On the Structure of Complex Words: the Morphology-Syntax Interplay

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This paper is mainly devoted to discuss some topics concerning the organization of morphology and to show some of the theoretical and empirical advantages of a syntactic approach to word formation processes over the standard lexicalist approach. It is argued that complex word formation obeys the same general principles that apply at each level of the syntactic component, and that the differences between morphological and syntactic operations can be derived from the interaction of general conditions of the system. This move from the lexicalist approach to a syntactic view of morphology is possible due to two independent factors that have combined within the linguistic theory only in the last few years: on the one hand, the development of morphology theory itself has made evident a large number of regularities in those processes that, I think, were misconceived in earlier stages of the inquiry; these properties manifest a highly complex organization of the morphological component and its relationship with other components of the grammar. On the other hand, a rather productive development of comparative linguistics within what has been called the *Principles and Parameters* approach has permitted a considerable extension in the range of linguistic studies on a variety of languages that show very different morphological and syntactic patterns. This new material reveals a considerable number of general properties that systematically appear in morphological processes even across languages that superficially appear to be very different.

The first section presents a study of the different thematic and structural relations among the internal constituents of complex words and the general mechanisms and conditions that apply in word formation processes. Based on the

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comparison of general morphological processes in three languages (Basque, English and Spanish), I argue that the current theories of morphology within the lexicalist hypothesis fail to explain interesting generalizations with respect to both, the internal properties of this component and its relationship with the syntax. I specially argue that neither of the two main distinctions that have been argued to motivate the radical division of the two components —i.e., the rules of formation for morphology and syntax, and the syntactic atomicity of words— can be maintained without sacrifying the explanation of very general properties of morphological entities and without making quite 'ad hoc' and stipulative moves.

In section 2., I will argue that the morphological condition that govern word formation processes can be derived from independently motivated principles of the syntax, if such complex units are assumed to be created by the transformational complex in the mapping from D-structure to S-structure. In particular, an account of their thematic and Case properties is proposed that solves some of the problems observed in those approaches that assumed the lexical status of the morphological component. Finally, some suggestions are made concerning the possible organization of the different components of the grammar. In particular, I will discuss the way in which the phonological information of lexical items is inserted in the syntactic component. I will also consider some theoretical consequences of this proposal concerning the relationship between the syntactic and the phonological components.

1. The Structure and Thematic Relations of Complex Words

In the last years, a highly complex organization of the morphological component has been developed that tries to capture the distributional regularities of the processes involved in word formation and the different relations among morphological constituents; although the details of the systems proposed differ depending on the approach each author pursues, a general model has emerged from most works in the literature that consists of the following subsystems:[1]

(1) *Lexicon*

(i) Pre-lexicon (subcategorization frame, category features,...)

(ii) Morphological component

(a) categorial component (← word-structure rules)
(b) transformational component (← lexical transform.)

(1) In general, the model of morphology is not made so explicit in the literature and the parallelism between the morphological component and the syntactic one is very rarely presented in this way; in fact, as far as I know, no single morphological model in recent work appeals to all the mechanisms observed here. The organization in (1), consequently, does not intend to reflect any particular morphological approach; instead, it tries to reflect the unquestionable fact that the lexicalist approach, in relegating the morphology to the lexicon, has basically translated the discussion from one area of inquiry to another. Indeed, the same kind of problems that originally confronted transformationalists and lexicalists in the late sixties and early seventies have been reproduced within this second approach.

(iii) Interpretative component

(a) phonological component (← phonological rules)
(b) semantic component (← rules of semantic interpretation)

(iv) Terminal lexicon

What I call the *pre-lexicon*[2] is a list of lexical items, including bound morphemes (prefixes and suffixes), each of them having a lexical entry that includes information about the category type and subcategorization frame of the item, and that specifies its meaning and other idiosyncratic information. An important property of this component that will play a crucial role in the general view of morphology is that morphemes, as well as words, are specified for categorial features and their lexical entry contains a subcategorization frame similar, in most respects, to the specification of subcategorization in any other lexical entry. Thus, for instance, the lexical entry of the morpheme *-ness* would include information specifying that it belongs to the category N, i.e. [+N, -V], and that it subcategorizes for an adjective, as in (2):

(2) *-ness*: N, [+ Adj _____]

The *categorial component* consists of a set of *word structure rules* that are responsible for defining the set of well-formed morphological objects (complex words), in accordance with some general conditions and conventions that apply to this component of the grammar. Originally, these rules were conceived as a system of context-free rules of the *Aspects*-type, which generated labelled trees in which the lexical information was inserted:[3]

(3) a. N → V - N: book-reader

The development of a notion of "morphological head" by Williams (1981a), however, has permitted to reduce the information these word structure rules have to specify; a great amount of the work initially assigned to them in previous models is then reduced to the role of the head, along with a general *Feature Percolation* rule proposed by Lieber (1980).

The *phonological component* consists of a set of phonological rules that are organized according to what Siegel (1974) called the *Level Ordering Hypothesis*. The set of *rules of semantic interpretation*, on the other hand, captures those aspects of the meaning,

(2) The term tries to capture the difference between the initial dictionary, containing the information relevant for the morphological component that, in turn, is assumed to be in the lexicon, from the final dictionary that will serve as the input for lexical insertion in the syntax and contains all the complex words generated by the morphological component, as well as the atomic lexical entries. In those approaches that consider morphology as a module different from the lexicon but still separated from the syntax, the lexicon simply consists of a list of words with their idiosyncratic properties and, presumably, it will only contain what is called here the "prelexicon", the remaining being part of the autonomous morphological component.

(3) For the development of word-structure rules, a mechanism borrowed from the syntax, see Halle (1972), Jackendoff (1977) and Aronoff (1976). The idea of a set of lexical redundancy rules is already suggested in Chomsky (1970), as a device to capture the regularities of the morphological component, and its origins go back to structuralist grammarians.

thematic structure, and other semantic properties of the complex word that can be regularly derived from the properties of its parts, and they also interpret the scope relations among the constituents of the word. It has been observed since Allen (1978) that there is a dysfunction between these two components thus the morphological structure attributed to certain complex words on the basis of considerations related to the phonological and combinatorial properties of morphemes frequently does not match with a compositionality requirement on semantic interpretation. Most approaches have solved this inadequacy by favouring the Level Ordering Hypothesis, and by postulating, in addition, a set of semantic rules that are governed by mechanisms other than the Principle of Compositionality.[4]

As an alternative to the non-compositionality of semantic interpretation, some authors argue for what Roeper & Siegel (1978) call *lexical transformations.* These transformations applying to a very regular subset of compounds (what have been called "verbal compounds") are responsible for changing the structural relations among the different constituents of these complex words in a way that permited to reflect the thematic and more general semantic relations of their parts compositionally.

Finally, the *terminal lexicon* is a list of the words of the language that contains both the atomic and the complex words generated by the morphological component, and that serves as the input for lexical insertion in the syntax. An interesting property of this terminal lexicon in most lexicalist approaches to morphology is that it contains some mechanism that acts as a filter distinguishing between real words of the language, which will be listed in this component (what Allen (1978) calls *Permanent Lexicon*), and potential words, those that satisfy all the conditions of well-formedness in the morphological component but are not actual words of the language (Allen's *Conditional Lexicon*). In addition, some version of the *Lexical Integrity Hypothesis* is assumed, according to which the syntax will have a very reduced access to the morphological information that exclusively consists of being sensitive to the final properties of the word when it is inserted in an X^0 position but not having access to its internal structure. This condition guarantees that the tokens listed in the terminal lexicon "keep memory" of the syntactic and semantic properties that derive from the morphological structure of complex words, but prevents those components from having access either to the derivation itself or to the internal structure of the word.[5] This important property of the lexicon is the one that guides the relationship between the syntactic and the morphological role of complex words. From this point of view, the morphological component, and particularly word structure rules, can be considered as a redundancy mechanism to check, rather than generate, the well-formedness of the words listed in the terminal lexicon.

(4) In recent years, Pesetsky (1985) and Sproat (1985) have argued for a different way to approach this dysfunction. In Ormazabal (1992) I present an account of the *Bracketing Paradoxes* that relies on some of the ideas defended in these works.

(5) This hypothesis of the autonomy of the morphological component has been approached in very different degrees that go from the total modular view, as in Lapointe's (1979) *Generalized Lexicalist Hypothesis* and the *Bracketing Erasure Convention* of Lexical Phonology, or Selkirk's (1982) *Word Structure Autonomy Condition* and Di Sciullo & William's (1987) *Atomicity of Words*, to a very weak autonomy that allows syntactic manipulations of the internal structure of words once lexical insertion has taken place, as implicitly assumed in Pesetsky (1985).

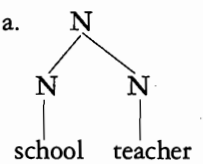
In the next subsections, I will discuss these subcomponents in more detail, focusing on the consequences and problems (both internally and with respect to other components of the grammar) that such a model of morphology has. It will be argued that when analyzed one by one these mechanisms seem to present a descriptively accurate picture of the morphological component but, considered in combination, the system has a considerable amount of redundancies and circularity, and, further, it fails to give an adequate explanation of a large number of properties involved in morphological processes.

1.1. Word-Structure Rules

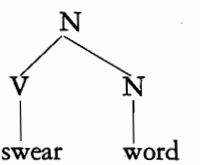
Although one of Chomsky's (1970) original motivations for relegating the morphological component to the lexicon was the idiosyncratic behavior of part of the processes involving morphologically complex words in all languages, once morphology was argued not to be part of the syntax some general mechanism had to be proposed that substituted the role played by both phrase structure rules and the transformational component in generating those word formation processes that show a regular and predictable pattern. Chomsky (1970) already suggested that this could be achieved by a set of redundancy rules in the lexicon; further developments, and in particular Jackendoff (1976) and Aronoff (1976), elaborated this proposal, offering a set of rules that were able to characterize the internal structure of all words in the language. This mechanism is conceived as a device not only to capture the intuitions of speakers concerning the internal structure of complex words, but also to allow the semantic and phonological interpretations of such words. It was clear, since the first formulations, that an appropriate system of word formation rules responsible for compounding could be one that had the same general properties the system of phrase structure rules had, i.e., a mixed system of context free structure rules that generated labelled trees in which the terminal string was introduced by a mechanism of lexical insertion according to the subcategorization frame of lexical items:[6]

(4) a. $N \rightarrow N \quad N$
b. $N \rightarrow V \quad N$

(5) a.

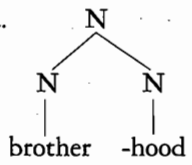


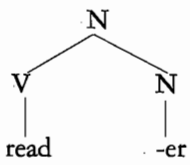
b.



