

Prosodic restrictions on stacking up affixes

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1. INTRODUCTION¹

The ordering of affixes and the restrictions on their combination within complex words is one of the traditional topics of morphology. A well known system for the description of the regularities involved is that of position classes. In such an approach a language-specific morphological template is defined with a number of slots, with for each slot specified which morphemes can fill it (cf. Inkelas 1993: 560 and the references mentioned there).

The obvious question that is raised by the templatic approach is whether the generalizations expressed by such a template can be made to follow from a general principle. Such general principles of affix ordering can be found in the literature. For instance, Bybee (1985: 15) proposed to derive the order of inflectional morphemes in verbs from a semantic principle: the more relevant (i.e. affecting the lexical content of the verb stem) an affix is to the verb stem, the closer it is to that stem. Bybee's principle of relevance also predicts that inflectional morphemes are peripheral to derivational ones. A related idea in the realm of inflection is the hypothesis that contextual inflection is always peripheral to inherent inflection (Booij 1994, 1996).

Another example of an attempt to predict morpheme ordering patterns is the theory of level ordering in which the order of morphemes correlates with phonological properties of affixes in terms of two or more levels. This theory, however, raises many problems (cf. Fabb 1988, Plag 1996, 1999, Booij 1995), and will therefore be left out of discussion here.²

It should also be noted at the outset that the non-occurrence of certain affix combinations may simply follow from the subcategorization requirements they impose on the stem to which they attach (Booij 1977: Ch. 3, Plag 1999). For instance, the Dutch suffixes *-baar* '-able' and *-heid* '-ness' only occur in that order within a complex word, as in *open-baar-heid* 'publicity', because the nominalizing

suffix *-heid* requires an adjectival stem, and the adjectivalizing suffix *-baar* does not take nominal stems. Hence, a form like *openheidbaar* with the sequence *-heid-baar* is impossible.

In the early days of generative morphology, there were some attempts of formulating general principles of affix combination such as a prohibition on recursivity of affixes (cf. Schultink 1975 and Bauer 1997: 548 for critical discussion), but this has not led to well established language-independent generalizations.

Recently, new attempts have been made to find generalizations for restrictions on stacking up affixes, in particular Hay (2000) for English³, and Aronoff & Fuhrhop (in press) for English and German. The present article is intended as a third contribution to the analysis of affix sequencing in Germanic languages, by presenting an analysis of the facts of Dutch. I will argue that both morphological and phonological properties of affixes play a role in accounting for the restrictions on affix sequences in Dutch.

In Section 2 I will discuss restrictions on suffix combination, in Section 3 prefix sequences will be dealt with, and Section 4 will draw some general conclusions as to the influence of phonology on the combinability of affixes.

2. RESTRICTIONS ON SUFFIX COMBINATION

The absence or occurrence of specific suffix combinations is co-determined by the specific properties of individual suffixes. The outer suffix may impose certain requirements on the base word: semantic requirements, requirements as to its syntactic category, requirements as to its morphological composition, and conditions on its phonological form. As to morphological conditions, a suffix may require the base word to be simplex. This appears to be the case for the Dutch deadjectival suffix *-te* (as in *stil* 'silent' - *stil-te* 'silence'). Hence, there will be no suffix sequences of the type 'suffix + *-te*'. Aronoff & Fuhrhop (in press) argue that such a constraint holds for English suffixes that require a native base word: they can only be attached to simplex bases.

Secondly, it may also be the case that, just the other way round, a certain type of suffixed word imposes requirements on the kind of suffix that can be attached to it. For instance, if one wants to coin the female form of Dutch suffixed personal nouns ending in *-aar*, a particular suffix from the set of Dutch female suffixes has to be chosen, namely *-es* or *-ster* (as in *minn-ar-es* 'female lover', and *wandel-aar-ster* 'female walker'). The other female suffixes (*-in*, *-e*) cannot be used. Hence, the suffix sequences *-ar-es* and *-aar-ster-* are possible suffix sequences of Dutch, whereas the suffix combinations *-ar-in* and *ar-e* do not occur.

The role of the base word is particularly clear in the case of closing suffixes. These are suffixes that close a word for further word formation. Aronoff & Fuhrhop mention a set of closing suffixes for German, such as *-e*, *-in*, and *-ung*. An example from Dutch is the suffix *-e* (female or deadjectival substantivizing suffix), which blocks further suffixation (Van Marle 1985).

Interestingly, these observations imply that the internal morphological structure of a word has to remain accessible once it has been coined. Thus, such restrictions form counterexamples to the hypothesis of A-morphous Morphology, as defended in Anderson (1992).

