice])$_{\omega}$	*[+voice]	IDENT STOP (voice)	IDENT (voice)
a.	[(klɑb.də)]				**	*!	*
b.	[(klɑp.də)]	*!			*		
c.	[(klɑb.tə)]	*!			*	**	**
d.☞	[(klɑp.tə)]					*	*

(61) <tobde> 'drudged'

	Input: /tɔb/+ /də/	S-IDENT	IDENT PWOS	*[+voice])$_{\omega}$	*[+voice]	IDENT STOP (voice)	IDENT (voice)
a.☞	[(tɔb.də)]				**		
b.	[(tɔp.də)]	*!			*	*	
c.	[(tɔb.tə)]	*!			*	*	
d.	[(tɔp.tə)]					**	*!*

(62) <mafte> 'snoozed'

	Input: /mɑf/+ /də/	S-IDENT	IDENT PWOS	*[+voice])$_{\omega}$	*[+voice]	IDENT STOP (voice)	IDENT (voice)
a.	[(mɑv.də)]				**		*!
b.	[(mɑf.də)]	*!			*		
c.	[(mɑv.tə)]	*!			*	*	**
d.☞	[(mɑf.tə)]					*	*

We accounted for resyllabification of stem-final obstruents before some suffixes and devoicing of stem-final obstruents before other suffixes and in compounds by assuming two different prosodic structures for the respective suffixes and a markedness constraint that is sensitive to Prosodic Word boundaries (*[+voice])$_{\omega}$. The same prosodic

structures and an identity constraint that is sensitive to Prosodic Word boundaries (IDENT PWOS) help to explain why we find regressive voicing assimilation with one class of suffixes (i.e. the so-called 'semisuffixes') and progressive assimilation with others (i.e. the so-called 'internal affixes').

The next issue to be addressed in this paper is the behaviour of clitics with respect to devoicing of obstruents and voicing assimilation.

6. The prosodic structure of clitics

With respect to devoicing of stem-final obstruents, weak forms of personal pronouns (63b) differ from internal suffixes (63c), whereas they are similar to semisuffixes (see (63d)).

(63)	a.	Ik gee/v/ haar een boek	[ɪk xe:f ha:r ən buk]	'I give her a book'
	b.	Ik gee/v/'r een boek	[ɪk xe:fər ən buk]	'I give'r a book'
	c.	gee/v/ + -er$_{\text{Affix int}}$	[xe:vər]	'someone who gives'
	d.	die/v/ + -achtig $_{\text{Semisuffix}}$	[di:fɑxtəx]	'thievish'

We conclude from this that, unlike internal affixes, clitics (weak forms of personal pronouns) do not belong to the same Prosodic Word as the preceding morpheme. The question then arises whether clitics form a Prosodic Word of their own, or whether they are outside a Prosodic Word structure.

Booij (1995) points out that in Dutch, a Prosodic Word contains at least one full vowel. Moreover, a Prosodic Word may contain the reduced vowel /ə/, but it may not begin with it:

(64)	a.	tel	[t ɛ l]	'a second'
	b.	ebak	* [ə b ɑ k]	
	c.	gebak	[x ə b ɑ k]	'pastry, cake'
	d.	bakken	[b ɑ k ə]	'to bake'

Since most clitics contain only a Schwa syllable (or even begin with a Schwa), these clitics cannot be Prosodic Words. This means that they differ from stems and semisuffixes that form a Prosodic Word of their own. In section 3, we followed Selkirk (1995) and analysed clitics as 'free' elements outside the Prosodic Word structure. This has consequences for stem-final consonants which are final in a Prosodic Word before Schwa-initial clitics, i.e. they are voiceless:

(65) /xe:v/ + /ət/ <geef 't> 'give it'

	Input: xe:v$_{\text{Stem}}$+ ət$_{\text{Clitic}}$	ALIGNL STEM	ALIGNR PWD	*[+voice])$_{\omega}$	ONSET
a.	[(xe:v)] .ət			*!	*
b.☞	[(xe:f)] .ət				*
c.	[((xe:). v] ət)		*!		
d.	[(xe: . v] ət)		*!		
e.	[(xe:f)] .(ət)		*!		*

When a clitic begins with a voiced obstruent, the obstruent assimilates in voicing to a preceding consonant and this is accounted for by the constraint-ranking that we established in section 5:

(66) /xe:v/ + /zə/ <geef ze> 'give them'

