

# Affixation and integrity of syllable structure in Dutch

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## 1. Introduction

This article deals with the different phonological behaviour of prefixes and suffixes, especially their different behaviour with respect to syllable structure.<sup>1</sup> Focus will be on the Dutch facts only, but similar observations have been made for other languages as well (Polish: Szpyra 1992, Italian: Nespor and Vogel 1986, Indonesian: Cohn 1989, to mention just a few references).

I assume that the only difference between a prefix and a suffix is that a prefix occurs to the left of the base and a suffix to its right. Even though this assumption seems quite simple, it is not a very popular one. All previous approaches I am aware of share the idea that prefixes are not as closely connected to the base as suffixes are, but all of these approaches also share the disadvantage of having to stipulate this difference. The fact that there are no prefixes which incorporate into a Prosodic Word rather than adjoin to it, has to be treated as a mere coincidence in these accounts. This is an undesirable aspect of these theories, even more so if we consider the cross-linguistic facts. I therefore propose an analysis based on the notion *integrity* (Harris 1993), in which the left/right asymmetry can be derived from more basic phonological principles.<sup>2</sup>

## 2. Dutch prefixes and suffixes

Most Dutch suffixes trigger two processes related to syllabification: resyllabification of stem-final consonants and deletion of stem-final schwa.

Stem-final consonants are resyllabified into the onset of the first syllable of the suffix if this suffix starts with a vowel. In the following examples the dot in the phonetic representation indicates a syllable boundary and the '+' sign in the orthographic example indicates a morphological boundary:

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<sup>1</sup> I want to thank Clemens Bennink, John McCarthy, Paola Monachesi, Lisa Selkirk and the LING reviewer for comments on various earlier versions of this paper. I alone am responsible for any remaining errors.

<sup>2</sup> Unfortunately, this notion is homophonous with the unrelated concept of *syllable integrity* as used in e.g. Rice (1988).

- (1)      concert      concert+eer  
          [kOn.sɛrt]   [kOn.sɛr.tɛr]/\*[kOn.sɛrt.ɛr]  
          'concert'   'give a concert'

The resyllabification process is not just phonetic.<sup>3</sup> This can be demonstrated on the form *rodig* [ro.dɪχ]. Dutch has a process of Final Devoicing which applies uniformly to all obstruents at the end of a syllable. Now obviously it did not apply to the [d] in *rodig* (as it did in the final segment [t] of *rood*). If we assume that Final Devoicing is a rule of (the last stratum of) Lexical Phonology (Booij 1993), the resyllabification should have applied in the lexicon as well.

There is one exception to this generalisation: the suffix *-achtig*. This suffix does not show any resyllabification at all:

- (2)      rood+achtig  
          [rot.αχ.tɪχ]/\*[ro.dαχ.tɪχ]  
          'red-like'

Final Devoicing does apply to the final /d/ of *rood* in this word and the resyllabification of this segment into the next syllable [ro.tαχ.tɪχ] is only found in the phonetics of (very) fast speech.

The second process applying in the realm of suffixes is prevocalic schwa-deletion. A schwa ending a base is deleted before a suffix starting with a vowel:

- (3)      elite      elite+air  
          [e.li.tə]   [e.li.tɛr]/\*[e.li.tə.ɛr]  
          'elite'      'snobbish'

These examples show that resyllabification applies in these examples as well: we have [e.li.tɛr] in stead of [e.lit.ɛr].

Again, the suffix *-achtig* is the only exception to this generalisation:

- (4)      oranje+achtig  
          [o.rɑn.jə.αχ.tɪχ]/\*[o.rɑn.jəχ.tɪχ]  
          'orange-like'

<sup>3</sup> The terminology I use here is derivational. John McCarthy has suggested to me to use 'transjunctural syllabification' as a more neutral descriptive term. However, the approach I will defend in section 4 is crucially meant to be compatible also with Item-and-Process theories of morphology like Anderson (1992) which do not recognise the concept of morphological junctures at all. Given this lack of strictly 'neutral' terms, I will stick to *resyllabification* and *schwa-deletion*.

