POSTPRINT

DIAGNOSTICS FOR PROSODIC WORDS REVISITED:
THE CASE OF HISTORICALLY PREFIXED WORDS IN ENGLISH*

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0. *Introduction*

The prosodic word (henceforth pword) has been defined as "the lowest con-
stituent of the prosodic hierarchy which is constructed on the basis of mapping
rules that make substantial use of nonphonological notions" (Nespor & Vogel
1986:107). That is, unlike the boundaries of feet or syllables pword boundaries
must align with (morpho)syntactic boundaries. While linguists seem to agree
that languages may differ regarding the questions of whether and which word-
internal constituents (e.g. stems, prefixes, suffixes, members of compounds)
form a pword there is no consensus regarding the question of which diagnostics
are relevant for determining pword structure. In fact, in some descriptions
pword structure is motivated primarily on the basis of nonphonological proper-
ties like semantic analyzability or the productivity of affixes (cf. Hannahs
1995, Wennerstrom 1993). It is the aim of this study to help clarify the validity
and status of the various diagnostics proposed in the literature by identifying
and analyzing the systematic correlations between various types of
phonological and non-phonological properties in historically prefixed words in
English.

    Since Aronoff & Sridhar (1983) there has been a consensus that there are
word-internal pwords in English which are derived from morphological struc-
ture with crucial reference to affix subclasses (cf. the use of distinct affix-
linked boundary strengths in Chomsky and Halle 1968). Consider Szpyra's

algorithm for mapping morphological structure onto prosodic structure in (1a) which is illustrated in (1b) (cf. Szpyra 1989):

(1) a $[] \rightarrow ([])_\omega$ where $[]$ can contain any number of left and right brackets, but no internal occurrences of $][$.

b $[in+[moral]_A]_A$ $\rightarrow$ $([in+[moral]_A]_A)_\omega$

     $[[un+][ripe]_A]_A$ $\rightarrow$ $([[un+])_\omega([ripe]_A]_A)_\omega$

     $[[in+[polite]_A]_A[ness]]_N$ $\rightarrow$ $([[in+[polite]_A]_A)_\omega([ness]]_N)_\omega$

     $[[[un+][grammatical]_A]_A ity]_N$ $\rightarrow$ $([[[un+])_\omega([grammatical]_A]_A ity]_N)_\omega$

As is illustrated in (1b), prosodic structure is largely determined by the lexical representations of the affixes shown in (2), which encode their class-member-ship (cf. Szpyra 1989:185):

(2) | | suffixes | prefixes |
|----------|-------------------|-------------------|
| Class I | +X (e.g. +ity) | X+ (e.g. in+) |
| Class II | [+X] (e.g. [+ness]) | [X+] (e.g.[un+]) |

Prefixes and suffixes are each divided into two classes on the basis of their combinability with "stems", "words", or other affixes[1] as well as their phonological and semantic properties. Some of the correlations which have been posited for the two affix classes are shown in (3) (cf. Chomsky and Halle 1968, Siegel 1974, Aronoff 1976, Allen 1978, Kiparsky 1982, Selkirk 1984):

(3)

properties:	Class I affixes:	Class II affixes:
morphological:	♦ can attach to non-word bases ♦ unproductive	♦ attach to words only ♦ productive
phonological:	♦ stress-determining ♦ trigger Nasal Assimilation ♦ trigger Trisyllabic Laxing	♦ stress-neutral ♦ block Nasal Assimilation ♦ block Trisyllabic Laxing
semantic:	♦ yield idiosyncratic meaning	♦ yield compositional meaning

As the correlation of the properties in (3) is generally presupposed in genera-tive descriptions of English the debate has focused on the question of how to account for them in a generative model. As is illustrated by Szpyra's algorithm in (1a) the basic approach to this question in terms of pword structure is to

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[1] The claim that the class membership of affixes restricts their combinability is known as the Affix Ordering Generalization (cf. Siegel 1974). There is considerable evidence against the Affix Ordering Generalization (cf. Aronoff and Sridhar 1983, Raffelsiefen 1992).

integrate class I affixes, but not class II affixes, into the pword of the stem. As for the causal relatedness between the three types of properties in (3) it is generally assumed that they all are directly determined by the class membership of the affixes. For example, lack of productivity or semantic idiosyncrasy are considered inherent class I properties, whereas productivity and semantic compositionality are considered inherent class II properties. The description of derived words thus amounts to the proper identification of the class membership of the affixes where the properties contrasted in (3) serve as diagnostics for affix classification (cf. Aronoff and Sridhar 1983, Booij and Rubach 1984, Nespor and Vogel 1986, Szpyra 1989, Inkelas 1989, Lieber 1993, Hannahs 1995).

Based on a study of English words historically derived by prefixation I will present evidence against the affix-class based approach to pword structure. Specifically, it will be shown that affix-inherent properties such as assimilation and productivity fail to correlate with other phonological and semantic properties of derived words. While there is evidence against the affix-class based correlations in table (3) some of the properties listed there do indeed correlate and indicate a subdivision of historically prefixed words into two types: those which conform phonologically to simplexes (i.e. single pwords) versus those which show certain phonological "irregularities" indicating that the prefix constitutes a separate pword. There is some evidence that words with category-determining prefixes belong to a third type in which the prefix is neither completely integrated into the prosodic structure of the stem nor forms a separate pword. To account for the observation that only words in which the prefix forms a separate pword have compositional meaning I propose a hearer-based model in which semantic interpretation is determined by the prosodic parsing of phonetic input structures.

The article is structured as follows. In section 1 I investigate the question of which phonological diagnostics for pword structure correlate in English prefixed words. The systematic correlation between morphosyntactic and prosodic properties of historically prefixed words is analyzed in section 2. It is argued there that conditions on the prosodification of loanwords and on the historical fusion of pwords can be stated only in a hearer-based model which describes the prosodic parsing of phonetic input strings. The relation between the prosodic and the semantic structure of historically prefixed words is the topic of section 3. In section 4 the prosodic representation of words derived by category-determining prefixes is discussed. In section 5 I address the question of whether the diagnostics for pwords established for English hold cross-linguistically. The conclusions are presented in section 6.

1. *Phonological diagnostics for pword structure*

1.1 *Nasal Assimilation*

Consider the different relative prominences in the adjectives in (4a) and (4b):

(4) a   rétrogràde   b   ùnafráid
         tácitùrn   ùncorrúpt
         débonàir[2]   ùnawáre
         dífficùlt   ùnadúlt
         érudìte   ùnalíke
         mánifèst   ùnimpréssed
         béllicòse   ùnoppósed
         ásinìne   ùninclíned
         dérelìct   ùnreláxed

In underived three-syllable adjectives with final stress, the word-initial syllable has regular main stress. This generalization is stated by the redundancy rule in (5) where "x" indicates a stressed syllable and "$\_$" indicates an unstressed syllable.[3]

(5)   If: $[x \_ x]_A$

                 ⋀
                s   w
       Then: $[x \_ x]_A$

The fact that the three-syllable adjectives in (4b) violate rule (5) correlates with their morphological structure: in contrast to the adjectives in (4a) each adjective in (4b) has the structure [prefix][word] with a strictly compositional meaning (cf. sections 2 and 3). The fact that every adjective with the irregular stress pattern illustrated in (4b) has the structure [prefix][word] indicates that the prefix in those adjectives forms a separate pword as is shown in (6b).

(6) a   (retrograde)$_\omega$ b   (un)$_\omega$(afraid)$_\omega$

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[2] Only words with a special stress-attracting ending are exceptions to the generalization that three syllable adjectives or nouns do not have final main stress (e.g. the ending *-air*, or word-final syllables with high tense vowels). Final main stress in such words is always unstable and tends to shift to the initial syllable (the symbol ">" denotes historical sound changes):

(i)   -[ɛr]   (dèbonáir)$_\omega$ >   (débonàir)$_\omega$ (mìllionáire)$_\omega$ >   (míllionàire)$_\omega$
          -[iC]   (òbsoléte)$_\omega$ >   (óbsolète)$_\omega$ (màgazíne)$_\omega$ >   (mágazìne)
          -[uC]   (àbsolúte)$_\omega$ >   (ábsolùte)$_\omega$ (màcaróon)$_\omega$ >   (mácaròon)$_\omega$

[3] The rule in (5) also applies to nouns (e.g. (húrricàne)$_\omega$, (ántelòpe)$_\omega$, (ánecdòte)$_\omega$, (cándidàte)$_\omega$, (mísanthròpe)$_\omega$).

Specifically, assuming the prosodic structures in (6) the distinct stress contours of the adjectives in (4a) versus (4b) can be explained by positing the rules in (7):

(7) a If: $([x\_x]_A)_\omega$ b If: $(\text{prefix})_\omega(\text{word})_\omega$

Then: $\overset{\displaystyle\frown}{\underset{([x\_x]_A)_\omega}{\text{s}\quad\text{w}}}$ Then: $\overset{\displaystyle\frown}{\underset{(\text{prefix})_\omega(\text{word})_\omega}{\text{w}\quad\text{s}}}$

Rule (7b) determines the relative prominence relation between pwords regardless of their internal stress contour and applies without exception to prefixed verbs and adjectives. Only certain types of nouns have main stress on the prefix.[4]

Assuming rules (7a, b) the placement of main stress indicates that the prefix *un-* in the adjectives in (4b) constitutes a separate pword. In general, relative prominence is a reliable diagnostic for all three-syllable adjectives with final stress: word-initial main stress indicates that such adjectives consist of a

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[4] Nouns which are derived by a prefix which ends in a bilabial or velar consonant have the prominence pattern strong - weak. The examples in (i) show that this exceptional relative prominence pattern is indeed restricted to nouns:

(i)   súbcùlture, súbdivision   sùbatómic, àbnórmal
       círcumcènter, círcumcircle   cìrcumfúse

The examples in (ii) show the relevance of the place of articulation of the prefix-final consonant for relative prominence:

(ii)   stépbròther, stéppàrent   twìnbróther
   ár[k]àngel   àr[č]bíshop

The generalization here is perhaps that noun prefixes with a non-canonical form tend to have compound stress (i.e. strong weak) where non-canonical prefixes are those with a non-coronal coda consonant. This generalization does not pertain to prefixes in which the non-coronal coda consonant is due to nasal assimilation (cf. *imbálance, i*[ŋ]*cáution*).

The second type of nouns with the prominence pattern strong - weak includes all nouns which are converted from verbs in which the prefix forms a separate pword. This exception is perhaps motivated by a constraint to avoid homophony with respect to the prefixed base. Such conversions typically involve verbs with monosyllabic stems. Examples are given in (iii):

(iii) $\overset{\displaystyle\frown}{\text{w}\quad\text{s}}$ $\overset{\displaystyle\frown}{\text{s}\quad\text{w}}$
       $[(\text{mìs})_\omega(\text{prínt})_\omega]_V \rightarrow [(\text{mís})_\omega(\text{prìnt})_\omega]_N$
       $[(\text{prè})_\omega(\text{plán})_\omega]_V \rightarrow [(\text{pré})_\omega(\text{plàn})_\omega]_N$
 $[(\text{rè})_\omega(\text{rún})_\omega]_V \rightarrow [(\text{ré})_\omega(\text{rùn})_\omega]_N$

Unconverted nouns and nouns with a polysyllabic stem generally follow the rule in (7b) (e.g. *mìsalliance, mìsbehávior, mìsbelief, dìsármament, dìsadvántage, dìshármony, àsýmmetry, àsýnchrony* etc.).

single pword (cf. (8a)) whereas final main stress indicates that the prefix forms a separate pword (cf. (8b)). The arrow "$\Rightarrow$" will henceforth be used to relate input phonetic structures to inferred pword structures.

(8) a.
    s   w $\Rightarrow$ b.   w   s $\Rightarrow$

   retrograde   (retrograde)$_\omega$ unafraid   (un)$_\omega$(afraid)$_\omega$
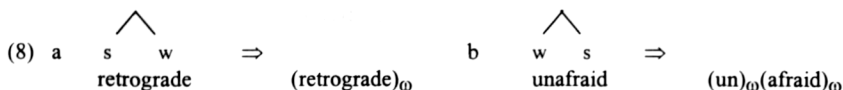
The prosodic parsings in (8) based on the rules in (7) relate to the notion of positive and negative boundary signals introduced in Trubetzkoy (1939). The stress pattern in (8a) is a negative boundary signal in that it indicates the absence of a pword boundary in adjectives. The stress pattern in (8b) constitutes a positive boundary signal in that it indicates the presence of a pword boundary somewhere between the two stressed vowels. Crucially, pword boundaries consistently align with morphosyntactic boundaries.[5]

Turning now to adjectives derived by a prefix which shows nasal assimilation the evidence from stress suggests that there are words in which such prefixes also form separate pwords.[6] For example, the adjective *impolite*, which has final main stress, follows the stress pattern of the prefixed adjective in (8b), rather than the single pword structure in (8a). Compare *impolite* with *erudite*:

(9) a.
    s   w $\Rightarrow$ b.   w   s $\Rightarrow$

    érudìte   (érudìte)$_\omega$ impolite   (im)$_\omega$(polìte)$_\omega$

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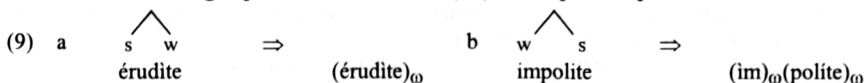
[5] Similarly the relative prominence pattern in the compound *pówer stàtion* as opposed to the noun *fòrestátion* functions as a positive boundary signal as is shown in (i):

(i)
    w   s $\Rightarrow$ s   w $\Rightarrow$

    forestation   (forestation)$_\omega$ power station   (power)$_\omega$(station)$_\omega$
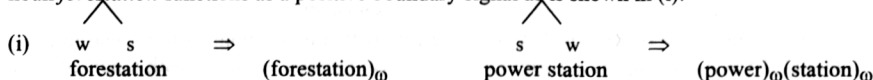
The noun *fòrestátion* has the relative prominence pattern weak-strong because for nouns or adjectives the last stress in a word is regularly the main stress unless it is on the last syllable or the word ends in a liquid or -*y*. The violation of that rule in *pówer stàtion* indicates that the relative prominence pattern is determined by the compound rule in (ii):

(ii)   If: (word)$_\omega$(word)$_\omega$

     Then: s   w

          (word)$_\omega$(word)$_\omega$
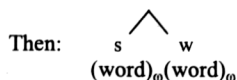
[6] Nasal assimilation can also apply in words derived by *un*-prefixation (cf. *u*[m]*pleasant*, *u*[ŋ]*kind*). This type of assimilation, which also applies in compounds (e.g. *su*[m]*bath*) and phrases (e.g. *ca*[m] *buy*), differs from nasal assimilation in *iN*-prefixations in that it is sensitive to register (i.e. it is most likely to occur in fast or casual speech).

Additional examples are given in (10):

(10)　(im)$_\omega$(matúre)$_\omega$　　　　(in)$_\omega$(corréct)$_\omega$
　　　(in)$_\omega$(distínct)$_\omega$　　　　(in)$_\omega$(exáct)$_\omega$
　　　(im)$_\omega$(precíse)$_\omega$　　　　(in)$_\omega$(diréct)$_\omega$
　　　(in)$_\omega$(discréte)$_\omega$　　　　(in)$_\omega$(corrúpt)$_\omega$

The data reviewed above indicate a conflict between two of the phonological diagnostics mentioned in table (3): the stress patterns indicate that the prefix *iN-* constitutes a separate pword as shown in (9) and (10), whereas nasal assimilation indicates that all those adjectives consist of single pwords. One argument for relying on stress rather than assimilation as a diagnostic for pword structure relates to the fact that all adjectives in (9b) and (10) combine with words (rather than 'stems') and show compositional semantics. In these respects they are identical to the uncontroversial examples in (4b).

There is evidence then that assimilation is not a valid diagnostic for pword structure. The difference in assimilation between the prefixes *un-* and *iN-* is better described in terms of segmental rather than prosodic representation.[7]

The evidence against the putative correlation between nasal assimilation and stress extends beyond relative prominence relations in adjectives. Consider next the stress patterns of the adjectives and nouns in (11), all of which end in an unstressed syllable:

(11)	a		b		c	
		ínnocent		indí[fr]ent		imbálance
		ínsolent		incárnate		immódest
		ímpotent		inférnal		impróper
		ínfamous		incóndite		immóral
		índolent		impórtune		indócile
		ínfidel		impórtant		instáble
		ímpudent		insípid		illégal
		ímbecile		intrépid		imprúdent

The words in (11a) and (11b) follow the regular stress patterns of English adjectives. When the last syllable is unstressed, and the penult vowel is followed by at most one consonant, stress falls on the antepenultimate syllable.[8] Stress on the penultimate syllable is stable only if its vowel is followed by a

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[7] One possible approach refers to underspecification: whereas the consonant in *un-* could be fully specified for the features [nasal] and [coronal] the consonant in *iN-* could be analyzed as lacking specifications for those features.
[8] This generalization does not pertain to British English in those cases where the *r* in the coda has been lost (cf. *incarnate, infernal, importune, important*).

consonant cluster (cf. the boldfaced clusters in (11b)), or in the presence of certain word-endings such as -*id* and -*ic*.[9] As was shown by Nessly (1974), penultimate stress due to vowel length is unstable in English adjectives and nouns. Some examples of historical stress shifts are given in (12) (the symbol ">" will henceforth be used to indicate historical phonological change):[10]

(12)   corónal > córonal   canórous > cánorous
         sonórous > sónorous   vagínal > váginal
         decórous > décorous   abdómen > ábdomen

In view of the historical stress shifts in (12) the stability of penultimate stress in the nouns and adjectives in (11c) needs to be explained. The observation that the "irregular" stress in those words correlates consistently with the morphological structure [prefix][word] and with compositional semantics (e.g. 'lack of balance', 'not modest', 'not proper', etc.; (cf. section 3) suggests that the prosodic structures are as shown in (13c):

(13) a   (ínnocent)$_\omega$ b   (indífferent)$_\omega$ c   (im)$_\omega$(bálance)$_\omega$
         (ínsolent)$_\omega$ (incárnate)$_\omega$ (im)$_\omega$(módest)$_\omega$
         (ímpotent)$_\omega$ (inférnal)$_\omega$ (im)$_\omega$(próper)$_\omega$
         (ínfamous)$_\omega$ (incóndite)$_\omega$ (im)$_\omega$(móral)$_\omega$
         (índolent)$_\omega$ (impórtune)$_\omega$ (in)$_\omega$(dócile)$_\omega$
         (ínfidel)$_\omega$ (impórtant)$_\omega$ (in)$_\omega$(stáble)$_\omega$
         (ímpudent)$_\omega$ (insípid)$_\omega$ (il)$_\omega$(légal)$_\omega$
         (ímbecile)$_\omega$ (intrépid)$_\omega$ (im)$_\omega$(prúdent)$_\omega$

The pword structures in (13c) explain not only the different stress patterns in (11a) and (11c), but also the contrast in word-initial stress in prestress position between the words in (11b) and (11c). In Webster's (1990) all words in (11c), but none of the words in (11b), are transcribed with the initial stress mark ('). Similarly, in Jones and Gimson (1977) and in Wells (1990) the words in (11c), but none of the words in (11b), are transcribed with an optional word-initial stress mark ",". Further support for the subtle difference in word-initial stress between the words in (11b) and (11c) is cited in Kenyon and Knott (1944):

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[9] The ending [sənt] also attracts penultimate stress (e.g. *adjácent, adoléscent, reminiscent, translúcent*, etc.)

[10] While there are English dialects in which the stress shifts in (12) have not (yet) occurred the direction of the shift is always the same: stress on an open penultimate syllable tends to shift to the left, never vice versa. That is, *anchóvy > ánchovy* is a possible phonological change in English, whereas *hármony > harmóny* is not.

In words like *inactive*, where *in-* means 'not', and the second part clearly has its separate meaning, the *in-* just before the main accent has a slight stress that could be marked thus: ˌɪn'æktɪv, or under emphasis even 'ɪn'æktɪv. But if the second part does not show a clear meaning, being fused with the *in-* int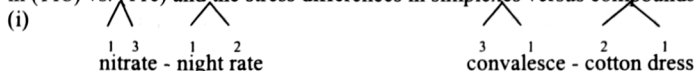o a simple word, as *insipid* ɪn'sɪpɪd, then the *in-* is quite stressless. Since with different speakers and styles of speech there are all grades between no stress and full stress, it is not feasible to mark this accent, though it often exists in speech. The same statement applies to *il-* and *im-*. (Kenyon and Knott 1944:218)

Since the the contrast in word-initial stress in (11b,c) cannot be explained on the basis of differences in the segmental or accentual structure of the words it suggests itself to analyze this contrast in terms of distinct pword structures. What makes the prosodic analysis in (13c) compelling is the correlation between "irregular" word-initial stress and "irregular" penult stress. Both of these phenomena indicate the existence of two separate stress domains, that is, two separate pwords. Pwords are necessarily stressed because of the condition that every pword must dominate at least one foot. The prosodic structure of *imbalance* is given in (14). Relative prominence relations between the pwords are determined by rule (7b).