	Input: $xe:v_{Stem}$ + $zə_{Clitic}$	S-IDENT	IDENT PWOS	*[+voice])$_{ω}$
a.	[(xe:f)].zə	*!		
b.	[(xe:v)].zə			*!
c.☞	[(xe:f)].sə			

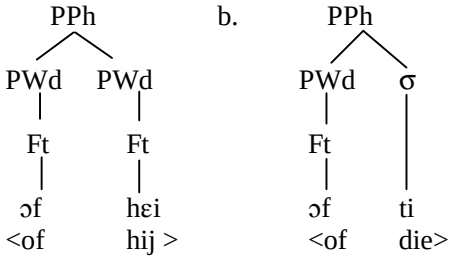
Clitics may have lexical words as their host (see (63)), or function words. Selkirk (1995) distinguishes between different prosodic structures for function words. Stressable function words may have the status of a Prosodic Word, other function words may be incorporated into a Prosodic Word and still others are 'free' (i.e., they are not part of a Prosodic Word and they are directly linked to the Phonological Phrase). The complementizer *of* 'whether' is stressed and we therefore assume that function words like *of* may be the head of a Prosodic Word:

(67) of + die 'whether he'

	Input: ɔf + di_{Clitic}	S-IDENT	IDENT PWOS	*[+voice])$_{ω}$
a.	(ɔf).di	*!		
b.	(ɔv).di			*!
c. ☞	(ɔf).ti			

We furthermore propose that strong forms of personal pronouns are Prosodic Words (see 68a), but clitics such as *'t, ze* and *die* (weak forms of the 3rd sg. neut., 3rd pl., and 3rd sg. masc. personal pronouns, respectively) are 'free' (see 68b):

(68) a.

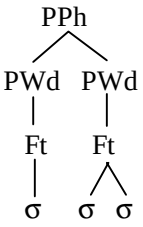


b.

'whether he'

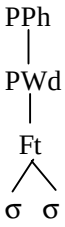
Clitics differ from stems and semisuffixes which form a Prosodic Word of their own (see 69a) and from internal affixes which are inside the Prosodic Word (see 69b):

(69) a.



di:f. ɑx.təx
<diefachtig> ‘like a thief’

b.



di:.vən
<dieven> ‘thieves’

Final devoicing before clitics and voicing assimilation do not pose a problem for our analysis and can be accounted for with the same constraint ranking proposed above for the phenomena of final devoicing before semisuffixes and voicing assimilation in the case of internal affixes and compounds (see section 5). One may ask now whether clitics have to be marked as such in the lexicon. We assume that clitics are functional elements which lack categorial information. Under this assumption, we reduce the number of categories to two, viz. to stems (i.e. morphological stems and semisuffixes) and affixes. Clitics do not have a specification for stem- or affixhood. If a clitic is neither an affix nor a stem, it cannot be subject to the Alignment constraints mentioned above which regulate the emergence of prosodic output structure. The Alignment constraints ALIGNR PWD and ALIGNL STEM are responsible for the fact that stems, semisuffixes, and internal affixes are incorporated into a Prosodic Word. These constraints have nothing to say about clitics and, for this reason, Dutch clitics remain outside the domain of a Prosodic Word. They rely on the “last resort” with regard to prosodification: the Phonological Phrase.

Forms like *vɔn.tɪk* ‘found I’ used to pose a problem for analyses of Dutch, since in such forms, an underlying voiced plosive is devoiced in onset position. McCarthy (1998) proposes that the output candidate [*vɔn.tɪk*] wins because it is sympathetic to a losing candidate [*vɔnt*] and being ‘sympathetic’ outranks being faithful to the input form /vɔnd/. McCarthy bases himself on Booij (1995, 1996) who assumes that in the case of a stem plus a following vowel-initial clitic, the stem-final obstruent is devoiced at the lexical level. The stem-final obstruent is resyllabified after the clitic is added at the postlexical level in order to avoid syllables without onsets:

(70)

	Underlying Representation		Lexical Level (devoicing)			Postlexical Level (resyllabification)	
a.	/hɛb/	→	/hɛp/	+ /ɪk/	→	[hɛ.pɪk]	‘have I’
b.	/xe:v/	→	/xe:f/	+ /ət/	→	[xe:.fət]	‘give it’
c.	/vɔnd/	→	/vɔnt/	+ /ɪk/	→	[vɔn.tɪk]	‘found I’

In contrast Booij, we note that there is no reliable means to determine the syllabic position of medial obstruents in words like *hɛpɪk*, *xe:fət*, or *vɔntɪk* and we assume that they should be treated as ambisyllabic obstruents rather than obstruents in onset position. This is most obvious in the case of *hɛpɪk*, since most linguists (including Booij) assume that there are no syllables in Dutch that end in a short lax vowel. Hence, the syllable [.hɛ.] is impossible and the syllabification given in (70a) is therefore questionable.