2.1 The role of phonological properties of suffixes

The addition of an affix to a stem often creates marked phonological forms. Therefore, we may wonder if the fact that the attachment of a suffix creates a marked phonological output, will block or impede the attachment of that suffix. For instance, when we add the Dutch comparative suffix *-er* /χr/ to the adjectival stem *nobel* /no:bχl/ 'noble', we create a word *nobeler* 'nobler' that ends in two 'schwallables' (syllables headed by a schwa). From a prosodic point of view, this is a marked form, because the last of these two schwallables cannot be parsed into a foot. In Dutch, syllables are parsed into left-headed feet, which are preferably bisyllabic, so Dutch is a trochaic language. Schwallables cannot function as heads of feet, which require a full vowel to be present. Consequently, when we parse the comparative form *nobeler* 'nobler' into feet, the first two syllables are parsed into a trochaic foot, but the last syllable will not form part of a foot. This last syllable will then be dominated directly by the prosodic word node. Unlike complex words, lexical morphemes of Dutch never end in a

sequence of two schwallables, and thus lead to unmarked prosodic forms if they remain unsuffixed (Booij 1999). The marked phonological form of a complex word will reduce the ease of articulation of that word compared to that of its base. On the other hand, this markedness may contribute to the ease with which its morphological parsability is determined: a speaker of Dutch who hears a word ending in two schwallables can be certain that the word is a suffixed word. Note, however, that the prosodic form of a word like *nobeler* does not contain clues as to where exactly the suffix begins. The morphological parsing is impeded by the fact that the comparative suffix is vowel-initial, and therefore, the left boundary of the suffix does not coincide with a syllable boundary since the condition Onset forbids empty onsets, and hence the syllabification of *nobeler* is *no.be.ler* (where the dots indicate syllable boundaries).. We should also note that although attachment of the comparative suffix may lead to marked prosodic structures, this does not impede its productivity: it is attached freely both to simplex and suffixed adjectives. For instance, the comparative form of the suffixed (denominal) adjective *gelukk-ig* 'happy' is *gelukk-ig-er* 'happier', a word that ends in two schwallables, just like the comparative form *nobeler*. There is simply no alternative way of making comparatives in Dutch.

Besides vowel-initial suffixes such as the comparative suffix *-er*, Dutch also has a number of consonant-initial suffixes headed by the vowel schwa, for instance the diminutive suffix *-tje* and the feminine suffix *-ster*. These suffixes may then also lead to words ending in two schwallables of which the last one cannot be parsed into a foot, but they have a perceptual advantage above vowel-initial suffixes in terms of parsability: the left edge of the suffix will always coincide with a syllable boundary since the initial obstruents of these suffixes cannot be preceded by other consonants within the same syllable onset (the Sonority Sequencing Generalization, cf. Booij 1995).

In sum, suffixation will not be blocked although marked output forms are created, and their phonological markedness will be counterbalanced by their being easier recognizable as complex words. Nevertheless, it may be the case that phonological markedness factors do play a role in the productivity of suffixes, and stacking up suffixes, and this is what we will look at here in more detail.

Let us assume that the following universal but violable phonological constraints are relevant for Dutch (Booij 1998, Kager 1999):

(1) ParseSyllable: syllables must be parsed into feet

Align: a morpheme boundary must align with a syllable boundary

Onset: syllable onsets may not be empty

The use of vowel-initial suffixes such as *-er* will lead to words that violate the first two constraints, whereas consonant-initial suffixes such as *-tje* and *-ster* may only lead to violations of the first one.

These constraints might then be relevant for stacking up suffixes in the following way:

(2) The more it leads to violations of phonological constraints, the more attachment of a suffix to a word will be avoided.

As to the role of ParseSyllable in the morphology of Dutch, it has been shown in Booij (1998) that this constraint plays an essential role in the selection of the correct allomorph of suffixes, and also in the choice between competing suffixes such as the two plural suffixes *-en* and *-s*. It is therefore a reasonable step asking to which extent the same constraint also plays a role in restricting the set of possible suffix sequences. Hypothesis (2) should be taken to apply in particular (though not exclusively) to situations in which the use of a suffix can be avoided because there is an alternative morphological expression.

Before we can deal with the relevant data concerning restrictions on suffix sequences in Dutch, we need a clear picture of the phonological properties of the different classes of suffixes in Dutch. The following classification is relevant:

(3) Classification of Dutch suffixes

	native	non-native
	/	
	\	
cohering	non-cohering	cohering

If a suffix is cohering, it forms one prosodic word with the preceding stem; if a suffix is non-cohering, it forms a prosodic word of its own. The relevance of the distinction between native and non-native suffixes is argued for in Booij (1977:131-39), and Booij (2002: Chapter 3). The basic generalization is that non-native suffixes only attach to non-native stems, whereas native suffixes attach to both native and non-native stems.⁴ This asymmetrical constraint correctly predicts that native suffixes will always be peripheral to non-native suffixes, and hence we do not need level ordering to account for this generalization. The term 'non-native' is not meant to suggest that all native speakers of Dutch know the historical origin of these stems, roots and suffixes, but suggests that the foreignness of such words is recognizable. There are phonological cues for being non-native: non-native stems contain often at least two full vowels, unlike native stems, and non-native suffixes bear the main stress of the word, always contain a full vowel, and are always vowel-initial. As Van Heuven, Neijt, and Hijzelendoorn (1994) argue, this makes non-native suffixes recognizable as such. The asymmetrical pattern for native versus non-native suffixes is illustrated in (4):

(4)	<i>native stem</i>	blind 'blind'	blindheid 'blindness' *blind-iteit
		doof 'deaf'	doofheid 'deafness' *dov-iteit
	<i>non-native stem</i>	stabel 'stable'	stabelheid 'stableness' stabil-iteit 'stability'
		divers 'diverse'	diversheid 'diversity' divers-iteit 'diversity'

The non-native suffixes of Dutch are all cohering, i.e. they form one prosodic word with the stem to which they attach. Their phonological behaviour (syllabification, type of phonotactic patterns, location of main stress on the last stressable syllable of the word) is identical to that of simplex words. Compare, for instance, the simplex word *korporaal* 'corporal' with the complex word *rector-aal* 'rectorial'. From the point of view of syllabification and location of stress (main stress on the final

syllable), there is no difference in behaviour between these two words. A list of non-native suffixes of Dutch is provided in Table 1.

