# Splitting morphology

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## *0. Introduction*

In this paper we will try to reconcile two opposed approaches to morphological derivation, viz. morpheme-based and process-based theories.[1] The former are based on the assumption that all derivation is the result of concatenating stems and affixes. The properties of a derived item then follow from the properties of the morphemes involved via some general mechanism. This view leads to serious problems in explaining morphological processes where no concatenation of morphemes takes place (e.g. conversion), or where the 'wrong' concatenation of morphemes with regard to other components of the grammar seems to be involved (i.e. bracketing paradoxes). Instead of relating morphological derivation directly to the morphemes involved, process-based theories, therefore, propose a radical separation between morphological derivation and affixation.

In this paper, we will sketch the outlines of an approach that incorporates the advantages of both approaches. First, we will discuss the respective (dis)advantages of both theories in some more detail in section 1. Then, in section 2 a theory is proposed which maintains the claim that all derivation is affixation, but which, at the same time, separates morphosyntactic affixation processes from their phonological reflex. In section 3, we will show how this works out for some problematical processes.

## *1. Morpheme-based theories versus process-based theories*

The basic claim of morpheme-based theories can be phrased as 'all derivation is affixation'. The idea is that morphological structures are built in the same way as syntactic structures, the only difference being that in syntax the concatenation involves words, while in morphology the concatenation involves morphemes. In this view, morphological structure, like syntactic structure, can be generated via a set of context-free rewrite rules. Such rules have been proposed in e.g. Selkirk (1982) and Lieber (1989).

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The main virtue of this approach is that it severely restricts possible derivational relationships between words (see Williams 1981a). The properties of derived words can be made to follow from restrictive and independently motivated morphosyntactic principles and need not by stipulation be ascribed to the various derivational processes as such. However, there are some serious problems.

The first type of problem consists of those cases where the concatenation imposed by the syntax or semantics leads to an order of affixation which is phonologically unacceptable: the well-known bracketing paradoxes.

The second type of problem is even more serious: there are cases in which word formation does not seem to involve concatenation of morphemes at all, like conversion, where two words are related while no affix appears to be involved. These problems seriously undermine the 'derivation is affixation' claim. Therefore, some authors have claimed precisely the opposite: derivation is strictly separated from affixation.

For example, Beard (1987, 1988) outlines a morphological model which separates derivation from affixation (the Separation Hypothesis). Derivation is regulated via so-called L(exical)-rules. These rules add or change features of the base, concerning e.g. its lexical category, syntactic valency or semantics. The L-rules are situated in syntax between D-structure and S-structure, although apart from the truly syntactic rules. In another component of the grammar (PF), which is ordered after the L-rules, affixation is regulated via another type of rules, which Beard calls M(orphological)-rules. Triggered by certain features of the derivative, these rules insert specific phonological strings and they are essentially phonological in character.

The main advantage of this approach is that it actually predicts that other means than concatenation can be employed in derivation. When the L-rules have provided a base word with certain features, M-rules can be applied which attach phonological affixes to the base. However, nothing rules out the possibility that *no* M-rule applies. Thus, the theory automatically incorporates the phenomenon of conversion: the same processes apply both in cases of overt affixation and conversion, but in the latter case no phonological string happens to be inserted at PF by an M-rule.

Furthermore, Beard (1990) claims that this model can give a more elegant account of morphological polysemy. For instance, the Dutch suffix *-er* can express a variety of semantic categories, like agent noun, instrument noun, etc. A theory which identifies derivation with affixation can only explain this by assuming several affixes *-er*. Beard's model predicts this phenomenon to occur: there is just one phonological suffix *-er*, but it can be attached by the M-rules to differently specified bases.

As a final advantage, note that bracketing paradoxes can never arise in this model. The morphosyntactic rules deriving the word make no reference

to affixes; consequently, at PF these affixes can be inserted in the phonologically desired order.