With regard to derivational morphology, however, only when it became clear that affixes, like any other lexical item, are also assigned a lexical entry containing information about their categorial properties and subcategorization frame was it possible to extend the system to this subarea of morphology:

(6) I will make free use of examples reported in previous works, especially Siegel (1974), Allen (1978) and Selkirk (1982), for the discussion of English, and Villasante (1976) and Azkarate (1988) for Basque morphology.

(6) a. 

b. 

These context-free rules can be seen as particular instances of a more general scheme like the one represented in (7), where X, Y and Z stand for some (not necessarily different) category type (N, V, P, etc.):

(7) $X \rightarrow Y\ Z$

Nevertheless, most authors assume that this scheme must be considered more a guideline for the general form each structure rule must satisfy than the representation of the actual rule governing the well-formedness of complex words, and that each language selects a particular subset of rules among those defined by the scheme. This restriction is intended to capture the fact that, among the possible category combinations schematized in (7), the grammars of particular languages do not allow all of them:

On the one hand, languages show systematic gaps in the paradigm of possible compounds allowed by their grammar. English, for example, does not present compounds of the form [$_V$ N + V] or [$_V$ V + V], combinations that are not only possible under the general rule in (7), but that, in fact, are available in other languages, as in the case of Basque:

(8) a. [$_V$ N + V]: hitz egin (to talk, lit.: word-do)
amets egin (to dream, lit.: dream-do)...
b. [$_V$ V + V]: eman-erazi (to make give, lit.: give-make)

It has been argued that if these gaps in the paradigm are particular to English (or some other language) and they do not follow from a general condition that rules them out, the grammar of each language will have to specify a particular set of context free rules that contain information about those particular categorial combinations permitted in that language, in such a way that this system generates all and only all the possible types of actual complex words in it.

On the other hand, although affixation and compounding can be generated by the same type of word structure rules, there are some differences between them, particularly in the type of combinations they allow: thus, while, as observed above, English contains no instance of the rule "V → N V" for compounding, this rule is a possible one for affixation, as examples in (4) show:

(9) a. [$_V$ [$_N$ atom] [v- ize]] b. [$_V$ [$_N$ activ] [v- ate]]

Based on these difference between the two types of words, Selkirk (1982) develops a dual system that specifies not only the category name but also the level of the elements in the rule; under this approach, the desired distinction can be obtained if affixes are assigned to a special category level in the lexicon; thus, the

lexical entry for a verbal affix like *-ize* has to specify that it belongs to the category V^{af}, where *af* is considered to be a category level specific for affixes:

(10) *-ize*: V^{af}, [+ |N |Adj |____]

She extends this mechanism so that non-affixes are also assigned a morphological category level, either *Root* or *Word*, in the lexicon. In that way, since the word structure rules specify the category level of the constituents, the gaps in the paradigm of either compounding or derivation can be distinguished from each other; to retake the example above, if the grammar of English contains rules like the ones in (11a-b), but not (11c), no compound of the form [v N + V] can be formed in this language, since no element of the category X^w can be inserted under an X^{af} node, nor under an Y^w node (where $X \neq Y$, and $af \neq w$):[7]

(11) a. $V^w \rightarrow N\ V^{af}$: winterize
b. $V^w \rightarrow P\ V^w$: overstep
c. * $V^w \rightarrow N\ V^w$: *cookie-eat

However, as argued by Williams (1981), there is no particular property of affixes that motivates this distinction, apart from the fact that they have to be morphologically bound. This becomes particularly clear when languages other than English are considered: although English shows a clear distinction between roots and morphemes, this dichotomy is not so clear in languages like Basque, where the distinction between compounding and derivation is not only arbitrary but almost impossible to make empirically, given that most morphemes in that language also exist or have existed as independent words.[8]

(7) Selkirk (*op. cit.*, sect. 3.3) also argues that the distinction between *Root* and *Word* makes it possible to derive the *Level Ordering Hypothesis* proposed by Siegel (1974) in a principled way, if the lexical entries of the items (including affixes) encode information about the category level of the element subcategorized for, along with its category name; thus, the affixes belonging to Level I in Siegel's system (e.g. *-ity, -ous,...*) will subcategorize for X^r.-s, while Level II affixes (e.g. *-ness, - less,...*) subcategorize for elements of the *Word* type. Assuming that an X^r. can be exhaustively dominated by an X^w., Selkirk derives the distribution of affixes and explains why Level I affixes cannot appear "outside" Level II affixes:

(i) a. *-ity*: N^{af}, [+ A^r___] *-ous*: A^{af}, [+ N^r___] b. *-ness*: N^{af}, [+ A___] *-less*: A^{af}, [+ N___]

(ii) a. [N [Adj [Adj-sr dangerous]] -ness], activitiless,...
b. * [N[N-sr [Adj heartless] - ity]]], *kind-ness- ous,...

It follows from her proposal that the language contains two different sets of word structure rules: the rules of derivation follow the schemata in (iiia-b), while those of compounding are in accordance with the rule scheme in (iv):

(iii) a. $X^n \rightarrow Y^n\ X^{af}$ b. $X^n \rightarrow Y^{af}\ X^n$ (where n= Root, Word)

(iv) $X \rightarrow Y\ X$

(8) Even with regard to the distributional and phonological properties of affixes, Selkirk's distinction has no more explanatory power than the distinction in terms of two phonological boundaries proposed in *SPE*, or Siegel's (1974) and Allen's (1978) *Level Ordering Hypothesis*; in all three cases, the relevant difference used to capture the two classes relies on the idiosyncratic properties specified in the lexical entry of each affix and word, be it by assigning each word to a specific lexical level (as in the Level Ordering Hypothesis), or by specifying a different morpheme boundary in the phonological frame (*SPE*) or a different level in the categorial frame (Selkirk).

For an approach that is more aware of the idiosyncratic behavior and distribution of morphological objects than of their regularities and predictability, as was the case of the first lexicalist works on morphology, a set of word structure rules like the one outlined above is a mechanism specific enough to capture the few regularities recognized in such processes and powerful enough to allow all their possible variations within a language. From the point of view of an approach that basically recognizes the regular properties of the morphology component, as has gradually happened in more recent studies even within the lexicalist program,[9] it is less obvious that a mechanism as explanatorily weak as a set of language particular word structure rules can be adequate to account for the crosslinguistic variation in word formation in a principled way and, in particular, that it can explain the gaps in the morphology of a given language.

For this second kind of approach, word structure rules are more interesting for the information they do not give than for what they explicitly say.[10] To retake the case of the gaps in the paradigm of complex word types observed above, it is worth noticing that the lack of [N + V] compounds, for instance, is not particular of English in any sense; languages like Spanish show the same gap in compound-formation and, more important, these languages share with English the property of not having compound combinations that result in a complex word of the category V, except for [P + V] (English: *overstep*, Spanish: *sobrevolar* (overfly), etc.). Even in a language that makes use of morphological devices in a more productive way like Basque, compounds of the form [N + V] constitute a very restricted group, with very narrow constraints on the kind of nominal (only 'abstract' names) and verbal (mostly *egin* (do, make) and *eman* (give)) elements which can form part of these words:[11]

(12) a. amets egin (to dream, lit.: dream-make), borroka egin (to fight)
hitz eman (to promise), onetsi (to consider good),...
b. * zine-ikusi (lit.: cinema-see), *argazki-egin (picture-make)

(13) zinea ikusi (to watch cinema), argazkiak egin (to make pictures)

What is interesting in these processes is that Basque has an alternative strategy

(9) A clear indication that this change has taken place in the field is the gradual shift in the focus from morpho-phonological properties of complex words, typical of the first lexicalist studies on morphology such as Siegel (1974) Aronoff (1976) and Allen (1978), to the study of semantic and 'syntactic' regularities of productive word formation processes, as in more recent studies. The different analyses proposed to deal with the problem of the so-called *Bracketing Paradoxes* are indicative in that respect: although some of them already observed by Allen (1978), these paradoxes were analyzed almost exclusively from the point of view of their morpho-phonological aspects; only more recent analyses have focused on the implications of such phenomena for the semantic component (see references in footnote 4).

(10) Observe that, once we recognize the interest of the regularities and predictability of morphological processes as the focus of inquiry, the way of looking at this component does not differ from the one we try to pursue in syntax, independently of the concrete place each subsystem has in the grammar. In particular, as in the case of syntax, the progressive move from language particular rules to general principles and parameters is a natural one also in morphology.

(11) The limited distribution of such processes, heavily restricted to a very reduced semantic class of nouns, is general to all languages that allow this kind of complex words, as has been noted elsewhere in the literature (see Mithun 1986, Baker 1988, and references cited there).

to derive verbs from abstract nouns via zero-derivation; thus, most of the verbs in (12) have a synonymous form where the nominal base is directly attached to the aspectual morpheme *-tu:*[12]

(14) $ames_N$/$ames_V$-tu, $borroka_N$/$borroka_V$-tu,...
$dream_N$/$dream_V$-Asp., $fight_N$/ $fight_V$-Asp.

Surprisingly, most of the pairs in (12)-(14) also have their English counterpart, also formed via zero-derivation: compare the English pairs in (15a-b) with the compounds in (12) and the derivatives in (14):

(15) a. $dream_V$/$dream_N$, $fight_V$/$fight_N$, $work_N$/$work_V$
b. $promise_N$/$promise_V$, $speak_V$/$speech_N$,...

Furthermore, if we compare the class of verbal affixes in languages like English or Spanish with other classes and, specially, with the class of nominal affixes, we observe an overwhelming numerical superiority of the second ones, which seems to correlate with what happens in compounding. More important, the only verbal suffixes appearing in those languages are causative affixes (*-ize, -ify, -ate, -en*) or passive ones (*-en, -ed*), the difference among them being the category type of the root they attach to, as exemplified in (16):

(16) a. real-ize, winter-ize, harden, modify, activate,...
b. broken, assumed,...

This fact cannot be casual: it has been observed in the literature,[13] that the group of verbs that induce verb-incorporation in other languages can be restricted to a very small number of processes. Interestingly, causative constructions constitute one of such classes, probably the most productive and widespread one, being common to a large number of different languages.