(14)
$$
\begin{array}{c}
\wedge \\
\omega_w\ \omega_s \\
|\quad | \\
\Sigma\quad \Sigma \\
|\quad \wedge \\
\sigma\ \ \sigma_s\,\sigma_w \\
\text{ímbǽləns} \\
\text{'imbalance'}
\end{array}
$$
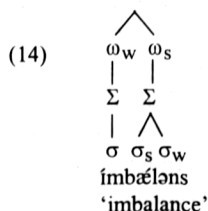
It seems plausible that hearers infer the prosodic structures in (14) on the basis of the contrasts in the accentual properties of the words in (11a, b) versus (11c).[11]

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[11] If correct, the analysis in (13c) also brings out the parallel between the distinct stress patterns in (11b) vs. (11c) and the stress differences in simplexes versus compounds shown in (i):

(i)
$$
\begin{array}{cc}
\wedge \qquad \wedge & \wedge \qquad \wedge \\
\text{1\ \ 3}\quad \text{1\ \ 2} & \text{3\ \ 1}\quad \text{2\ \ 1} \\
\text{nitrate - night rate} & \text{convalesce - cotton dress}
\end{array}
$$

In English the contrast between primary and secondary stress is more pronounced within simplexes than within compounds. In Chomsky and Halle (1968) this observation is accounted for by positing a rule which lowers secondary stresses within "words" by one (cf. the stress values in (i)). However, assuming that each member of a compound forms a separate pword and that pwords (rather than words) constitute the domain of stress the distinct degrees in secondary stress illustrated in (i) follow from the distinct prosodic structures involved:

The prosodic analysis in (13) also brings out the similarity between stable penult stress in (13c) and in (15b), where the claim that the prefixes form separate pwords is presumably less controversial. The examples in (15a) show that prefixes which are etymologically related to those in (15b) do not necessarily form separate pwords (cf. also the cases in (11a, b)). Words derived by *non*-prefixation support the claim that assimilation is not relevant for inferring pword structure because that prefix never undergoes nasal assimilation in careful speech and yet it can fuse with its stem into a single pword (cf. also (nónsense)$_\omega$, (nónparèil)$_\omega$).

(15) a (ápodal)$_\omega$ b (à)$_\omega$(móral)$_\omega$
         (díssonant)$_\omega$ (dìs)$_\omega$(hónest)$_\omega$
         (nónchalant)$_\omega$ (nòn)$_\omega$(gállant)$_\omega$
         (míschievous)$_\omega$ (mìs)$_\omega$(shápen)$_\omega$

In (15b) we again find a correlation between penultimate stress on an open syllable, secondary stress on the preceding syllable, wordhood of the base, and compositional semantics.

Although the distinction is rather subtle, the presence versus absence of secondary stress on the word-initial syllable is the most consistent diagnostic for word-internal pword structure in English. In the adjectives in (16), for instance, main stress on the penultimate syllable is regular (i.e. regular if they were single pwords). The word-initial secondary stress is accordingly the only phonological cue to indicate that the prefixes form separate pwords. The presence of initial stress is supported by the phonetic transcriptions of the adjectives in Jones and Gimson (1977), in Wells (1990), and in Webster's (1990).

(16) a ináctive ⇒ (in)$_\omega$(áctive)$_\omega$ b irrégular ⇒ (ir)$_\omega$(régular)$_\omega$
         invàlid ⇒ (in)$_\omega$(válid)$_\omega$ intólerant ⇒ (in)$_\omega$(tólerant)$_\omega$
         impátient ⇒ (im)$_\omega$(pátient)$_\omega$ impóssible ⇒ (im)$_\omega$(póssible)$_\omega$
         immórtal ⇒ (im)$_\omega$(mórtal)$_\omega$ impráctical ⇒ (im)$_\omega$(práctical)$_\omega$
         infértile ⇒ (in)$_\omega$(fértile)$_\omega$ illíberal ⇒ (il)$_\omega$(líberal)$_\omega$

Secondary stress in pre-stress position consistently correlates with compositional semantics and with bases which are independent words. There is no evi-

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(ii)   (nitrate)$_\omega$ - (night)$_\omega$(rate)$_\omega$ (convalesce)$_\omega$ - (cotton)$_\omega$(dress)$_\omega$
The only difference between compounds and prefixed words concerns relative prominence. Whereas the relative prominence between members of a compound is in most cases strong-weak it tends to be weak-strong in prefixed words (cf. rule (7b)).

dence from English that nasal assimilation in the prefix indicates prosodic fusion with the stem.[12]

This conclusion holds also for other languages. One compelling example concerns German words with a main-stress attracting ending (e.g. *-al, -är, -ant, -ent*). Secondary stress on such endings is found only in compounds or prefixed words and follows from the rule that the relative prominence between two word-internal pwords is strong-weak in German.

(17) a   b   s   w
      -al   (phänomenál)$_\omega$ (ún)$_\omega$(phänomenàl)$_\omega$
      -är   (spektakulär)$_\omega$ (ún)$_\omega$(spektakulär)$_\omega$
      -ant   (interessánt)$_\omega$ (ún)$_\omega$(interessànt)$_\omega$
      -ent   (intelligént)$_\omega$ (ún)$_\omega$(intelligènt)$_\omega$

Significantly, the rule that the endings in (17a) attract main stress is violated not only in words derived by *un*-prefixation as shown in (17b) but also in the loanwords in (18), which are historically derived by *iN*-prefixation. Both types of prefixed words are subject to the same type of nasal assimilation as the corresponding words in English.

(18)   s   w
      -al   (liberál)$_\omega$ (íl)$_\omega$(liberàl)$_\omega$
      -är   (regulär)$_\omega$ (ír)$_\omega$(regulär)$_\omega$
      -ant   (relevánt)$_\omega$ (ír)$_\omega$(relevànt)$_\omega$
      -ent   (kompetént)$_\omega$ (ín)$_\omega$(kompetènt)$_\omega$

The evidence from stress correlates also in German with compositional semantics and the condition that the stem is an independent word. There is clear evidence then that German is like English in that prefixes which show assimilation or are unproductive can form separate pwords.

1.2 *Voice assimilation*

The examples in (19) show that in the early nineteenth century the final fricative in the prefix *dis-*, but not in *mis-*, was subject to voicing assimilation before voiced segments in stressed syllables (cf. Walker 1826):

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[12] It is often claimed that Nasal Assimilation and Degemination are correlated. The native speakers I consulted did not confirm the claim that words such as *immodest* and *unnecessary* differ regarding degemination.

(19) a   mi[s]órder   di[z]órder
         mi[s]léad   di[z]líke
         mi[s]gúide   di[z]glórify
         mi[s]rúle   di[z]róbe
    b   mi[s]cónduct   di[s]cólour
         mi[s]téach   di[s]fávor
         mi[s]spéak   di[s]kíndness
         mi[s]trúst   di[s]péople

Walker's transcriptions fail to indicate distinctions in the degree of nonprimary stress. However, the subsequent phonological development of these prefixed words indicates that both *mis-* and *dis-* can form separate pwords in spite of their historical differences regarding voicing assimilation. Consider first the rule of fricative devoicing, a rule which largely undid the effect of voice assimilation illustrated in (19). Fricative devoicing is similar to voice assimilation in that it applied only in prestress position (cf. the examples in (20a) vs. (20b)). However, unlike voice assimilation fricative devoicing is sensitive to syllabic structure: the rule applies applies only in coda position as is shown by the fact that the prevocalic fricatives in (20c) failed to devoice. The interesting observation is that devoicing did apply to the prevocalic fricatives in (20d):

(20) a   di[z]gúst > di[s]gúst   b   dí[z]mal   *> dí[s]mal
       di[z]dáin > di[s]dáin   grí[z]ly   *> grí[s]ly
       di[z]búrse > di[s]búrse   lé[z]bian   *> lé[s]bian

    c   di[z]áster *> di[s]áster   d   di[z]hónor   > di[s]hónor
       di[z]éase *> di[s]éase   di[z]órder   > di[s]órder
       di[z]ólve *> di[s]ólve   di[z]ínterest > di[s]ínterest

The devoicing of the prevocalic fricatives in (20d) correlates with secondary stress on the initial syllable (cf. Webster's 1990). Both of these properties indicate that the prefix forms a separate pword. This is because pwords constitute the domain of word stress and the domain of syllabification. The syllabification of prevocalic consonants in coda position violates the LOI (i.e. Law of Initials) and thereby clearly indicates the presence of wordinternal pword boundaries.[13]

   The correlation between voiced stability and lack of initial stress in (20c) versus the correlation between devoicing and initial stress in (20d) is captured in the prosodic representations in (21). The relative prominence relations in (21b) follow from rule (7b):

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[13] The LOI requires that all prevocalic consonants are syllabified in onset position unless they form clusters which never occur word-initially (cf. section 1.4.2).

(21) a (di[z]áster)$_\omega$ b (dìs)$_\omega$(hónor)$_\omega$
        (di[z]éase)$_\omega$ (dìs)$_\omega$(órder)$_\omega$
        (di[z]ólve)$_\omega$ (dìs)$_\omega$(ìnterest)$_\omega$

Fricative devoicing and initial stress in (21b) further correlate with the status of *honor*, *order*, and *interest* as independent words and with compositional semantics ('lack of honor', 'lack of order', 'lack of interest'). The same holds for all *dis*-prefixations in (19).

The claim that *dis*- can constitute a separate pword is also supported by relative prominence relations in verbs. Consider the data in (22), which illustrate the regular stress patterns in three-syllable verbs which consist of a single pword. As is shown in (22a), such verbs have regular main stress on the last syllable if that syllable ends in a consonant cluster. Otherwise, main stress on the final syllable is unstable, as is shown by the historical stress shifts in (22b) (cf. Walker 1826, Webster's 1862, Webster's 1990).[14]

(22) a w   s   b w   s   s   w
        (còmprehénd)$_\omega$ (rèconcíle)$_\omega$ > (réconcile)$_\omega$
        (còndescénd)$_\omega$ (ìmprovíse)$_\omega$ > (ímprovise)$_\omega$
        (còntradíct)$_\omega$ (còmpromíse)$_\omega$ > (cómpromise)$_\omega$
        (rècolléct)$_\omega$ (èxorcíse)$_\omega$ > (éxorcise)$_\omega$
        (còrrespónd)$_\omega$ (èxpedíte)$_\omega$ > (éxpedite)$_\omega$
        (rèsurréct)$_\omega$ (rètrográde)$_\omega$ > (rétrogràde)$_\omega$
        (cìrcumvént)$_\omega$ (cìrcumscríbe)$_\omega$ > (círcumscribe)$_\omega$
        (ìnterrúpt)$_\omega$ (sùpervíse)$_\omega$ > (súpervìse)$_\omega$

There is accordingly a systematic difference in stress between adjectives and verbs. Whereas three-syllable adjectives with final stress always have main stress on the initial syllable (cf. the data in (4a)), relative prominence in verbs depends on the structure of the final syllable.

The stability of final main stress in three-syllable verbs ending in a single consonant is significant for determining their pword structure. The historical shift of main stress to the initial syllable as in (22b) indicates that the entire verb consists of a single pword. By contrast, stability of final main stress

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[14] There is no case where a verb with a final consonant cluster has undergone the type of stress shift illustrated in (22b). All three-syllable verbs which end in a cluster and yet have initial main stress are converted from nouns or adjectives with initial main stress (cf. *to vágabònd, to ávalànche, to mánifòld*, etc.). For some systematic exceptions to the stress shift in (22b) see Raffelsiefen (1993: 82, footnote 104).

indicates that the word is subject to rule (7b) which means that the prefix forms a separate pword:

(23)

misdefine ⇒ (mis)$_\omega$(define)$_\omega$

Significantly, final main stress in verbs derived by *dis*-prefixation is just as stable as is final main stress in *mis*-prefixations. In all cases the stability of final main stress correlates with the fact that the prefix combines with an independent word in a compositional manner.

(24) a (mìs)$_\omega$(beháve)$_\omega$ b (dis)$_\omega$(inclíne)$_\omega$
         (mìs)$_\omega$(reláte)$_\omega$ (dis)$_\omega$(appróve)$_\omega$
         (mìs)$_\omega$(recíte)$_\omega$ (dis)$_\omega$(engáge)$_\omega$
         (mìs)$_\omega$(infér)$_\omega$ (dis)$_\omega$(obéy)$_\omega$
         (mìs)$_\omega$(assígn)$_\omega$ (dis)$_\omega$(agrée)$_\omega$
         (mìs)$_\omega$(applý)$_\omega$ (dis)$_\omega$(belíeve)$_\omega$
         (mìs)$_\omega$(decláre)$_\omega$ (dis)$_\omega$(allów)$_\omega$

The evidence from stress indicates accordingly that both *mis*- and *dis*- can form separate pwords.[15] The prefix *mis*- is also similar to *dis*- in that it does not always form a separate pword but also occurs fused into a single pword together with the stem. Some examples are given in (25):

(25) a (míschief)$_\omega$, (mísanthròpe)$_\omega$
     b (mistáke)$_\omega$, (misféasance)$_\omega$

The claim that the words in (25) consist of single pwords is supported by their stress patterns. Word-initial main stress in (25a) shows that the words violate rule (7b) and therefore do not consist of two pwords. The words in (25b) lack initial secondary stress (cf. Webster's 1990) which also indicates that the (historical) prefix does not form a separate pword. As a result, a classification based on assimilatory properties of *mis*- as a prefix which inherently forms a separate pword, and *dis*- as a prefix which prosodically fuses with the stem, fails. Voice assimilation is accordingly like nasal assimilation not a valid diagnostic for pword structure.[16]

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[15] Final main stress in the adjectice *discontént* also reflects the effect of rule (7b) thereby signaling that *dis*- is a separate pword (e.g. (dis)$_\omega$(content)$_\omega$). The "irregular" stress in *discontént* correlates with wordhood of the base and with compositional semantics.
[16] In accordance with the proposal to represent assimilatory properties by segmental underspecification the fricative in *mis*- in (19a) could be represented with the feature [-voice] whereas the fricative in *dis*- in (19b) could be left unspecified for the feature [voice] in earlier

While assimilation does not function as a negative boundary signal it might still hold that unassimilated clusters like *nb*, *np*, *nr* function as a positive boundary signal and indicate the presence of a pword boundary. However, although such clusters are rare in English simplexes they are occasionally introduced through loan words (e.g. French *bo*[nb]*on*, Chinese *re*[nm]*i*[nb]*i*, Japanese *sa*[np]*aku*, *ji*[nr]*icksha*) or historical syncope (*enemite* > *e*[nm]*ity*).[17] The issue of phonotactic boundary signals is discussed in section 1.4.1.

1.3 *Minimal Word Requirements*
Consider next the correlation between stress and Minimal Word Requirements in (historically) prefixed words in English. The initial stress marks in (26) are again adopted from Webster's (1990).[18]

(26) a absúrd ̣- àbnórmal
       pandémic – pànslávism
       foregó – fòreknów
       conféderate – cònfócal
       misféasance – misgúidance
       distúrb – distrúst
       cistérnal – cislúnar
       transpárent – trànsnátional

     b amórphous – àmóral
       rebúke – rèbúild
       precárious – prècáncerous
       deláy - dèlóuse
       propórtion – pròlífe
       coágulum – còáuthor
       binócular – bìmónthly
       dichótomy – dìsýllable

The examples in (26) show that every historical prefix which is stressed in prestress position is at least bimoraic thereby satisfying the Minimal Word Requirement (cf. McCarthy & Prince 1986). The stressed prefixes in (26a) are (minimally) bimoraic because they contain a full vowel followed by one or more consonants. The stressed prefixes in (26b) are bimoraic because they have a long vowel or a diphthong, depending on the dialect. The claim that these prefixes satisfy the Minimal Word Requirement is supported by the facts that they can be pronounced in isolation and that they rhyme with independent words as is shown in (27):

(27)   [ey] - h[ey]   cf. [èy]móral
        'a-' – 'hay'
        r[iy] - b[iy]   cf. r[iy]búild
        're-' – 'bee'
        pr[ow] - l[ow]   cf. pr[òw]lífe
        'pro-' - 'low'

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stages of English.
[17] In addition such clusters occur in proper names (e.g. *De*[nm]*ark*, *Sta*[nl]*ey*, *He*[nr]*y*).
[18] In Webster's (1990) secondary stress is transcribed with a parenthesized mark "(')".

Assuming that stress on a syllable in prestress position indicates that the syllable forms a separate foot the correlation between stress and moraic structure follows from the condition that a foot must be minimally bimoraic. This requirement applies also to pwords by virtue of the condition that a pword necessarily dominates at least one foot. Both the stress and the moraic structure in (26), (27) are accordingly explained on the assumption that the historical prefixes form a separate pword.

When not forming a separate pword the cognates of the prefixes in (27) have a rather different form. Consider the adjectives in (28) which, like *amoral*, were historically derived by *a*-prefixation:

(28) a   [ə]tómic   'atomic'   b   [æ]sbéstic   'asbestic'
           [ə]búlic   'abulic'   [æ]gnóstic   'agnostic'
           [ə]phásic   'aphasic'   [æ]mnésic   'amnesic'
           [ə]gónic   'agonic'   [æ]sthénic   'asthenic'

The examples in (28) show that in prestress position low vowels have historically reduced to schwa in open syllables and have been laxed in closed syllables.[19] While the reduction to schwa of non-low vowels is not accepted by all speakers the potential reduction indicates that the historical prefix does not form a separate pword.[20] The comparison of the pronunciations in (29a, b) indicate that, at least for some speakers, words with prosodically fused prefixes do not differ from comparable unprefixed words with respect to vowel reduction:

(29) a [ə]nómalous   b   m[ə]térial
        pr[ɪ]cárious - pr[ə]cárious   r[ɪ]dículous - r[ə]dículous
        pr[o]lífic - pr[ə]lífic   l[o]gístics - l[ə]gístics
        b[ay]nócular - b[ɪ]nócular - b[ə]nócular   rh[ay]nóceros - rh[ɪ]nóceros - rh[ə]nóceros

The generalization is then that vowels in pre-stress position tend to reduce with the result that the syllables count less than two moras. The initial syllable in the three variants listed for *binocular* or *rhinoceros* have two, one, and, provided that the schwa does not count, zero moras. The assumption that syllables which have less than two moras cannot form a separate pword rules out the prosodic parsings in (30) (the symbol "*⇒" indicates ill-formed prosodic parsings):

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[19] Stressless vowels do not reduce to schwa when followed by another vowel (e.g. c[o]*agulate*).
[20] The question of how to analyze the fact that some speakers do not allow for vowel reduction in historically prefixed words like *precarious* is discussed in section 4.

(30)   [ə]nomalous   *⇒ (a)$_\omega$(nomalous)$_\omega$
        pr[ɪ]carious   *⇒ (pre)$_\omega$(carious)$_\omega$
        pr[o]lific   *⇒ (pro)$_\omega$(lific)$_\omega$
        b[ɪ]nócular   *⇒ (bi)$_\omega$(lnocular)$_\omega$

Any syllable for which monomoraic variants are at least marginally acceptable does not form a separate pword (cf. *binócular* in (29a)). This is because reduction is entirely unacceptable in syllables which do form a separate pword as is illustrated in (31):

(31)   [èy]móral - *[ə]móral   ⇒ (a)$_\omega$(moral)$_\omega$
        r[iy]wríte - *r[ə]wríte   ⇒ (re)$_\omega$(wríte)$_\omega$
        pr[òw]lábor - *pr[ə]lábor   ⇒ (pro)$_\omega$(lábor)$_\omega$
        pr[iy]cóok - *pr[ə]cóok   ⇒ (pre)$_\omega$(cóok)$_\omega$

No stressed syllable in prestress position has less than two moras. The Minimal Word Requirement correlates further with the observation that all stems are independent words and with compositional semantics. These correlations indicate that the prosodic structures of the words in (26) are as follows.