Table 1. Non-native suffixes of Dutch

<i>Suffix</i>	<i>Base</i>	<i>Base word</i>	<i>Output</i>	<i>Derived word</i>
-aal	N	synode 'synod'	A	synod-aal 'synodical'
-aan	N	parochie 'parish'	N	parochi-aan 'parishioner'
-aat	N	doctor 'doctor'	N	doctor-aat 'doctorate'
-air	N	hypotheek 'mortgage'	A	hypotheek-air 'mortgage-'
-ant	V	predik 'to preach'	N	predik-ant 'clergyman'
-aris	N	bibliotheek 'library'	N	bibliothec-aris 'librarian'
-ast	N	gymnasium 'grammar school'	N	gymnasi-ast 'grammar school pupil'
-atie	V	organiseer 'to organize'	N	organis-atie 'organization'
-eel	N	fundament 'fundament'	A	fundament-eel 'fundamental'
-eer	N	parfum 'perfume'	V	parfum-eer 'to perfume'
-ees	N	Taiwan 'id.'	N	Taiwan-ees 'inhabitant of Taiwan'
-ein	N	republiek 'republic'	N	republiek-ein 'republican'
-erie	N	parfum 'perfume'	N	parfum-erie 'perfume shop'
-esse	N	secretaris 'secretary'	N	secretar-esse 'secretary, fem.'
-ette	N	opera 'id.'	N	oper-ette 'operetta'
-esk	N	ballade 'ballad'	A	ballad-esk 'ballad-like'
-eur	N	ambassade 'embassy'	N	ambassad-eur 'ambassador'
-eus	N	rancune 'rancour'	A	rancun-eus 'rancorous'
-iaan	N	presbyter 'id.'	N	presbyter-iaan 'presbyterian'
-ide	N	broom 'bromine'	N	brom-ide 'bromide'
-ief	N	agressie 'agression'	A	agressief 'aggressive'
-ier	N	juweel 'jewel'	N	juwel-ier 'jeweler'
-iet	N	metropool 'metropolis'	N	metropol-iet 'metropolitan'
-ieus	N	mode 'fashion'	A	mod-ieus 'fashionable'

-ine	A	blond 'id.'	N	blond-ine 'blonde'
-isch	N	algebra 'id.'	A	algebra-isch 'algebraic'
-iseer	A	banaal 'banal'	V	banal-iseer 'to banalize'
-isme	A	absurd 'id.'	N	absurd-isme 'absurdism'
-ist	N	propaganda 'id.'	N	propagand-ist 'id.'
-oir	N	emancipatie 'emancipation'	A	emancipat-oir 'emancipatory'
	N	urine 'urine'	N	urin-oir 'urinal'
-oot	N	psyche 'id.'	N	psych-oot 'psychotic'

In addition, there is also a set of non-native suffixes that only occur with roots, i.e. bases that do not occur as words (cf. Booij 2002). These suffixes have exactly the same phonological properties as those listed in Table 1.

Since complex non-native words have exactly the same relevant phonological properties as simplex ones, hypothesis (2) predicts that the presence of a non-native suffix at the end of a stem will not decrease the ease with which one can attach a native suffix to a non-native stem, not even a vowel-initial one: non-native words end in a stressed syllable, and hence, the addition of vowel-initial suffixes will lead to phonological forms of the same kind as the addition of such suffixes to native monosyllabic stems (that are by definition also stressed on the last syllable). For instance, from the point of view of ParseSyllable, *massíev-ig* 'somewhat solid' derived from the non-native adjective *mass-ief* 'solid' is as good as *gróen-ig* 'greenish' derived from the native stem *groen* 'green': both these words with the vowel-initial suffix *-ig* /χπ/ violate Align, but do not have unparsed syllables, and thus do not violate ParseSyllable. This prediction appears to be correct: in Dutch the presence of a non-native suffix in a word has no restrictive effect on further suffixation to that word.

This implies that we do not need a diacritic feature (non-)native for a proper account of the behaviour of such suffixes with respect to stacking up suffixes. Thus, this analysis seems to strengthen the doubts raised in Luedeling et al. (this volume) about the relevance and validity of the native – non-native distinction. Nevertheless, I do not think that we can conclude that we should give up the distinction completely. It is indeed true for German, and for Dutch, that there is no absolute restriction,

and that some non-native suffixes attach occasionally to native stems. It remains the case, however, that the attachment of non-native suffixes to native stems remains the exception in Dutch, and is often felt as playful or intentional language use.