It seems clear that a mechanism based on language particular rules fails to explain all these facts in various ways: first, and most obvious, by their language particular nature these rules can only attribute these and similar parallelisms across languages to a coincidental fact; second, these rules fail to relate similar phenomena not only across languages but also language-internally, since apart from the categorial features of each node in the complex word, they do not encode the relevant information about the constituents that can enter to form part of these processes. By the very same reason, nor can they discriminate the relevant classes of elements involved in each process, except for their pertenence to the categories N, V, etc. Finally, these rules create a serious problem of overgeneration; to exemplify this, note that in order for the grammar of Basque to allow [N + V] combinations of the kind exemplified in (12a), it would have to contain a particular rule of the form $V \rightarrow N - V$; but once this rule is available in the language, it would open the possibility of

(12) See Uribe-Etxebarria (1989) for detailed discussion of these processes and for a unified analysis in terms of Noun-Incorporation. As Uribe-Etxebarria herself observes, some of the complex [N + V] verbs lack their corresponding form derived by zero-derivation, specially those where the verbal head is other than *egin* (do, make).

(13) See, especially, Baker (1988) and references cited there for discussion.

generating compounds like the ones in (12b), that clearly are not possible in the language.

Of course, the grammar could rule these concrete combinations out on the basis of independent mechanisms and principles; but then, there is no reason to attribute other gaps in the paradigm to word structure rules, specially considering that the scarce information they provide can be redundantly derived by other mechanisms independently motivated in the grammar.

Summarizing, it then seems appropriate to get rid of language particular word structure rules in favor of a general scheme like the one in (7), and to attribute the systematic gaps and similarities between different processes, both language internally and cross-linguistically, to more general mechanisms of the grammar, a task that will guide the lines of the remaining sections of this paper.

1.2. Categorial Features in Morphology and the notion of "head"

The idea that words have heads, just as syntactic phrases do, has played a central role in most approaches to morphology in the last years: the basic idea is that morphological heads, by means of a general convention on Feature Percolation, determine the syntactic properties and, in particular, the categorial features of the whole complex word in quite the same way a syntactic head determines the categorial features and other syntactic properties of its projections. An important difference between morphology and syntax, however, is that the morphological word is not considered a projection of the head in the sense of X-bar theory, since the category-level of the mother is not determined by the categorial feature of its sister head but they are of the same X^0 level, and the members of a complex word are not necessarily different from one another nor from the resulting word:

(17) $[_N\ [_N$ taxi$]\ [_N$ driver$]]$

Williams (1981a) observes that the head of a word is determined, instead, by its position in the complex structure, and he proposes the following general rule:

(18) *Righthand-head Rule* (RHR):
The righmost member of a morphological structure is its head, where a category and its head share all relevant features. (Williams 1981).

Observe that, in fact, the RHR subsumes two different rules: the first part of the definition in (18) identifies the head by looking at the position it occupies with respect to the other components of the complex word; the second part guarantees that words agree with the heads in their syntactic features. This second function has been assumed, since Lieber (1980), to be satisfied by the recursive application of a general convention that specifies the way in which the features of the head percolate up to its dominating node:

(19) *Percolation*: If a constituent a is the head of a constituent β, α and β are associated with an identical set of features (syntactic and diacritic) [from Selkirk (1982: 21)].

The rules (18) and (19) together can correctly account in a straightforward manner for the resulting categorial features of compounds, where the rightmost member determines the categorial features of the word, as shown in (20):[14]

(20) a. *English*: [N [P over] [N dose]], [a [N nation] [a wide]],...
b. *Spanish*: [N [P sobre] [N carga]] (overload),
[V [P ante] [V poner]] (to foreput),...
c. *Basque*: [V [P azpi] [N marratu]] (to underline),
[V [N lan] [V egin]] (to work, lit.: work-do),...

Given that, as discussed in the previous section, suffixes are also assigned categorial features in their lexical entry, the same mechanism can be extended to derivational morphology without further stipulation:

(21) a. *English*: [N [V eat] [N- er]], [Adv [Adj close] [Adv-ly]],...
b. *Spanish*: [N [V governa-] [N- dor]] (governor),
[Adv [Adj simple] [Adv- mente]] (simply),...
c. *Basque*: [N [V eda-] [N- le]] (drinker),
[Adv [Adj on] [Adv- gi]rb (good-ly = well),...

Although this is the general pattern of derivation and compounding, there are some cases reported in the literature that seem to violate the RHR:

First, Jaeggli (1980) notes that the diminutive affix in Spanish can attach to the right of words belonging to various categories but that, contrary to what we would expect if the RHR applied, it does not change the category of the whole word; i.e., the resulting word does not inherit the categorial features of the suffix, which is assumed not to be lexically specified for any, but it has the ones of the root to which the diminutive morpheme attaches:[15]

(22) a. [N casa] (house) - [N casita] (little house)
b. [Adj claro] (clear) - [Adj. clarito] (a little clear)
c. [Adv ahora] (now) - [Adv ahorita] (just now)

Second, there is a very reduced group of prefixes in English, *en-, be-, a-, de-*, that, contrary to the RHR and to the general assumption that prefixes are not specified

(14) The rule in (18) does not apply to all languages in the same way and there seems to be parametric variation in that, as in syntax, languages can be morphologically head-initial or head-final. Interestingly, there is no direct correspondence between the values chosen for the syntactic parameter and those selected for the morphological one in each language; thus, English and Spanish, for instance, differ from Japanese and Basque in that the former are syntactically head initial, while the latter are both head final, but they all agree morphologically, showing a general head-final pattern. Lieber (1980) reports, on the other hand, that Vietnamese is head initial in its morphology, and from the examples given by Baker (1988), the same seems to be true of Niuean. Given that the languages I will be concerned about systematically show the same morphological head final pattern, I will not consider this cross-linguistic variation here.

(15) In peninsular Spanish, the diminutive *-ito / -ita* can only attach to nouns and adjectives but never to adverbials, as is the case in Jaeggli's dialect and, in general, in American Spanish (see example (7c)). His observation, however, holds true for both dialects in the same way. In fact, this is a property of a semantically related group of affixes in various languages. Notice that if these degree morphemes are functional heads, as argued in Ormazabal (1992), the question mostly reduces to the categorial transparency of functional projections in general.

for categorial features, change the category of the word they attach to; *en-*, for example, attaches to nouns and the resulting word is a verb:

(23) [V en- [N slave]], [V be- [N cloud]], [[a a- [V sleep]], [Vde-[N bug]

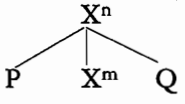
Furthermore, inflectional morphology raises a more general problem for the RHR in any approach that tries to reduce this subcomponent to derivational morphology:[16] if a morphological element must be in the head position in order for its properties to percolate up and be 'visible' in the syntactic component, and if the RHR determines the right-most element as the unique head of a word, in languages that have a rich inflectional system where more than one affix is attached to the head, only the right-most element would be selected as the head of the word. The verbal root and the other inflectional affixes would then be excluded from the head position, and their features would not percolate up to the complex word. Consequently, none of their syntactic properties would be reflected in the syntax. Consider the following synthetic verbal form in Basque:

(24) d-arama-zki-o-te
bring-them-to him-they (they are bringing them to him)

According to the RHR, only the ergative agreement affix in the rightmost position of the word would be the head, and neither the verbal features of the root nor the diacritic features of the intermediate inflectional affixes would be visible in the syntax, given that they cannot percolate to their mother node from a non-head position.[17]

Based on some of these facts, Selkirk (1982) proposes a revision of Williams' original RHR that, under certain circumstances, permits to select a head that is not the rightmost element of the complex word:

(25) *Righthand Head Rule (Revised)*: In a word-internal configuration



where X stands for a syntactic feature complex and Q contains no category with the feature complex X, X^m is the head of X^n (Selkirk 1982: 20).

(16) See Lapointe (1980), Selkirk (1982), Di Sciullo & Williams (1987) and references cited there.

(17) Exocentric compounds like the ones in (i) also constitute a counterexample to the RHR, since none of the elements of the compound are the head, and the resulting categorial features can even be different, in some cases, from those of their constituents:

(i) a. English: redhead, pickpocket, cutthroat,...
b. Spanish: petirrojo (lit.: breast-red, "robin"), sacacorchos (lit.: gets out-corks, 'corkscrew')
c. Basque: buruhandi (lit.: head-big, 'bigheaded'), mihiluze (lit.: tongue-long, 'chatterbox')...

The analysis of these compounds fall far beyond the scope of this paper, and I will not consider them here. Note, however, that they constitute a system totally independent from endocentric compounds, and their general properties also suggest a different origin.

The rule in (25) serves to solve the problem of the head in most of the cases considered above, if we also assume that affixes like the Spanish diminutive can be neutral for lexical features in some cases: then, even if the root is not the rightmost element in the word it will be the head, since the element to its right does not share the relevant features with its mother node:[18]

(26) [a [a clar-] [$_{diminut}$ -it-] [$_{masc}$ -o]]

On the other hand, Di Sciullo & Williams (1987) argue for a revision of the rule in a different direction that relies on a notion of head relative to a given feature F. The definition in (27) is empirically similar to Selkirk's in that it allows for an element that is not on the righthand of the complex word to be the head with respect to a feature F, as long as the elements on its right are not specified for F:[19]

(27) *Relativized Head*: The head of a word with respect to a feature F is the rightmost element of the word marked for the feature F. (Di Sciullo & Williams 1987: 26).

Although both approaches to a notion of relativized head potentially solve the problem of those cases not captured by the original version of the RHR, they both face a serious problem that Williams' original definition did not have: their circularity. Observe that, in either approach, the categorial features of the dominating node are given by the category of the head through the percolation convention; however, according to the rules in (25) and (27), the head of this node, in turn, can only be defined in a relative way, by having the property of sharing these same categorial features with the dominating node. In consequence, either percolation takes place before identifying the head, in which case no feature would percolate, or the head is identified before the features of its mother node are specified (and, therefore, independently of them, contrary to what (25) and (27) state).[20]

Considering this, two different ways of getting rid of this circularity seem to be possible at this point: either we abandon the notion of head, at least with respect to its role in determining the categorial status of the complex word (see footnote 20), or we maintain the original non-relativized definition of the RHR that relies on

(18) In order to solve the problem of inflectional morphology, Selkirk must also revise the percolation convention in (19), so that percolation of diacritic features of inflectional affixes is allowed, even if these elements are not the heads of the word under the revised version of the RHR. Selkirk proposes the following new version:

(i) *Percolation (Revised)*:

a. If a head has a feature specification [α F$_i$], $\alpha \neq$ u, its mother node must be specified [α F$_i$] and viceversa.

b. If a nonhead has a feature specification [β F$_j$], and the head has the feature specification [uF$_j$], then the mother node must have the feature specification [β F$_j$]. (Selkirk 1982: 76).

(19) See di Sciullo & Williams (1987, sect. 2.1.2.) for discussion of some conceptual differences between the two approaches.