(32) a (absúrd)$_\omega$ - (àb)$_\omega$(nórmal)$_\omega$ b (amórphous)$_\omega$ - (à)$_\omega$(móral)$_\omega$
         (pandémic)$_\omega$ - (pàn)$_\omega$(slávism)$_\omega$ (rebúke)$_\omega$ - (rè)$_\omega$(búild)$_\omega$
         (foregó)$_\omega$ - (fòre)$_\omega$(knów)$_\omega$ (precárious)$_\omega$ - (prè)$_\omega$(cáncerous)$_\omega$
         (conféderate)$_\omega$ - (còn)$_\omega$(fócal)$_\omega$ (deláy)$_\omega$ - (dè)$_\omega$(lóuse)$_\omega$
         (misféasance)$_\omega$ - (mìs)$_\omega$(gúidance)$_\omega$ (propórtion)$_\omega$ - (prò)$_\omega$(lífe)$_\omega$
         (distúrb)$_\omega$ - (dìs)$_\omega$(trúst)$_\omega$ (coágulum)$_\omega$ - (cò)$_\omega$(áuthor)$_\omega$
         (cistérnal)$_\omega$ - (cìs)$_\omega$(lúnar)$_\omega$ (binócular)$_\omega$ - (bì)$_\omega$(mónthly)$_\omega$
         (transpárent)$_\omega$ - (tràns)$_\omega$(nátional)$_\omega$ (dichótomy)$_\omega$ - (dì)$_\omega$(sýllable)$_\omega$

Moraic structure serves also as a diagnostic for determining the prosodic structure of words in which a (historical) vowel-final prefix precedes an unstressed syllable. Consider the phonological contrasts between the etymologically related prefixes in (33a) and (33b) (cf. Webster's 1990):

(33)   a-   a [æ]taráctic   b [èy]polítical
        re-   r[è]presént   r[iy]defénd
        pre-   pr[è]decéssor   pr[iy]detérmine
        pro-   pr[à]pagánda   pr[òw]Canádian

The words in (33a) obey a restriction to monomoraic vowels in syllables which are followed by at least two syllables, the first of which is unstressed. This constraint which is known as "Trisyllabic Laxing" accounts for the illformedness of the hypothetical forms shown in (34b).

(34) a (m[ǽ]caróon)$_\omega$　　　b　*(m[èy]caróon)$_\omega$
　　　　(p[ɛ́]lican)$_\omega$　　　　　　*(p[íy]lican)$_\omega$
　　　　(v[í]negar)$_\omega$　　　　　　*(v[áy]negar)$_\omega$
　　　　([á]peràte)$_\omega$　　　　　*([ów]peràte)$_\omega$

Violations of Trisyllabic Laxing often indicate an intervening pword boundary. The words in (35a) are either compounds or words with consonant-initial suffixes, which are not integrated into the pword of the stem, and therefore include a pword boundary. Trisyllabic Laxing never applies in such contexts. However, there are also many violations of Trisyllabic Laxing in words derived by vowel-initial suffixes, which consist of one pword, as is illustrated in (35b).

(35) a b[iy]ver dam　　　　　(beaver)$_\omega$(dam)$_\omega$
　　　　n[ey]ghborhood　　　　(neighbor)$_\omega$hood
　　　　br[ey]zenness　　　　　(brazen)$_\omega$ness

　　　b ob[iy]sity　　　　　　(obesity)$_\omega$
　　　　m[ey]kable　　　　　　(makable)$_\omega$
　　　　h[iy]thenish　　　　　(heathenish)$_\omega$

The exceptions in (35b) are systematic in that the tense vowel in the suffixed form corresponds to a tense vowel in the base (e.g. ob[iy]se 'obese', m[ey]ke 'make' h[iy]then 'heathen'). The occurrence of the bimoraic vowels in (35b) accordingly does not argue against the "Trisyllabic Laxing constraint" but rather shows that this phonological constraint can be dominated by an identity constraint which requires the vowels in the derived word to be identical to the corresponding vowel in the base.[21] If identity constraints cannot play a role because a word is not based on an independent word there is a tendency for bimoraic vowels in the Trisyllabic Laxing position to destabilize as is shown by the relatively recent changes in (36):[22]

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[21] This constraint ranking accounts for the distribution of lax and tense vowels in the three-syllable words in (i). For additional examples see Raffelsiefen (to appear).

(i)　　([ɛ́]nergy)$_\omega$　　　　　　(s[íy]crecy)$_\omega$ (cf. s[íy]cret)
　　　(l[ɛ́]gacy)$_\omega$　　　　　　(fr[íy]quency)$_\omega$ (cf. fr[íy]quent)
　　　(r[ɛ́]medy)$_\omega$　　　　　　(d[íy]cency)$_\omega$ (cf. d[íy]cent)
　　　(met[í]culous)$_\omega$　　　　(d[éy]ngerous)$_\omega$ (cf. d[éy]nger)
　　　(cr[ɛ́]dulous)$_\omega$　　　　(f[íy]verous)$_\omega$ (cf. f[íy]ver)
　　　(tr[ɛ́]cherous)$_\omega$　　　　([ów]dorous)$_\omega$ (cf. [ów]dor)

[22] The few words in question which show no sign of instability are synchronic pseudo-compounds, which exhibit the stress contour characteristic for compounds (e.g. níghtingàle) or pseudo-suffixations whose ending is homophonous to an inflectional suffix (e.g. evening).

(36)   (t[íy]nable)$_\omega$ >   (t[έ]nable)$_\omega$
        (am[íy]nable)$_\omega$ >   (am[έ]nable)$_\omega$
        ([ów]celot)$_\omega$ >   ([á]celot)$_\omega$
        ([éy]pricot)$_\omega$ >   ([æ]pricot)$_\omega$

Violations of Trisyllabic Laxing in prefixed words indicate reliably that the prefix forms a separate pword. That is, such violations always correlate with compositional semantics and the fact that the stem is an independent word. The pword structures indicated by the moraic structures of the initial syllables in (33) are given in (37):

(37) a   (àtaráctic)$_\omega$ b   (à)$_\omega$(polítical)$_\omega$
           (rèpresént)$_\omega$ (rè)$_\omega$(defénd)$_\omega$
           (prèdecéssor)$_\omega$ (prè)$_\omega$(detérmine)$_\omega$
           (pròpagánda)$_\omega$ (prò)$_\omega$(Canádian)$_\omega$

The claim that the historical prefixes in (37a) do not form separate pwords is supported not only by their susceptibility to Trisyllabic Laxing but also by the illformedness of forms such as *([æ])$_\omega$ or *([prɛ])$_\omega$. Such forms are illformed pwords because they violate the Minimal Word Requirement and also because of a constraint against lax vowels in pword final position.[23] The only systematic exception to this generalization is the low back vowel [ɑ], which differs from other lax vowels in that it satisfies the Minimal Word Requirement as is shown by independent words like [spɑ] 'spa', [brɑ] 'bra'.[24] The existence of these words indicates that the vowel [ɑ] is bimoraic in spite of being lax.[25]

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[23] The claim that the constraint against lax vowels refers to the pword-final and not to the syllable-final position is supported by words like [sæ.tʰair] 'satire' where the *t* is syllabified exclusively in onset position as is shown by its aspiration. (cf. section 1.4.2.1).

[24] These words are transcribed with a short [ɑ] in Kenyon and Knott and with a long [ɑː] in Jones and Gimson (1977) and in Wells (1990).

[25] The assumption that vowels which are low and back are bimoraic also resolves a conflict exhibited by the negative prefix *a-* in German. Hall (this volume) concludes that that prefix cannot be a pword because it violates the Minimal Word Requirement. His conclusion conflicts with the evidence from stress because the prefix *a-* always carries main stress when it attaches to an independent word thereby yielding patterns which do not occur in simplexes (e.g. *ásymmètrisch* 'asymmetrical', *ápolìtisch* 'apolitical'). This apparent violation of regular stress patterns indicates that stress is determined by a relative prominence rule which requires the lefthand pword within a (syntactic) word to be stronger than the righthand pword. This rule applies to compounds and prefixed words alike (e.g. *únsympàthisch* 'unappealing', *Tíschbèin* 'table leg'). Assuming that low vowels are bimoraic the evidence from stress, which indicates that the prefix *a-* forms a separate pword, no longer conflicts with Minimal Word Requirements.

Since wordinitial syllables which precede an unstressed syllable are always stressed in English the data in (37) do not shed light on the question of whether the moraic evidence correlates with the evidence from stress when it comes to determining the pword structure of historically prefixed words.[26] However, there are cases which allow for the correlation between these properties to be tested. Recall that verbs with three syllables and final stress have regular main stress on the initial syllable unless they end in a consonant cluster (e.g. *improvìse* vs. *interrúpt*). Since verbal prefixes which form a separate pword always have secondary stress the correlation between Minimal Word Requirements and stress can be tested by examining verbs which consist of a monosyllabic vowel-final prefix and an iambic stem which ends in maximally one consonant. Relevant examples are listed in (38):

(38) a r[ɛ́]concìle   b r[iy]combíne
        r[ɛ́]cognìze   r[iy]compóse
        r[ɛ́]gulàte   r[iy]divíde
        r[ɛ́]legàte   r[iy]commít
        r[ɛ́]plicàte   r[iy]alígn

The native coinages in (38b) violate both Trisyllabic Laxing and the constraint against final main stress in the type of three-syllable verb described above. Both these violations signal that those verbs consist of two separate pwords (cf. (39b)). By contrast, the satisfaction of Trisyllabic Laxing together with the regular initial main stress in the historically prefixed verbs in (38a) show that these verbs consist of only one pword (cf. (39a)). These examples thus show a perfect correlation between the two types of phonological evidence under consideration.

(39) a (r[ɛ́]concìle)$_\omega$ b (r[iy])$_\omega$(combíne)$_\omega$
        (r[ɛ́]cognìze)$_\omega$ (r[iy])$_\omega$(compóse)$_\omega$
        (r[ɛ́]gulàte)$_\omega$ (r[iy])$_\omega$(divíde)$_\omega$
        (r[ɛ́]legàte)$_\omega$ (r[iy])$_\omega$(commít)$_\omega$
        (r[ɛ́]plicàte)$_\omega$ (r[iy])$_\omega$(alígn)$_\omega$

The phonological evidence for pword structure correlates further with the observation that all stems are independent words (e.g. *combine, compose,* etc.) and with compositional semantics.

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[26] In careful pronunciation the stress on the prefixes in (37b), which form separate pwords, should be stronger than the stress on the historical prefixes in (37a), which are integrated into the pword of the stem. These distinctions in the degree of stress are perhaps too subtle to judge consistently (cf. also footnote 11).

For additional evidence for the correlation between stress and moraic structure consider the data in (40) (cf. Walker 1826, Webster's 1862, Webster's 1990):

(40) a recógnìze   > r[ɛ]cognìze   b   r[iy]lócàte
     renóvàte   > r[ɛ]novàte   r[iy]prócèss
     desígnàte   > d[ɛ]signàte   r[iy]finànce
     enérvàte   > [ɛ]nervàte   r[iy]áccèss
     demónstràte > d[ɛ]monstràte   r[iy]cóntàct

The stress shifts in (40a) reflect the transition from quantity-sensitive to alternating stress. The stability of main stress oń the penultimate syllable in (40b) correlates with the fact that the preceding syllable satisfies the Minimal Word Requirement. Both of these phonological properties indicate that the historical prefixes in (40b) form separate pwords as is shown in (41).

(41) a (récognize)$_ω$ b   (rè)$_ω$(lócàte)$_ω$
     (rénovàte)$_ω$ (rè)$_ω$(prócèss)$_ω$
     (désignàte)$_ω$ (rè)$_ω$(finànce)$_ω$
     (énervàte)$_ω$ (rè)$_ω$(áccèss)$_ω$
     (démonstràte)$_ω$ (rè)$_ω$ (cóntàct)$_ω$

The data in (40) indicate a consistent correlation between stress patterns and moraic structure. From the perspective of the hearer reference to moraic structure often allows for a more precise location of pword boundaries than does reference to stress. Lax vowels other than [ɑ] signal precisely that no pword boundary follows immediately. By contrast, schwa can occur in pword-final position (e.g. *comm*[ə] 'comma', *zebr*[ə] 'zebra') but any string which contains no vowel other than schwa cannot form a pword. It follows that a schwa in a word-initial syllable signals that none of the following consonants is preceded or followed by a pword boundary (cf. the historically prefixed word in (28a)). While schwa and lax vowels function as negative boundary signals unreducible bimoraic vowels signal the presence of a pword boundary. In prestress position such vowels indicate a following pword boundary whose precise location with respect to the following consonants is not determined (e.g. (b[iy])$_ω$(hive)$_ω$, (cr[iy]m)$_ω$(pie)$_ω$, (f[iy]ld)$_ω$(work)$_ω$). A bimoraic vowel before two or more syllables the first of which is unstressed strongly suggests that the first and the third syllable do not belong to a single pword but the precise location of the boundary is not further determined.[27] In historically

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[27] Recall that this applies only to unsuffixed words in which the occurrence of a tense vowel

prefixed words the occurrence of an unreducible bimoraic vowel always corre-
lates with the evidence from stress to indicate that the prefix forms a separate
pword.

1.4 *Syllable structure*

One of the defining properties commonly associated with pwords is their role
as the domain of syllabification (cf. Booij and Rubach 1984). In this section I
investigate the correlation between syllable structure and other prosodic prop-
erties, wordhood, and semantic compositionality in English.

1.4.1 *The phonotactic structure of syllables*

Phonotactics plays a stronger role as a negative than as a positive boundary
signal. That is, there are few clusters which signal the presence of a pword
boundary but there are many clusters which signal the absence of a preceding
or following pword boundary. This difference is based on the asymmetrical
distribution of clusters in word-internal position compared to word edges.
While there are many clusters which occur within words but not word-initially
or word-finally the opposite case does not exist. That is, there are no clusters
which occur word-initially or word-finally but not within pwords:

(42)		*within words*	*word-initially*	*word-finally*
	-mn-	inso[mn]ia, a[mn]esia	—	—
	-bs-	a[bs]ent, a[bs]urd	—	—
	-lg-	a[lg]orithm, vu[lg]ar	—	—
	-mpstr-	se[mpstr]ess	—	—

Clusters like [mn] accordingly function as negative boundary signal in that
they rule out certain pword boundaries (e.g. *(mnX)$_\omega$, *(Xmn)$_\omega$) but they do
not indicate the presence of any pword boundaries.

The asymmetry in question is also reflected in loan word phonology. It is
quite common for clusters to be simplified word-initially but not word-
internally as is illustrated in (43a, b):

(43)				b	
	[ps]ychology	>	[s]ychology		ca[ps]ize, har[ps]ichord
	[pn]eumonia	>	[n]eumonia		hy[pn]otize, di[pn]oid
	[pt]omaine	>	[t]omaine		ba[pt]ize, ana[pt]yxis
	[bd]ellium	>	[d]ellium		a[bd]uct, he[bd]omad
	[kn]ickerbocker	>	[n]ickerbocker		pi[kn]ic, ara[kn]oid
	[gn]occhi	>	[n]occhi		ma[gn]et, co[gn]ition

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could not be due to an identity constraint (e.g. *ob*[iy]*sity* - *ob*[iy]*se*).

[mn]emonic   > [n]emonic   a[mn]esty, gy[mn]asium

Even word-internal clusters of three or more consonants or clusters which include obstruents which differ in voicing tend to be adopted unmodified as is illustrated in (44). The claim that those words, all of which are historically prefixed, are parsed as single pwords is supported by the fact that they have only one word stress. The evidence from stress correlates with non-compositional semantics and with the fact that the stems of those words are not necessarily independent words.

(44)   (e[kskl]úde)$_\omega$, (é[kstr]a)$_\omega$, (e[kspr]éss)$_\omega$, (e[kskj]úse)$_\omega$, (é[kskr]ement)$_\omega$
         (di[sgr]úntle)$_\omega$, (di[sgr]áce)$_\omega$, (tra[nsgr]éss)$_\omega$, (a[bstr]áct)$_\omega$, (su[btr]áct)$_\omega$

The data in (44) suggest that complex word-internal clusters are easily adapted by English speakers even if they have not been encountered before. However, there are limits to the adaptation of internal clusters as is indicated by the simplification of clusters consisting of consonants which differ only in voicing illustrated in (45) (cf. the transcriptions in Kenyon and Knott 1944 and Webster's 1990):

(45)   [səbpíynə] > [sə.píynə]

In a word like *subpoena*, which is not based on an independent word, the cluster *bp* necessarily destabilizes. In other cases such clusters do presumably signal an intervening pword boundary (e.g. su[bp]*lot*, su[bp]*rofessional*, su[bp]*otent*).

There are no conflicts between boundary signals relating to phonotactics and other phonological evidence for pword structure. Consider the adjective *amnesic*, for which all phonological diagnostics correlate and indicate that the historical prefix is not followed by a pword boundary as is shown in (46):

(46)   *(æ)$_\omega$(mníyzɪk)$_\omega$ *(æ)$_\omega$ violates the Minimal Word Requirement, the constraint
         against lax vowels in pword-final position, and the constraint
         which requires every pword to have word stress
         *(mníyzɪk)$_\omega$: initial cluster violates phonotactic constraint

A form such as [èymníyzɪk], where the vowel indicates that the historical prefix forms a separate pword and yet an illicit word-initial cluster follows, could not exist in English. Similarly, the cluster following the lax vowel could not be affected by simplification (i.e. [æmníyzɪk] *> [æníyzɪk] is not a possible change in current English).

1.4.2 *Syllabification*

The syllable structure of a string which forms one domain of syllabification is determined entirely by its segmental and accentual properties. According to the LOI (i.e. Law of Initials) prevocalic clusters are syllabified in onset position unless they do not occur word-initially (cf. rule I in Kahn 1976).[28] All remaining segments are syllabified in coda position (cf. rule II in Kahn 1976). In American English every segment in onset position which is followed by an unstressed vowel and preceded by a [-consonantal] segment is associated with the preceding syllable thereby becoming ambisyllabic (cf. rule III in Kahn 1976). As will be shown in this section any violations of these rules indicate separate domains of syllabification and are hence positive boundary signals. Consider the LOI violations in (47a) which signal the presence of an intervening pword boundary.

(47) a sú[b.l]ìterature $\Rightarrow$ (súb)$_\omega$(literature)$_\omega$ b (cf. [bl]ue)
         sú[b.r]ègion $\Rightarrow$ (súb)$_\omega$(règion)$_\omega$ (cf. [br]ead)
         dì[s.l]íke $\Rightarrow$ (dìs)$_\omega$(líke)$_\omega$ (cf. [sl]ang)
         mì[d.w]ínter $\Rightarrow$ (mìd)$_\omega$(wínter)$_\omega$ (cf. [dw]arf)

The words in (47a) violate the LOI because the obstruents are not syllabified together with the following sonorant in onset position even though the clusters in question occur word-initially (cf. the words in (47b)). LOI violations in historically prefixed English words correlate consistently with two word stresses, with stems which are independent words, and with compositional semantics. By contrast, the syllabification of the final consonant of a historical prefix exclusively in onset position correlates with one word stress and with noncompositional semantics as is illustrated in (48):

(48) su[.bl]íminal $\Rightarrow$ (sublíminal)$_\omega$
      su[.b]úrban $\Rightarrow$ (subúrban)$_\omega$
      di[.s]íntegràte $\Rightarrow$ (disíntegràte)$_\omega$
      di[.z]ólve $\Rightarrow$ (dissolve)$_\omega$
      di[.z]éase $\Rightarrow$ (disease)$_\omega$
      mi[.s]ánthropy $\Rightarrow$ (misánthropy)$_\omega$

The correlation of these properties indicates that pwords form the domain of syllabification. Unfortunately, the evidence from syllabification is somewhat impaired by the fact that in many cases speakers find the distinctions in question too subtle to judge. However, for some consonants the pronunciation

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[28] For strictly phonological conditions on syllabification see especially Vennemann (1988).

varies greatly depending on the position within the syllable. Recall the process of fricative devoicing in coda position mentioned in section 1.2. In American English voiceless stops have distinct allophones whose distribution is determined entirely by their position within the syllable. Reference to those allophones allows for a conclusive study of the correlation between syllabification and other diagnostics for pword structure.

1.4.2.1 Aspiration
Consider the correlation between word-initial stress and aspiration in (49):

(49) a   dis[p]árage   b   dis[pʰ]éople
      dis[k]óver   dis[kʰ]ólor
      dis[t]úrb   dis[tʰ]rúst
      mis[t]áke   mis[tʰ]íme

In (49a) lack of initial stress correlates with non-aspiration of the bracketed voiceless stops. Both of these properties indicate that the historically prefixed words form a single domain of stress and a single domain of syllabification. Specifically, the lack of aspiratedness of the prevocalic voiceless stop shows that the prefix-final s is syllabified in onset position in accordance with the LOI. This is because stops are aspirated only if they occur in syllable-initial position as is shown in (50) (cf. Kahn 1976). Only relevant association lines are shown in this section:

(50) a   σ   b   σ

       s[p]in   [pʰ]in

The aspiration of the stops in (49b) indicates that they occur in syllable-initial position and hence violate the LOI. This LOI-violation correlates with the 'irregular' word-initial stress and indicates that the prefix forms a separate pwords as is shown in (51b):

(51) a   σ   b   σ   σ

     (dis[p]árage)ω   (dis)ω([pʰ]éople)ω

The aspiration of a stop after s is a positive boundary signal which indicates that a pword boundary immediately precedes the stop. The same analysis applies to the remaining examples in (52), to compounds, and across words as is illustrated in (52b).