As mentioned above, the native suffixes of Dutch divide phonologically into two classes: non-cohering and cohering suffixes. Recall that the distinguishing property of non-cohering suffixes is that they form a prosodic word of their own, and do not form a prosodic word together with the stem to which they attach. The set of non-cohering suffixes of Dutch is listed and exemplified in (5):

(5) *Non-cohering suffixes*

-achtig /axtɣɪ/	rood-achtig 'reddish'
-baar /ba:r/	eet-baar 'edible'
-dom /d]m/	adel-dom 'nobility'
-heid /hɛid/	schoon-heid 'beauty'
-ling /lɔŋ/	naar-ling 'unkind person'
-loos /lo:z/	draad-loos 'wireless'
-schap /sxʃɪp/	vriend-schap 'friendship'
-zaam /za:m/	deugd-zzaam 'virtuous'

The non-cohering nature of these suffixes is illustrated by the contrast between the suffix *-achtig* and its cohering semantically equivalent counterpart, the suffix *-ig*; both occur with the adjectival stem *rood* 'red', and contribute the same meaning '-ish', but show different phonological behaviour:

(6) rood-achtig [ro:t.ɪx.tɣx] rodig [ro:.dɣx]

Since *-achtig* forms a prosodic word of its own, it is an independent domain of syllabification. Hence, the /d/ of *rood* occurs in syllable-final position, and is devoiced due to the constraint Final Devoicing (obstruents are voiceless in coda position). On the other hand, the suffix *-ig* is cohering, and forms one

prosodic word with its base. Therefore, the morpheme-final /d/ of *rood* fills an onset position in *rodig*, and will be thus exempted from Final Devoicing, and remains voiced.

A related characteristic of non-cohering suffixes is that they allow for backward gapping: of two identical non-cohering suffixes, the first can be deleted. A crucial condition on this kind of gapping is that the suffix forms a prosodic word of its own, and is thus similar to the constituents of compounds, which also allow for this kind of gapping (Booij 1985):

(7) *backward gapping in compounds:*

land- en tuinbouw 'agriculture and horticulture'

wespen- en bijesteken 'wasp stings and bee stings'

hoofd- of nevenaccent 'main stress or secondary stress'

backward gapping in suffixed words

storm- en regenachtig 'stormy and rainy'

zicht- en tastbaar 'visible and tangible'

christen- en heidendom 'christianity and heathendom'

eenzijdig- of partijdigheid 'onesidedness or partiality'

twee- en drielingen 'twins and triplets'

oever- en zouteloos 'lit. bankless and saltless, endless and insipid'

zwanger- en moederschap 'pregnancy and motherhood'

eer- en deugdzaam 'respectable and virtuous'

A cohering suffix, on the other hand, cannot be gapped. For instance, the gapping of the cohering suffix *-ig* in the phrase *rodig en groenig* 'reddish and greenish' is impossible witness the impossibility of **rood- en groenig*.

From the perspective of hypothesis (2), non-cohering suffixes are the ideal candidates for being attached to an already suffixed word: since they begin a new prosodic word, their attachment will not result in unparsed syllables; moreover, their left boundary will always coincide with a syllable

boundary.⁴ This later property makes them maximally parsable. And it is indeed the case that they freely attach to suffixed words, as will be shown below.

For an evaluation of the empirical correctness of hypothesis (2), the following list of cohering derivational suffixes of Dutch is relevant. Most of them have a schwa as their only vowel; hence it is predictable that they are cohering suffixes, because, in order to form a prosodic word of their own, minimally one full vowel has to be present. In addition, there are two consonantal suffixes, which are also predictably cohering due to the lack of a vowel. Thirdly, there is a number of cohering suffixes with a full vowel. Particularly noteworthy are the suffixes *-elijk* and *-erig* that due to their containing two schwas by definition create complex words with unparsed syllables. Thus, they form a clear illustration of the generalization that morphology has priority above phonology

(8) *Derivational cohering native suffixes of Dutch*

Consonantal

-s /s/ goed-s 'something good'

-st /st/ dien-st 'service'

vowel-initial with schwa

-e /ɤ/ grappig-e 'funny person / thing'

-elijk /ɛlɛk/ lief-elijk 'lovely'

-er /ɛr/ bakk-er 'baker', rod-er 'redder'

-erd /ɛrd/ viez-erd 'dirty person'

-erig /ɛrɛrɪŋ/ groen-erig 'somewhat greenish'

-ig /ɛŋ/ groen-ig 'greenish'

consonant-initial with schwa

-de /dɛ/ lief-de 'love'

-lijk /lɛk/ heer-lijk 'lovely'

-sel /sɛl/ aanhang-sel 'appendix'

-ster /stɛr/ molenaar-ster 'miller, female'

-te /tχ/	leeg-te 'emptiness'
-tig /tχπ/	zeven-tig 'seventy'
-tje /tjχ/	traan-tje'tear, diminutive'

vowel-initial, full vowel, final stress:

-erij /χrei/	vlieg-erij 'flying'
-es /ɛs/	voogd-es 'guardian, female'
-in /ξn/	held-in 'heroine'
-ij /ɛi/	voogd-ij 'guardianship'

vowel-initial, full vowel, no main stress, possible rhythmic secondary stress:

-aar /a:r/	molen-aar 'miller'
-enaar /βna:r/	Utrecht-enaar 'inhabitant of Utrecht'
-erik /βrξk/	viez-erik 'dirty person'
-ing /ξ /	belon-ing 'reward'
-nis /nξs/	vuil-nis 'garbage'

The four suffixes *-erij*, *-es*, *-in*, and *-ij* behave morphologically as native suffixes since they combine with native stems, although they bear main stress, just like non-native suffixes.