However, maintaining a radical separation between derivation and affixation also leads to serious problems. Note that the inherent claim of the Separation Hypothesis is that the rules responsible for affixation cannot be conditioned by the derivational history of the word. As a consequence, the theory is unable to distinguish underived words from derived ones. The output of the L-rules are derived words with specific values for specific features. However, there may be underived words that are specified in exactly the same way. The M-rules crucially refer only to these features, not to the way the word acquired them; if we would link the M-rules to the derivational history of the word, there would be no separation any longer. Consequently, we could (incorrectly) apply M-rules to underived words or not apply M-rules to derived words (also in cases other than conversion).

Take, for example, the Dutch process of *-er* suffixation, which can result in instrument nouns, like *opener*. There are also underived instrument nouns in Dutch, like *tang* ('pincers'). The M-rule responsible for the insertion of *-er* should only be sensitive to features like [+Noun] and [+Instrument], not to the derivational history (or absence of it). If this M-rule is obligatory, the implication is that *tang* (and other underived instrument nouns) are ungrammatical and one expects affixed forms like **tanger* instead. On the other hand, if the pertinent M-rule is optional, one expects that *open* can be interpreted as an instrument noun, which it cannot. Note that in a morpheme-based model this problem does not arise. There, it is the affix *-er* itself that is responsible for the categorial change, and since *-er* does not productively attach to nouns we cannot derive **tanger*. (1) and (2) contain the relevant derivations under both approaches.

(1) Process based

| stem: | *open*<br>[+V,-N]<br>[Agent, Theme, (Instrument)] | *tang*<br>[+N,-V]<br>[+instr] |
|---|---|---|
| L-rule deriving instrument nouns from verbs: | *open*<br>[+N,-V]<br>[+instr] | not applicable |
| M-rule attaching *-er* to [+instr] nouns | | |
| a. if applying: | √$opener_N$ | *$tanger_N$ |
| b. if not applying: | *$open_N$ | √*tang* |

(2) Morpheme-based
*-er*: $[V\ \text{--}]_N$ $\quad$ $\surd[[\text{open}]_V\ \text{er}]_N$ $\quad$ $*[[\text{tang}]_N\ \text{er}]_N$

Similar problems arise in view of the fact that in many cases there *is* a one-to-one correspondence between the order of addition of features to a base and the order of affixation. This is effectively the content of Baker's (1985) Mirror Principle. If the rules responsible for the insertion of the affixes cannot be conditioned by the derivational history of the word, this phenomenon would remain unexplained.

Beard (1990) notices this problem and tries to resolve it by assuming that the L-rules give rise to layered feature-bundles on a word. Each time an L-rule applies, the features already present are pushed one layer down. At PF, the M-rules first operate on the deepest level, then on the next higher one and so on from bottom to top. Note that this would also solve the problem indicated above, because exactly this procedure enables the M-rules to distinguish derived words, containing at least two layers of features, from underived ones, which contain only one.

However, this move basically seems to be in conflict with the primary goal of the Separation Hypothesis, because it boils down to re-establishing a direct link between derivational and affixational processes. Each derivational process creates one new layer of features and each M-rule is sensitive to one such layer. This amounts to claiming that there is a one-to-one relation between L-rules (derivation) and M-rules (affixation), which is precisely the claim underlying morpheme-based approaches.

Therefore, on the one hand, one would like to say that all derivation is affixation, because of the restrictive nature of such a theory, while on the other, one would also like to separate derivation from affixation, simply because not all derivation consists of concatenation of affixes. We will deal with this paradoxical situation in the next section, and try to formulate a resolution that has the best of both worlds.

## 2. *Distinguishing syntactic affixation and phonological affixation*

As noted above, we would like to claim both that derivation is affixation and that derivation is not affixation. Although this seems a logical impossibility at first sight, this is not so if the term 'affixation' does not refer to the same thing in both statements. We think that precisely this is the case. In the first statement we are dealing with an abstract process of affixation, i.e. a morpho-syntactic process of creating X-bar structures. In the second statement we are dealing with the actual implementation of phonological strings in these structures. Thus, basically we adopt Beard's Separation Hypothesis, with one crucial difference: the 'L-rules' are not just rules adding or changing features

of the base, with virtually no restrictions, but consist of morphosyntactic operations, to wit the addition of abstract affixes, thereby building (X-bar) structures that are subject to general syntactic principles. To distinguish this process of (morpho-)syntactic affixation from its actual phonological reflex, we will henceforth speak of AFFIXATION and AFFIXES in reference to the morphosyntactic process and of *affixation* and *affixes* in reference to the morphophonological process. We are now able to formulate our stand as follows: all derivation is AFFIXATION, but derivation is separated from *affixation*.