In the account given in this paper, intervocalic obstruents in cliticized forms belong simultaneously to the right edge of a Prosodic Word and the left edge of the next syllable. As such, they are subject to *[+voice])$_{\omega}$ which outranks general IDENTITY constraints. Furthermore, the underlying voicing specification of these obstruents is not "protected" by IDENT PWOS, because they are not in the onset of a prosodic word.

Another issue which may cause potential problems for accounts of Dutch cliticization is that the pronunciation is subject to variation. Ernestus (1997) found that in both frequent and non-frequent instances of a stem plus a clitic, a stem-final stop may be pronounced voiced or voiceless when followed by a vowel-initial clitic. Her findings do not show a preference for either pronunciation. In this respect, we note that for postverbal pronouns three possibilities are attested. The pronoun may be realized as a full pronominal form in which case we find stem-final devoicing (71a), or it can be a clitic in which case we also find stem-final devoicing (71b), or it may form a stronger unit with its host in which case we do not find stem-final devoicing (71c):

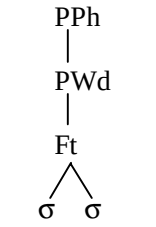
(71) Different realisations of *heb ik* 'have I':
  a. *hɛp ɪk* (two words)
  b. *hɛpɪk/hɛbək* (X^0 plus clitic)
  c. *hɛbək* (X^0 plus affix)

According to Selkirk (1995), function words can constitute independent Prosodic Words (as in 68a, 71a), they can be 'free' and adjoined to a higher prosodic category (see the clitic in 68b, 71b), or they can be part of a Prosodic Word (71c). If Ernestus is right, we have to assume that weak forms of personal pronouns are sometimes considered to be 'free clitics' (as in 71b) and sometimes they are considered affixes (as in 71c).

7. Conclusion

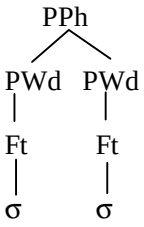
Stem-final obstruents in Dutch behave differently in derivation, compounding, and cliticization. With respect to derivation, we have argued that one group of affixes are 'internal affixes' which do not form independent Prosodic Words, but form a Prosodic Word together with a preceding stem (e.g., *-ər, -də, -əx, -ələk, -(t)jə*). Another group of affixes are 'semisuffixes' which, like the members of compounds, form a Prosodic Word on their own (e.g., *-axtəx, -ba:r, -lo:s, -sxɑp, -za:m*). We have also argued that weak forms of personal pronouns are clitics that are not incorporated in a Prosodic Word and do not form a Prosodic Word of their own (e.g., *ər, ət, zə*):

(72) a.



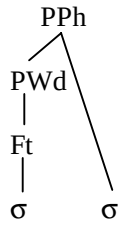
Stem Affix$_{int}$
(ro: . dər)
<roder> ‘redder’

b.



Stem Semisuffix
(e:d) . (ba:r)
<eetbaar> ‘edible’

c.



Stem Clitic
(ba:t) . ər
<baad’r> ‘bathe her’

Prosodic structure is not prespecified in the lexicon, but assigned by the grammar which contains constraints which align the edge of a stem or semisuffix with the edge of a Prosodic Word (ALIGNL STEM).