As mentioned above, Aronoff and Fuhrhop (in press) proposed the following morphological constraint on suffix sequences in English:

(9) Monosuffix constraint: suffixes that select Germanic bases select unsuffixed bases

One may wonder if a similar general morphological constraint holds for Dutch. The answer is negative: native suffixes of Dutch do relatively freely attach to stems that end in a native suffixes.⁵ This is illustrated by the behaviour of the productive deverbal nominalizing suffix *-ing* that clearly attaches to words ending in a native suffix:

- (10) [be[vocht-ig]_A]_V-ing 'moisturizing'
 [be[kracht-ig]_A]_V-ing 'ratification'
 [ont[moed-ig]_A]_V-ing 'discouragement'
 [ver[weten-schapp-elijk]_A]_V-ing 'scientification'
 [ver[waar-looz]_A]_V-ing 'neglect'
 [ver[onacht-zaam]_A]_V-ing 'disregard'

The same holds for the deverbal suffix *-er* 'er' that can be used instead of the suffix *-ing* in all the examples given here: *bevochtiger*, *verwaarlozer*, etc.. The last three examples in (10) also form a problem for the Complexity Ordering Hypothesis of Hay (2000) (see Plag, this volume for discussion of this hypothesis) which claims that less parsable suffixes are internal to more parsable suffixes: the less parsable vowel-initial suffix *-ing* follows the better parsable (non-cohering) suffixes *-schap*, *-loos*, and *-zaam*.

Although there is no general prohibition on stacking up native suffixes in Dutch, we may expect differences in behaviour between the different subsets of native suffixes given hypothesis (2). In particular, when there are competing synonymous suffixes, a non-cohering suffix is expected to be used more often and more easily than a cohering one. This appears indeed to be the case for the synonymous suffixes *-ig* and *-achtig*: both have the meanings 'ish' and 'like', but the non-cohering suffix *-achtig* is used for many more types of base words than *-ig* as shown in (11). The question mark indicates that, although the relevant word is not strictly ungrammatical, native speakers feel unhappy about it.

(11) *simplex nouns*

aap 'monkey'	?ap-ig	aap-achtig
hyena 'id.'	?hyena-ig	hyena-achtig
lente 'spring'	?lent-ig	lente-achtig
mens 'man'	?mens-ig	mensachtig
olie 'oil'	?olie-ig	olie-achtig

schimmel 'mould'	schimmel-ig	schimmel-achtig
<i>suffixed nouns</i>		
raad-sel 'riddle'	raad-sel-ig	raad-sel-achtig
bakk-er 'baker'	?bakk-er-ig	bakk-er-achtig
muggezifter 'niggler'	muggezift-erig	muggezift-er-achtig
held-in 'heroine'	?held-inn-ig	held-in-achtig
gevangenis 'prison'	?gevangeniss-ig	gevangenis-achtig
winkel-ier shop keeper'	?winkel-ier-ig	winkel-ier-achtig

What we observe here is that there are restrictions on and hesitations with respect to suffixation with the cohering suffix *-ig*, whereas suffixation with the non-cohering suffix *-achtig* is always possible. The complex words with *-ig* listed here lead to more violations of the constraints in (1) than their counterparts in *-achtig*.

The relevance of the prosodic constraint ParseSyllable can also be seen in the behaviour of the suffix *-ster* /stɣr/ that creates female counterparts to personal nouns attaches to suffixed words:

(12)	molen-aar 'miller'	molen-aar-ster 'miller, fem.'
	wandel-aar 'walker'	wandel-aar-ster 'walker, fem.'
	winkel-ier 'shop keeper'	winkel-ier-ster 'shop keeper, fem.'
	vrijwill-ig-er 'volunteer'	vrijwill-ig-ster 'volunteer, fem.'

The last example is special in that a sequence of three schwallables, as in the incorrect *vrijwillig-er-ster* is avoided here by replacing the suffix *-er* with *-ster*. This kind of suffix substitution is the systematic pattern for the formation of female counterparts of personal nouns in *-er*. If other female suffixes are used, for instance, the stress-bearing suffix *-es*, the suffix *-er* remains, as in *zang-er-és* 'singer, fem.' because in this word there is no sequence of schwallables. Thus, this specific pattern of suffix substitution serves to avoid the prosodically marker suffix sequence *-er-ster*.

It should be stressed once more, however, that the morphology of Dutch does create violations of Parse Syllable. There are even two cohering suffixes consisting of two schwallables, *-erig* /χrχπ/ and *-elijk* /χlχk/ which therefore by definition create such violations. This also applies to the diminutive allomorph *-etje*. Note, however, that these phonological strings will be easily morphologically parsable because phonological sequences such as /rχπ /, /χk/, and /tjχ/ do not occur in lexical morphemes and hence function as unique identifiers of these suffixes.