(20) Of course, we can avoid this circularity if the categorial features of the complex word are inherently specified in the word structure rules, as already discussed in section 1.1; but, then, the Percolation Convention is redundant, at least for category features, and the function of the head in morphology is weakened considerably.

pure positional mechanisms to identify the head, and we try to derive these cases that do not fit into the rule on independent grounds.

1.3. Thematic relations in Morphology

One of the most controversial topics in the recent literature on morphology, —and probably the most interesting one—, concerns the way of capturing the semantic properties of complex words and, in particular, the relationship between the internal structure of words and their semantic interpretation. In syntax, it has been generally assumed, within the standard generative approach, that the semantic interpretation of the different thematic relationships between heads and maximal projections obey some sort of compositionality. For example, a given NP is semantically interpreted as bearing a certain thematic relation with the verbal head by virtue of the position it (or some element that forms a chain with it) occupies at the level of LF and, by the Projection Principle, at every syntactic level.[21] In morphology, however, the situation is less clear, and any theory that tries to derive the meaning of words through a direct mapping from the structural organization of its parts in a compositional way faces several challenges.

To begin with, the very nature of the word structure rules (or the alternative more general scheme in (7) above) makes it impossible to distinguish the considerable variation of semantic relations that can be observed between the head and the nonhead elements of compounds on the basis of structural configurations. To exemplify this, compounds like the ones in (28a), where there is a complement-head relation between the first and the second element of the compound, are generally assumed to have the same internal structure as those in (28b), where the nonhead is interpreted more like an adjunct or a modifier of the head:

(28) a. [$_N$ house cleaning], [$_N$ cake baker], [a germ-resistant]...
b. [$_N$ spring cleaning], [$_N$ concert singer], [a home-grown]...

It has been argued that it is impossible to characterize all the semantic relations obtaining between the head and the nonhead constituent in complex words except for that subclass that systematically shows a complement-head relation, and that any attempt to make explicit the semantics of nonverbal compounds is mistaken.[22] The fact that a systematic classification of these thematic relations shows to be extremely difficult (if not impossible) is not more surprising than the fact that this same goal has failed with respect to adverbials and, in general, adjuncts in syntactic structure. Roughly speaking, the same variety of thematic relations between heads and 'complements' in non-verbal compounds can be found between syntactic heads and their "modifiers", the difference being that the latter (but not the former) are more transparent and somehow identified by the prepositional element or the Case-

(21) See Chomsky (1981, ch. 2) and references cited there for discussion and alternative approaches.

(22) See Downing (1977), Selkirk (1982), di Sciullo & Williams (1987) and references cited there. Following Selkirk (1982), I am using the term *verbal compound* in its broad sense, i.e. to refer to any "endocentric compounds in which a nonhead satisfies an argument of the deverbal head constituent" (Selkirk 1982: 24), rather than in its more restrictive use in Roeper & Siegel (1978).

marker that accompanies them in the phrase structure.[23] In this respect, notice that there is a total correlation between the range of semantic interpretations available to verbal compounds and the argument structure of their verbal constituent; to illustrate this relation, compare the minimal pair in (29) with the syntactic behavior of the two verbs in (30):

(29) a. [tree eater] b. [tree devourer]

(30) a. The bird was eating/devouring the tree...
b. The bird was eating __ on the tree...
c. * The bird was devouring __ on the tree...

(23) Treating the relationship between the head and its nonhead constituent in nonverbal compounds as parallel to those syntactic relations between heads and non-complements in the syntax has the advantage of capturing a similarity between compounding and derivation that, as far as I can see, has been misconceived in the literature: as discussed above, it has been generally assumed, since Lieber (1980) and Williams (1981), that affixes have lexical status, and that, like any other lexical item, they are specified for categorial features. In the case of suffixes, their categorial features will percolate and define the category the complex word belongs to. Prefixes, however, have been excluded from this extension and it is considered that their lexical entry is not specified for categorial features, except for those few cases in which the prefix determines a change in the category of the whole word; see Lieber (1980), Williams (1981), Selkirk (1982), Marantz (1984), and di Sciullo & Williams (1987).

If affixes in general had preference over roots in determining the category of the mother node, as in Lieber's (1980) original proposal, the categorial unspecificity of prefixes would be necessary to capture the general observation that these elements, unlike suffixes, do not change the category of the resulting word. If some version of Williams' RHR is incorporated, however, this stipulation is not needed any more: what distinguishes suffixes from prefixes is their position within the word, so that the former, but not the latter, satisfies the righthand requirement on heads; in fact, it is those cases where the suffix does not behave as a head, or where the prefix does, that separate from the general pattern. In this respect it is worth noticing that, in all three languages we are considering here, most prefixes have a prepositional/adverbial origin. (Basque language does not have a very productive prefixation system, and most of the prefixes are independent words or they are borrowed from neighbouring Romance languages. Interestingly, however, all of the productive prefixes in that language correspond to negative or locative/temporal adverbials):

(i) a. *un*-gramatical, *mis*-represent,...
b. *sub*-estimar (to underestimate), *pre*-decir (to predict), *extra*-limitar (to go too far)...
c. *des*-bideratu (to misdirect), *gain*-begiratu (to overlook),...

The assignment of prefixes to the category P captures an interesting generalization that could help us to understand the nature of the gaps we observed in compounding and derivation: recall that a large group of languages show a total lack, or a very restricted set, of compounds where the head of the complex word is a verbal element, i.e., compounds of the form [v X V], where X stands for some lexical category; a clear exception to this gap in these languages is the [v P + V] combination that, paradoxically, is a very productive one:

(ii) a. *English*: OVERstep, OFFset, OUTline, UProot,...
b. *Spanish*: SOBREponer (to put on top), ANTEponer (to place in front)...
c. *Basque:* KONTRAjarri (to contradict), AZPImarkatu (to underline)...

Interestingly, this exception has its parallel in derivational morphology, where, except for those verbs obtained by affixation of a causative morpheme, the only productive derived verbs are those in which the verbal base receives a prefix that modifies it. Consider the parallelism in the contribution to the semantic interpretation of the word made by the prepositional elements in (ii) and the prefixes in (iii):

(iii) a. *pre*-judge, *mis*-represent,... b. *sub*-estimar (to underestimate), *pos*-poner (to postpone)...
c. *des*-bideratu (to go astray), *berr*-ikusi (to see again),...

It follows from here that the gap of compounds of the category V cannot be considered to follow from a general restrictions on derived words of this category in general, but rather the grammar of languages like English or Spanish (and, in a large extent, Basque) do not allow complex verbs where the two constituents are in a complement-head relation of some sort; see Ormazabal 1990 for an analysis of these restrictions in terms of Case-theory.

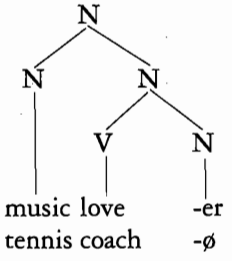
According to Selkirk (1982), the nonhead constituent in (29a) can be ambiguously interpreted either as a complement of the deverbal element or as a locative modifier of the head; this ambiguity is possible because the verb *eat* optionally subcategorizes for an object that can (but need not) be realized, as the grammaticality of the examples in (30a-b) shows. However, when the verb of the compound is a real transitive one, as *devour*, the compound cannot be ambiguously interpreted, and only the argument interpretation is available; thus, (29b), unlike (29a), is unambiguous, correlating with the ungrammaticality of (30b), where the theme-argument of the verb *devour* is not syntactically realized.

In any case, it is clear that the different role played by the nonhead in the semantic interpretation of complex words cannot be directly obtained by appealing exclusively to its position in the structure of those words.

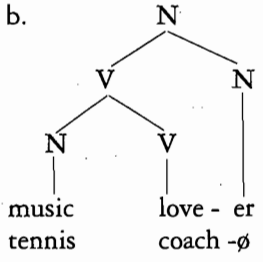
Even with respect to verbal compounds, a principle of compositionality in semantic interpretation has serious problems, as noted in the literature.[24] Consider the possible internal structures of the verbal compounds in (31), represented in (32):

(31) music lover, tennis coach, church going, schoolteacher,...

(32) a.



b.



It is obvious that in order to maintain a compositional interpretation of the compounds in (31), (32b) must be the relevant structure, since it is the only one in which the argument is the complement of the verbal element whose argument structure is satisfying; in (32a), the verbal constituent is neither the head of the compound nor that of its complex head, but rather it is the complement of the affix within the deverbal head. Nevertheless, the structure in (32b) must be independently ruled out (at least in some cases), in the light of the distributional properties of affixes and, more concretely, considering the Level Ordering Hypothesis formulated by Siegel (1974):[25] this hypothesis, in its different formulations,[26] states that the morphological component of the lexicon is hierarchically organized in different

(24) See, for instance, Allen (1978), Williams (1981), Selkirk (1982) and Di Sciullo & Williams (1987).

(25) It has also been pointed out in the literature (see Aronoff (1976), Lieber (1980), and Selkirk (1982), among others) that this alternative structure is not possible because the left-hand elements of these compounds ([v music-love], [v tennis coach], etc.) do not exist as independent words. This argument, however, seems quite weak in some respects: as already pointed out by Di Sciullo & Williams (1987), if we assumed it in all its extent, compounds like "church-goer" would not be possible words of English, since none of their parts is an independent word, i.e. neither "church-go" nor "goer" are English words, as shown by the ungrammaticality of (ia-c):

(i) a. * Peter church-goes every week b. * The goer received a gift
c. * The goer to/of the church used to confess every week

levels, each of them containing a separate class of morphological processes. The theory is intended to explain the observed fact that affixes in English can be divided in two distinct groups that behave differently from one another as well as with respect to compounding, both in their distributional properties and in the set of phonological rules to which they are sensitive. Siegel observes that these two levels are ordered in such a way that while class II affixes can combine with words that contain either class I or class II affixes, affixes belonging to class I can only be sisters of words containing other affixes of the same class, but not of class II; ie., complex words with the structures in (33a-c) are possible, but those with the structure in (33d) are not; in addition, she argues that neither of these affixes can attach to words created by compounding, as represented in (34):[27]

(33) a. [[X +Affix] +Affix]: e.g. convers+ation+al
b. [[X +Affix] #Affix]: e.g. confus+ion#ism
c. [[X #Affix] #Affix]: e.g. friend#ly#ness
d. * [[X #Affix] +Affix]

(34) * [[X Y] +/#Affix]

Independently of whether this theory is adequate to explain the facts under consideration or not, what seems clear is that the distinction between the two different classes of affixes that motivates the analysis is (at least in part) empirically accurate. If so, words that involve both derivation and compounding, like the ones in (31) can only have the structure in (35a), but not (35b):

(35) a. [music [love #er]] b. [[music love] #er]

If, on the other hand, Selkirk (1982) is right in claiming that affixes do belong to two different classes but that Level II also groups compounding (see footnotes 7. and 8. above), complex words that mix compounding and Level II affixation could have the structure in (35b) and, consequently, be interpreted in a compositional way; but the problem remains as for those processes involving Level I affixation and compounding combined in the same word, since the structure in (36a) will still be incompatible with the phonological and distributional properties of the affixes, and (36b) would not capture the semantic properties of the word:

(36) a. [[word format-] +ion] b. [word [format- +ion]]

Several theories have been proposed in the literature to solve this problem; most

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See Ormazabal 1990 for discussion of related matters and a possible explanation for these distributional properties of compounds and derived words.