Final devoicing and voicing assimilation in Dutch are accounted for in a constraint-based framework with the help of two Alignment constraints which are ranked with respect to each other (73a). Other devices which are crucial to our analysis are positional markedness and positional faithfulness. Positional markedness constraints against voicing are ranked with respect to positional IDENTITY(voice) constraints (73b). Assimilation is due to an undominated Surface Identity constraint:

(73) a. ALIGNL STEM >> ALIGNR PWD >> ONSET
b. S-IDENT, IDENT PWOS >> *[+voice])$_{\omega}$, IDENT PWO >> IDENT STOP (voice), IDENT (voice), *[+voice]

It has been shown in this paper that Dutch neutralization facts cannot be explained adequately within a theory in which neutralization is seen as an effect of simple markedness, i.e. *LAR or *[+voice]. Positional markedness and positional faithfulness constraints can be complex. Both types of complex constraints are regarded as local conjunction of two or more less complex constraints of the same type. Several other authors (e.g. Beckman 1997, Lubowicz 1998, Zoll 1998) have shown the necessity and relevance of positional markedness and positional faithfulness. How the powerful tool of local conjunction can be constrained and which types of constraints can in fact be conjoined with each other is a topic of future research.

Our analysis captures all Dutch data that were problematic in a rule-based account and in recent Optimality-theoretic approaches (Lombardi 1996, 1999). Furthermore, we have shown that in this analysis, no need arises to assume different levels (in the sense of Booij 1995 and Kiparsky 1998), or different ‘co-phonologies’ in one language (Inkelas 1999), and neither do we have to assume ‘Sympathy’ (in the sense of McCarthy 1998) to explain the Dutch data.

Appendix: List of constraints

AGREE: Obstruent clusters should agree in voicing. (see Lombardi 1999)

Alignment constraints

ALIGNL STEM [ALIGN (stem, Left, Prosodic Word, Left)]: Align the left edge of every stem with the left edge of some Prosodic Word.

ALIGNR PWD [Align (Prosodic Word, Right, lexical word, Right)]: Align the right edge of every Prosodic Word with the right edge of some lexical word (N, V, or A).

Faithfulness Constraints

IDENT(F): Let α be a segment in S_1 and β be any correspondent of α in S_2. If α is [γF] then β is [γF]. (Correspondent segments are identical in feature F.)

IDENT STOP (voice): Let α be a stop in S_1 and β be any correspondent of α in S_2. If α is [γvoice] then β is [γvoice]. (Stops should be faithful to their underlying laryngeal specification.)

IDENT PWO [IDENT PROSODIC WORD ONSET (voice)]: Let α be a segment in S_1 and β be any correspondent of α in onset position of a Prosodic Word in S_2. If α is [γvoice] then β is [γvoice]. (Onsets of Prosodic Words should be faithful to underlying laryngeal specification.)

IDENT PWOS [IDENT PROSODIC WORD ONSET STOP (voice)]:Let α be a stop in S_1 and β be any correspondent of α in onset position of a Prosodic Word in S_2. If α is [γvoice] then β is [γvoice]. (Stops in onsets of Prosodic Words should be faithful to underlying laryngeal specification.)

IDONSLAR [IDENTONSET(Laryngeal)]: Onsets should be faithful to underlying laryngeal specification. (see Lombardi 1999)

S-IDENT (SURFACE-IDENTITY[voice]): Let α be an obstruent in a string and β be any adjacent obstruent in that string. If α is [γvoice] then β is [γvoice]. (Adjacent obstruents are identical in voicing.)

Markedness constraints

FRICVOICE (Postobstruent Fricative Voicing Constraint): * [–son] [–son] [+cont] [+voice]
(see Lombardi 1999)

ONSET: Syllables have a consonantal onset.

Positional markedness: ***[+voice])$_{\omega}$** (Prosodic Word-final obstruents are voiceless.)

Simple markedness: ***[+voice]** **(**Obstruents are voiceless.)

References

Beckman, Jill N. (1997). Positional faithfulness, positional neutralisation and Shona vowel harmony. *Phonology* 14, 1-46.

Beckman, Jill N., Laura Walsh Dickey and Suzanne Urbanczyk (1995). *University of Massachusetts Occasional Papers 18: Papers in Optimality Theory*, Amherst: GLSA, University of Massachusetts, Amherst.

Benua, Laura (1995). Identity Effects in Morphological Truncation, in Jill N. Beckman et al., 77-136.

Berendsen, Egon (1983). Final devoicing, assimilation, and subject clitics in Dutch. In *Linguistics in the Netherlands*, Hans Bennis and W.U.S. van Lessen Kloeke (eds.), 21-29. Dordrecht: Foris.

Berendsen, Egon, Ellis Visch and Wim Zonneveld (1984). *Generatieve Fonologie en de Linkerkant van de Grammatika*. Den Haag: Nijhoff.

Booij, Geert (1995). *The Phonology of Dutch*. Oxford: Clarendon Press.