Dutch has a number of competing female suffixes, among which *-ster*, *-in*, *-es* and *-e*. The last of these suffixes, which consists of a schwa only, can be used after suffixed stems, but not when the stem ends in a schwallable. For instance, *leer-ling-e* 'pupil, fem.' is an example of a wellformed word with two suffixes of which the first is non-cohering, but female nouns such as *bakk-er-e* 'baker, fem.' that end in a sequence of two schwallables are impossible. That is, the number of constraint violations can be reduced if there is an alternative suffix available. On the other hand, the homophonous substantivizing deadjectival suffix *-e* is used freely for the substantivization of complex adjectives, as in *ge-lov-ig-e* 'believer', a word that ends in two schwallables, presumably since there is no alternative derivational process available for making such deadjectival personal nouns .

2.2. Non-cohering suffixes can open closed words

In the above, we came across the notion 'closing suffix'. Some derivational suffixes of Dutch such as the diminutive suffix and the female suffix *-e* appear to close a word for further derivation. Dutch inflectional suffixes, including participial suffixes also function as closing suffixes with respect to most kinds of derivation. However, there is one systematic exception: closing suffixes can be followed by non-cohering suffixes, as illustrated in (13) for diminutive nouns: the diminutive suffix closes a word for further word formation with cohering suffixes such as *-ig*, but non-cohering suffixes can be allowed. In that case, the diminutive noun is followed by a linking phoneme /s/,

(13) *meis-je* 'girl' **meisj-ig* *meisje-s-achtig*

sprook-je 'fairy tale'	*sprookj-ig	sprook-je-s-achtig
vriend-je 'friend'	*vriendj-ig	vriend-je-s-loos

There are also suffixes that impede further word formation, except for the attachment of the diminutive suffix; they may be called semi-closing suffixes. This applies to the female suffixes *-in*, *-es*, and *-ster*, the nominalizing suffix *-ing*, and the suffixes *-heid* ' and *-te -ness*'. Again, these suffixes nevertheless freely combine with non-cohering suffixes, sometimes with an intervening linking phoneme

(14)	koning-in 'queen'	*koning-inn-ig	koning-inn-etje	koning-inn-e-loos
	zond-ar-es 'sinner, fem.'	*zondar-ess-ig	zond-ar-es-je	zond-ar-es-achtig
	wandel-aar-ster 'walker, f.'	*wandel-aar-ster-ig	wandel-aar-ster-tje	wandel-aar-achtig
	won-ing 'home'	*won-ing-ig	won-ing-kje	won-ing-loos
	waar-heid 'truth'	*waar-heid-ig	waar-heid-je	waar-heid-s-loos
	stil-te 'silence'	*stil-t-ig	stil-te-tje	stil-te-loos

The participial affix *-end* (present participles) and *-t/d* (past participles, cooccurring with the prefix *ge-*) occurs in a vast number of words that are used as adjectives. The presence of these suffixes blocks further deadjectival word formation (again, except the addition of the substantivizing suffix *-e*), but non-cohering suffixes can be added:

(15)	dring-end 'urgent'	*dring-end-ig	dring-end-heid
	vermoei-end 'tiring'	*vermoei-end-ig	vermoei-end-heid
	woed-end 'furious'	*woed-end-ig	woed-end-heid
	beken-d 'known'	*beken-d-ig	beken-d-heid
	ge oefen-d 'trained'	*ge oefen-d-ig	ge oefen-d-heid

Languages tend to have their inflectional endings peripheral to derivational morphemes, and this may be seen then as a general principle on affix ordering. However, as shown in Booij (1994, 1996), there are systematic exceptions to this generalization in Dutch. In particular, inherent inflection such as pluralization of nouns, comparative forms, and the formation of non-finite forms of verbs may precede the attachment of non-cohering derivational suffixes. The effect is that inflectional endings will always occur at the right edge of a prosodic word. The following data from Dutch show that inherent inflection can indeed feed certain types of derivation;

(16) *plural nouns*

boek-en 'books'	boeken-achtig 'bookish'
meisje-s 'girls'	meisjes-achtig 'girlish'
held-en 'heroes'	helden-dom 'heroism'
leerling-en 'pupils'	leerlingen-dom 'the group of pupils'

passive participles

aangepas-t 'adjusted'	aangepast-heid 'adjustedness'
geslot-en 'closed'	gesloten-heid 'closedness'

present participles

opwind-end 'exciting'	opwindend-heid 'excitingness'
doeltreff-end 'effective'	doeltreffend-heid 'effectiveness'

comparatives

bet-er 'better'	beter-schap 'recovery'
oud-er 'older'	ouder-dom 'old age'
oud-er 'older'	ouder-ling 'elder'

infinitives

nalat-en 'to leave'	nalaten-schap 'heritage'
wedd-en 'to bet'	wedden-schap 'bet'
wet-en 'to know'	weten-schap 'science'
zegg-en 'to say'	zeggen-schap 'authority'

We should realize, however, that the use of comparatives and infinitives as inputs for word formation is of an incidental, non-systematic nature, whereas the use of plural nouns and participial adjectives in this way is productive.

Cohering derivational suffixes, on the other hand, are never suffixed to inflected forms of words. For instance, an agent noun such as **zegg-en-er* 'sayer' derived from the infinitive form *zegg-en* 'to say' is impossible, and *zegg-er* has to be used instead. Thus, we see that again the prosodic properties of affixes play a role in the kind of suffix sequencing we can get in Dutch: a sequence of an inflectional suffix followed by a derivational suffix is possible, but only if that derivational suffix is non-cohering.