In many occurrences, there will be a one-to-one correspondence between AFFIXES and *affixes*. If this is the case, our approach is in effect identical to that of Sproat (1985) (cf. also Marantz 1984). In Sproat's model, the connection between morphosyntactic structure and morphophonological structure is determined via individual affixes. Thus, the lexical entry of each individual affix comprises both a morphosyntactic and a morphophonological representation of the affix. The morphosyntactic part specifies the lexical category the AFFIX belongs to and the categories to which it can attach; the morphophonological part specifies whether the *affix* is a *prefix* or a *suffix* (and its phonological form). In (3), examples are given for *-less* and *-ness*:

(3) $\text{LESS'} = \langle \text{LESS}_{\langle N,A \rangle}, \text{-less} \rangle \qquad \text{NESS'} = \langle \text{NESS}_{\langle A,N \rangle}, \text{-ness} \rangle$

The category labels between the brackets indicate, respectively, the input and the output category of the AFFIX in question. In other words, -LESS is an AFFIX which derives adjectives from nouns, while -NESS derives nouns from adjectives. Using these specifications, we can build morphosyntactic structures like the one in (4).

(4) $[[[\text{FEAR}]_N \ \text{LESS}_{\langle N,A \rangle}]_A \ \text{NESS}_{\langle A,N \rangle}]_N$

Leaving the details of Sproat's mapping mechanism between the syntactic and the phonological structure aside, it is crucial to note that this connection is exclusively established by means of the lexical entries of individual affixes. This seems to imply that for Sproat there should always be a one-to-one relation between a syntactic AFFIX and a phonological *affix*, because these are just two sides of the same coin.

In our framework this is different, because AFFIXATION and *affixation* are two distinct processes, operating independently from one another. Of course, there must be some mapping between both structures, but this does not necessarily imply a one-to-one correspondence between syntactic and phonological positions. In section 3 we will give an illustration of some advantages of this approach.

A further difference between our approach and Sproat's concerns the linear order of the morphemes. According to Sproat, linear order is irrelevant as far as morphosyntax is concerned. Linear order is determined by the

morphophonological specification of the *affixes*, in particular by the fact whether an *affix* is specified as being a *prefix* or a *suffix*. We think there are good reasons to deal with linear order in morphosyntax.

First, no principled reason for the linear orders one encounters can be given if this order is determined by the accidental fact whether the *affix* used is a *prefix* or a *suffix*. Being a *prefix* or a *suffix* must be regarded, as Sproat does, as a phonological characteristic. However, there seems to be no phonological reason why in e.g. English category-changing *affixes* must be *suffixes*. So, the fact that languages seem to have a preference for either category-changing prefixes (e.g. Bantu languages, see Van Beurden 1988) or category-changing suffixes seems to be a coincidence under this view.

Second, compounds pose a problem for this approach. If neither morpheme in a complex word is a *prefix* or a *suffix*, the order is undetermined in Sproat's system. Nevertheless, compounds are not ambiguous between a reading where the lefthand part is the head and a reading where the righthand part is the head. So, apparently there must be morphosyntactic principles to regulate morpheme order anyway. But if this is the case, we might wonder if these principles cannot be made to apply to AFFIXES as well. This is not to deny that every *affix* must have a phonological specification for *suffix*- or *prefix*hood, to preclude a *prefix* being inserted after a *stem*. However, whether there are PREFIX-positions or SUFFIX-positions must be determined by syntactic principles. In other words, in our opinion the linear order of the morphemes should be accounted for in syntax, not in phonology.