(52) a (dis[k]óver)$_\omega$ (dìs)$_\omega$([k^h]ólor)$_\omega$
     (dis[t]úrb)$_\omega$ (dìs)$_\omega$([t^h]rúst)$_\omega$
     (mis[t]áke)$_\omega$ (mìs)$_\omega$([t^h]íme)$_\omega$
    b (mús[t]àche)$_\omega$ (príce)$_\omega$([t^h]àg)$_\omega$ (kìss)$_\omega$([t^h]ím)$_\omega$
     (mís[t]ràl)$_\omega$ (bráss)$_\omega$([t^h]ràde)$_\omega$ (mìss)$_\omega$([t^h]rácy)$_\omega$
     (ás[p]èct)$_\omega$ (bús)$_\omega$([t^h]icket)$_\omega$ (pàss)$_\omega$([p^h]ám)$_\omega$

The evidence for prosodic structure based on aspiration correlates with the evidence from stress, wordhood, and semantic compositionality. In all prefixed verbs and adjectives in which an aspirated stop is preceded by *s* we find that relative prominence relations are determined by rule (7b). The fact that aspiration is weaker in the verbs in (53a) compared to the examples in (53b) is explained by the respective phonetic environments: the more stress a vowel has the stronger is the aspiration on the preceding stop.

(53) a   (mìs)$_\omega$([p$^{(h)}$]ronóunce)$_\omega$ b   (mìs)$_\omega$([p^h]rínt)$_\omega$
       (mìs)$_\omega$([k$^{(h)}$]onstrúe)$_\omega$ (mìs)$_\omega$([k^h]lássify)$_\omega$
       (dìs)$_\omega$([k$^{(h)}$]ompóse)$_\omega$ (dìs)$_\omega$([k^h]óurteous)$_\omega$
       (dìs)$_\omega$([k$^{(h)}$]onfírm)$_\omega$ (dìs)$_\omega$([p^h]léasure)$_\omega$

As was noted before, there is no evidence for a prosodic difference between the prefixes *dis-* and *mis-*.

1.4.2.2 *Glottalization*
Consider next the correlation between word-initial stress and the distribution of aspirated versus glottalized coronal stops in (54). The symbol [t'] represents a glottalized *t*:

(54) a   De[t^h]róit   b   òu[t']ríde
       pe[t^h]róleum   òu[t']ránk
       ma[t^h]rículate   òu[t']rún
       me[t^h]rópolis   òu[t']réach

The words in (54b) are marked because of the secondary stress in pre-stress position. Furthermore, the glottalization of the [t] indicates syllabification in coda position even though an *r* follows. Since the cluster *tr* forms a wellformed syllable onset the stops should be aspirated rather than glottalized as is illustrated by the "regular" examples in (54a). The glottalization of stops before *r* indicates accordingly another LOI-violation and signals that a pword boundary immediately follows the stop. The pword structures in (55) account for the correlation between unstressed word-initial syllables and aspiration on the one hand and secondary stress in prestress position and glottalization on the other:

(55) a   σ   b   σ   σ

$\qquad\qquad$ (De[tʰ]róit)ω $\qquad\qquad$ (òu[t'])ω(ríde)ω

The correlation between initial stress and glottalization also holds for compounds and across words:

(56)   (ní[tʰ]ràte)ω $\qquad$ (nígh[t'])ω(ràte)ω $\qquad\qquad$ (figh[t'])ω(Rón)ω

In contrast to aspiration, glottalisation is sensitive not only to syllable position but also to place of articulation.[29] Kahn notes that glottalisation is strongest for *t*, applies less to *p*, and is weakest for *k*. Consequently, glottalization is a good diagnostic for prosodic structure only in words whch include a *t* followed by *r*.

1.4.2.3 *Flapping*
Consider the distribution of flapped versus aspirated stops in (57):

(57) a   pró[ɾə]stant   'protestant'   b   prò[tʰə]hítian   'pro-Tahitian'
$\qquad\quad$ pró[ɾə]sis   'protasis' $\qquad\qquad\qquad$ prò[tʰə]bétan   'pro-Tibetan'

According to Kahn flapping is another rule which is sensitive to syllable structure. Specifically, he claims that coronal stops are flapped when ambisyllabic. One condition for ambisyllabicity relates to stress. Kahn's rule III associates an onset consonant with the preceding syllable when it is preceded by a [−consonantal] segment and followed by an unstressed vowel. The relevant association line is dashed in (58):

(58)   σ   σ   σ   σ

$\qquad\quad$ (bu[ɾə]r)ω $\qquad\qquad$ (de[tʰ]áin)ω

The failure of rule III to apply in the words in (57b) indicates the existence of separate prosodic domains. Like rules I and II, rule III applies only within pwords. The relevant structures are given in (59):

(59) a   σ   σ   b   σ   σ

$\qquad\quad$ (pro[ɾ]estant)ω $\qquad\qquad$ (pro)ω([tʰ]ahitian)ω
$\qquad\quad$ 'protestant' $\qquad\qquad\qquad\quad$ 'pro-Tahitian'

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[29] In addition, glottalization applies only if the preceding segment has the feature [−consonantal].

The occurrence of an aspirated coronal stop which is preceded by a [−consonantal] segment and followed by an unstressed vowel in American English indicates accordingly that the stop is immediately preceded by a pword boundary.

There are also cases where the occurrence of a flap functions as a positive boundary signal. Consider the contrast between the aspirated and flapped stops in (60):

(60) a   de[tʰ]áin   b   òu[ɾ]éat   'outeat'
           ró[tʰ]àte   hì[ɾ]Ál   'hit Al'

The flaps in (60b) are marked because a consonant before a stressed vowel should regularly be syllabified exclusively in onset position and not be ambisyllabic. Flapping in such an environment is described by Kahn's rule V, which creates ambisyllabicity by associating a consonant with a following vowel across pword boundaries regardless of stress. The application of rule V is marked by the dashed line in (61):[30]

(61)   σ σ   σ   σ
           /   \ _ - -
        (detain)ω   (out)ω(eat)ω

The occurrence of a flapped stop in pre-stress position in American English indicates consistently that the stop is immediately followed by a pword boundary.[31]

To summarize, the LOI violations and the 'irregularities' relating to ambisyllabicity correlate consistently with the evidence from stress, with the satisfaction of Minimal Word Requirements, with stems which are independent words, and with compositional semantics. Syllabification not only signals the presence of word-internal pword boundaries but also reliably indicates their precise location.

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[30] Kahn's claims that ambisyllabicity arises whenever a consonant-final word is followed by a vowel-initial word and that flapping is an automatic consequence of ambisyllabicity are contradicted by examples such as *host Al*, where the *t* is not flapped.

[31] McCarthy & Prince (1993) describe the ambisyllabicity of the final consonant in (60b) with reference to a constraint "Final-C" which requires that every pword end in a consonant. The relevance of that constraint is not clear since the ambisyllabicity results from the satisfaction of both the constraint which requires every segment to be syllabified within a given domain of syllabification (i.e. the pwords (out)ω, (hit)ω) and the constraint Onset, which requires every syllable to have an onset.

As one might expect there is no evidence for a correlation between syllabi-fication and assimilation. That is, the syllabification of the nasal in the prefix *iN-*, which assimilates to the following stop or sonorant, does not differ from the syllabification of the nasal in the prefix *un-*, which does not assimilate. Both are ambisyllabic if a vowel follows (cf. (62a, b), which is not true for nasals which are not followed by a pword boundary (cf. (62c)).

(62) a σ   σ   b σ   σ   c σ σ
         \ /   \ /   /

    (ùn)$_\omega$(áble)$_\omega$ (in)$_\omega$(áctive)$_\omega$ (ináne)$_\omega$

    (ùn)$_\omega$(éven)$_\omega$ (in)$_\omega$(élegant)$_\omega$ (inórdinate)$_\omega$

    (ùn)$_\omega$(interesting)$_\omega$ (in)$_\omega$(áccurate)$_\omega$ (inímical)$_\omega$

    (ùn)$_\omega$(éthical)$_\omega$ (in)$_\omega$(ádequate)$_\omega$ (inépt)$_\omega$

    (ùn)$_\omega$(éasy)$_\omega$ (in)$_\omega$(áction)$_\omega$ (iníquity)$_\omega$

However, 'since there are no distinct allophones associated with the position of the *n* within the syllable it is generally not possible to elicit clear judgements concerning the syllabification contrasts in (62).

1.5 The correlation between focus and other diagnostics for pword structure
According to Wennerstrom (1993) the accent on the historical prefixes in (63), which is represented by capital letters, indicates focus:

(63)   That country has both INternal and EXternal problems.
           This function is DEcreasing here, but INcreasing there.
           John expected to be promoted, and was shocked at being DEmoted.
           I still say she's a very effective manager; it's the equipment that's DEfective

She analyzes the data as follows:

> I conclude that prefixes form separate prosodic words when they are semantically analyzable with respect to their stems, and that the prosodic word is the minimum domain of PAA [Pitch Accent Association, R.R.], a process which links pitch accent to the highest grid mark within a focused $_\omega$. (Wennerstrom 1993:322)

The type of semantic analyzability Wennerstrom has in mind differs from the notion of semantic compositionality crucially involving word bases used in this paper (cf. section 3). Using her notion of semantic analyzability and focusabil-ity as diagnostics she claims that the capitalized prefixes in (63) form separate pwords. However, focus does not correlate with the phonological diagnostics for pwords established here. None of the historical prefixes in (63) is stressed in regular pronunciation (cf. Webster's 1990, Jones & Gimson 1977, Wells

1990) and vowel reduction in open syllable is possible (e.g. *pr*[ə]*moted,* *d*[ə]*fective*). As has been shown above, these phonological properties indicate that the prefixes are not separate pwords. The fact that the prefixes in (63) do not combine with words also argues against their analysis as pwords (cf. section 2). It can be concluded then that focusability does not correlate with the phonological evidence and is not a useful diagnostic for pword structure.

1.6 *Types of correlating properties*

In the preceding sections I have presented evidence that the phonological properties which serve as diagnostics for pword structure relate either to syllabification (e.g. onset or coda conditions, LOI-violations, ambisyllabicity), stress (stress patterns, relative prominence patterns, stress-sensitive rules like Trisyllabic Laxing or vowel reduction) or to Minimal Word Requirements. All of these properties consistently correlate with respect to the question of whether a historic prefix in English forms a separate pword or is integrated into the pword of the stem. By contrast, assimilation correlates with none of those properties. Perhaps this difference between assimilation and syllabification, stress, and Minimal Word Requirements relates to the fact that the latter properties all relate directly to the Prosodic Hierarchy. That is, assuming that pwords, feet, syllables, and moras are part of a hierarchically arranged set of phonological units such that each unit is properly contained in the superordinate unit of which it is a part (cf. Nespor & Vogel 1986) the correlation between these properties makes sense. For example, the observation that LOI violations indicate pword boundaries relates to the proper containment of syllables within pwords. The observation that pwords are subject to Minimal Word Requirements follows from the fact that pwords dominate feet, which must be minimally binary (either on the moraic or on the syllabic level) and hence necessarily satisfy the Minimal Word Requirement.

Assimilation differs from syllabification, stress, and Minimal Word Requirements not only in that it fails to relate to the Prosodic Hierarchy. In addition it holds that to the hearer clusters exhibiting "assimilation" do not signal the absence of an intervening pword boundary. That is, the relevant clusters occur both within and across pwords as is illustrated in (64):

(64)   i[mb]alance   ⇒   ?   (cf. (stea[m])$_\omega$(b]oat)$_\omega$, (ba[mb]oo)$_\omega$)
        i[mp]roper   ⇒   ?   (cf. (crea[m])$_\omega$(p]ie)$_\omega$, (la[mp]oon)$_\omega$)
        di[zm]ember   ⇒   ?   (cf. (ja[z])$_\omega$(m]usician)$_\omega$, (pla[zm]a)$_\omega$)
        di[zb]urden   ⇒   ?   (cf. (chee[z])$_\omega$(b]urger)$_\omega$, (le[zb]ian)$_\omega$)

In general there exist no clusters which signal the absence of an intervening pword boundary. From the point of view of the hearer assimilation accordingly never functions as a negative boundary signal for pword structure which distinguishes assimilation from the phonological properties which relate to the Prosodic Hierarchy.[32]

1.7 Cases of non-correlation in suffixation

While the evidence from syllabification, stress, and Minimal Word Requirements correlates consistently when determining the pword structure of historically prefixed words in English these properties occasionally conflict for suffixed words. Consider the two words in (65), which represent consonant-initial and vowel-initial suffixation respectively:

(65)   a   slíyp' ləs   b   ǽlfəbət^{h}àyz
           'sleep+less'   'alphabet+ize'

In *sleepless* the stop is glottalized rather than aspirated even though *pl* is a well-formed onset cluster in English. This LOI violation indicates that the stop is followed by a pword boundary. Yet the suffix is unstressed which shows that it does not form a pword itself.

Rather than illustrating a conflict between the evidence from stress and from syllabification when it comes to determining pword structure this example contradicts the Strict Layer Hypothesis. Specifically, this example conflicts with the requirement that every unit is composed of one or more units of the immediately lower category (cf. Nespor & Vogel 1986). Assuming that this requirement does not hold universally the adjective *sleepless* can be analyzed as a concatenation of a pword and a syllable which together form a clitic group as is shown in (66). The same analysis holds for all words derived by consonant-initial suffixes in English.[33]

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[32] In fact, total assimilation as in *irregular, illiberal, immodest*, etc. can function as a positive boundary signal provided that the sonorants are indeed long (cf. the transcriptions in Webster's 1990). This is because long consonants do not occur within pwords in English.

(i)   i[mm]odest   ⇒   (im)$_\omega$(modest)$_\omega$
         i[ll]iberal   ⇒   (il)$_\omega$(liberal)$_\omega$
         i[rr]egular   ⇒   (ir)$_\omega$(regular)$_\omega$

[33] Cf. Raffelsiefen (to appear).

(66)   C
           /⟍
        ω /   ⟍
        | ⟍
        Σ   ⟍
        | ⟍
        σ   σ
      slíyp' ləs

The example in (65b), which is derived by a vowel-initial suffix, exhibits a genuine conflict between syllabification and stress. Specifically, sequences of unstressed syllables never occur in underived verbs (e.g. *elíminàte, exácerbàte, intérrogàte*) which might suggest that the stem and the suffix do not form a single domain of stress. In fact, Aronoff & Sridhar (1983) analyze the suffix *-ize* as a clitic to account for stress-neutrality (i.e. (alphabet)$_\omega$ize). However, this analysis conflicts with the fact that in American English a prevocalic *t* would always be flapped when followed by a pword boundary regardless of the stress on the following syllable as is shown by the clitic group [pǽrɪz] 'Pat is' and the compound [bǽrìyr], 'bat ear'.

How can the conflict between aspiration and apparent stress-neutrality be resolved? Assuming the pword structure (alphabetize)$_\omega$ one could account for the word-initial stress by associating the suffix *-ize* with an identity constraint which requires the stress in the derived form to be identical to the stress in the base.[34] By contrast, the syllabification of the *t* in onset position in *alphabetize* could not be explained by any identity constraint regardless of the pword structure of that word.

To conclude, the evidence from syllabification, which suggests the pword structure (alphabetize)$_\omega$, is the critical diagnostic for determining pword structure because syllabification is determined exclusively by its domain and strictly phonological constraints like the LOI. By contrast, stress patterns in English can also be determined by identity constraints which potentially obscure the strictly phonological evidence for pword structure (cf. also the discussion of the violations of Trisyllabic Laxing in (35b)). Once identity effects are disregarded the evidence from stress and syllabification correlate perfectly in English suffixation.[35]

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[34] Note that the stress pattern of *álphabetìze* does not indicate that the word includes two separate domains of word stress. This can be inferrred from contrasts in the non-primary stress in *álphabetìze*, which forms a single pword, and compounds like *consúmer prìce*, which consist of two pwords. That is, the stress on the weak member of a compound is stronger than any non-primary stresses within pwords (cf. footnotes 11, 26).

[35] Note that the relative prominence between pwords cannot be affected by identity constraints

2. The relation between morphological and prosodic structure

2.1 *The correlation between prosodic and morphosyntactic properties of (historically) prefixed words*

It was demonstrated in section 1 that in English all properties relating to prosodic structure (i.e. Minimal Word Requirements, stress patterns, syllable structure) consistently correlate with respect to the question of whether a historic prefix forms a separate pword or is integrated into the pword of the stem. The claim that these diagnostics are relevant for determining pword structure is supported by their additional correlation with morphosyntactic stem properties. The boundaries of pwords established on the basis of prosodic structure align consistently with morphological boundaries. The generalization for English is that pword boundaries which align with the right edge of a prefix align also with the left edge of an independent word. This generalization is best illustrated with cases where the stem is somewhat obscure being familiar to some speakers but not to others. Such prefixed words are typically listed with two variants in dictionaries, one indicating that the prefix forms a separate pword, and the other indicating that it is fused with the stem into a single pword. Consider for example the variants of the adjective *acephalous* in (67) listed in Webster's (1990):

(67)   [èysέfələs] ~ [əsέfələs]

The adjective *acephalous* means 'having no head' and is part of the learned vocabulary along with other adjectives such as *dicephalous* 'having two heads', *microcephalous* 'having an abnormally small head' etc. The word status of *cephalous* is unclear: it is listed as an adjective in Lehnert (1971), as a bound stem with the meaning 'indicates a head' in *The American Heritage Dictionary* (1985), and has no entry in Webster's (1990). The variants in (67) reflect the dubious word status of *cephalous*. Only speakers who have *cephalous* stored as a meaningful unit in their mental lexicon (for example pathologists) can have the prosodic representation $(a)_\omega(\text{cephalous})_\omega$ and pronounce the word [èysέfələs]. Other speakers pronounce the adjective [əsέfələs] instead which reflects the prosodic structure $(\text{acephalous})_\omega$. The claim that the variation illustrated in (67) depends on whether or not the base exists as an independent word is supported by the fact that prefixed adjectives with either a non-existing (cf. (68b)) or a common base (cf. (68c)) lack comparable variants (W is the "set of words"):

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which accounts for the fact that the evidence from relative prominence and from syllabification never conflict with respect to pword structure.

(68) a   [èy]céphalous ~ [ə]céphalous   cephalous ?∈ W

        b   [ə]nómalous (*[èy]nómalous)   nomalous ∉ W

        c   [èy]týpical (*[ə]týpical)   typical ∈ W

The question of whether or not the base is an independent word also accounts for the variation in the form of the prefix in (69):

(69) a   [èy]chlamýdeous ~ [æ]chlamýdeous   chlamydeous ?∈ W

        b   [æ̀]taráctic (*[èy]taráctic)   taractic ∉ W

        c   [èy]polítical (*[æ]polítical)   political ∈ W

The fact that both pronunciations of *achlamydeous* in (69a) are listed in Webster's reflects the obscurity of *chlamydeous*, a word which is likely to be known only by botanists. *Chlamydeous* is listed in some dictionaries (cf. *The American Heritage Dictionary* 1985, *OED* 1992), but not in others (cf. Webster's 1990). Only speakers familiar with this word are likely to pronounce the prefix in (69a) as a separate pword. For all others *achlamydeous* is represented as a single pword with the result that the historical prefix is subject to Trisyllabic Laxing. Among (historically) prefixed words whose base is clearly not a word in English Trisyllabic Laxing is never blocked (cf. (69b)). For words with a common base such as *apolitical*, on the other hand, there is no tendency for the prefix and the stem to fuse into a single pword with the result that Trisyllabic Laxing does not apply.

    The dependence of prosodic structure on the syntactic category of the base applies also to *iN*-prefixations. The rareness of the adjective *clement* is reflected in the variation in (70a). That variation, like the variants considered above, reflects distinct prosodic structures: one in which the prefix forms a separate pword and one in which it is fused with the stem into a single pword.

(70) a   inclément ~ ínclement   clement ?∈ W

        b   índolent (*indólent)   dolent ∉ W

        c   impróper (*ímproper)   proper ∈ W

The condition that the base must be a word refers to surface forms and is satisfied only if the stem of a prefixed word exists independently. The existence of cognates which are phonologically distinct from the base plays no role. For example, the existence of the words *dole, doleful, dolor, dolorous* is entirely irrelevant for the prosodic parsing of their historically prefixed cognate *indo-*

lent. The fact that the adjective *dolent* became obsolete in English rules out the prosodic structure $(in)_\omega(dolent)_\omega.$[36]

2.2 Alignment constraints on word formation
The correlation between morphological and prosodic structure in English word formation observed in section 2.1 is accounted for by the alignment constraints in (71).