In sum, we have seen the following relation between the phonological properties of Dutch suffixes and their combinability:

- (i) non-cohering suffixes can be used more readily than comparable cohering suffixes when a word is coined on the basis of a suffixed stem;
- (ii) if a cohering suffix behaves as a closing suffix (or as a semi-closing suffix), non-cohering suffixes can nevertheless follow the closing suffix;
- (iii) inflectional suffixes can only appear inside derivational suffixes if the derivational suffix is non-cohering.

This higher combinatory potential of non-cohering suffixes can be seen as an effect of the fact that the complex words coined by such suffixes are prosodically more optimal, and also more parsable. This may also explain the fact that, as observed by Plag (this volume), the English suffixes *-full*, *ness-* and *-wise* violate Monosuffix constraint (9) since there are also non-cohering suffixes.

3. CONSTRAINTS ON PREFIX SEQUENCES

Can Dutch prefixes be stacked up? This is an obvious question to be answered in a systematic investigation of restrictions on Dutch affix sequences.

The native prefixes of Dutch are all non-cohering, that is, they do not syllabify with the stem, and their right boundary coincides with a syllable boundary (Booij 1995, 2002). Some of them have a full vowel, and bear stress, but the native verbalizing prefixes (some of which have schwa as their vowel) are unstressed. Hence, such prefixes form unparsed syllables at the beginning of a word, and thus violate Parse Syllable systematically.

Our first observation is that unstressed verbalizing prefixes cannot easily be attached to an already prefixed verb that begins with a native unstressed prefix (De Haas & Trommelen 1993: 64), but a stress-bearing (non-cohering) prefix such as *on-* does not impede further prefixation. For instance, the unstressed verbalizing prefix *ver-* appears to attach to verbs with a non-native prefix (which bears a rhythmic, secondary stress), and to prefixed nouns and adjectives, but not to prefixed verbs with a native unstressed prefix. This prefix *ver-* expresses that the action expressed by the stem fully affects the object, and often in a negative sense (recall that the citation form of Dutch verbs is the infinitive which consists of stem + *-en*):

- | | | |
|------|--|---|
| (17) | [ont-[bóssen] _V] _V 'to deforest' | * <i>ver-ont-bossen</i> 'to destroy by deforestation' |
| | [òn-[áangenàm] _A] _A 'unpleasant' | <i>ver-on-aangenamen</i> 'to make more unpleasant' |
| | [ón-[gelùk] _N] _N 'accident' | <i>ver-on-gelukken</i> 'to die in an accident' |
| | [dè-[montéren] _V] _V 'to excuse' | <i>ver-de-monteren</i> 'to destroy by taking apart' |
| | [rè-[forméren] _V] _V 'to rehearse' | <i>ver-re-formeren</i> 'to destroy by reforming' |

The last two examples illustrate that the presence of non-native prefixes does not impede native prefixation, in line with what we observed above for non-native suffixes. They behave as cohering affixes, and form one prosodic word with their stem (Booij 1995). The avoidance of a sequence of two unstressed prefixes can thus be seen as a strategy for reducing the number of violations of Parse Syllable. Note also that Dutch lexical morphemes never contain a sequence of two

schwa-headed syllables, and never begin with a schwa-headed syllable, because that would also lead to sub-optimal prosodic structure (Booij 1999).

The native unstressed verbalizing prefixes of Dutch are *be-* /bɛ/, *ont-* /ɔnt/, and *ver-* /vɛr/ (the vowel of this latter prefix is often realized as schwa); in addition, there are some verbs with the unproductive prefixes *er-* /ɛr/ and *ge-* /gɛ/. The relevant generalization is that Dutch tends to avoid the use of a sequence of two unstressed prefixes in a word (De Haas & Trommelen 1993: 64). This tendency is also grammaticalized in the rule of Dutch that participles of verbs with an unstressed prefix do not have the participial prefix *ge-*, unlike simplex verbs:

(18)	vangen 'to catch'	ge-vangen 'caught'
	ont-vangen 'to receive'	ontvangen 'received'
	sturen 'to send'	ge-stuurd 'sent'
	be-sturen 'to govern'	bestuurd 'governed'
	pre-figeren 'to prefix'	ge-prefigeerd 'prefixed'
	re-animeren 'to reanimate'	ge-reanimeerd 'reanimated'

Thus, a sequence of two unparsed syllables at the beginning of a word is avoided. As the last two examples illustrate, non-native prefixes are invisible for this rule: they are parsed as heads of the first foot of the prosodic word of the stem, and thus receive secondary stress..