(26) Siegel's LOH forms part of practically all the works on morphology in some way or another; a special mention is deserved by Allen's (1974) Generalized LOH, and the different versions of what has been called *Lexical Phonology*.

(27) Following a tradition in the literature, I adopt the *SPE* notation + and # to distinguish between Level I and Level II affixes respectively. Unlike in its original formulation, however, this notational device does not intend to reflect any phonological property inherent to each affix, but its belonging to either of the two levels discussed above.

of them have in common some mechanism that allows percolation of the subcategorization frame and the selectional restrictions of the verbal component in the derivative word up to its mother node, even if the position this verbal element occupies in the complex word is not the head position. The theoretical consequences of such a system, however, can only become clear when considered in connection with its role in defining the final thematic properties of complex words inserted in the syntactic component, specially in the light of the *Lexical Integrity Hypothesis.*

1.4. The Syntactic properties of Words and the Autonomy of Morphology

The problem discussed in the previous section with respect to the realization of thematic relations in verbal compounds is a more general problem of derivational processes in all their extent, and it reappears when we consider the final thematic properties of these words as syntactic heads in phrase structure. To illustrate this point, consider the following noun phrases in English and Basque:

(37) a. The destruction of the city b. The criticism of the book

(38) a. langileen zapal-keta
workers-gen oppress-ion-Det
b. lanaren aipa-men-a
work-gen mention-Det

In all these examples, the head of the noun phrase is a complex word, formed by the combination of a nominal affix, *-ion, -ism, -keta, -men*, etc., with a verbal base; according to the RHR discussed in section 1.2, the nominal affixes must be the heads of the derived words, a prediction that, indeed, is confirmed by the fact that the resulting words are of the category N. As in the case of verbal compounds, however, the argumental structure of these complex words must be built in such a way that the arguments of the verbal nonhead, along with the ones of the head, determine the thematic structure of the whole word: this is so because the syntactic complements of the nominal (*of the city, of the book, lanaren*, etc.) satisfy the argument structure of the verbal constituent (*destruct-, critic(ize)-, zapal-, aipa-*, etc.), rather than the one of the nominal affixes.

In order to capture this intervention of the nonhead element in the thematic structure of the derived words, various analysis have been made in the literature:[28]

Selkirk adopts the idea, developed by Bresnan (1982) and subsequent work in the framework of Lexical-Functional Grammar, that affixes are associated to a set of lexical rules that map the argument structure of the lexical base they attach to onto a different argument structure, which will be the resulting thematic structure of the derived word. In a slightly different direction, Di Sciullo & Williams (1987) consider affixes as functors that project the argumental structure of their

(28) For verbal compounds, Roeper & Siegel (1978) propose a system of lexical transformations that allow the mapping from a structure that reflects the semantic relations between the verbal element and its complement to the structure that satisfies the phonological requirement. This mechanism, however, cannot relate the thematic properties observed in compounds to these same general properties of derivation in the syntactic component, and some independent semantic rules are needed to derive the argument structure of derived words in the syntactic component anyway.

complement up to the argumental structure of the derivative word, along with its own argument structure.[29]

Either mechanism extends trivially to verbal compounds discussed in the previous section: since the head in verbal compounds is a derived word of the type discussed above, its argument structure is derived via application of the same semantic rules that determine the final properties of derivatives also in syntax; its complement in the compound, consequently, satisfies an argument in the thematic structure in the same way the complement *of the city* in (38a) satisfies the *theme* argument of *destruction* The resulting compound, in turn, will have its argument structure by applying the rules of semantic interpretation to the combination of the nominal head and its complement, so that, for purposes of subsequent derivation —either in the morphology, by forming part of a more complex compound, or in the syntax, as the head of an NP—, the *theme* θ-role has been filled by the complement, and it is not available for subsequent derivation; (39a-b) illustrate the cases where the argument of the deverbal head *eating* has been satisfied by a complement in the syntax and in a verbal compound respectively. Example (39c) shows the impossibility of satisfying this argument in both ways at the same time; i.e., once the *theme* argument of the derived word has been discharged to its complement in the compound, this θ-role cannot be assigned to another complement:

(39) a. eating of pasta b. cookie-eating
c. * cookie-eating of pasta

A crucial point of these approaches that must be kept in mind is that neither the complement in the compound (*cookie*, in *cookie-eater*, etc.) nor the one in the phrase structure (*of the city* in *the destruction of the city*, etc.) are considered to satisfy the argument structure of the verbal constituent, *destruct-*, *eat*, etc., but rather they are arguments of the deverbal nouns themselves, which get this thematic structure via application of the morphological rules of semantic interpretation.

Although the system ensures the correct results when we consider both compounding and syntax separately, a serious problem arises when we combine the results in the two systems altogether: there is a well-known difference between morphology and syntax in that the lexical elements that form part of a complex word are necessarily generic in meaning, while syntactic phrases are not; thus, for instance, *book* in *book-seller* cannot be interpreted as specific in any sense, but rather it has a generic meaning. At a first glance, this property could seem to support the autonomy of the two subsystems in the grammar, in the lines of the Lexical Integrity Hypothesis; in fact, Di Sciullo & Williams (1987) argue that this is one of the most important differences that motivate the atomicity of words in the syntactic component, i.e., the opacity of the morphological structure of complex words to syntactic derivation.[30]

(29) See Williams (1981a) for the origin of this proposal.

(30) The other main distinction between morphology and syntax that, according to these authors, motivates the autonomy of the morphological component is the different order in which the constituents appear in each subsystem (see section 1.2. above, and especially footnote 14). Anderson (1989) also argues for this distinction based on similar arguments. I will discuss these two arguments separately, focusing here on the semantic interpretation of morphologically complex words.

This conclusion could be supported if that property held only in one direction, namely if it was a property exclusively restricting the interpretation of lexical items in morphology, or if it systematically held in both directions, the two components being separated in two disjoint sets with regard to the semantic interpretation of their respective elements; that is, if, parallel to a generic interpretation of morphological complements, there was a necessary condition on syntactic NP-s to be semantically specific in all cases. The facts, however, show to be more complicated, suggesting a different conclusion; to illustrate this, consider the paradigm in (40-42):

(40) a. the proof-examination
b. ?* the examination of proofs
c. the examination of the proofs

(41) a. * to proof-examine
b. to examine proofs
c. to examine the proofs

(42) a. The bottle of wine

As we would expect, the compound in (40a) is unambiguously interpreted in a generic sense, where *proof* does not refer to a concrete set of proofs but it has a non-specific meaning. What is surprising is that a complementary restriction applies to the syntactic complement: as the contrast between (40b) and (40c) shows, the complement of *examine* in the phrase structure must be interpreted in its specific reading (i.e., as a concrete set of proofs), its generic counterpart in (40b) being ruled out.[31]

Notice that there is no general constraint that prevents a generic reading on noun phrases in the syntax, as the paradigm in (41b-c) illustrates, nor a general prohibition on interpreting the complements of a noun in this way, since *wine* in (42) can perfectly be understood (in fact, it must be understood) as non-specific. On the other hand, this property is not exclusive of English in any sense, and it appears in a large number of languages even in a more general way; the paradigm in (43-45) shows the same phenomenon in Basque: while *ardoa* (wine/the wine) is ambiguous between the referential and the generic reading in (43), *ardoaren* (of the wine) can only be interpreted as specific in (44), and *ardo*, in the corresponding compound (6), is clearly generic:[32]

(31) There are derived words that allow for a non-specific syntactic complement, as it is the case of verbal affixes like *-ing* in *reading books*, etc.; what is relevant, in any case, is that there are other derivative words that show this semantic contrast as well. Notice that the acceptability of the complement in the phrase structure improves considerably when it is made more specific: a complement containing a demonstrative determiner or a restrictive relative clause, for instance, becomes more specific and, hence, more natural:

(i) a. ?the eater of the cookies will have a terrible stomachache tomorrow
b. the eater of this box of cookies...
c. the eater of the cookies that I left on the table yesterday...

(32) Naoko Nemoto (p. c.) points out that the same effect can also be observed in Japanese. Notice, on the other hand, the different case of Romance languages, where the generic reading of the syntactic complement is possible in general, but, interestingly, the corresponding verbal compounds do not exist; consider the reversal of the Spanish and English paradigms in (i)-(ii):

(i) a. criador de caballos
b. * caballo-criador

(ii) a. ?? breeder of horses
b. horse-breeder

(43) ardoa edan dut
wine-det drink Aux-it-I

(44) ardoaren edalea
wine-det-gen drinker-det
(the drinker of the wine)

(45) ardo-edalea
wine-drinker-det

These facts pose a serious problem to the atomicity of words and to the rules of semantic interpretation for derivative words of the type proposed by Selkirk or Di Sciullo & Williams: in order to capture the necessary referential character of the syntactic complement within these proposals, the only plausible way seems to be by making specific reference in the lexical entry of the derivative word to some selectional restriction on the type of complement it can take. Note, however, that the final argument structure for a derived word cannot differ depending on whether it will undergo subsequent compounding operations, as in (40a), or its argument structure will be satisfied in the syntax, as in (40c): when lexical rules of semantic interpretation apply to obtain the argument structure of a derived word like *examination*, they have no access to information other than the semantic properties of the affix (*-ion*) and those of the base attached to it (*examine*). Consequently, if the final selectional restriction of the word made specific reference to the referentiality of the complement in order to disallow a generic complement in the syntax, verbal compounds like the one in (40a) would be ruled out, since the nominal complement violates the selectional restrictions of the derivative head. If, on the other hand, the semantic frame of the deverbal derivative does not make explicit reference to the interpretation of the complement, the NP in (40b), where this complement is interpreted as generic, is predicted to be grammatical, contrary to the facts, since no independent syntactic or semantic condition rules this structure out.