Let us give a simple illustration of the way the system we have in mind works. Consider again the English suffix *-less*, forming adjectives from nouns. This is syntactically expressed in an X-bar system by stating that there is a head A which selects a nominal complement. The morphosyntactic structure of e.g. *fearless* will therefore be as follows.

(5) $[[\text{"FEAR"}]_N \ \text{NEG}_A \ ]_A$

At some level of representation, the phonological *stems* and *affixes* must be inserted.[2] The question arises which aspects of the morphosyntactic structure should be represented at this level. For phonological interpretation only the linear order of the words or morphemes seems to be relevant, not the hierarchical relations between them (cf. Sproat 1985, Spencer 1991:420). In other words, PF is like S-structure run over by a bus. The PF-representation of (5) therefore looks as follows.

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[2] For the sake of simplicity, we will call this level PF here. However, insertion should take place at a level where the syntactic structure is not totally eradicated. Therefore, we believe that this insertion takes place at an intermediate level between S-structure and phonology proper.

(6) noun-stem meaning 'fear' - negative adjectivizing suffix

The insertion of the right morphemes into this PF-structure is mediated via the semantic characteristics in ((5) and thus in) (6), which must correspond with those associated with the *affix* or *stem*; this link is established via individual lexical entries.

However, as pointed out above, there does not need to be a one-to-one correspondence between AFFIXES on the one hand and *affixes* on the other. The mapping procedure must be a relation which takes the terminal nodes of the syntactic tree as input and assigns each of these an arbitrary number of corresponding *affixes* and *stems*. Schematically, if S is the set of syntactic MORPHEMES and P is the set of phonological *morphemes* then the relation between the two might look like e.g. (7).