Among the most important differences between prefixes and suffixes in Dutch is the fact that the former category is never subject to either resyllabification or schwa-deletion:

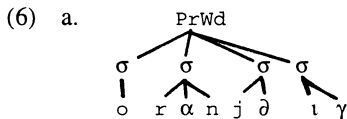
- (5)      ademen      uit+ademen  
           [a.də.mən] [œyt.a.də.mən]/\*[œy.ta.də.mən]  
           ‘breathe’    ‘breathe out’
- ademen      be+ademen  
           [a.də.mən] [bɛ.a.də.mən]/\*[ba.də.mən]  
           ‘breathe’    ‘breathe upon’

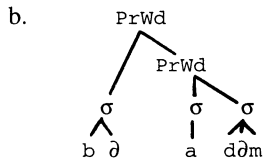
All prefixes behave alike in this respect. There are a few cases like *abortus* [a.bOr.təs] which can historically considered to be prefixed form *ab+ortus*, but it is safe to assume these forms are no longer morphologically complex in Dutch (cf. Booij 1993).

### 3. Earlier analyses

The question now arises why prefixes show this systematic difference with suffixes. In this section I will discuss and reject two analyses: Prosodic Phonology and Alignment Theory. Both analyses have the disadvantage that they basically have to stipulate the difference in behaviour between prefixes and suffixes.

3.1. *Prosodic phonology* --- Booij (1993). Booij (1993) can be seen as a reformulation in terms of prosodic phonology of an analysis given in Booij (1977) which was stated in terms of Siegel (1974). Booij (1993) assumes that the domain of syllabification and schwa deletion is the Prosodic Word. Now whereas most suffixes are uniformly incorporated into the Prosodic Word which is formed by the base, the prefixes and some suffixes rather are adjoined to the Prosodic Word. Consequently, we have the following representations for *oranjig* ‘orange-like’ and *beadem* ‘breathe upon’ respectively (I omitted irrelevant parts of the Prosodic hierarchy for clarity):





The rules of schwa deletion and subsequent (re)syllabification only apply in (6a) because this is the only place where schwa is directly dominated by the same Prosodic Word as the full vowel which triggers deletion.

Booij's analysis still does not answer the question why prefixes behave differently from most suffixes. The difference is basically stipulated; this is somewhat problematic if we take into consideration the fact that the same distinction shows up in language after language.

The analysis also has some problems with regard to lexical specification. There are some suffixes which behave as independent units with respect to syllabification, as Booij (1993) notes. One example is *vijf+ling* 'quintuplet' which is syllabified as *vijf.ling*, respecting the morphological boundary, not as *vij.fling* which would satisfy the onset maximization requirements operative in Dutch monomorphemic strings.

Stem and suffix behave as a single domain for syllabification in *oranjig*, but as two separate domains in *vijfling*. Using Booij's (1977) terminology I will call suffixes like *-ig* class I suffixes and suffixes like *-ling* class II suffixes. An important observation is that all class I suffixes start with a vowel, whereas all class II suffixes but one start with a consonant; the exception is *-achtig*. In Booij's (1993) account there is no direct link between the syllable structure of a suffix and its behaviour as class I or class II.

An important empirical problem to this type of approach has been noted by Simone Langeweg (1988): the prosodic status of affixes we set up for syllabification does not seem to correspond to the prosodic status we have to set up for other phonological phenomena like stress. In particular, it seems useful to draw a distinction between two classes of prefixes, even though all prefixes behave alike with respect to syllabification. Dutch has two negative prefixes, latinate *in-* and germanic *on-*. It seems useful to say *in-* is a class I prefix because its final nasal is subject to several assimilation processes: *impopulair* 'unpopular', *irregulier* 'irregular', etc. Under this view *on-* is class II: *onpopulair* 'unpopular', *onreglementair* 'irregular'. The syllabification of both prefixes before a vowel-initial word is parallel, however: *in.adequaat* 'inadequate', *on.uitstaanbaar* 'insufferable'. I will henceforth call this paradox *Langeweg's problem*; see Trommelen (1993) for a recent overview of arguments for lexical levels in Dutch.