Even if we could maintain a compositional semantic interpretation in some way, the assignment of a θ-role either to the syntactic XP-complement or to the morphological X^0-element within the compound would raise, as pointed out by Howard Lasnik (p. c.), a serious conceptual question about the role of the θ-criterion in the grammar; it would follow from this system that there are two radically different ways of satisfying the argument structure of a lexical item and, hence, the θ-criterion: in the standard way, a lexical head subcategorizes for a position in the phrase structure and, hence, it θ-marks both that position and the category that occupies it; in this second the argument structure of a lexical element can also be satisfied by a non-maximal projection, a word, in the lexicon.[33]

Notice, moreover, that a weaker version of the *Lexical Integrity Hypothesis* that allowed for the syntactic component to have access to the morphological derivation would also show the same problem in a different way: the relevant information for the satisfaction of the theme-argument of a derived word like *eater* in the syntax is

(33) The same problem would arise, in slightly different terms, in analyses of the type proposed by Fabb (1984) where, although the assignment of a θ-role to an X^0. complement in compounding and to an XP at the phrasal level are both purely syntactic operations, θ-assignment is split into two different mechanisms with regard not only to the potential position but also to the X-bar level of the θ-role receiver.

given by the semantic properties of the morphologically non-realized complement if it was present. In other words, the selectional restriction in the lexical entry of a word like *eater* would have to specify some condition like (46):

(46) If the theme of a derived word is not morphologically realized and semantically interpreted as non-specific, its argument must be satisfied by a semantically specific phrase in the syntax.

Although *a priori* possible, such a solution does not seem to be conceptually very appealing.

To summarize, in this section I have argued that the notion of head in morphology, as originally stated by Williams (1981a), plays a role in determining both the categorial features of complex words and the thematic relations observed among the two constituents of a compound word; this notion, however, does not have a unique role in determining the final thematic relations of these words either with respect to their argumental structure in the syntax or in complex words that involve more than one morphological process, since these relations are also mediated by the non-head elements of the word. On the base of the thematic interactions of morphology and syntax, I have argued against a strong version of the autonomy of the two components; similarly, a conceptual problem with the θ-criterion has been discussed of all approaches that assume some weaker version of this autonomy between the two components, a hypothesis that would permit the satisfaction of the criterion at both the level of word and the level of phrase structure.

In the next section, a syntactic model will be proposed where each morpheme is the head of an independent maximal projection at D-structure. I will argue that a theory where morphologically complex words are created in the transformational component can predict the right properties of the resulting words, solving several problems left behind by the lexicalist hypothesis.

2. A Transformational approach to Word-formation

In what follows, I will present an alternative account of complex word formation that analyzes these processes as the morphological result of the movement of lexical heads in the syntactic component. I will focus on the syntactic mechanisms of complex word formation, as well as on the general properties that result from the application of this process. Finally, I will consider a concrete model of lexical insertion compatible with my proposal in the paper.

2.1. The Mapping from D-structure to S-structure

In order to solve the problem discussed in sections 1.3. and 1.4. the argument structure of the deverbal element in a derived nominal has to have direct access not only to its complement in verbal compounds such as the ones in (1a), but also to the syntactic object in noun phrases like (1b):

(1) a. proof-examination b. examination of the proofs

For this to be the case, the nominal affix must behave 'as if it was not there' for

semantic purposes, so that it does not interfere in the relation between the verbal element and the complement. Among the hypotheses available, only two seem to capture this property of affixes in a straightforward way:

It could be the case that the nominal affix be absolutely transparent semantically; in that view, the role of this affix is exclusively reduced to determine the categorial properties of the whole word (i.e., whether it is of the category N, V, etc.) and, consequently, the structural environment where it can appear, but it is empty of semantic content and the thematic properties of the word are determined by the base.[34] This approach has a considerable advantage in that, at the same time that it captures the relation between the deverbal nominal and its verbal base with regard to their thematic structure, it also predicts their different distribution in the syntax and, more concretely, the different ability of each item to assign Case to its complements depending on its categorial features.

A priori, this could be the case of nominalizations involving affixes like *-ion*, where the affix seems not to contribute to the derived word with additional thematic structure of its own; there are some other affixes, however, whose contribution to the final properties of the word does not reduce to determining its category, and they have a clear semantic content. A well known case of this property of some affixes can be seen in the attachment of the passive morpheme to a verbal base, which 'demotes' the external argument in the thematic structure of the resulting verbal form. Narrowing our discussion to the nominal derivatives presented above, notice that the role of a nominal affix like *-er* in *eater* is far from innocuous; consider the following contrast between the nominal affixes *-ion* and *-er* when they attach to a verbal base:[35]

(2) a. The organization of the meeting (was great).
b. John's organization of the meeting (was great).

(3) a. The organizer of the meeting (was great).
b. *John's organizer of the meeting (was great).

Unlike *-ion* in (2a-b), the affix *-er* changes the thematic relations of the verb to which it attaches: thus, the *agent* argument of the verbal element in (3) cannot be realized when the affix appears attached to it. In fact, this argument of the verb is, intuitively speaking, borne by the affix itself; that is, the meaning of *-er* is directly related to the absent subject of the nominal. Observe that while the nominal in (2a-b) refers to "the act of organizing the meeting", the NP with the affix *-er* in (3) rather refers to "the person who organized it". In that respect, the phrase is in a

(34) In fact, this is the intuitive idea underlying Chomsky's (1970) original approach to the problem, where lexical items can appear in more than one category with the same contextual features (as could be the case of *proof/prove*). In that approach, the relationship between, say, *transform* and *transformation* was captured by the fact that the two lexical items share most of the properties listed in their lexical entry, except for their categorial specification (see op. cit. for discussion).

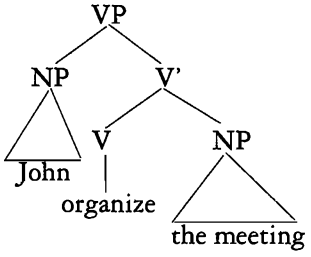
(35) See Roeper & Siegel (1978).

relation with the affixal head quite similar to the one between the relative clause and its head in (4):[36]

(4) The person [who organized the meeting] (was great).

The properties of these affixes suggest a second alternative: suppose that the semantic 'transparency' of the affix with respect to the thematic relation between the verbal base and the syntactic complement in (2) is due to the fact that the affix is not intervening at the level where the thematic relations among the elements of the sentence are represented, i.e., that, at D-structure, the two complements in (2b) are the arguments of *organize*, and not of *organization*, as in (5):

(5)

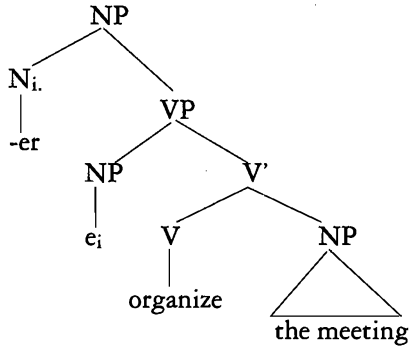


Moreover, given that the affix has scope over the whole VP, it seems natural to propose that the affix is higher in the D-structure configuration, as in (7); in this way, we can account for the fact that this element in (3) (repeated below) is modified not only by the verb but by the whole structure, in the same way the relative clause in the paraphrase in (6) is modifying the head:[37]

(3) b. The organizer of the meeting

(6) [$_{NP}$ the person$_i$ [$_{S'}$ who$_i$ [t$_i$ organized the meeting]]]...

(7)



(36) See Williams (1981a) and Di Sciullo & Williams (1987) for details and for discussion of other affixes that change the thematic relations of the base to which they attached to. These authors give an account of the properties of some affixes by considering them as functors that 'activate' a set of semantic rules of either of the following two classes: a) what Williams (1981) calls *E(X)* (Externalize an internal argument), typical of passive morphology and some other processes, and b) I(X) (Internalize the external argument), in causativization and nominalization. In addition, a mechanism of coindexation between the arguments in the thematic structure of the lexical entry and the position where this argument is realized guarantees that the affix *-er* in (3) be interpreted as the *agent* role of the verbal base (see also Grimshaw 1990).

Assuming this structure, the complex word must be created by the transformational component at some point between D-structure, where each morpheme is the head of an independent projection, and PF, when the two elements form part of a single complex word. Since these two levels are mediated by S-structure, two hypotheses can be pursued at this point: either move-α applies in the mapping from D-structure to S-structure or the complex words are created by the application of the transformational rule to the S-structure representation, yielding a complex word only at PF. For the time being, I will just assume this process to be an instance of "syntactic" head-movement of the verbal element to the nominal affix that governs it, postponing the discussion of the motivations for this choice. Notice that the way in which the movement of the verbal element takes place, or more accurately, the possible "landing site" for the moved element must be constrained in some way, so that only the right order can be derived. Consider the general rule of word formation discussed in section 1 and, more concretely, the general rule scheme in 1.(7), repeated in (8), and Williams's (1981a) formulation of the RHR in (9):

(8) $Z \rightarrow Y\ X$

(9) *Righthand-head Rule* (RHR): The righmost member of a morphological structure is its head, where a category and its head share all relevant features. (Williams 1981).

The application of these two rules together generates complex words with the general structure in (10), where the category identity of the mother and the right-hand sister derives from the application of the RHR:

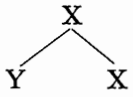
Apart from the problems discussed in section 1.4, such an approach has two major disadvantages. First, it has to assign each affix a set of semantic rules inherently connected in their lexical entry. In particular, the lexical entry for an affix like *-er* has to encode a mechanism of coindexation between the external argument of the verbal base and the resulting deverbal word of which it is the head. Second, this mechanism cannot capture the fact that the affix *-er* in a configuration like (3) above has scope over the whole NP, and not only over the verbal complement, i.e., that the semantic interpretation of *-er* in that configuration is not "the person who organized", but "the person who organized *the meeting*.

(37) The same relationship between the affix and the whole phrase holds in the case of the affix *-ion* in a different way: observe that the paraphrase of an NP like *the destruction of the city* would be something like "the act of destroying the city", where the nominal is modified by the whole PP and not only by the verbal element. The main difference between the NP-s in (3a) and (3b), besides the semantic content of each affix (or, probably, because of it), is that the relationship between the affix *-er* and the VP is mediated through an argument of the verb (again, like in relatives and small clauses), while the morpheme *-ion* is modified by the VP (as a whole) in quite the same way the complement phrase modifies the head in a pure complex NP construction like (i):

(i) [$_{NP}$ the fact [$_{CP}$ that the government is not moving to solve the main ecological problems]]...

With respect to the empty subject that is correferential with *-er* in (7), the concrete properties of this empty category are not clear, and various proposals have been made to capture this relation in similar structures. The most plausible hypothesis is to postulate an empty operator controlled by the affixal head of the nominal. This would capture the intuition underlying Di Sciullo & Williams's analysis and other works that, borrowing notions from Lexical-Functional Grammar, attribute a functor-like property to the affix (see Selkirk 1983 and Grimshaw 1990 among others). I will not consider the details here.