(7)
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A  B  C  D  E  ...  S
|  |  \  \  |
a  b  c  d  e  ...  P
```

We argued above that the linear order of the morphemes is determined in syntax. This implies that we have to impose a restriction on the mapping between syntax and phonology, such that the arrows in (7) may not cross.[3] In other words, the following condition on the mapping exists (where '-->' means 'maps onto' and '<' means 'precedes').[4]

(8) Let X,Y be MORPHEMES, x,y be *morphemes*
If X --> x and Y --> y then X<Y => x<y

This condition precludes a *prefix* from being inserted when syntactically there is a SUFFIX present or vice versa. In section 3.1. some additional evidence for (8) will be given.

Note that, although the number of affixes corresponding to an AFFIX is arbitrary in principle, there is a strong preference not to have too many 'empty' positions on either side (where an empty syntactic position is an AFFIX with no phonological reflex and an empty phonological position is an

[3] There might be a formal correspondence here with the No Crossing Constraint known from autosegmental phonology, cf. Goldsmith (1976)

[4] In languages showing nonconcatenative morphology this is blurred by the fact that the phonological affixes are inserted on different autosegmental planes. However, syntactically speaking, these languages are as configurational as concatenative languages; see e.g. McCarthy (1981) and Lieber (1988) for discussion.

affix without a syntactic counterpart).[5] Plausibly, this is because there is a general one form - one function preference (Von Humboldt's principle).

Summarizing so far, we have split morphology into two distinct components, a syntactic one and a phonological one. This distinction between morphosyntactic structures (containing the morphological AFFIXES) and phonological structures (containing the phonological *affixes*) will enable us to say that the morphosyntax of words is always configurational (and thus principally restricted) in nature, as we will see in the next section.

## 3. *Applications*

*3.1. Bracketing paradoxes.* Consider the morphological X-bar structure in (9).

(9) $[[[N]_N\ A]_A\ N]_N$

This structure underlies well-formed words like *artfulness*, but also unwellformed ones like **fearlessity*. Because (9) is a correct syntactic structure, both words are syntactically well-formed. However, the latter is not so phonologically. As is well-known, the affix *-less* is a stress-neutral, or '#'-boundary, or class II affix, while *-ity* is a stress-attracting, or '+'-boundary, or class I affix. It is important to note that this is a phonological property of these *affixes*, not a syntactic one. Now, let us assume that the insertion of these phonological *affixes* is conditioned by the following principles. The first principle follows from assuming Level Ordering at PF, the second one from interpreting the Stray Affix Filter as a condition on lexical insertion at PF.

(10) Class I affixes must be attached before Class II affixes
(11) An affix must be attached to a phonological base

From this, the phonological unwellformedness of *fearlessity* follows directly. Condition (10) requires that *-ity* be attached before *-less*; (11) requires that in that case it must be attached to the stem. Now, if *-less* is inserted, it cannot split up the already constructed string. Therefore, it must attach to its right-hand side, but this necessarily leads to a violation of the condition in (8), cf. (12).

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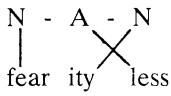
[5] Examples of AFFIXES without corresponding *affixes* will be given in section 3.2. Examples of affixes without corresponding AFFIXES are linking morphemes like the *s* in *frühlingshaft* 'spring-like', *voorjaarsmoeheid* 'spring-tiredness', etc. Examples of one-to-many and many-to-one mappings are respectively overdetermination (like Dutch *kind* 'child' - *kind-er-en* 'children', where one plural AFFIX corresponds to two *affixes*) and underdetermination (like German articles, e.g. *einer*, where *-er* expresses both gender, number and case).

(12)




Thus, although the AFFIXATION of *fearlessity* is perfect, the phonological implementation of the *affixes* will always go wrong.

With this in mind, the analysis of bracketing paradoxes becomes straightforward. Consider e.g. *unhappier*, which, on the basis of its meaning, must have the following morphosyntactic structure.

(13) $[[\text{NEG } [\text{"HAPPY"}]_A]_A \text{ COMPARATIVE}]_A$

Here we have two AFFIXES, the comparative and a negative PREFIX. Consider now the PF-structure of the word in (14).

(14) negative prefix - stem (with meaning 'happy') - comparative suffix

First, the stem *happy* will be inserted in this structure. Now, as is well known, there is a phonological condition on *-er* affixation such that it cannot occur after (a.o.) trisyllabic words. Therefore, the comparative *suffix* has to be inserted before *un-* is inserted. Although the comparative SUFFIX is outside the negative PREFIX in S-structure (13), this insertion does not in this case lead to a conflict with the condition in (8). This is because we are now dealing with a *suffix* and a *prefix*, instead of two *suffixes* (or two *prefixes*), and because of the fact that PF is sensitive only to linearity. (So, at PF it does not make a difference whether *-er* or *un-* is inserted first, as long as the conditions in (8), (10) and (11) are obeyed). After *-er* is inserted right adjacent to *happy*, we do not need to break up this string to get *un-* in its proper position. In this way, we explain why bracketing paradoxes can only arise in case of a *prefix* + *suffix* combination, never in case of two *suffixes* or two *prefixes*.

Note that we do not need any rebracketing procedure that derives a phonologically desirable bracketing from the syntactic one (cf. Sproat 1985) or vice versa (cf. Kiparsky 1983), because *affixation* is a procedure that takes place independently of AFFIXATION - there just is a match between (some) AFFIXES and (some) *affixes* linearly. On the other hand, our analysis implies that lexical (phonological) insertion is an ordered process. In fact, this was already implied by the conditions in (10) and (11). For instance, (11) implies that the *stem* always has to be inserted first. We must leave to future research whether this assumption has any further consequences.