3.2. *Alignment theory.* I believe that some of the problems listed at the end of the previous subsection can be avoided if we assume the theory of Alignment which is (among other things) a theory of the morphology-phonology interface stated in terms of Optimality Theory (McCarthy and Prince 1993a, 1993b) and a generalisation of the work by Selkirk (1986) on the syntax-phonology interface to the interface between phonology and morphology (cf. Cohn 1989).

The difference between prefixes and suffixes also does not have to be specified explicitly in this theory. Alignment theory basically says that morphological boundaries and phonological boundaries preferably coincide. Specifically, we can assume that there is a constraint which says that the left boundary of an  $X^0$  category should coincide with a syllable boundary (McCarthy and Prince 1993a, I give informal versions of the Alignment constraints here):

- (7) ALIGN-LEFT:  $[_{X0} = (_{PrWd}$

This constraint accounts for the behaviour of prefixes if we assume that the particular instance of Align given in (7) is ranked higher than the constraint ONSET, which says all syllables should have an onset. The two relevant syllabifications for *ont+erven* 'disinherit' are given below (square brackets indicate morphological structure):

- (8) ONSET: Every syllable node dominates an onset.

(9)

Candidates	ALIGN-LEFT	ONSET
<b>■</b> [ont.[?er.ven]]	?	**
[on.[ter.ven]]	t	*

The first option violates ONSET twice (there are two onsetless syllables) but it violates ALIGN-LEFT only in a minimal way, the glottal stop being (almost) featureless. Since the second option *does* violate ALIGN-LEFT by several features (the features of [t]), it is ranked lower than the first option. Even though the second version has one fewer violation of ONSET than the first one, it is considered to be non-optimal.

Now even if we assume there to be a right-peripheral counterpart to ALIGN-LEFT as formulated in (10), we could imagine that this particular version of Align is ordered *lower* than ONSET. We then get the Optimality tableau in (11) for *rod+ig*:

- (10) ALIGN-RIGHT:  $]_{X0} = )_{\sigma}$

(11)

Candidates	ONSET	ALIGN-RIGHT
[[rod].ig]	*	
→ [[ro.d]ig]		*

Because ONSET is ranked higher than ALIGN-RIGHT, in the case of suffixes it is more important to form an onset than to keep to morphological borders. The difference between *-achtig* and the other suffixes in this approach would be that *-achtig* has its own  $X^0$  category in the lexicon.<sup>4</sup>

We would also have to devise a theory for schwa-deletion in Optimality terms but this does not seem to be impossible for any principled reason. The same is true for the difference between vowel-initial and consonant-initial suffixes: the need for a syllabification of *vijfling* as *vij.fling* would not involve the ONSET Constraint, but rather something like Vennemann's (1988) Syllable Contact Law, which is a perfectly likely candidate for a Optimality constraint. The Syllable Contact Law could be ranked lower than the Alignment Constraints, thereby (correctly) yielding *vij.fling* as the output.

Again, the asymmetry between left and right edges of stems has to be stipulated in this theory which is all the more unexpected if we take into account that the same asymmetry is observed in so many other languages.<sup>5</sup> McCarthy and Prince (1993a) claim the left-right asymmetry is to be explained by psycholinguistic theory rather than by formal phonology. Because human parsing is on-line, people would pay more attention to the beginning of words than to their ends (Hawkins and Cutler 1988). Experimental researchers do not seem to agree among themselves on this point however (cf. Van der Vlugt and Nooteboom 1986). Furthermore this type of functional explanation still keeps us in the dark why it is exactly *syllabification* that cuts the distinction this way.

#### 4 An analysis based on integrity

My basic assumption about prefixes and suffixes is that prefixes occur to the left of the stem and suffixes to the right of it. Furthermore, I assume that phonological rule application is cyclic and that the first cycle is on the underived word. I

<sup>4</sup> An analysis of words with *-achtig* as pseudo-compounds can be found in Zonneveld and Trommelen (1979).