Booij, Geert (1996). Cliticization as prosodic integration: the case of Dutch. *Linguistic Review* 13, 219-242.

Butska, Luba (1998). Faithfulness to [voice] in Ukrainian: An Analysis of Voicing Alternations within Optimality Theory. *RuLing Papers 1*, 59-73. Rutgers University.

Ernestus, Mirjam T. C. (1997). The Voicedness of Intervocalic Word-Final Stops in Dutch. In *Linguistics in the Netherlands*, Jane Coerts and Helen de Hoop (eds.), 73-84. Amsterdam: John Benjamins.

Hulst, Harry van der (1985). Ambisyllabicity in Dutch. In *Linguistics in the Netherlands*, Hans Bennis and Frits Beukema (eds.), 57-66. Dordrecht: Foris.

Inkelas, Sharon (1994). The Consequences of Optimization for Underspecification. *NELS* 25, 287-302.

Inkelas, Sharon (1999). Exceptional stress-attracting suffixes in Turkish: representations vs. the grammar. In *The Prosody Morphology Interface*, René Kager, Harry van der Hulst and Wim Zonneveld (eds.), 134-187. Cambridge: Cambridge University Press.

Itô, Junko and Armin Mester (1994). Reflections on CodaCond and Alignment. In *Phonology at Santa Cruz* 3, Jason Merchant, Jaye Padgett and Rachel Walker (eds), 27-46.

Kager, René (1996). Stem Stress and Peak Correspondence in Dutch. Ms., Utrecht University. To appear in *Optimality Theory: phonology, syntax, and acquisition*, Joost Dekkers et al. (eds.). Oxford: Oxford University Press.

Kiparsky, Paul (1998). Paradigm effects and opacity. Ms., Stanford University.

Krämer, Martin (1998). A Correspondence Approach to Vowel Harmony and Disharmony. *Arbeiten des Sonderforschungsbereich 282 'Theorie des Lexikons', 107*. University of Düsseldorf (also available as ROA 293-0199).

Krämer, Martin (to appear). Voicing Alternations and Underlying Representations: The case of Breton. *Lingua* 110.

Lombardi, Linda (1995). Laryngeal neutralization and alignment. In Jill N. Beckman et al., 225-47.

Lombardi, Linda (1996). Restrictions on direction of voicing assimilation: an OT account. *University of Maryland Working Papers in Linguistics* 3, 89-115.

Lombardi, Linda (1999). Positional Faithfulness and Voicing Assimilation in Optimality Theory. *Natural Language and Linguistic Theory* 17, 267-302.

Lubowicz, Anna (1998). Derived Environment Effects in OT. Ms. University of Massachusetts, Amherst.

McCarthy, John (1998). Sympathy and Phonological Opacity. Ms., University of Massachusetts, Amherst.

McCarthy, John and Alan Prince (1993). Generalized Alignment. *Yearbook of Morphology 1993*, 79-153. Dordrecht: Kluwer.

McCarthy, John and Alan Prince (1995). Faithfulness and reduplicative identity. In Jill N. Beckman et al., 249-384.

Nespor, Marina and Irene Vogel (1986). *Prosodic Phonology*. Dordrecht: Foris.

Prince, Alan and Paul Smolensky (1993). Optimality Theory: Constraint Interaction in Generative Grammar. Ms., Technical Report # 2 of the Rutgers Center for Cognitive Science, Rutgers University.

Selkirk, Elisabeth (1995). The Prosodic Structure of Function Words. In Jill N. Beckman et al., 439-470.

Smolensky, Paul (1993). Harmony, markedness, and phonological activity. Paper presented at Rutgers Optimality Workshop-1 at Rutgers University: New Brunswick, NJ, October 1993.

Smolensky, Paul (1995). On the internal structure of the constraint component of UG. Paper presented at University of California, Los Angeles, April 7, 1995.

Trommelen, Mieke and Wim Zonneveld (1989). *Klemtoon en metrische fonologie*. Muiderberg: Coutinho.

Zoll, Cheryl (1998). Positional Asymmetries in Licensing. Ms. MIT.

Zonneveld, Wim (1983). Lexical and Phonological Properties of Dutch Voicing Assimilation. In *Studies for Antonie Cohen: Sound Structures*, Marcel van den Broecke, Vincent van Heuven and Wim Zonneveld (eds.), 297-312. Dordrecht: Foris.