(71) a   ALIGN (PREFIX, L; PWORD, L)
           ALIGN (PREFIX, R; PWORD, R) (first version)
      b   ALIGN (WORD, L; PWORD, L)
           ALIGN (WORD, R; PWORD, R)

The constraints in (71) align the edges of prefixes and words with pword boundaries. Assuming that prefixes combine only with independent words (rather than stems) in English word formation and that the derived words have the structure [prefix][word] (cf. the native coinages in (72b)) the alignment constraints in (71) account for the prosodic forms in (72c).

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[36] It is unclear whether the effect illustrated in (68) to (70) exists for all prefixes. Consider the historically prefixed word *uncouth*, whose base has become obsolete in modern English. Both in Jones and Gimson (1977) and in Wells (1990) the adjective *uncouth* is not transcribed with (optional) secondary stress on the prefix which distinguishes this word from other *un*-prefixations such as *unkind*, *unclear*, *unfair*. This difference might indicate that the prefix *un-* is similar to the prefixes discussed above in that it can form a separate pword only in combination with an independent word (e.g. *unkind*), but not otherwise. However, the historical *un*-prefixation *unkempt*, whose base has also become obsolete, is transcribed with secondary stress on the prefix. Consider next the verb *outstrip*, whose historical base *strip* 'to move fast' is obsolete in modern English. We find that all verbs derived by *out*-prefixation based on independent words, but not the verb *outstrip*, are transcribed with an initial stress mark in Webster's (1990):
(i) a òutgrów, òutnúmber, òutránk, òutréach, òutrún, òutséll, òutspénd, òuttálk   b outstríp
The contrast in initial stress in (i a, b) indicates that the prefix *out-* does not form a separate pword in *outstrip* which supports the claim that prefixes cannot form a separate pword unless they combine with a word. However, in Jones and Gimson (1977) and in Wells (1990) all verbs in (i) are transcribed with stress on the prefix, including the verb *outstrip*.
There is some evidence then that the Germanic prefixes *un-* and *out-* differ from the other English prefixes in that they inherently form a separate pword regardless of the morphosyntactic category of their stem. However, the evidence is inconclusive since there are only three relevant words, at least two of which (i.e. *uncouth*, *outstrip*) can also be pronounced without stress on the prefix.

(72) a [un]$_{Pref}$: [-A]   b [un]$_{Pref}$[pleasant]$_A$ c (ùn)$_\omega$(pléasant)$_\omega$
        [iN]$_{Pref}$: [-A]   [iN]$_{Pref}$[practical]$_A$ (im)$_\omega$(práctical)$_\omega$
        [iN]$_{Pref}$: [-A]   [iN]$_{Pref}$[redeemable]$_A$ (ir)$_\omega$(redéemable)$_\omega$
        [a]$_{Pref}$: [-A]   [a]$_{Pref}$[typical]$_A$ (à)$_\omega$(týpical)$_\omega$
        [sub]$_{Pref}$: [-A]   [sub]$_{Pref}$[conscious]$_A$ (sùb)$_\omega$(cónscious)$_\omega$
        [dis]$_{Pref}$: [-A]   [dis]$_{Pref}$[symmetrical]$_A$ (dis)$_\omega$(symmétrical)$_\omega$
        [non]$_{Pref}$: [-A]   [non]$_{Pref}$[essential]$_A$ (nòn)$_\omega$(esséntial)$_\omega$

The prosodic structures in (72c) determine the relative prominence between the prefix and the stem (cf. rule (7b)). They further account for the facts that prefixes and stems form separate domains of syllabification and of stress and that they both satisfy Minimal Word Requirements. The prosodic structures in (72c) say nothing about the questions of whether and to what extent the segments of a prefix assimilate to those of the stem. As was noted in sections 1.1. and 1.2 there is clear evidence that assimilation is not determined by the prosodic but rather by the segmental structure of prefixes.

What accounts for the observation that prefixes form a separate pword only in combination with a word? As for (native) English word formation morphological structures like [iN]$_{Pref}$[dolent]$_{Root}$ could not be generated because affixes combine only with words. Even if morphological structures like [iN]$_{Pref}$[dolent]$_{Root}$ were assumed the representation of the prefix as a separate pword can be ruled out by ranking the constraint in (71b), which requires pword boundaries to align with word (rather than with root) boundaries (e.g. *(dolent)$_\omega$), and the alignment constraint in (73), which requires pwords to be followed by pwords,[37] higher than the alignment constraint in (71a), which requires prefixes to be parsed as separate pwords.

(73)   ALIGN (PWORD, R; PWORD, L)

There is no need to refer to prefix classes to describe the prosodic structure of English prefixation.

2.3 Prosodic parsing

In section 2.2 the relation between morphological and prosodic structure is described in terms of constraints on word formation. This relation can be

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[37] The alignment constraint in (73) relates to the clause of the Strict Layer Hypothesis which requires that a prosodic constituent of a given level dominates only constituents of the next level down in the prosodic hierarchy. The constraint in (73) is violable as is shown by the fact that pwords can also combine with unstressed function words and suffixes, which do not form pwords in English.

depicted as in (74), where the mapping between morphological and prosodic representations is described by the alignment constraints in (71). The relation between prosodic and phonetic representations could also be partially described by alignment constraints, i.e. constraints which align the edges of pwords with the edges of feet and of syllables.

(74) | Morphological Representation | → | Prosodic Representation | → | Phonetic Representation |
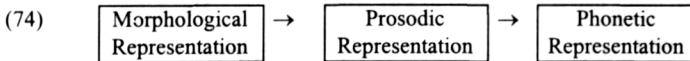
While the mappings of morphological to prosodic and then to phonetic representations shown in (74) pertain to speech synthesis the inverse relations describe speech analysis, i.e. the perspective of the hearer (or learner) as is shown in (75).

(75) | Phonetic Representation | ⇒ | Prosodic Representation | ⇒ | Morphological Representation |
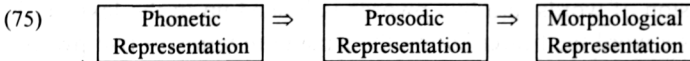
The relation between phonetic and prosodic structure refers directly to the notions of positive and negative boundary signals referred to in section 1. A possible model of that relation is presented in figure (76) where the input consists of the phonetic representation of a historically prefixed word (i.e. $[XY]_C$). "C" is a variable ranging over nouns, verbs, and adjectives. For reasons to be discussed in sections 2.4 and 2.5 I assume that historically prefixed words are parsed as single pwords unless phonological wellformedness conditions for pwords are violated.

(76)

$([XY]_C) \rightarrow$ | Is $(XY)_\omega$ phonologically wellformed? |

→Yes → $(XY)_\omega$

No → | Subdivide [XY] into wellformed pwords | → $(X)_\omega(Y)_\omega$
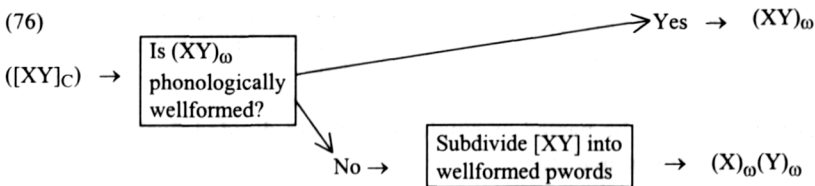
As it stands the model in (76) does not include any reference to word-internal syntactic categories. The empirical adequacy of this model depends on the question of how hearers parse phonetic strings such as [èyséfələs], which indicate the prosodic form $(a)_\omega(cephalous)_\omega$, if they do not know the word *cephalous*. If the word is parsed in terms of two pwords on the basis of its prosodic

properties the model in (76) is adequate.[38] If the word is parsed as a single pword in spite of its phonetic properties the model needs to be modified as follows:

(77)

$([XY]_C) \rightarrow$

| Is $(XY)_\omega$ phonologically wellformed? |

$\rightarrow$ Yes $\rightarrow$ $(XY)_\omega$

No

No$\rightarrow$ | Subdivide [XY] into wellformed pwords $\{(X)_\omega(Y)_\omega,...\}$ | $\rightarrow$ | Is $(Y)_\omega$ a word? | $\rightarrow$ Yes $\rightarrow (X)_\omega(Y)_\omega$
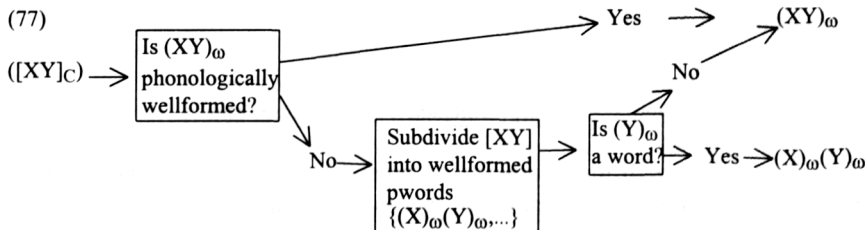
The model in (77) differs from that in (76) in that the righthand pword resulting from the subdivision of words into two pwords is looked up in the lexicon. If the word matches a word the hearer knows the parsing in terms of two pwords is accepted. Otherwise the word is parsed as a single pword. Since the model in (77) allows for a more straightforward description of the parsing of loanwords (cf. section 2.4) it will be assumed in this paper.

The flowchart in (77) is illustrated below by parsing the (historically) prefixed adjectives *impotent* and *unpleasant*. Wellformedness conditions for pwords are satisfied for as long as the parsing is consistent with all negative and positive boundary signals for pwords.

(78) Phonetic input: Prosodic parsing: wellformedness conditions for pwords:

[ímpʰətənt]$_A$ $\Rightarrow$ √(impʰətənt)$_\omega$ no violation

[ʌ̀npʰlézənt]$_A$ $\Rightarrow$ *(ʌ̀npʰlézənt)$_\omega$ initial secondary stress in prestress position signals an intervening pword boundary

Strings which cannot be parsed as single pwords are divided further into two pwords as is illustrated in (79):

(79)   wellformedness conditions for pwords:

*(ʌ̀)$_\omega$(npʰlézənt)$_\omega$ *(ʌ̀)$_\omega$ lax vowel signals that no pword boundary follows

*(npʰlézənt)$_\omega$ initial cluster signals that no pword boundary precedes

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[38] The question of how a word is parsed can be determined on the basis of its pronunciation. The consistent pronounciation of *acephalous* as [èyséfələs] indicates that the word has been parsed as two pwords.

$(\grave{\Lambda}n)_\omega(p^h l\acute{e}z\partial nt)_\omega$ No violation

$*(\grave{\Lambda}np^h)_\omega(l\acute{e}z\partial nt)_\omega$ $*(\grave{\Lambda}np^h)_\omega$ cluster signals that no pword boundary follows aspiration signals that syllable boundary precedes

$*(\grave{\Lambda}np^h l)_\omega(\acute{e}z\partial nt)_\omega$ $*(\grave{\Lambda}np^h l)_\omega$ cluster signals that no pword boundary follows

$*(\grave{\Lambda}np^h l\acute{e})_\omega(z\partial nt)_\omega$ $*(\grave{\Lambda}np^h l\acute{e})_\omega$ lax vowel signals that no pword boundary follows

                       $*(z\partial nt)_\omega$ lack of stress signals that string does not form a pword

As is shown in (78), (79) $(un)_\omega(pleasant)_\omega$ is on purely phonological grounds the only possible pword parsing for the input $[\grave{\Lambda}np^h l\acute{e}z\partial nt]_A$. For words derived by a productive prefix such as *unpleasant* there may exist an alternative approach to inferring the prosodic structure. That is, on the basis of recognizing the morphological structure of the word, in particular due to recognizing the prefix *un-*, hearers might 'recreate' the formation as described in (72) (i.e. analysis by synthesis).[39] The possibility that words are analyzed morphologically regardless of prosodic features must be allowed for in principle as is shown by cross-linguistic evidence. Compare for example the historically prefixed English and Italian words in (80). While the English words have prosodic properties (i.e. moraic structure, stress patterns, syllable structure) which signal that they consist of two pwords there is no evidence that the cognate prefixes in Italian form separate pwords. Rather the prosodic properties exhibited by the prefixed words in (80b) in (standard) Italian are indistinguishable from those exhibited by comparable simplexes.[40]

(80)

		Phonetic input:		Prosodic parsing:
a	English:	$[\grave{i}m.pri.s\acute{a}ys]_A$	$\Rightarrow$	$(im)_\omega(precise)_\omega$
		$[d\grave{i}s.\acute{o}.n\partial st]_A$	$\Rightarrow$	$(dis)_\omega(honest)_\omega$
		$[\grave{e}y.s\acute{o}w.\int\partial l]_A$	$\Rightarrow$	$(a)_\omega(social)_\omega$
b	Italian:	$[im.pre.ts\acute{i}.zo]_A$	$*\Rightarrow$	$(im)_\omega(preciso)_\omega$
		$[di.zo.n\acute{e}s.to]_A$	$*\Rightarrow$	$(dis)_\omega(onesto)_\omega$
		$[a.so.t\int\acute{a}.le]_A$	$*\Rightarrow$	$(a)_\omega(sociale)_\omega$

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[39] This type of analysis is the less plausible the less productive the prefix is. The prosodic parsing of a loanword like *abnormal*, which cannot be formed natively, can perhaps be inferred only on the basis of its prosodic features.

[40] Nespor & Vogel (1986) have argued that the blocking of intervocalic *s*-voicing in *asociale* indicates a pword boundary. In Standard Italian intervocalic [s] occurs also in simplexes (cf. ca[s]a 'house') and therefore does not function as a positive boundary signal.

One can safely assume that Italian hearers also recognize the morphological complexity of the prefixed words in (80b). The difference to English is that the morphological analysis of the Italian words in (80b) is not guided by prosodic structure.[41] Note that the Italian data do not argue against the universality of the prosodic diagnostics for pword structure established in section 1 but rather show that the alignment of specific morphosyntactic and prosodic boundaries is language specific. This point will be addressed again in section 5.

2.4 *The prosodic parsing of loan words*
Not all historically prefixed words whose stem matches an independent word in English are parsed as two pwords. Consider the cognate verbs in (81a) and (81b) (cf. Kingdon 1958:55):

(81) a   r[ɪ]fúse   'decline to do'   b   r[iy]fúse   'fuse again'
          r[ɪ]márk   'comment'   r[iy]márk   'mark again'
          r[ɪ]léase   'free'   r[iy]léase   'lease again'
          r[ɪ]pláce   'substitute'   r[iy]pláce   'place again'

The evidence from both stress and from the moraic structure indicates that the historically prefixed verbs in (81a) consist of single pwords whereas the verbs in (81b) consist of two pwords.[42] This difference results from the fact that the verbs in (81a) were borrowed whereas those in (81b) have been formed natively. The fact that prefixes generally form separate pwords in native word formation results from the mapping of morphological to prosodic structure described in section 2.2. Loanwords are not subject to constraints on English word formation (including the alignment constraints in (71)). Rather their prosodic form is determined by the rules for parsing phonetic input strings modelled in (77). Specifically, the observation that most historically prefixed words which have been borrowed into English are parsed as single pwords is accounted for in the model in (77) by making single pword parsing the default option which applies whenever there are no positive boundary signals.[43]

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[41] Based on Thornton's claim that prosodic words in Italian are minimally disyllabic (cf. Thornton 1996) Peperkamp (1997) proposes that only disyllabic prefixes can form separate pwords in Italian. Similarly, Szpyra (1992) claims that all monosyllabic, but no disyllabic, prefixes in Polish are integrated into the pword of the stem. Disyllabic prefixes satisfy Minimal Word Requirements but, at least in Italian, form a single domain of syllabification together with the stem.

[42] The correlation between the phonological and the semantic properties of the cognates in (81) is the topic of section 3.

[43] The default status is expressed by parsing words as single pwords unless phonological well-

Not all loanwords are parsed as single pwords as is shown by the examples in (82). While those words were borrowed from French according to the *OED* 1991 their phonological structure indicates that the prefix forms a separate pword:

(82)　(rè)$_\omega$(convéne)$_\omega$
　　　(sùb)$_\omega$(divíde)$_\omega$
　　　(dè)$_\omega$(compóse)$_\omega$

A possible explanation for the distinct parsings of the loanwords in (81a) and in (82) relates to their French origin. That is, assuming that French loanwords kept their word-final final stress when introduced into English stress may have functioned as a positive boundary signal in the three-syllable verbs in (82), but not in the disyllabic verbs in (83a). This is because final stress is common in native disyllabic verbs (e.g. *forgíve, believe*), but not in trisyllabic verbs. The result of parsing the words according to the model in (77) is shown in (83):

(83)　a　refúse　⇒ √(refúse)$_\omega$　b reconvéne ⇒ *(rèconvéne)$_\omega$ ⇒ (rè)$_\omega$(convéne)$_\omega$
　　　submérge ⇒ √(submérge)　　subdivíde ⇒ *(sùbdivíde)$_\omega$ ⇒ (sùb)$_\omega$(divíde)$_\omega$
　　　defráud　⇒ √(defráud)$_\omega$　decompóse ⇒ *(dècompóse)$_\omega$ ⇒ (dè)$_\omega$(compóse)$_\omega$

The claim that stress functioned as a positive boundary signal in (82), but not in (81a), is supported by the further development of the loanwords which were not based on independent words in English. Recall that such words are always parsed as single pwords according to the model in (77) with the result that they (eventually) adjust to the phonological wellformedness conditions for single pwords. The fact that disyllabic, but not trisyllabic, verbs invariably kept their final stress shows that final stress functioned as a positive boundary signal only in trisyllabic verbs (cf. also the examples in (22b)):

(84)　a　refér ⇒ √(refér)$_\omega$　　　　　　b　reconcíle ⇒ *(rèconcíle)$_\omega$ > (réconcile)$_\omega$

The parsing of disyllabic French loan verbs as single pwords is entirely regular as is illustrated by the additional examples in (85) all of which relate to independent words in English.

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formedness conditions for pwords are violated. The opposite generalization would be expressed if a given input string was first checked with respect to its divisibility into wellformed pwords.

(85)   (dischárge)$_\omega$, (discláim)$_\omega$, (disclóse)$_\omega$, (discóunt)$_\omega$, (disgúise)$_\omega$, (diséase)$_\omega$,
        (recíte)$_\omega$, (restráin)$_\omega$, (decláim)$_\omega$, (decrý)$_\omega$, (defáce)$_\omega$, (retúrn)$_\omega$, (defáme)$_\omega$,
        (defáult)$_\omega$, (defórm)$_\omega$, (degráde)$_\omega$, (denóte)$_\omega$, (despóil)$_\omega$, (excláim)$_\omega$,
        (depárt)$_\omega$, (depóse)$_\omega$, (depréss)$_\omega$, (subsérve)$_\omega$, (encháin)$_\omega$, (exchánge)$_\omega$,
        (enclóse)$_\omega$, (enróll)$_\omega$, (ensúre)$_\omega$, (encrúst)$_\omega$, (enfórce)$_\omega$

Assuming that the stress shift in (84b) indicates indeed that final main stress functions as a positive boundary signal in trisyllabic verbs which triggers the parsing of the prefixes in (82) as separate pwords it follows that the effect should be limited to verbs which do not end in a cluster. This is because final main stress is always stable in trisyllabic verbs which end in a cluster including verbs which are not based on an independent word and therefore form a single pword (e.g. (rèsurréct)$_\omega$, (còmprehénd)$_\omega$, (còntradíct)$_\omega$). The observation that the prefixes form a separate pword in (86b), but not in (86a), confirms the claim that final main stress functions as a positive boundary signal only in verbs which do not end in a cluster.[44] All verbs in (86) are borrowed from French:

(86)   a   (r[ɛ̀]comménd)$_\omega$ b   (r[ìy])$_\omega$(consígn)$_\omega$
           (r[ɛ̀]colléct)$_\omega$ (r[ìy])$_\omega$compóse)$_\omega$
           (r[ɛ̀]presént)$_\omega$ (r[ìy])$_\omega$confér)$_\omega$
           (dìsappóint)$_\omega$ (dìs)$_\omega$(obéy)$_\omega$
           (dìsafféct)$_\omega$ (dìs)$_\omega$(allów)$_\omega$
           (dìsconcért)$_\omega$ (dìs)$_\omega$(engáge)$_\omega$

The prosodic parsing of the verbs in (86) according to the model in (77) is illustrated in (87):[45]

(87)   a   recomménd ⇒ √(rècomménd)$_\omega$ b   reconsígn ⇒ *(rèconsígn)$_\omega$ ⇒ (rè)$_\omega$(consígn)$_\omega$

If the analysis illustrated in (87) is correct it follows that final stress on trisyllabic adjectives should always function as a positive boundary signal. This is

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[44] Apparent counter-examples are typically native coinages which are subject to the alignment constraints in (71) (e.g. (dìs)$_\omega$(connéct)$_\omega$, (prè)$_\omega$(seléct)$_\omega$).