<sup>5</sup> McCarthy and Prince (1993b) mention two languages which would possibly have the inverse ordering of constraints: Shona and Mohawk (Choctaw is another case in point). The relevant phenomena in these two languages involve word minimality effects and epenthesis. Crucially, no language is known where prosodic boundary effects seem to involve a closer attachment of prefixes to the stem than of suffixes.

believe the distinction between prefixes and suffixes follows from these two axioms if they are worked out in the right way.

An interesting proposal to this effect has been made by James Harris, extending work of Steriade (1988), Halle (1990) and Halle and Kenstowicz (1991). The latter authors identified several situations in which rules building metrical structure cannot alter structure that has been built during previous stages of the derivation. Harris (1993) proposed to extend this theory also to the level of syllable structure.

In this way, he explained the contrast between the prefixed form *desecho* 'waste' = [dehečo], in which a rule has applied changing /s/ to [h] in syllable-final position and *deseo* 'desire' = [deseo] in which the same rule did not apply. The reason for this is that *deseo* does not contain a morphological boundary at the relevant site and therefore is syllabified as *de.se.o* (where the dots indicate syllable boundaries.) The /s/ escapes the rule shifting it to [h].

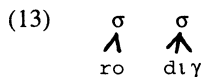
On the other hand, *desecho* is morphologically complex and best analysed as *des+echo*. In this form we first syllabify *echo* and get *e.cho*. It is only after this syllabification process is completed that we add the prefix. But now the structure of the stem can no longer be altered: therefore we get syllabification as *des.e.cho* and a subsequent change of *s* to *h*. (In the phrase level phonology, *h* is subsequently resyllabified in Spanish, so we get *de.he.cho*, but this need not concern us here.)

It is tempting to try to apply this theory to the Dutch facts. I give a sample derivation to make things clear. The word *rodig* is derived in the following way. We start out with the stem *rood*. This form gets one syllable assigned to it on the first cycle: [rod].

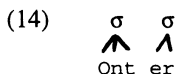
In the second cycle we attach the suffix *-ig*. We immediately start building a syllable on top of this suffix but if we do this, the resulting syllable will violate the constraint stating that all syllables should have onsets. Now assume the following principle of cyclic syllabification:

- (12) **Syllable Integrity:** A syllable  $\Sigma$  can only incorporate segments on the first cycle of  $\Sigma$ 's existence.

This is a specific interpretation of the proposal by Harris (1993). We can only optimize a syllable the moment it comes to its existence. Because we are still on the second cycle, i.e. the first cycle of the existence of *-ig*, we can incorporate the coda-segment of the previous syllable into the onset of the suffixing syllable. Technically speaking, this can be done in at least two ways: we can incorporate the coda constituent completely or we can make the consonant ambisyllabic. I will arbitrarily choose the first option, since I do not see a way to make an empirical distinction between the two proposals at this point:



Now let us turn to the prefixed word *ont+eer* and try to derive this in a cyclic way too. On the first cycle we just have the word *eer*, which syllabifies as [eer.]. This syllable violates the ONSET constraint but since there is no way to repair this violation now, we have to accept this violation. We then prefix *ont-* and start to build syllables on top of it:<sup>6</sup>



Both syllables in this word now violate ONSET, but neither of these violations can be repaired. There is no segmental material to fill in an onset for the first syllable. The second syllable could incorporate the coda segment of the first syllable but according to *Syllable Integrity* (12) it is too late to do that. A syllable can only incorporate material during its first cycle. We are already at the second cycle now whereas the second syllable has been created during the first cycle.

The difference between prefixes and (most) suffixes with respect to resyllabification is now reduced to the fact that in the relevant prefixed forms it is the base that is looking for an onset and in suffixed forms it is the affix itself that is looking for an onset. Because in an affixed form the affix is still not syllabified whereas the base is, the affix is on the right cycle for resyllabification, whereas the base is not.