(10)

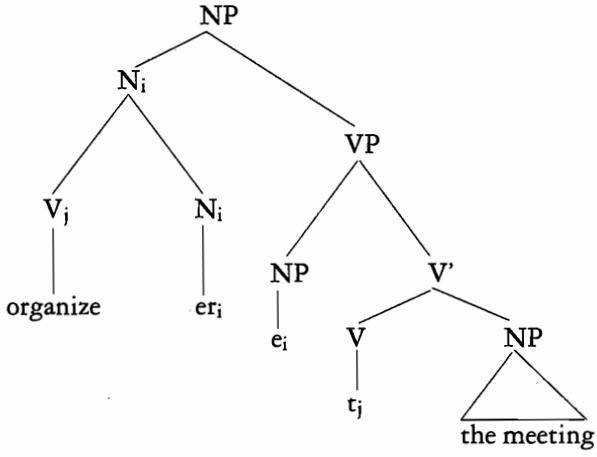


Notice that the general structure of complex words represented in (10) is the same configuration as the one that would result from left-adjunction of the element Y to the node X in the syntax. This suggest that the rules in (8)-(9) can be reinterpreted as language-particular instanciations of a more general well-formedness condition of X-bar Theory that restricts the output of adjunction operations in the syntactic component. As for the directionality of this adjunction operation, covered by the first part of the RHR, let us assume that it is a parameter associated with some property of the heads involved in the process which has the effect of preventing adjunction to both sides of a syntactic head. This restriction can be seen as part of a more general condition that guarantees the proper identification of the different heads involved in the process, in the lines of the *Mirror Principle* proposed by Baker (1985):

(11) Mirror Principle: Morphological derivations must directly reflect syntactic derivations (and vice versa). (Baker 1985)

Assuming all this, the application of move-a to the D-structure representation in (7) yields an S-structure like (12), abstracting from Case-assignment of the complement, a matter to which I return in section 2.2:

(12)



On the other hand, recall that considerations of the sort discussed in the last part of section 1. led us to propose a unified D-structure position for both the nominal complement in the verbal compound and the syntactic complement of the deverbal nominal; consider again the pair in (1), repeated under (13):

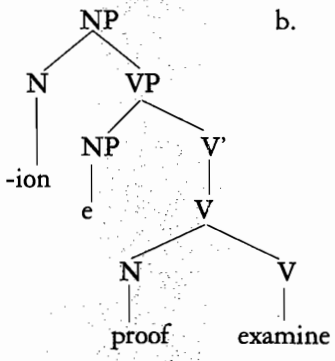
(13) a. proof-examination b. examination of the proofs

As was observed there, in the configurations in (13) the two nominal complements, *proof* and *the proofs*, bear the same thematic relation with the verbal

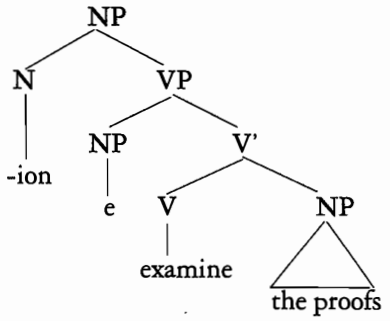
head, *examine*, but at the same time, they differ in their semantic interpretation: the complement *proof* in (13a) has always a generic reading, whereas *the proofs* in (13b) has to be interpreted necessarily as specific. In the general framework I am assuming here, where the interpretation of a string in the semantic component is assumed to be mediated by its syntactic structure, the semantic difference in the "specifity" of the two complements in (13a-b) must correspond to some difference between these elements in the syntactic structure. Two main syntactic differences between the nominal complements can be considered as the source for their semantic distinction: this difference can be attributed either to the different position they occupy within the VP, or to their internal structure (or both).

Suppose, first, that the different positions the complements occupy with respect to the verbal head directly correspond to their original position at D-structure; assuming what has been said so far, the D-structure representations for (13a-b) would then be as in (14a) and (14b) respectively:

(14) a.

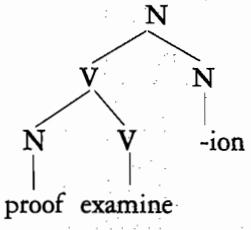


b.



Whether in (14a) the complex verb is created in the lexicon and inserted as a lexical unit in the syntax or the nominal element is base-generated in an independent position within the complex verb,[38] the assumption of these two different D-structures will reproduce all the problems observed in section 1.4.: first, in relation to the distribution of the morphemes in a complex word, when the complex verb containing the nominal element in (14a) incorporates to the nominal head *-er*, the resulting word will have the internal structure in (15), contrary to what the Level Ordering Hypothesis predicts:

(15)

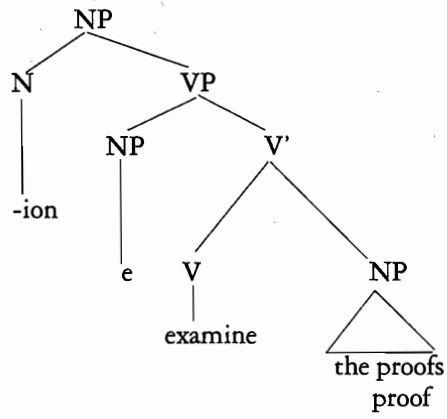


(38) See Fabb (1984) for a syntactic approach to word formation where each morphological constituent in a complex word is base-generated in a different node within X^0, the differences between syntax and morphology being derived from the different level, in terms of X-bar Theory, of the elements involved in the process.

Second, with regard to the θ-criterion, it follows from the two D-structures in (14) that the theme argument in the argument structure of the verbal head can be assigned to either of two different positions at D-structure, the position occupied by the complement NP in the phrase structure in (14b), or the one filled by the nominal element within the complex head in (14a).

In order to maintain a unified definition of the θ-criterion, the only available possibility is to assign the same D-structure position to the element that receives the theme θ-role in (13a) and (13b), and derive the different position they occupy in the surface from the movement of one of them. Let us thus assume that the two structures have the D-structure represented in (16):[39]

(16)



Notice that the same indirect connection between movement and the semantic interpretation of the two complements in (13a-b) is common to other processes in the grammar. Consider, for instance, the case of wh-movement: the wh-phrase in (17a) shows the same thematic relation with the verb as the NP in (17b); consequently, the D-structure position of the complement must be the same in both cases. The trace left by the movement of the wh-phrase guarantees that this thematic relation is maintained at every syntactic level:

(17) a. *What*$_i$ will you eat t_i ? b. You will eat *the cookies*

Despite their thematic relation, the two complements differ in their semantic interpretation: thus, while the NP in its original D-structure position is semantically

(39) In the light of this discussion, a third alternative suggests itself: suppose that the nominal is base-generated within the verbal head and the complement position is filled by an empty category, as has been proposed for Romance and Hebrew clitics, among others, by Rivas (1976), Grimshaw (1982) and Jaeggli (1982) (see also Borer (1983) for detailed discussion). The discussion of the relevant empirical facts that could distinguish between the two hypotheses goes beyond the limits of this paper. Note, however, that this alternative hypothesis fails to assign the appropriate internal structure to the complex word that will be relevant for the phonological component, as discussed above. In any case, an important property shared by both hypotheses is that, in both structures, the thematic role assigned by the verb is satisfied by its syntactic complement (be it an empty category or the 'real' NP) and not by the nominal element within the verbal head.

Notice that the view presented in the text leads us to assume some condition similar, if not identical to Baker's Uniformity of Thematic Assignment Hypothesis (UTAH); see Baker (1988) and Baker, Johnson & Roberts (1988) for discussion.

interpreted as a referential expression, the moved wh-phrase, by virtue of its feature [+ WH], is interpreted as an operator. Observe that the very same difference in the features each NP contains plays also a role in determining the obligatoriness of the movement in the case of the wh-phrase and the lack of movement of the non-operator NP.

Although in the current theory it is not clear how to address the relevant facts in a systematic way, the semantic referentiality of a phrasal element in syntax also seems to be related in some way to its internal structure and, in particular, to the presence or absence of some functional categories in the phrase structure; thus, references to time, aspect or modality seem to be associated with the appearence of verbal inflection. Similarly, the definiteness or indefiniteness effects of noun phrases are also related to the presence or absence of some types of determiners in the phrase structure.

It is a well-observed property of morphology that, in general, inflectional elements cannot appear 'inside' derivational morphology or compounding;[40] to put it in more general terms, functional categories (either affixes or words) cannot 'mix' within lexical ones. Note, for instance, that the complement of the deverbal head in the compound cannot be modified by a determiner, even in languages where this element is morphematic, as (18c-d) exemplifies:

(18) a. Basque: [liburu [sal-tzaile]]-A
[book [sell-er]]-the
b. English: THE [[book] seller]
c. * Basque: [liburu-A [sal-tzaile]](-A)
[book-THE [sell-er]](-the)
d. * English: (The) [[the-book] seller]

This fact has been generally considered an inherent property of morphology that distinguishes it from syntax, where functional projections can clearly appear dominated by lexical ones.

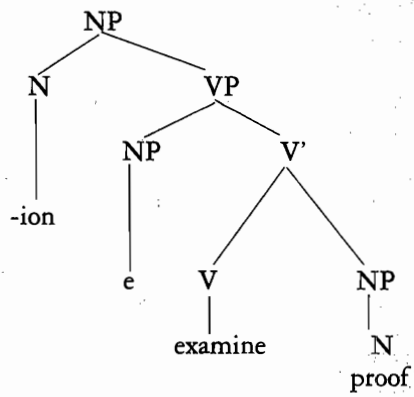
Considering what has been said so far, we can reinterpret this observation in a different way: suppose that the lack of functional categories is the cause, rather than a consequence, of morphological processes; that is, suppose that, the nominal head in (16) can only (in fact, under certain circumstances, it must) move if it is not modified by a functional category. If this is the case, both the position occupied by the complement in each construction and the distinction in their semantic interpretation follow from their different internal structure. As in the case of wh-movement mentioned above, this is the optimal result from a theoretical point of view.

Notice that the proposed structure not only captures the relevant thematic relations between the different elements involved in both configurations but, with an additional assumption, it also permits us to derive a complex word whose internal structure satisfies the Level Ordering Hypothesis. Consider the possible S-structure

(40) Once again, exocentric compounds are exceptional in this regard; see footnote 17. above.