[45] The hypothesis that the final main stress on French loanwords functioned as a positive boundary signal accounts furthermore for the fact that the historically prefixed verbs in (86b), but not those in (i), were parsed as two pwords. This is because the verbs in (i) were borrowed from Latin rather than from French and never had final main stress in English (cf. Danielsson 1948):

(i)   récreàte   ⇒ √(récreàte)$_\omega$
        díslocàte   ⇒ √(díslocàte)$_\omega$
        állocàte   ⇒ √(állocàte)$_\omega$

because such adjectives differ from verbs in that they never have regular main stress on the final syllable when forming a single pword (cf. (tácitùrn)$_\omega$, not *(tàcitúrn)$_\omega$, (dérelìct)$_\omega$, not *(dèrelíct)$_\omega$). The hypothesis is supported by the prosodic parsing of French loanwords in English as is illustrated in (88).

(88) (dìs)$_\omega$(contént)$_\omega$, (im)$_\omega$(matúre)$_\omega$, (in)$_\omega$(sincére)$_\omega$, (im)$_\omega$(políte)$_\omega$,
      (in)$_\omega$(discréte)$_\omega$, (in)$_\omega$(distínct)$_\omega$, (in)$_\omega$(corréct)$_\omega$, (in)$_\omega$(exáct)$_\omega$
      (in)$_\omega$(diréct)$_\omega$, (in)$_\omega$(corrúpt)$_\omega$

The hypothesis that final main stress has functioned as a positive boundary signal in certain types of French loanwords may also account for the prosodification of the loanwords in (89), all of which have undergone historical stress shifts in English.

(89) a   (rè)$_\omega$(báptize)$_\omega$, (dè)$_\omega$(céntralize)$_\omega$, (rè)$_\omega$(vívifỳ)$_\omega$, (prè)$_\omega$(sígnifỳ)$_\omega$
     b   (im)$_\omega$(módest)$_\omega$, (dìs)$_\omega$(hónest)$_\omega$, (il)$_\omega$(légal)$_\omega$, (àb)$_\omega$(nórmal)$_\omega$,
         (im)$_\omega$(mórtal)$_\omega$, (in)$_\omega$(fértile)$_\omega$, (in)$_\omega$(décent)$_\omega$, (in)$_\omega$(tólerant)$_\omega$,
         (in)$_\omega$(élegant)$_\omega$, (im)$_\omega$(móral)$_\omega$, (im)$_\omega$(móbile)$_\omega$, (ir)$_\omega$(régular)$_\omega$

The fact that the words in (89), but not those in (82), (86), and (88) underwent stress shifts indicates perhaps that the words in (89) were analyzed as suffixations and therefore subject to a constraint against main stress on suffixes. For verbs original main stress on suffixes is preserved in the form of secondary stress (cf (89a)) whereas adjectival suffixes have largely lost stress entirely (cf. (89b)).[46] The assumption that the prefixes were systematically parsed as separate pwords in the loanwords in (89) accounts for the fact that stress never shifted onto the prefix regardless of the moraic structure of words (e.g. *immodést > immódest, dishonést > dishónest*). For illustration of this point consider the hypothetical development in (90):[47]

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[46] This property distinguishes English from German where main stress on suffixed French loanwords persists (e.g. *ideál* 'idea', *elegánt* 'elegant', *maliziös* 'malicious' etc).

[47] The words in (i) may appear to contradict the analysis illustrated in (90) since final stress failed to function as a positive boundary signal:

(i)   Presumed original stress pattern: Prosodic form in Modern English:
        [impotént]$_A$ (ímpotent)$_\omega$
        [infiníte]$_A$ (ínfinite)$_\omega$
        [infamóus]$_A$ (ínfamous)$_\omega$
        [impióus]$_A$ (ímpious)$_\omega$

However, the conditions for prosodic parsing in (i) may have differed from those applying in (90b). Consider the possibility that a prefixed word may have been borrowed before its base or may have occurred more frequently than its base. Once a word is parsed as a single pword (due to the absence of a base) it is bound to adjust to the phonological wellformedness conditions

(90)   Prosodic parsing of loanwords   Subsequent destressing of the suffix:
        with final main stress:

    a   [rebaptíze]$_V$ $\Rightarrow$ (rè)$_\omega$(baptíze)$_\omega$ >   (rè)$_\omega$(báptize)$_\omega$

    b   [immodést]$_A$ $\Rightarrow$ (im)$_\omega$(modést)$_\omega$ >   (im)$_\omega$(módest)$_\omega$

The data reviewed here are theoretically significant in two respects. First, they suggest that certain generalizations lend themselves to an analysis within a hearer-based prosodic parsing model but not within a speaker-based model of synthesis. Specifically, the types of regularities reflected in the prosodic structures of the loanwords in (82), (85), (86), (88) could hardly be accounted for in terms of alignment constraints (cf. (71a)). Second, assuming that the prosodic structures of the words considered here have indeed been determined by their phonological properties (e.g. number of syllables, final stress) it follows that correlations between their prosodic form and semantic compositionality require a model where semantic interpretation is based on prosodic forms rather than the other way around. This point is the topic of section 3.

2.5 Historical fusion of pwords

The data in (91) illustrate cases where native coinages which at one point presumably consisted of two pwords historically fused into one pword (cf. *OED* 1991):

(91) (dìs)$_\omega$(íntegràte)$_\omega$ > (disíntegràte)$_\omega$ (néck)$_\omega$(làce)$_\omega$ >   (nécklace)$_\omega$

      (fòr)$_\omega$(gíve)$_\omega$ > (forgíve)$_\omega$ (cúp)$_\omega$(bòard)$_\omega$ >   (cúpboard)$_\omega$

      (fòr)$_\omega$(éver)$_\omega$ > (foréver)$_\omega$ (shéep)$_\omega$(hèrd)$_\omega$ >   (shépherd)$_\omega$

      (àll)$_\omega$(óne)$_\omega$ > (alóne)$_\omega$ (víne)$_\omega$(yàrd)$_\omega$ >   (vínyard)$_\omega$

The main cause for prosodic fusion is presumably high token frequency. Yet, phonological factors may also play a role. Note that the main stress in the fused pword conforms to the typical stress patterns for single pwords (e.g. trochaic stress for disyllabic nouns, iambic stress for disyllabic verbs) and also

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for pwords and consequently lose the properties which functioned as positive boundary signals. As a result the word will continue to be parsed as a single pword by future generations even if its base happens to be introduced into the language at a later stage. This explanation may account for the prosodic forms of the adjectives *impotent* and *infinite* both of which were attested earlier than their respective bases according to the *OED* 1992. The adjective *infamous* was in fact pronounced *infámous* in the past (cf. *OED* 1992) and may have undergone stress shift due to analogy with the noun *infamy*. The adjective *impious* may have been pronounced with two syllables by some in which case final stress would have failed to function as a positive boundary signal.

preserves the location of the main stress in the original pword sequence. Perhaps fusion is blocked in cases where the main stress in the pword sequence would violate the stress patterns of single pwords (e.g. √(dìs)$_\omega$(engáge)$_\omega$ but *(dìsengáge)$_\omega$, √(ùn)$_\omega$(awáre)$_\omega$ but *(ùnawáre)$_\omega$). In addition pword fusion may be more likely if the resulting cluster forms either a good syllable contact (cf. *fo*[rg]*ive*) or a wellformed syllable head (cf. *ne*[kl]*ace*).[48]
The opposite phenomenon, that is the historical "defusion" of a single pword into two separate pwords, is rather unusual. The perhaps only relevant examples are spelling pronunciations (e.g. (weyst)$_\omega$(cowt)$_\omega$ for former (wɛskət)$_\omega$ 'waistcoat' (cf. Jespersen 1942:141ff) or folk etymologies, which are typically based on words whch are too long to be accepted as simplexes (e.g. (sparrow)$_\omega$(grass)$_\omega$ for (asparagus)$_\omega$). The fact that fusion of two pwords into one pword is a common historical process whereas the opposite process occurs rarely supports the default status attributed to the parsing of words as single pwords.

3. The semantic interpretation of historically prefixed words

3.1 *Two accounts of compositional versus noncompositional interpretation*
In generative grammar, both phonological and semantic rules interpret morphosyntactic structure. Systematic correlations between phonological and semantic structure must consequently relate to morphosyntactic structure. In morphology such correlations are described in terms of affix classes. For example, Allen (1978) proposes that class I affixes trigger the operation of content-changing rules whereas class II affixes block the operation of such rules.[49] The notion "content-changing" refers to both phonological and semantic structure. On her analysis the allegedly systematic correlation between nasal assimilation, stress retraction, and semantic idiosyncracy in (92a) motivates the analysis of *iN-* as a class I prefix. By contrast, the correlation between the

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[48] For a discussion of preferred syllable contacts see Vennemann (1988:40ff). Pword fusion may also be more likely if the relevant consonants are homorganic and hence assimilate more easily (cf. *cu*[pb]*oard*, *bla*[kg]*uard*), or if the second pword starts with the perceptually nonprominent consonant [h] (cf. *shee*[ph]*erd*, *fo*[rh]*ead*).

[49] This type of analysis is characteristic for all generative models of the morphology-phonology interface in which phonology and semantics are interpretive rule components. Cf. the following quote by Mohanan (1986)

> "The reader will have noticed that affixation at stratum 1 is by and large less productive than affixation at stratum 2. This also correlates with the fact that there are fewer lexical exceptions, and fewer cases of semantic opacity in words derived at stratum 2." (Mohanan 1986:57)

absence of these phonological properties and semantic compositionality in (92b) follows from the classification of *un-* as a class II prefix.

(92)

$$
\begin{array}{c}
\text{iN\textcircled{i} - \text{potent}} \\
a \quad [\text{ímp}^h\text{ətənt}] \qquad\qquad\qquad\qquad \text{'sterile'} \\[1em]
\text{un\textcircled{i} - \text{pleasant}} \\
b \quad [\text{ʌnp}^h\text{lézənt}] \qquad\qquad\qquad\qquad \text{'not pleasant'}
\end{array}
$$

The correlation between phonological and semantic structure illustrated above could, however, also be explained without reference to distinct prefix-classes and, in fact, without reference to prefixes. Specifically, those correlations can be captured in the model outlined in (93). If a (historically prefixed) word XY is prosodically parsed as a single pword by the English hearer it is interpreted solely with reference to the context in which it has been encountered. If a historically prefixed word XY is parsed as two pwords it is interpreted compositionally ("X'(Y')" reads "the meaning of X applied to the meaning of Y"):[50]

(93) a

Phonetic Representation	⇒	Prosodic Representation	⇒	Semantic Representation

  b   [XY] ⇒ $(XY)_\omega$ ⇒ XY'
       [XY] ⇒ $(X)_\omega(Y)_\omega$ ⇒ X'(Y')

  c   [ímp^{h}ətənt] ⇒ $(\text{imp}^h\text{ətənt})_\omega$ ⇒ impotent'
       [ʌnp^{h}lézənt] ⇒ $(\text{ʌn})_\omega(\text{p}^h\text{lézənt})_\omega$ ⇒ un'(pleasant')

The semantic interpretation of historically prefixed words depends accordingly on the question of whether or not the prefix is synchronically parsed as a separate pword. As was shown in (78), (79) the word *unpleasant* is necessarily parsed as $(\text{un})_\omega(\text{pleasant})_\omega$ on the basis of its prosodic properties. The meaning assigned to *unpleasant* by the hearer will consequently be a function of the meaning of *un* applied to the meaning of *pleasant*. By contrast, the word *impotent* can as a result of its stress contour only be parsed as a single pword. Therefore the meaning assigned to that word is inferred from context alone. On

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[50] Alternatively, one could also map prosodic representations first to morphological and then to semantic representations (cf. figure (75a)).

this view the semantic interpretation of words with prosodically fused prefixes does not differ from that of simplexes. There is hence no need to posit obscure 'content-changing' rules to explain the correlation between the fused prosodic structure and the idiosyncratic meaning in (92).

The approaches to the semantic interpretation of derived words illustrated in (92) versus (93) differ empirically in various respects. As was mentioned in section 2.4. the main empirical evidence in support of the approach outlined in (93) concerns the predictability of the semantic interpretation of words on the basis of their phonological properties. Recall that the observation that for example disyllabic, but not trisyllabic, verbs borrowed from French are typically interpreted non-compositionally is coincidental on Allen's approach, but can be explained within the model in (93). As the result of linking the semantic interpretation of words to affix classes it is in general not possible to account for the observation that historically prefixed words are interpreted compositionally whenever they consist of two pwords. Consider the native coinage [ìmpʰówtənt], which, unlike [ímpʰətənt], is prosodically parsed as (im)$_\omega$(potent)$_\omega$ and is interpreted compositionally (i.e. 'not potent'). The evidence for the claim that historically prefixed words are interpreted compositionally whenever they consist of two pwords regardless of putative class membership is reviewed in the next section.

3.2 Empirical evidence for compositional interpretation

Compositional interpretation of historically derived words is often difficult to determine synchronically because cognates tend to exhibit similarities in meaning simply as a result of their common origin.[51] One criterion for establishing compositional interpretation (rather than just similarity in meaning) relates to the stability of the semantic relation between the derived word and its base through time. If a derived word consistently mirrors the historical semantic changes affecting its base it can be concluded that it is interpreted compositionally. Compare for example the obsolete with the current definitions of the adjectives *honest* and *dishonest* cited in the *OED*:

(94)   honest   dishonest
     former: †worthy of honour   †dishonourable
     current: free from fraud   fraudulent

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[51] This observation also holds for cognates in different languages where semantic similarity obviously could not result from compositional interpretation (cf. the similar meanings of the English adjective *pious* and its French cognate *pieux*).

In the adjective *dishonest* the prefix forms a separate pword as can be inferred from the stress on the open penultimate syllable, the secondary stress on the prefix, and from the historical devoicing of the intervocalic *s*. Consequently, the meaning assigned to *dishonest* by hearers is bound to be a function of the meaning of *d̦is-* applied to the meaning of *honest* (i.e. 'not honest'). The parallel semantic development illustrated in (94) indicates that the prefixed word has indeed been subject to compositional interpretation by generations of English hearers.

For additional illustration of this point consider the adjective *disloyal*. The prefix forms a separate pword as can be inferred from its stressedness and from the syllabification of the *s* in coda position, which constitutes an LOI violation. Compositional interpretation is indicated by the parallel semantic development of the adjectives *loyal* and *disloyal* shown in (95):

(95)		loyal	disloyal
	former:	faithful in love, true to a lady or a lover (Walker 1826)	false in love, not true to the marriage bed (Walker 1826)
	current:	steadfast in one's allegiance to a person or cause or to one's country.	not steadfast in one's allegiance to a person or cause or to one's country.

Returning to *iN*-prefixations we find that whenever the prefix forms a separate pword the semantic development of the derived word mirrors the semantic development of its base ("A" stands for *The American Heritage Dictionary*, "We" stands for *Webster's*). Relevant examples are listed in (96):

(96)		polite	impolite
	former:	Obs. polished, smooth	Obs.: unpolished, wanting smoothness
	current:	courteous	discourteous
		plausible	implausible
	former:	*OED*: worthy of applause	*OED*: not worthy of applause
	current:	appearing worthy of belief	provoking disbelief
		curious	incurious
	former:	A: extremely careful or scrupelous. Wa: solicitous of perfection	Wa: inattentive, negligent
	current:	eager to acquire information	uninterested
		docile	indocile
	former:	teachable, easily instructed	unteachable, incapable of being instructed
	current:	willing to obey	unwilling to obey

	liberal	illiberal
former:	We: of or befitting a man of free birth. Wa: not mean, not low in birth; becoming a gentleman.	We: lacking culture and refine-ment. A: mean, ill-bred; ungentlemanly. Wa: not noble
current:	broad-minded, progressive	narrow-minded, bigoted
	modest	immodest
former:	Wa: not loose, not unchaste	Wa: unchaste, impure, obscene
current:	shy, reserved, not self-assertive	arrogant
	decent	indecent
former:	Wa: becoming; We: appropriate	unbecoming
current:	morally praiseworthy	offensive to manners or morals

All *iN*-prefixations in (96) consist of two pwords as can be inferred from the secondary stress on their initial syllable (cf. Webster's 1990).[52] As a result of their prosodic structure they are interpreted compositionally which accounts for the parallel semantic developments demonstrated in (96).

The data in (96) conflict with the common assertion that semantic idiosyncracy is an inherent property of words derived by *iN*-prefixation:

> *iN*-: "...the resultant derived forms are lexicalized, semantically and phonologi-cally opaque..."
> *non*-: "...the resultant derived forms are in general unlexicalized, semantically and phonologically transparent..."
> *un*-: "...*un*-forms are situated between the *iN*- and *non*- forms with respect to these criteria, depending on how productively or freely the prefix combines with a given base: the less productive, the more like *iN*-; the more productive, the more like *non*-." (Horn 1989:282ff)

Horn's claim that *iN*-prefixations are in general "semantically and phonologi-cally opaque" is simply wrong. As has been shown in section 1, *iN*- like *un*- can form a separate pword. The observation that the semantic developments of *iN*-prefixations in which *iN*- forms a separate pword reflect the semantic devel-opment of their base indicates compositional interpretation. The fact that lexi-calization and semantic opacity is more common for words historically derived by *iN*-prefixation than for those derived by *un*- or *non*- prefixation is not an inherent property of the respective prefixes but rather reflects on the origin of the derived words. Whereas many words derived by *iN*-prefixation have been

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[52] In some of those prefixations there are additional phonological cues which show that the prefix forms a separate pword (e.g. the main stress on the final syllable in *impolite* or on the penultimate syllable in *immódest, indócile*.

borrowed into English almost all words derived by *un-* or *non*-prefixation have been coined natively.[53] The correlation between non-productivity and semantic opacity posited by Horn is not systematic either. Prefixed words such as *abnormal* and *malodor* are interpreted compositionally as a result of their prosodic structure (i.e. $(ab)_\omega(normal)_\omega$, $(mal)_\omega(odor)_\omega$)[54] even though they involve extremely rare prefixes.

The prosodic determination of semantic interpretation posited for English does not extend to all languages. Compare the Italian prefixed verbs in (97a), which are interpreted compositionally, with the homophonous verbs in (97b), which have idiosyncratic meanings (cf. Peperkamp 1997:72):

(97) a riflettere   'to bend again'   b riflettere   'to think'
        riguardare   'to look again'   riguardare   'to concern'
        ripiegare   'to fold again'   ripiegare   'to make do with'

Italian differs from English in that hearers cannot infer semantic composition-ality on the basis of pword structure. While the semantic interpretation of words is apparently not necessarily determined by prosodic structure it is conceivable that pwords always play a role in semantic interpretation.

4. Head prefixes
4.1 Systematic differences between head and non-head prefixes
The observation that prefixes form separate pwords in English word formation has been accounted for by positing the alignment constraints in (71a), which are repeated in (98):

(98)   ALIGN (PREFIX, L; PWORD, L)
       ALIGN (PREFIX, R; PWORD, R) (first version)

In this section I discuss evidence for a modification of the second alignment constraint in (98) to the effect that head prefixes (i.e. prefixes which determine the syntactic category of the derived word) be excluded. Compare the adverbs in (99a), whose prefix functions as head, with the words in (99b), in which the stem functions as head.[55]

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[53] Unlike loanwords natively coined words are generally based on independent words and are subject to the alignment constraints in (71).
[54] Both words are transcribed with secondary initial stress in *Webster's*.
[55] The basis for the comparison of prefixes here and in the following examples is purely phonological: when not forming a separate pword certain instances of the (historical) negative

(99) a $[a[X]_A]_{ADV}$ $[a[X]_N]_{ADV}$ $[a[X]_V]_{ADV}$

[ə]lóud   [ə]píece   [ə]míss
[ə]éw   [ə]field   [ə]sléep
[ə]frésh   [ə]fire   [ə]glítter
[ə]lóne   [ə]fóot   [ə]wáre
[ə]bróad   [ə]héad   [ə]gó
[ə]fóul   [ə]bláze   [ə]stír
[ə]wrý   [ə]dríft   [ə]glów

b $[a[X]_A]_A$ $[a[X]_N]_N$

[èy]polítical   [èy]sýmmetry
[èy]týpical   [èy]sýnchronism

The examples in (99) have correlated morphosyntactic and prosodic structures. The prefix *a-* in (99a) combines with adjectives, nouns, or verbs and always yields adverbs. This prefix clearly does not form a separate pword as is shown by its lack of stress. By contrast, the prefix *a-* in (99b), which is not a head, forms a pword as is indicated by stress and diphthongization.