The prefix *ge-* can also be used for nominalizing verbs. *Ge-*nominalizations of prefixed verbs are, however, marginal, though possible (Mackenzie 1985): *ge-ver-huis* 'continuous moving', *ge-be-loof* 'continuous promising' are a few examples. Similarly, we do find a few verbs with a sequence of unstressed prefixes such as *be-ge-leiden* 'to accompany', but again these are marginal.⁶

This prosodic explanation of the restriction on double prefixation of unstressed prefixes is supported by the observation that the few native prefixes that form prosodic words of their own and bear the main stress of the prefixed word combine freely with prefixed bases. This applies to the prefixes *aarts-* 'very', *her-* 're-', *oer-* 'primal', and *on-* 'not':

- (19) áarts-ge-voelig 'very sensitive', áarts-be-drieger 'arch deceiver'
 hér-be-ginnen 'to re-begin', hér-ver-overen 'to reconquer', hér-ge-buiken 'to reuse', hér-
 ont-dekken 'to rediscover'
 óer-ge-zellig 'very cosy', óer-ge-zond 'very healthy'
 ón-ont-cijferbaar 'undecodable', ón-ont-koom-baar 'unescapable', ón-ge-rept 'unspoiled', ón-
 be-duidend 'insignificant', ón-ver-hoeds 'unexpected'

In these words, the first prefix forms a prosodic word of its own, and hence there will not be a sequence of two unstressed syllables word-initially.

In the beginning of this article, we observed that non-native suffixes attach to non-native stems only. In this respect they differ from non-native prefixes that bear the main stress of the word, which appear to attach to native stems as well, as shown in Table 2.

Table 2 Non-native prefixes with native bases

<i>prefix</i>	<i>example</i>
anti- 'id.'	anti-godsdienstig 'anti-religious'
co- 'co-'	co-ouderschap 'shared parenthood after divorce'
contra- 'id.'	contra-gewicht 'counterweight'
ex- 'former'	ex-man 'former husband'
hyper- 'id.'	hyper-gevoelig 'hyper-sensitive'
infra- 'id.'	infra-rood 'infrared'
loco- 'vice-'	loco-burgemeester 'vice-mayor'
meta- 'id.'	meta-taal 'metalanguage'
micro- 'id.'	micro-golf 'microwave'
neo- 'id.'	neo-gelovige 'neo-believer'
pre- 'id.'	pre-zwangerschap 'pre-pregnancy'
pro- 'id.'	pro-apartheid 'pro-apartheid'

pseudo- 'id.'	pseudo-wetenschap 'pseudo-science'
semi- 'id.'	semi-overheid 'semi-government'
sub- 'id.'	sub-groep 'subgroup'
super- 'id.'	super-gaaf 'very nice'
turbo- 'super'	turbo-koe 'very productive cow'
ultra- 'id.'	ultra-zacht 'very soft'
vice- 'id.'	vice-voorzitter 'vice -chairman'

All these non-native prefixes are non-cohering affixes that form a prosodic word of their own, unlike non-native suffixes, which are all cohering. These prefixes all have at least one full vowel, and they bear the main stress of the word, that is, prosodically words with such prefixes behave like compounds. Such complex words remain morphologically transparent, because the prefix forms its own domain of syllabification, and will preserve the prosodic properties of its stem as used as a word by itself, and do not give rise to marked prosodic structure. Thus, we can explain why non-native prefixes freely attach to native stems, and differ in this respect from non-native suffixes, which can only be attached to non-native stems.

These facts also suggest, in line with Luedeling et al. (this volume), that we do not need a diacritic feature [non-native] for these prefixes since it is their phonological form that determines their combinability. However, there are a few prefixes in Dutch such as *re-* ‘re-’ that are restricted to combinations with non-native stems, which speaks against the radical conclusion that the stratum feature [non-native] can be given up completely.

4. CONCLUSIONS

The general conclusion of this paper is that the prosodic properties of affixes and the words in which they occur are important for understanding the restrictions on affix sequences in Dutch. In the case of suffixes, it is only non-cohering suffixes that freely attach to suffixed stems since they keep the prosodic structure of complex words optimal, and its morphological structure transparent, just like compounds. As to unstressed prefixes, their sequencing is inhibited by the fact that such sequences will lead to suboptimal prosodic structure because two the first two syllables of such a doubly prefixed word cannot be parsed into a foot. One stray syllable at the beginning of a prosodic word appears to be about the maximum that Dutch speakers judge to be acceptable.

The promiscuity of non-native prefixes with main stress compared to non-native suffixes should also be seen as an effect of their prosodic properties: such non-native prefixes form a prosodic word of their own, unlike the non-native suffixes. Hence, prosodically they are compounds, and exhibit the same degree of morphological transparency, and thus the same degree of productivity as morphological compounds.

NOTES

1. I would like to thank Harald Baayen, Mirjam Ernestus, Matthias Hüning, Jaap van Marle, Anneke Neijt, Anke Lüdeling, and Ingo Plag for their constructive comments on an earlier draft of this paper.
2. The hypothesis of level ordering is sometimes equated with the theory of Lexical Phonology. However, as argued in Booij (2000), this is incorrect, and rejection of level ordering by no means implies rejection of the basic tenets of Lexical Phonology concerning the interaction of phonology and morphology.
3. See Plag (this volume), and Baayen (in press) for a detailed discussion of Hay's proposals.

4. The suffix *-achtig* seems to violate Onset, but usually a glottal stop is inserted before the first vowel.
5. Note, however, that most native suffixes of Dutch do not select Germanic bases only, they also attach to non-native stems, as discussed above.
6. The prefix sequence *ver-ont* also occurs in a few verbs as an effect of reinterpretation. For instance, the verb *ver-ont-rusten* 'to alarm' derives from *on-rust* 'unrest', with a replacement of the negative prefix *on* - with the negative verbal prefix *ont-* (cf. Booij 2002).

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