It is possible to extend this approach to schwa deletion. It has been argued several times in the literature on Dutch schwa that this vowel remains unsyllabified at least at some level of representation. The interested reader is referred to Kager and Zonneveld (1986) and Kager (1989), but here I will only summarize the main arguments for this position:

- (i) Consonant clusters with an increasing sonority level are disallowed before schwa, just like they are disallowed at the end of a syllable. Thus we have *orde* 'order' [Ordə] but not \**odre* [Odrə], we have *Bolke* [bOlkd] (a name), but not \**bokle* [bOkld]. This suggests that the consonants are not licensed by the schwa,

<sup>6</sup> Except perhaps by putting in a slot which is phonetically filled by a glottal stop, so that we get [ont?eren] just like McCarthy and Prince (1993b).



but are incorporated in the previous syllable at some stage in the derivation. We also have possible like [Ort], but not \*[Otr] and [bOlk] but not \*[bOk].<sup>7</sup>

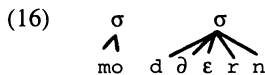
(ii) A consonant like [h] which cannot occur in a coda position (while it can occur in the onset) in Dutch, also is not found before schwa: \*[kəh], \*[kəhə]. On the other hand [ŋ] (the velar nasal) is only found in coda's and never in intervocalic position, *except* if the second vowel is schwa. Again this strongly suggests that the consonants before schwa are licensed by the previous syllable rather than by schwa itself.

(iii) Schwa is invisible for stress assigning rules. If we assume that schwa has no rhyme (or no mora) and stress is built on top of rhymes (or on top of moras) this is easily explained.

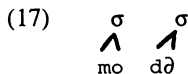
The following structure would be assigned to the word *mode* 'fashionable' in this view:



Now suppose we try to derive *modern* (id.) from this. The first cycle looks like (15). Now we add the suffix and build syllable structure on top of it. This syllable has no onset and because of (12) we can incorporate the coda consonant of the preceding syllable into the onset. Because schwa does not project into the syllable structure at all, it also does not block this resyllabification process:



I assume that at a later stage of the derivation schwa has to receive syllabic interpretation in order to get phonetically interpreted. In (15) there is no problem. The schwa can project into a syllable, creating an onset where possible:



<sup>7</sup> The word *oranje* which I used as an example several times in this paper is an apparent counterexample to this and in effect, this type of word has led Zonneveld (1993) to abandon the notion of schwa presented here altogether. I cannot go into the matter in any detail but will assume the 'old' Kager and Zonneveld (1986) approach here.

However, in order for schwa to project in (16) it would have to break up the structure surrounding it. If we assume that for one reason or another this breaking-up of old structure is not possible, the schwa can only remain stray here and is deleted in the phonetic module by Stray Erasure (Itô 1986).

The process of schwa deletion now is reduced to two independently motivated processes: first, the failure of schwa to project to a syllable, secondly, the cyclic syllabification discussed above. It is important to note that we do not need any ordering of the processes, unlike the approaches in Boundary Theory and Prosodic Phonology, presented above, where it was necessary to extrinsically order schwa deletion and syllabification.

It is probably clear that this also works for prefixes, but let me briefly discuss *geacht*. The first cycle is unproblematic. We syllabify *acht* into one syllable, which by necessity violates ONSET. Subsequently we add *ge-*. Nothing happens at the lexical level after this step. Schwa does not form a syllable of its own, and it is too late to incorporate *g* into the syllable of the base (which should have happened during the very first cycle, if anytime). In the postlexical phonology, schwa is free to form its own syllable and we get *ge.acht* as a result. No Stray Erasure has to apply here: schwa is not deleted. Again, the distinct behaviour of prefixes and suffixes does not have to be stipulated in any way. It follows from the general workings of the system.

We can now understand the behaviour of consonant-initial suffixes like *-ling*. This suffix starts with a consonant and therefore is not in need of an onset. Apparently, the Syllable Contact Law all by itself is not a sufficient driving force for resyllabification.