Two other differences correlate with the prosodic and morphosyntactic properties contrasted in (99a) and (99b). First, the negative prefix *a-* has a specific lexical meaning (i.e. 'not', 'lack of'). No such meaning can be defined for the category-determining prefix *a-*, which is yet another parallel to the (category-determining) suffixes. Furthermore, adverbs derived by *a*-prefixation tend to develop idiosyncratic meanings as can be illustrated with a comparison of the adverbs *loudly* and *aloud*. Whereas the meaning of *loudly* is fully compositional (i.e. 'in a loud manner') the meaning of *aloud* cannot be inferred from the meanings of its parts. Specifically, the adverb *aloud* only applies to human voices (cf. *Play the music aloud!*) and does not mean 'in a loud manner', but rather 'in a voice loud enough to be heard; not in a whisper'. In contrast to adverbial *a*-prefication, the meanings of words historically derived by negative *a*-prefixation are strictly compositional whenever the prefix forms a separate pword. This difference is explained by the mapping of phonetic to prosodic and then to semantic structure described in section 2:

(100)   [əláwd] $\Rightarrow$ (əláwd)$_\omega$ $\Rightarrow$ aloud'

        [èytípəkəl] $\Rightarrow$ (èy)$_\omega$(típəkəl)$_\omega$ $\Rightarrow$ a'(typical')

prefix *a-* are homophonous to the (etymologically unrelated) adverbial prefix (e.g. *[ə]tomic* 'atomic' - *[ə]loud* 'aloud'.

The prefixes compared in (99a) and (99b) differ in yet another respect. The negative prefix *a-*, which forms a separate pword, is insensitive to the stress pattern of the base as the native coinages in (101) illustrate:

(101)   [èy]týpical, [èy]polítical, [èy]tónal, [èy]syntáctic, [èy]pèriódic, [èy]sýnchronism

By contrast, the adverbial prefix *a-* combines only with monosyllabic or trochaic words. The observation that prefixes which do not form a separate pword may be sensitive to the phonological properties of their stem whereas prefixes which form a separate pword are insensitive to those properties makes sense. In the latter case prefixation amounts to the concatenation of two pwords where — as in compounding — internal phonological structure does not matter.

The differences between the adverbial prefix *a-*, which is the head of the derived word, and the negative prefix *a-*, which is not a head, are summarized in (102). All properties in (102b) follow from the prosodic difference in (102a):[56]

(102)

	head prefixes:	non-head prefixes:
a	♦ do not form separate pwords	♦ can form separate pwords
b	♦ have no lexical meaning ♦ derived words may show semantic idiosyncrasies ♦ sensitive to the phonological shape of the base	♦ have a lexical meaning ♦ derived words have a compositional meaning ♦ insensitive to the phonological shape of the base

The correlation between morphosyntactic function and prosodic form summarized in (102) holds also for English suffixes all of which function as heads and none of which forms a separate pword.[57] For English word formation it holds

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[56] There are some prefixes which are not heads and yet may affect the category of the derived word as is shown in (i):

(i)   She is very pro-government.   *She is very government
        She is very anti-government
        non-stop flight   *stop flight

The prefixes *pro-, anti-* and *non-* are not heads because, unlike the prefixes *a-, be-*, and *en-*, they do not yield words of a specific category. That is, words like *pro-European, anti-European*, and *non-European* can be both adjectives and nouns. The prefixes *pro-, anti-*, and *non-* clearly form separate pwords in (i).

[57] Cf. Raffelsiefen, to appear.

then that head affixes do not form separate pwords which distinguishes them from non-head affixes.

For further illustration of the correlations in (102) compare the native coinages in (103a) and (103b):

(103) a   [bɪ]héad   b   [rìy]wríte

        [bɪ]ráte   [rìy]fértilize

        [bɪ]fríend   [rìy]márry

        [bɪ]síege   [rìy]finànce

        [bɪ]cóme   [rìy]estáblish

        [bɪ]líe   [rìy]convéntionalize

        [bɪ]táke   [rìy]appéar

        [bɪ]grúdge   [rìy]hóspitalize

        [bɪ]wáre   [rìy]bírth

Verbs derived by *be*-prefixation are based on adjectives, nouns, or verbs as is shown in (104):

(104) $[be[X]_A]_V$ $[be[X]_N]_V$ $[be[X]_V]_V$

        [bɪ]little   [bɪ]witch   [bɪ]moan

        [bɪ]long   [bɪ]devil   [bɪ]set

        [bɪ]numb   [bɪ]labor   [bɪ]smirch

Since the prefix *be-* determines the category of the derived word it should not form a separate pword according to the table in (102). In fact, the prefix is unstressed and the vowel cannot be diphthongized. These prosodic facts lead us to expect that no specific meaning can be assigned to *be-* and that *be*-prefixations tend to be semantically idiosyncratic. Clearly, the facts that *behead* means 'to decapitate', that *belittle* means 'to disparage', etc. cannot be inferred from the meanings of their parts. Finally, the prefix *be-* shows precisely the same prosodic restrictions as the adverbial prefix *a-*. That is, it combines only with consonant-initial monosyllabic or trochaic words.

Consider now the words in (103b) derived by the prefix *re-*. The fact that the category of words derived by *re*-prefixation is identical to the category of their base indicates that *re-* is not a head and correlates with the phonological evidence which shows that *re-* forms a separate pword. That is, the prefix *re-* is stressed and satisfies Minimal Word Requirements. In words of the form $(re)_\omega(X)_\omega$ *re-* means 'again', and the meaning of such words is always fully

compositional. As is shown by the examples in (103b), coinages in *re-* are not subject to any phonological restrictions on the base.[58]
Compare finally the native coinages in (105a) and (105b):[59]

(105)	a	$[iN[X]_A]_A$	$[iN[X]_N]_N$	b	$[eN[X]_N]_V$
		impráctical	imbálance		embódy
		imprecíse	ináptitude		embéd
		irredéemable	inconfórmity		entráp
		illégible	imprecísion		encómpass
		illógical	inabílity		enlíst
		impláusible	inexáctitude		encóde
		ináccurate	impercéption		encírcle
		inatténtive	irrècognítion		empówer

The prefix *iN-* combines with adjectives and nouns such that the category of the derived word is always identical to the category of the base. By contrast, *eN-*prefixation always yields verbs.[60] It is therefore expected that *iN-*, but not *eN-*, can form a separate pword (cf. table (102)). As was noted earlier, the evidence from stress shows that *iN-* can indeed form a pword when attached to words. The prefix *eN-*, on the other hand, is always unstressed (cf. the transcriptions in Webster's 1990, Wells 1990, Jones and Gimson 1977). Interestingly, *iN-* assimilates more extensively than *eN-*, since *iN-*, but not *eN-*, assimilates to following sonorants.[61] This observation confirms the claim that assimilation is irrelevant for pword structure.

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[58] Interestingly, there are a few verbs historically derived by *re-*prefixation which are based on adjectives. A perhaps complete list of relevant examples is given in (i) where only the first two verbs are native coinages:
(i) [ɾɪ]fine, [ɾɪ]new, [ɾɪ]lax, [ɾɪ]fresh, [ɾɪ]strict, [ɾɪ]vile
The verbs in (i) illustrate a correlation of the properties listed in the lefthand column in table (102). The fact that the category of the prefixed forms differs from the category of their respective bases correlates with the fact that the prefixes do not form a separate pword as is shown by the lack of stress (cf. Webster's 1990). As for their semantic structure none of the verbs in (i) means 'to make A' again', where A' is the meaning of the adjectival stem. In fact, the notion 'again' is not crucial to the meaning of any verb in (i). Finally, the verbs in (i) are all based on consonant-initial monosyllabic or trochaic stems. Unfortunately, there are not enough examples of *re-*prefixation based on adjectives to draw any firm conclusions. It is also unclear whether or not the prefix *re-* originally formed a separate pword in the native coinages *refine* and *renew*.
[59] All words in (105) are native coinages according to the *OED*.
[60] Cf. also the verbs *embitter, enable, enlarge, enrich, endear*, which are based on adjectives.
[61] For some speakers, *eN-* also assimilates to following nasals (cf. the variants *enmesh ~ emmesh, enmarble ~ emmarble, enmantle ~ emmantle*). The prefix *eN-* never assimilates to following liquids.

The semantic compositionality of words derived by *iN*-prefixation consisting of two pwords has been discussed in section 2. When forming a separate pword, the prefix *iN*- consistently means 'not' when combining with an adjective and 'lack of' when combining with a noun. By contrast, the unstressed prefix *eN*- has no specific meaning and verbs derived by *eN*-prefixation tend to exhibit semantic idiosyncrasies.[62] According to table (102) we furthermore expect *iN*-, but not *eN*-prefixation, to be insensitive to the prosodic structure of the base. In fact, *eN*- combines only with monosyllabic or trochaic bases which is also true for the other head prefixes. At least for the prefix *eN*- this restriction cannot be considered a consequence of a restriction to (typically monosyllabic or trochaic) Germanic stems because there are many native formations based on Romance stems (e.g. *encode, encircle, empower*).[63]

4.2 *The prosodic structure of head-prefixation*

So far it has been assumed that there are two types of (historically) prefixed words: those in which the prefix forms a separate pword and those in which the prefix is integrated into the pword of the stem. However, while head prefixes clearly do not form separate pwords there is some evidence that they do not form a single domain of syllabification together with the stem. Consider the following historical cluster simplifications in verbs derived by *be*-prefixation:

(106)   be[Ø]nit 'beknit' (cf. OE be[kn]yttan 'becnyttan')
          be[Ø]naw 'begnaw' (cf.OE be[gn]agan 'begnagan')

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[62] Consider the idiosyncrasies of verbs like *endear, enrich, embitter*. The verb *embitter*, for example, is semantically restricted to the emotional sense (**The coffee was embittered*) and syntactically to passive constructions *(She was embittered.)*.

[63] The only counter-example to the correlations described in (102) are denominal verbs derived by *de*-prefixation illustrated in (i). While functioning as head the prefix *de*- forms a separate pword as is shown by its phonological form:

(i)   [de[X]N]V   d[iy]fróst
          d[iy]lóuse   d[iy]thróne
          d[iy]háir   d[iy]códe

The prefixed verbs in (i) do not quite follow the patterns in either column in (102). While having by and large compositional meaning some idiosyncrasies do occur. For example, *dethrone* means 'remove (someone) from N', where N is the base noun, rather than having the more typical meaning 'to remove N from' (cf. *(delouse, dehair, ?defrost)*). Verbs which are based on an abstract noun can typically not be paraphrased in terms of either pattern (e.g. *decode, devalue*). These idiosyncrasies correlate with the fact that some of the verbs in (i) are listed with variants showing reduced prefixes in Wells (1990). In addition the prefix *de*-combines typically with monosyllabic or trochaic nouns. It appears then that while currently exhibiting a mixed behavior *de*-prefixation may eventually follow the patterns of other words derived by head-prefixation listed in the lefthead column in (102).

If the prefixed verb formed a single domain of syllabification the constraint against onset clusters consisting of a velar stops and a nasal should lead to (historical) resyllabification rather than cluster simplification. Compare the historical developments of the stem-initial cluster *kn* in the verbs *beknit* and *acknowledge* shown in (107):

(107)   Stage I   Onset: √[kn]   a[.kn]owledge   be[.kn]it
        Stage II Onset: *[kn]   a[k.n]owledge   be[.n]it (*be[k.n]it)

The fact that the velar stop disappeared in *beknit* indicates that verbs derived by *be*-prefixation do not form a single domain of syllabification. Furthermore, for many speakers the unstressed vowel in the prefix *be-* differs from the unstressed vowel in comparable simplexes in that it is raised or even tense. Consider the following transcriptions from Jones & Gimson (1977):

(108) a b[ɪ]líe (b[ə]líe)   'belie'   b b[ə]llóon   'balloon'
         b[ɪ]fáll (b[ə]fáll)   'befall'   b[ə]ffóon   'buffoon'
         b[ɪ]táke (b[ə]táke)   'betake'   b[ə]tánic   'botanic'

The variants in parentheses are characterized as "widely used", but somewhat less common than the first variant listed (cf. Jones & Gimson 1977: xxiv).

What is the significance of the contrast between the high vowel [ɪ] and the schwa in the words in (108) in terms of prosodic structure? According to Brunner (1960) there has been a general tendency in English for back vowels to reduce to schwa and for front vowels to reduce to [ɪ] in prestress position (cf. Brunner 1960:353). On that account, the distribution of [ɪ] versus [ə] is independent of morphological structure as is shown by the simplexes in (109a) and the historically prefixed words in (109b) (cf. Jones & Gimson 1977, Kenyon & Knott 1944):

(109) a [ɪ]leven 'eleven'   [ə]possum 'opposum'
      b [ɪ]mit 'emit', r[ɪ]mit 'remit'   [ə]mit 'omit', s[ə]bmit 'submit'

The data in (109) suggest that the contrast in (108) is the residue of a historical rule which concerns only segmental, but not suprasegmental, structure with a tendency to disappear altogether (cf. the variants with schwa in (108a)). However, while this analysis may be correct for some speakers there are others for which the contrast in (108) has morphological significance. For those speakers vowel reduction in prestress position is acceptable in simplexes (e.g. [ə]*léven* 'eleven', *b*[ə]*nígn* 'benign'), but not in any verbs (historically) derived

by *be*-prefixation. In fact, Wells (1990) cites a third variant with a long, tense vowel for every verb derived by *be*-prefixation (e.g. b[ɪ]líe, b[ə]líe, b[iː]líe). This correlation between the phonotactic restrictions on the stem-initial cluster shown in (106) and the variation in the pronunciation of the vowel in the prefix in words derived by *be*-prefixation is not captured in the prosodic representation in (110), which, however, is adequate for iambic simplexes like *balloon*.

(110) a ? ω   b   ω
          | |
          Σ   Σ
         /\   /\
        σ_w σ_s   σ_w σ_s
        bi.nɪt   bə.luwn
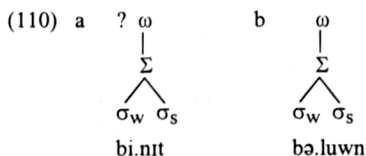
How can the phonological differences between simplexes like *balloon* and prefixed words like *beknit* be represented in terms of prosodic structure? Clearly, the prefix *be-* does not form a separate pword. This is because even when pronounced with a long vowel the prefix *be-* is unstressed which indicates that it is not dominated by a foot. The prefix *be-* thereby differs from prefixes which form a separate pword as is illustrated by the transcriptions in (111a, b) adopted from Wells (1990):

(111) a   b[ɪ]gín, b[ə]gín, b[iː]gín 'begin'   b   r[iː]gáin 'regain'
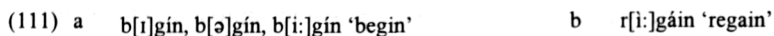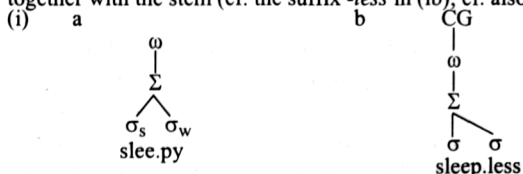
Stress on the prefix always correlates with stems which are independent words and with compositional semantics. Only non-head prefixes can be stressed.[64] Assuming that the prefix *be-* neither forms a separate pword nor is fused into a single pword with the stem as in (110a) one might consider to represent verbs derived by *be*-prefixation as clitic groups as in (112).[65]

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[64] The only exception in English is the prefix *de-* discussed at the end of section 4.1.
[65] While there is evidence that in English all vowel-initial suffixes are integrated into the pword of the stem (cf. the suffix *-y* in (ia)) consonant-initial suffixes form a clitic group together with the stem (cf. the suffix *-less* in (ib); cf. also section 1.7):
(i)   a   b   CG
            ω |
            | ω
            Σ |
           /\   Σ
          σ_s σ_w   /\
          slee.py   σ   σ
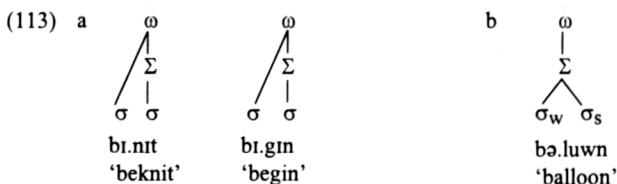   sleep.less
The dependency of prosodic structure on the stem-initial segment is supported by the evidence from syllabification (cf. the occurrence of the stem-final consonant in onset position in (ia) vs. the LOI violation in (ib)), from stress (consonant-initial suffixes are always stress-neutral and

(112)　　?　CG

$$
\begin{array}{c}
\text{CG} \\
| \\
\omega \\
| \\
\Sigma \\
| \\
\sigma \quad \sigma \\
\text{bɪ.nɪt}
\end{array}
$$
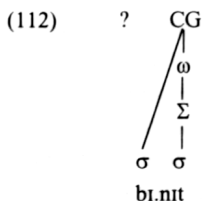
The structure in (112) is problematic in various respects. On the assumption that all verbs which are derived by the same prefix historically and synchronically exhibit the same phonological properties (including the same types of variation) have identical prosodic structures verbs like *begin* also form clitic groups (cf. the variants in (111a)). If the stem *-gin* in *begin* is a pword then what accounts for the restriction of pwords to stems which are independent words observed earlier?

Another argument against the structure in (112) concerns the observation that *be*-prefixation exhibits phonologically conditioned gaps. Recall that the prefix combines only with monosyllabic or trochaic stems. To my knowledge there is no evidence that other clitics in English (including consonant-initial suffixes) exhibit sensitivity to the stress patterns of the stem.

It appears then that the prefix *be-* is neither outside of the pword of the stem, nor that it is fully integrated into it. One possible approach to the conflicting evidence for pword structure reviewed here is to represent the prefix *be-* as a syllable which is integrated into the pword, but not the foot, of the stem as is shown in (113a). The prosodic structure of verbs derived by *be*-prefixation thus contrasts with that of simplexes like *balloon*, which is repeated in (113b):

(113)　a

$$
\begin{array}{cc}
\omega & \omega \\
/ \backslash & / \backslash \\
\Sigma & \Sigma \\
| & | \\
\sigma \quad \sigma & \sigma \quad \sigma \\
\text{bɪ.nɪt} & \text{bɪ.gɪn} \\
\text{'beknit'} & \text{'begin'}
\end{array}
\qquad
b
\quad
\begin{array}{c}
\omega \\
| \\
\Sigma \\
/ \backslash \\
\sigma_w \quad \sigma_s \\
\text{bə.luwn} \\
\text{'balloon'}
\end{array}
$$

Assuming that a unit of a given level must be exhaustively contained in every superordinate unit of which it is a part the structure in (113a) accounts for the

never bear main stress neither of which holds for all vowel-initial suffixes), from allomorphy (some vowel-initial suffixes, but no consonant-initial suffixes, trigger allomorphy), and from gaps (most vowel-initial suffixes, but no consonant-initial suffixes, attach only to stems with specific phonological properties). For a detailed discussion of these correlations, cf. Raffel-siefen, to appear.

historical loss of the velar stop in verbs like *beknit*. This is because heterosyllabic clusters like *be*[k.n]*it* are ruled out by the condition that syllables must be properly contained within feet. The generalization that the vowel in the initial syllable in (113a), but not in (113b), is subject to tensing can also be expressed with reference to the distinct prosodic structures. In addition the structure in (113a) does not require that stems like *-gin*, which are not independent words, be analyzed as pwords. Finally, the prosodic structure in (113a) expresses the generalization that in English affixes exhibit sensitivity to the phonological properties of the stem only if they are integrated into the pword of the stem. The prosodic structure in (113a) is also proposed for the other words derived by head prefixes.[66] That structure is partially described by the alignment constraint in (114b), which aligns the right edge of a head prefix with the left edge of a trochaic or monosyllabic foot and by restricting the alignment constraint in (98) to non-head prefixes as shown in (114c).[67]

(114) a   ALIGN (PREFIX, L; PWORD, L)
     b   ALIGN (HEAD PREFIX, R; (LEFTHEADED) FOOT, L)
     c   ALIGN (NON-HEAD PREFIX, R; PWORD, R) (final version)

There is some evidence that the prosodic structure in (113a) describes not only words derived by head prefixes but also many historically prefixed Romance loanwords. Specifically, the same type of variation recorded for verbs derived by *be*-prefixation is also recorded for loanwords with stem-initial stress which were historically derived by a monosyllabic prefix ending in the grapheme <e> (cf. Kenyon & Knott 1944, Jones & Gimson 1977, Wells 1990). According to various English pronouncing dictionaries the words in question exhibit not

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[66] Wells also cites three variants for each verb historically derived by *en*-prefixation (e.g. [ɪn]*trap*, [en]*trap*, [ən]*trap* 'entrap'; [ɪn]*tice*, [en]*tice*, [ən]*tice* 'entice'). Adverbs derived by *a*-prefixation do not exhibit any variation but are always pronounced with initial schwa.