*3.2. Mismatches: Conversion.* Conversion shows particularly well how our approach can combine the advantages of both a morpheme-based approach and a Beard-style approach. The advantage of Beard's model in this case is that it predicts the phenomenon of conversion in an elegant way: it is simply

a case where no affixation corresponds to a derivational process. However, assuming a zero-affix to be involved in conversion also has advantages. The obvious one is that we can derive the properties of a converted word via the properties of the zero-affix, on a par with the way we can explain the properties of overtly derived words in morpheme-based approaches, viz. via X-bar structures and/or the RHR and/or percolation mechanisms etc.

Because we have separated syntactic AFFIXATION from phonological *affixation*, we predict conversion in the same way Beard's theory does. In the case of conversion, there happens to be no corresponding *affix* to an AFFIX. Still, we derive the properties of a converted word in the same way we derive the properties of overtly affixed words: via the properties of the AFFIX.

As an illustration, consider English nominalizations. As noted by Di Sciullo and Williams (1987) and others, the base verb may either retain its Θ-marking capacity or lose it. For instance, in case of *-er* suffixation, the suffix binds the external argument of the verb, but the internal argument can still be assigned:

(15) a libeler of Bill

In case of *-ee* suffixation on the other hand, the suffix binds the internal argument of the verb, but the external argument is not inherited:

(16) *a libelee by Bill

Di Sciullo and Williams explain this difference as follows. In principle, only the head of the word determines its argument structure. However, some heads, the so-called functors, compose their argument structure with that of the non-head. The contrast between (15) and (16) is explained by assuming that *-er* is a functor which combines its own argument structure with that of the verb, while *-ee* is not a functor. According to Di Sciullo and Williams (1987:39) the behavior of nominalizations that are formed via conversion supports this view. In these cases, argument inheritance is impossible:

(17) a *the hit of Bill
b *the kick of Bill

Although Di Sciullo and Williams defend a morpheme-based framework, conversion receives an exceptional treatment. The nominalizations in (17) are supposed to be formed via the special rewrite rule in (18), which is an instance of the general conversion rule X-->Y (Williams 1981a).

(18) N → V

This rule is headless; the V does not share the same features with the N of course and so cannot be its head. Because the non-head V cannot contribute anything to the argument structure of the whole word in the absence of a

functor head, this should explain the ungrammaticality of the examples in (17).

However, several difficulties arise. Di Sciullo and Williams themselves note that if there is no head, it is inexplicable that the converted nouns in (17) do have an argument structure, consisting of the external R-argument characteristic of nouns (cf. Williams 1981b). If there is a head N, this would be straightforwardly accounted for. We might add to this that it is also hard to explain where the nominal features of the derived N come from in the first place if there is no head. In syntax, one of the main principles of X-bar theory is that every phrase must be headed. A word group can only be an XP by virtue of the fact that its head is an X. A headless rewrite rule is excluded by X-bar theory. Therefore, we think it is not very felicitous to introduce such a mechanism in morphology to account for conversion.

Moreover, it creates a redundancy in the theory, in that there are now two distinct ways of explaining why arguments are not inherited: either the head is not a functor or there is no head. We could equally well say that there is a head in (17), but that it is not a functor. That this is preferable not only conceptually, but also empirically, becomes clear if we take into account cases in which there is argument inheritance in conversion, as in Dutch (19).

(19) de koop/bouw/sloop van het huis
the buy/build/demolish of the house

Within Di Sciullo and Williams' model, there must a functor present in these cases, which can only be a zero-head. So, we see that there are good reasons to assume a headed structure, or in fact two headed structures as in (20), underlying *all* nominalizations, those with affixes as well as those without.

(20) a [[ V ] N(functor)]$_N$ b [[ V ] N(no functor) ]$_N$

Our model makes it possible to say that in all cases of conversion there is a head, while at the same time there isn't. There is a head syntactically speaking - an AFFIX - but there is no head phonologically speaking - no affix. In other words, these are cases of words that are syntactically DERIVED, but phonologically *underived*. As argued above, this seems precisely what is needed in case of conversion.[6]

[6] Our model also predicts that not only can there be mismatches between AFFIXES and *affixes*, but also between STEMS and *stems* and between WORDS and *words*. This seems to be correct. A case where a word is syntactically simplex, but phonologically complex because of a mismatch between STEMS and *stems* might be formed by Dutch inseparable compound verbs (one STEM corresponding to two stems). Cases where one phonological *word* seems to correspond to two syntactic WORDS are well-known: we are dealing with cliticization here.

## 4. Conclusion

A theory that incorporates both the Separation Hypothesis and a configurational view on derivation seems desirable. We have obviously not given a completely worked out theory here. Nevertheless, we hope that the potential advantages of such a theory have become clear: derived words and their properties can be made to follow from relatively simple X-bar principles and other regular syntactic mechanisms, while at the same time there need not necessarily be a direct phonological reflex of this syntactic structure.

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