A potential problem for the integrity analysis is the vowel-initial Class II suffix *-achtig*. In our analysis, being vowel-initial means behaving as Class I for a suffix. Yet Booij (1977) already observed that Class I suffixes did not just start with a vowel: they also were either monosyllabic or bisyllabic where one of the two syllables contained schwa. If the conjectures I made above are correct and schwa does not project a full syllable, this means that class I suffixes are monosyllabic.<sup>8</sup> The suffix *-achtig* on the other hand is a really bisyllabic suffix (I assume the underlying form is  $[\alpha\chi t\iota\chi]$ , not  $[\alpha\chi t\partial\chi]$ ).

Now it is known from the analysis of other languages that bisyllabic suffixes tend to behave more as independent units than monosyllabic or subsyllabic ones. The most well-known example probably is Yidin'. Dixon (1977) divides the class of suffixes in this language into two classes: the first is the class of *cohering suffixes*, which integrate into the prosodic structure of the base, the second the class of *noncohering suffixes* which do not integrate. All noncohering suffixes are

<sup>8</sup> Like Booij (1977) I have to abstract away from the suffixes *-iteit*, *-iseer*, *-iaan* and *-ieus*, which are bisyllabic and Class I. Booij (1977) suggests that these are 'loan suffixes'. Another may be to view the initial vowel of these suffixes as a kind of theme vowel.

bisyllabic, all non-cohering suffixes have less structure. The classic example is the different behaviour of the verbalizing suffixes *-Na* and *-daga*, both of which can be attached to an adjective:

- |                              |   |
|------------------------------|---|
| (18) <i>adjective</i>        | <i>derived verb</i>                         |
| milba 'clever'               | milba-Na-l-ñu 'made clever'                 |
| guma:ri 'red'                | gumari-Na:-l 'made red'                     |
| gud <sup>y</sup> u:l 'dirty' | gad <sup>y</sup> ula-Na:-l 'made dirty'     |
|                              | milba-daga:-ñ 'became clever'               |
|                              | guma:ri-daga:-ñ 'became red'                |
|                              | gad <sup>y</sup> u:l-daga:-ñ 'became dirty' |

The shape of cohering suffix *-Na* is dependent on the number of syllables in the stem and furthermore, this suffix changes some aspects of the shape of the preceding stem. On the other hand, the noncohering suffix *-daga* does not change its stem and always has the same structure itself. *-daga* therefore forms a Prosodic Word of its own. It is to be a property of many languages that polysyllabic affixes and function words behave more like independent elements phonologically than smaller units. In the analysis of Hewitt (1992), prosodification in Yidin<sup>y</sup> is cyclic and furthermore there is tendency to *Vertical Maximization*: higher-order prosodic structure is built as soon as possible. As a consequence there is a preference for suffixes to get their own Prosodic Word. Now whereas this is possible for bisyllabic suffixes which by themselves can meet the restriction on Prosodic Minimality, this is not the case for monosyllabic suffixes. The latter therefore have to be incorporated into the Prosodic Word of the base.

Whatever the precise explanation for the contrast in Yidin<sup>y</sup> may be, it could give an analysis for the behaviour of *-achtig*, the only noncohering suffix of Dutch, as well.

## 5. Conclusion

The notion of Syllabic Integrity as proposed by Harris (1993) offers an interesting view on the difference between Dutch prefixes and suffixes with respect to syllabification. I feel the need to stress that two theoretical tools have not been argued against. The first of these is Optimality theory -- even though I have argued against the morphology-phonology interface approach of Generalized Alignment, the proposal made here is neutral with respect to Optimality Theory, or for that matter Generalized Alignment as applied to directionality of foot assignment, the syntax-phonology interface or other areas. The second is the analysis of Dutch morphology as one consisting of several levels of representation as in Lexical Phonology. I have shown that the syllabification behaviour is not ex-

plained by nor dependent on such levels - but it might well be that we need to distinguish lexical levels in Dutch for other reasons; for instance, to solve Langeweg's problem.

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