[67] The prosodic structure of simplexes like *balloon* obeys the clause of the SLH (i.e. Strict Layer Hypothesis) which requires that all prosodic constituents be dominated by constituents of the immediately higher category. The violation of that requirement in verbs derived by head prefixes indicates that the SLH can be dominated by other constraints (cf. Selkirk 1995). Specifically the prosodic properties of head-prefixations indicate that the SLH is dominated by the alignment constraint stated in (114b). The observation that verbs derived by *en*-prefixation form a single domain of syllabification if the stem begins with a vowel indicates that the alignment constraint in (114b) is in turn dominated by a constraint which prohibits onsetless syllables (cf the words *e.nable* 'enable' vs. *un.able* 'unable' in careful pronunciation).

only the same range of variation but the corresponding variants have also the same stylistic connotations (cf. Wells 1990):[68]

(115) b[ɪ]líeve, b[ə]líeve, b[i:]líeve   'believe'
       d[ɪ]créase, d[ə]créase, d[i:]créase   'decrease'
       r[ɪ]péat, r[ə]péat, r[i:]péat   'repeat'
       pr[ɪ]fér, pr[ə]fér, pr[i:]fér   'prefer'

All verbs which exhibit the variation in the pronunciation of the prefix vowel illustrated in (115) obey the constraint that the stem-initial cluster is a wellformed syllable onset (e.g. *de*[kr]*ease* 'decrease' but not *de*[kn]*X*, *de*[mn]*X*, *de*[ps]*X*, etc).
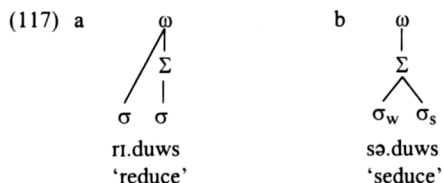
What distinguishes the words in (115) synchronically from simplexes like *benign*, *bizarre*, *eleven*, etc., which do not allow for the occurrence of tense vowels in prestress position? The examples in (115) may suggest that stem recurrence is relevant (cf. *-lieve* in *relieve*, *-peat* in *compete*, *-crease* in *increase*, *-fer* in *confer*, *-mit* in *commit*) but there is evidence that stem recurrence is neither a necessary nor a sufficient condition. That is, the three variants illustrated in (115) are also listed for the verbs in (116a), whose stem is unique. On the other hand, the variant with the tense vowel is not listed for any verb historically derived by *se*-prefixation regardless of stem recurrence (cf. (116b)):

(116) a b[ɪ]gín, b[ə]gín, b[i:]gín   'begin'   *Xgin
       r[ɪ]lént, r[ə]lént, r[i:]lént   'relent'   *Xlent
       d[ɪ]síre, d[ə]síre, d[i:]síre   'desire'   *Xsire

      b s[ɪ]dúce, s[ə]dúce, *s[i:]dúce   'seduce'   reduce, induce, produce, deduce, adduce
         s[ɪ]léct, s[ə]léct, *s[i:]léct   'select'   elect, prelect, collect
         s[ɪ]clúde, s[ə]clúde, *s[i:]clúde   'seclude' exclude, include, preclude, conclude

The variants with tense vowels are largely restricted to verbs derived by the native prefix *be-* or one of the Romance prefixes *re-*, *de-*, and *pre-*, which,

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[68] In some words for which Wells lists all three variants vowel length appears to be an identity effect with respect to the base, in which the length of the corresponding vowel is due to stress (e.g. [i:]gýptian 'Egyptian' - [í:]gypt 'Egypt', d[i:]mónic 'demonic' - d[í:]mon 'demon'). In a few others, the listing of all three variants appears to be random. For example, the name *Rebecca* is (mistakenly?) listed with all three variants (i.e. R[ɪ]bécca, R[ə]bécca, R[i:]bécca), but *Renata* is listed with only two variants (i.e. R[ɪ]náta, R[ə]náta).

unlike the historical prefix *se-*, have been adopted in native word-formation. It appears that the productivity of the prefixes *re-*, *de-*, and *pre-* in native word formation prompts some speakers to assign the prosodic structure in (113a) to loanwords whose initial syllable is phonologically similar to those prefixes. The prosodic differences between the Romance loanwords *reduce* and *seduce* can accordingly be represented as in (117a, b):[69]

(117) a

$$\omega$$
$$|$$
$$\Sigma$$
$$|$$
$$\sigma \quad \sigma$$

rɪ.duws
'reduce'

b

$$\omega$$
$$|$$
$$\Sigma$$
$$/\backslash$$
$$\sigma_w \quad \sigma_s$$

sə.duws
'seduce'

Assuming that the distinct prosodic representations in (117a, b) are adequate the question arises of how hearers infer them on the basis of phonetic inputs. Provided that the difference in those prosodic structures is indeed (ultimately) due to the fact that the prefix *re-*, but not the prefix *se-*, has been adopted in English word formation one might consider to invoke the alignment constraint in (118) for parsing verbs like *reduce*. On that view the inference of the prosodic structure in (117a) (rather than that in (117b)) on the basis of the phonetic input [rɪ.dúws] presupposes the recognition of a monosyllabic prefix which precedes a foot with initial prominence.

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[69] The evidence from stress shifts may seem to argue against the proposal that verbs derived by head prefixes like *beknit* and loanwords like *reduce* have identical prosodic representations. That is, verbs derived by head prefixes like those in (ia) systematically resist the type of stress shift which is characteristic for verb to noun conversion illustrated in (ib):
(i)   a   belíe]$_V$ *> bélie]$_N$ b   rejéct]$_V$ > réjèct]$_N$
   ensúre]$_V$ *> énsùre]$_N$ deféct]$_V$ > défèct]$_N$
However, it appears that the ungrammaticality of the stress shift in (ia) is not due to the prosodic but rather to the morphological structure of those verbs. Specifically, there is evidence that the process illustrated in (ib) consists of two rules: a strictly morphological conversion rule shown in (iia), which 'feeds' a sporadic rule of stress shift which applies to all nouns regardless of their morphological structure. The claim that these two rules are separate is supported by the examples in (iib) each of which undergoes only one of those rules.
(ii) a   V > N conversion   adjustment to stress patterns for disyllabic nouns
         rejéct]$_V$ > rejéct]$_N$ rejéct]$_N$ > réjèct]$_N$
     b   desíre]$_V$ > desíre]$_N$
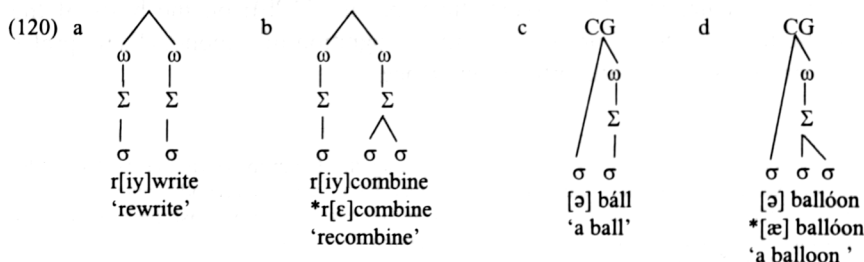   —   inséct]$_N$ > ínsèct]$_N$
As for verbs derived by head-prefixes they never undergo the rule of V > N conversion, which is a purely morphological property. Not being convertible to nouns they never meet the condition for adjusting to the stress patterns for nouns.

(118)   ALIGN (MONOSYLLABIC PREFIX, R; (LEFTHEADED) FOOT, L)

The alignment constraint in (118), while possibly originally due to analogy with the alignment constraint in (114b), is used only in analysis. The relevance of the leftheaded foot in (118) is shown by the fact that prefixes followed by a stressless syllable are always fully integrated into the prosodic structure of the stem. Compare the verb *derive* in (119a), which at least for some speakers has a non-integrated prefix, with the noun *derivation* in (119b), for which the prefix is prosodically fully integrated for all speakers:

(119) a   ω   b   ω

         /Σ   Σw   Σs
        / | /\   /\
       σ σ   σs σw   σs σw
       dɪ.rayv   dɛ.rə.vey.ʃən
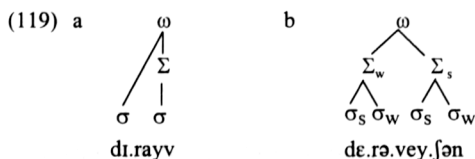
As has been demonstrated in section 4.1 prefixes which form separate pwords or in fact proclitics do not exhibit the dependence on stem-initial stress illustrated in (119a, b). That is, neither the prefix in (120b) nor the clitic in (120d) is subject to Trisyllabic Laxing:

(120) a   b   c   CG   d   CG

      ω   ω   ω   ω   /\   /\
      | | | | ω   ω
      Σ   Σ   Σ   Σ | |
      | | | /\   Σ   Σ
      σ   σ   σ   σ σ | |
    r[iy]write r[iy]combine   σ σ   σ σ σ
    'rewrite'   *r[ɛ]combine [ə] báll   [ə] ballóon
                'recombine'   'a ball'   *[æ] ballóon
                                           'a balloon'

The generalizations illustrated in (119), (120) confirm the claim that the prefix in (119a) is neither a separate pword nor a clitic.

5. *Universality*

In section 1 it has been shown that in English all and only the phonological properties which relate directly to prosodic constituents (e.g. stress, syllabification, moraic structure) correlate and indicate pword boundaries. The assumption that these diagnostics are not only crucial for determining pword structure in English but refer to essential properties of pwords calls into question several analyses proposed in the literature. The cross-linguistic evidence

considered here will be confined to prosodic properties of prefixed words in French. According to Hannahs (1995) all productive prefixes form separate pwords in French which can be expressed in terms of the alignment constraints in (121):

(121)　a　ALIGN (PREFIX, L; PWORD, L)
　　　　b　ALIGN (PREFIX, R; PWORD, R)

The most compelling phonological evidence for the claim that prefixes form separate pwords in French word formation concerns syllable structure. One argument concerns the rule of Glide Formation which requires the high vowels /i, y, u/ to be syllabified in onset position and accordingly pronounced as glides (i.e. [j, ɥ, w]) when another vowel follows (cf. the suffixed words in (122a)). The violations of Glide Formation in the prefixed words in (122b) indicate that the prefix does not belong to the same domain of syllabification as the stem (from Johnson 1987: 893, also cited in Hannahs 1995: 28):[70]

(122)　a　[kɔlɔni]+[al]　→　[kɔlɔnjal]　　b　[sɔmi]+[arid]　→　[sɔmiarid]
　　　　　　'colony' 'al'　　'colonial'　　　　'semi' 'arid'　　'semi-arid'

　　　　　[atriby]+[abl]　→　[atribɥabl]　　　[ɑ̄ti]+[alkɔlik]　→　[ɑ̄tialkɔlik]
　　　　　'attribute' 'able'　'attributable'　　'anti' 'alcoholic'　'antialcoholic'

There is also evidence that monosyllabic prefixes can form a separate domain of syllabification in French. Despite the occurrence of the word-initial clusters sp, st, and sk in French postvocalic s is regularly syllabified in coda position before a stop as is shown in (123a) (cf. Lowenstam 1981). The syllabification of postvocalic s in onset position in (123b) indicates that the prefixes do not belong to the same domain of syllabification as the following stems (from Johnson 1987:897, also cited in Hannahs 1995: 33f).[71]

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[70] Glide Formation is not entirely regular in French as is shown by minimal pairs like [ruɛl] rouelle 'disc' vs. [rɥɛl] ruelle 'alley'. The blocking of glide formation is accordingly not a reliable positive boundary signal in French.

[71] Lowenstam cites the application of a rule called 'Closed Syllable Adjustment' in (123a), but not in (123b), in support of the distinct syllabifications of the clusters consisting of s plus stop in (123). This rule describes the neutralization of the vowels [e], [ə], and [ɛ] in favor of [ɛ] when a tautosyllabic consonant follows (cf. Schane 1968, Lowenstam 1981:598, Hannahs 1995:34ff). However, according to Morin (1988) and Tranel (1987, 1988) Closed Syllable Adjustment is completely lexicalized in Modern French and apparently functions as a phonotactic rule synchronically.

(123) a   [rɛs.te] rester   b   [rə.stryk.ty.re] restrukturer
            'remain'   'to restructure'
            [dɛs.tɛ̃] destin   [de.sta.bi.li.ze] déstabiliser
            'destiny'   'to destabilize'

Unlike the clusters shown in (123) any clusters which also occur word-initially and for which sonority increases are regularly syllabified in onset position as is shown in (124a). The LOI-violations in (124b) show that consonant-final prefixes can also form a separate domain of syllabification.[72]

(124) a   su[.bl]imation   b   su[b.l]ingual
            'sublimation'   'sublingual'
            as[.tr]onomique   pos[t.r]omantique
            'astronomic'   'postromantic'

The type of LOI violation illustrated in (124b) is also common in prefixed words in English as has been shown in section 1.4.2. However, consonants which are followed by vowels are always syllabified in onset position in French regardless of the morphological structure of words (cf. 125).

(125) a   sub+odorer   →   su[.b]odorer   'to scent'
            post+operatoire   →   pos[.t]operatoire   'postoperative'
            sur+estimer   →   su[.r]estimer   'overestimate'
            mal+entendu   →   ma[.l]entendu   'misunderstanding'
            sous+alimenter   →   sou[.z]alimenter   'undernourished'
       b   in+acceptable   →   i[.n]acceptable   'unacceptable'
            pan+islamism   →   pa[.n]islamism   'panislamism'
            en+ivrer   →   e[.n]ivrer   'inebriate'
            non+intervation   →   no[.n]intervention   'non-intervention'

Hannahs (1995) assumes that all productive prefixes form separate pwords in French, including (most?) prefixes in the words in (125). Following Nespor & Vogel (1986) he argues that the nonalignment of syllable and pword boundaries in those words results from a rule of phrasal resyllabification. However, there is no evidence supporting the claim that the prefix-final consonant is syl-

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[72] The distinct syllabifications of the clusters in *sublimation* 'sublimation' and *sublingual* 'sublingual' in French are supported by the phonetic transcriptions of these words in Warnant (1962). The distinct syllabifications of the clusters in *astronomique* 'astronomic' and *postromantique* 'postromantic', which is not listed in Warnant (1962), are based on the judgements of several native speakers.

labified in coda position before the alleged rule of resyllabification applies.[73] Clearly, prosodic structures such as $(su[.]b)_\omega(odorer)_\omega$, where a syllable includes an internal pword boundary, are not consistent with the prosodic hierarchy and call into question the empirical basis for prosodic phonology.[74]

The observation that the prefixes belong to the same domain of syllabification as the stems in (125), but not in (122b), (123b), or (124b) calls for a description in terms of ranked constraints.[75] Specifically, ranking the constraint ONSET, which requires every syllable to have an onset, higher than the alignment constraint in (121b) yields the effect that prefixes are integrated into the pword of the stem only if they end in a consonant and the stem begins with a vowel.[76]

While the syllabic integration of the prefixes in (125) can be easily accounted for in terms of constraint dominance the proposal that prefixes form separate pwords in French is problematic in one additional respect. That is, even prefixes which form a separate domain for syllabification do not form a separate domain for stress[77] nor do they necessarily satisfy Minimal Word

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[73] While there is no evidence for a syllabification of the final consonants of the pretixes in (125) in coda position the application of 'Closed Syllable Adjustment' in *premi[ɛ]re amie* 'first(fem.) friend(fem.)', but not in *premi[e]r ami* 'first(masc.) friend(masc.)', is sometimes cited in support of lexical syllabification, which precedes phrasal resyllabification (cf. Peperkamp 1997 for references). This argument raises the question of how the final *r*, which must be absent from the lexical representation of the masculan form, is (re)introduced postlexically. Assuming that Tranel (1987, 1988) and Morin (1988) are correct in characterizing Closed Syllable Adjustment as a phonotactic rather than a phonological rule this argument for phrasal resyllabification can be discarded.

[74] The analysis of the data in (125) in terms of phrasal resyllabification is also not consistent with the requirement that syllabification rules may not alter existing structure (cf. Steriade 1982).

[75] Cf. the analysis of Lardil morphophonology in chapter 7 in Prince & Smolensky (1993).

[76] Assuming that violations of constraints are always minimal the question arises of how the constraint ranking in question affects pword structures. One possibility are the structures $(su)_\omega(bodorer)_\omega$ or $(subo)_\omega(dorer)_\omega$, where pword boundaries and syllable boundaries align and violation is minimal in that the pword boundary is 'shifted' by only one segment (cf. the candidate $(sub)_\omega(odorer)_\omega$) but where pword boundaries no longer align with morphological boundaries (cf. Peperkamp's (1997) proposal for comparable cases in Italian. The other possibility is the structure $(subodorer)_\omega$ where pword boundaries align with both morphological and syllable boundaries, but the pword boundary is 'shifted' by several segments (albeit only one morpheme). Assuming that pword boundaries must necessarily align with morphological boundaries the first possibility can be ruled out. For English there is clear evidence from stress which shows that violations of alignment constraints due to the high ranking of ONSET yield structures where pword boundaries align with morphological boundaries (cf. Raffelsiefen, to appear).

[77] The domain for stress in French is the phrase rather than words or affixes (cf. Trubetzkoy 1958: 246f)

Requirements (cf. (123b)). There are two possible conclusions. First, one can accept the analysis in (121) for French and modify the definition of the pword in French to the effect that it forms the domain of syllabification, but not of stress or Minimal Word Requirements. The second possibility is to reformulate the alignment constraints in (121) as shown in (126), and reserve the notion pword for cases where morphological boundaries align with all word-internal prosodic constituents.

(126) a   ALIGN (PREFIX, L; σ, L)
       b   ALIGN (PREFIX, R; σ, R)

The analysis in (126), which also presupposes the dominance of an alignment constraint (i.e. 126b) by ONSET, accounts for the violations of syllabification rules illustrated in (122b), (123b) and (124b). The first solution is desirable in that it allows for the generalization to be upheld that only pword boundaries, but not syllable or foot boundaries, are required to align with morphosyntactic boundaries thereby capturing one essential aspect of pwords.[78] However, this approach precludes a universal definition of pword diagnostics. The second approach, which implies that pwords play no role in French,[79] allows one to reserve the notion pword for cases where the domains of stress, syllabification, and Minimal Word Requirements coincide. Since the latter domains refer precisely to the units in the prosodic hierarchy which rank below the pword such a definition would be quite plausible. Perhaps increased knowledge of the relevant facts in a wide variety of languages will allow one to establish empirical criteria for resolving this issue.

6. Conclusion

There is evidence that historically prefixed words in English can be divided into three types on the basis of their prosodic properties: words in which the prefix forms a separate pword, words in which the prefix is fully integrated into the prosodic structure of the stem, and words in which the prefix is neither fully integrated nor forms a separate pword. The first category includes almost all native derivations where the prefix does not function as head but also certain types of loanwords whose stem matches an independent word in English (e.g. *unaware, imprecise*). The second category includes all loanwords whose stem does not match an independent word in English and for which the

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[78] Note though that the requirement that pword boundaries necessarily align with morphological boundaries does not conflict with the description in (126).
[79] Cf. Pulgram (1970).

prefix has not been adopted in native word formation (e.g. *seduce, commit*). The third category includes all native derivations where the prefix functions as head and many loanwords for which the prefix has been adopted in native word formation (e.g. *beknit, reduce*).

It has been shown that in English all and only those properties which relate to the prosodic hierarchy below the word level (e.g. foot structure, syllable structure, moraic structure) correlate and indicate pword structure. By contrast, assimilation, focusability, and productivity do not correlate with any of those properties nor with each other. The phonological evidence for pwords correlates with the morphosyntactic evidence which shows that pwords align only with stems which correspond to independent words whereas the notion of root (cf. Selkirk 1984) plays no role in the prosodic structure of English. It is argued that synthetic and analytic aspects of prosodic structure should be described separately where synthesis pertains to the speaker-oriented mapping of morphological to prosodic and then to phonetic structures whereas analysis pertains to the hearer-oriented prosodic parsing of phonetic input structures. Specifically, it is shown that certain generalizations which relate to the prosodic parsing of French loanwords in English can only be captured within an analytic model. The evidence from loanwords also argues for the correlation between prosodic structure and semantic compositionality to be described within an analytic model. The question of whether the diagnostics for pword structure established on the basis of the English data are valid universally requires further study.

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