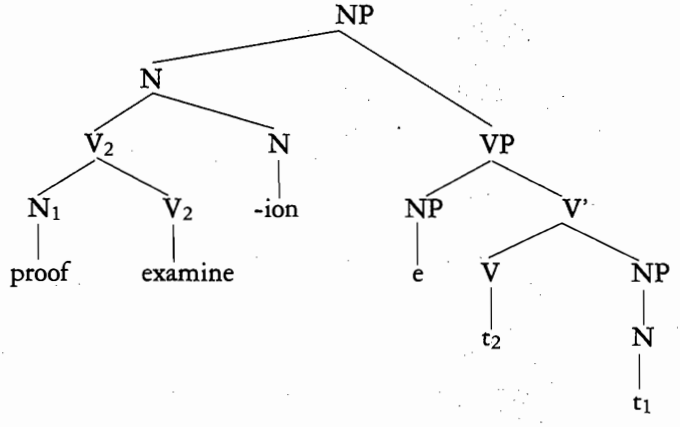
representations that can be derived from the application of head-movement to the D-structure in (19):

(19)



Suppose first that in the mapping from D-structure to S-structure, the complement head *proof* moves first to the verbal head that governs it, and then the complex verb adjoins to the nominal head *-ion*. The result of this derivation would yield an S-structure representation like (20):[41]

(20)



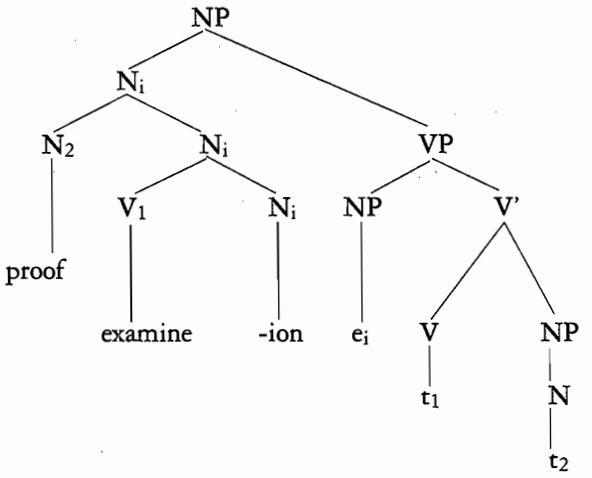
This derivation yields a well-formed S-structure and, in particular, each movement satisfies the Head Movement Constraint formulated by Travis (1984):

(21) *Head Movement Constraint* (HMC): An X^0 may only move into the Y^0 which properly governs it.

Notice, however, that the resulting complex head is not in acordance with the Level Ordering Hypothesis, since the morpheme *-ion* appears outside the compound. Consider, now, the alternative derivation in (22):

(41) The indices 1 and 2 in the following examples, apart from their standard use to indicate the relevant coindexation between the trace and the moved element, are used as a notational device to represent the order in which the two morphemes have moved from their D-structure position in the course of the derivation.

(22)

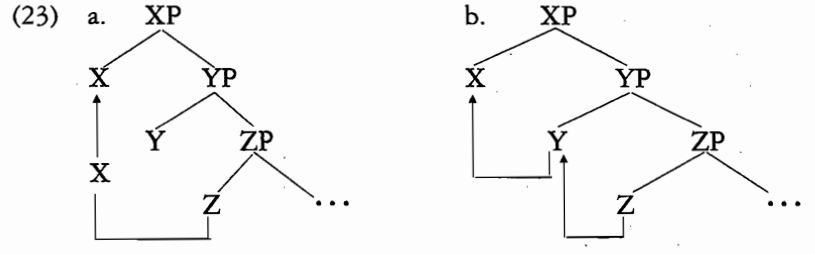


In this derivation, the verbal element has moved first to the noun head governing it, and then its complement has incorporated to the already complex noun *examination*; given that concrete order of incorporation, the internal structure of the resulting head in this case is organized according to the Level Ordering Hypothesis: the derived word within the complex head 'undergoes' compounding and not viceversa. Nevertheless, the movement of the complement-head *proof* directly from its original position to the nominal head, in (22) apparently violates the HMC, since N_i does not appear to govern the position N from where the movement of *proof* has taken place.

Let us consider this problem from a different point of view, comparing it with other cases of head-movement reported in the literature. As has been repeatedly argued,[42] the HMC is not a good candidate to be considered as an independent principle of the grammar and we eventually would like to derive it from a more general condition. The best candidate is the *Empty Category Principle* (ECP), which requires traces to be properly governed. As formulated in (21), however, the HMC cannot follow from this more general principle, since both conditions are of a very different nature: while the ECP is considered a condition on LF-representations, the HMC is explicitly stated as a condition on movement.

Suppose that the HMC is conveniently restated so that it follows from the ECP: the relevant two structures this constraint is intended to distinguish are (23a) vs. (23b):

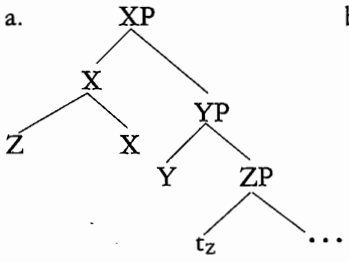
(23)



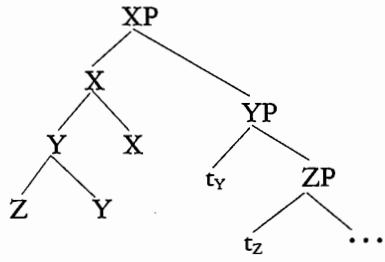
(42) See, for instance, Chomsky (1989) and references cited there.

(23a) represents the case to be blocked, where the head Z moves directly to the position X which does not govern it, without going through the intermediate head Y; in (23b) two subcases can be distinguished: Y can be either empty or filled by some lexical element; in this last case, the one that concerns us here, Z incorporates to Y and the complex head moves to X, adjoining to it.[43] Recall that the constraint that will distinguish between these two cases must be formulated, by hypothesis, in terms of the derived representation, not of the movement itself. Consider, then, the structures obtained from the different movements in (23a) and (23b), represented in (24a-b) respectively:

(24) a.



b.



The HMC (reformulated in ECP terms) would then state that while t_Z in (24b) is properly governed, t_Z in (24a) is not, violating the ECP. Consider the possible governors for t_Z in (24b): clearly, t_Y, by itself, cannot be the proper-governor of t_Z in this configuration, since then the trace would also be governed by Y in (24a), the case we want to rule out. The same is true of X, given that in the two relevant configurations this element is equally 'far' from t_Z. Obviously, the difference between the two structures must be that while X contains the 'antecedent' of t_Y in (24b), that is not the case in (24a); thus, t_Z in the well-formed structure is properly-governed by X (or some element of X) through the chain (Y, t_Y) created by the incorporation of Y to X, a possibility ruled out in (24a). There are several ways of capturing this fact, most of them with the same empirical results as far as I can see. One possibility is captured by the *Government Transparency Corollary*, proposed in Baker (1988):

(25) *Government Transparency Corollary* (GTC): A lexical category which has an item incorporated into it governs everything which the incorporated item governed in its original structural position. Baker (1988: 64).

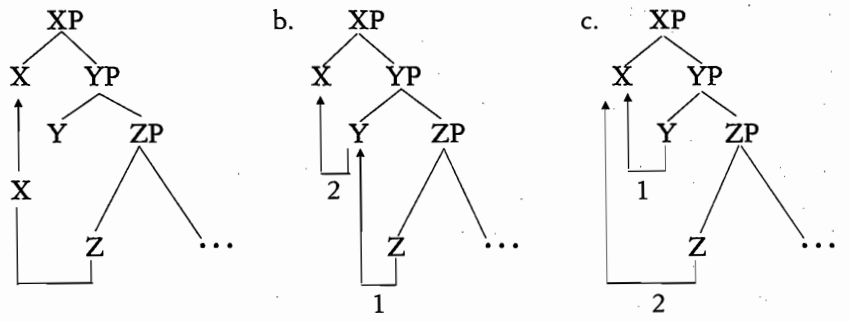
In the case that concerns us, this principle guarantees that the trace t_Z be governed by X, since this head contains Y, which has incorporated into it. X, however, does not govern t_Z in (24a) (assuming that a head does not govern itself), since Y is not part of the complex head in this configuration.

Considering all this, let us go back to the alternative derivations considered above: the derivation in (20), where the nominal head *proof* incorporates to the verb

(43) Notice that multiple head-adjunction is an option that cannot be ruled out; otherwise, phenomena like adjunction of inflectional heads when there is more than one functional projection, a very normal case (at least) in agglutinative languages, would not be allowed.

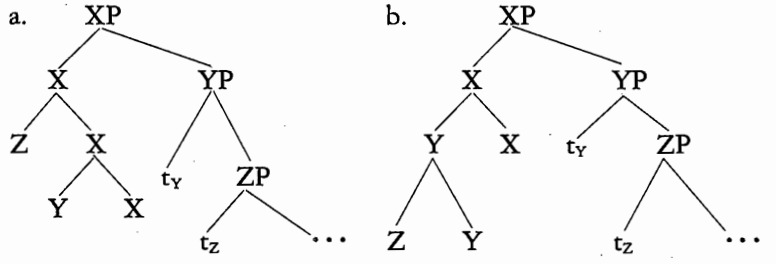
examine before this element moves to the governing affixal head, is similar to (24b), the one that has been ruled in; the structure of the second alternative in (22), with the two elements moved in different order, is however slightly different from both (24a) and (24b). In this case, the verbal element has incorporated first to the main head before its complement's head adjoins to it; this last element, hence, has to move directly to the main head without going through the intermediate verbal head. This movement is represented in (26c), as compared with case under (23a-b), repeated in (26a-b):

(26) a. b. c.



As observed above, (26c) violated the HMC, since the movement of Z directly to X is esentially the same as in (26a), the case that was excluded by the constraint. Recall, however, that the HMC has been restated, in order for it to follow from the ECP. The question, thus, is not whether the HMC blocks the movement in (26c), buth whether the resulting representation violates the ECP. To illustrate this point, compare the structure derived from the application of the movement in (26c), represented in (27a), with the good derivation (24b), repeated in (27b):

(27) a. b.



There are three differences between (27a) and (27b): (i) the order in which the movement of each element takes place is not the same, (ii) the movement of the most embedded head, Z, is 'longer' and, as a consequence of (i), (iii) the internal configuration of the complex head X is also different: If the constraint applies to the output of the transformational component rather than to the movement itself, however, neither (i) nor (ii) can be the reason to rule this structure out. Consider now the different distribution of the elements within the complex head X: in (27b), unlike in (27a), the head Y contains Z. Nevertheless, this difference cannot distinguish between the relevant government relations in the two cases, since the only consequence that could follow from it according to the GTC is that Y does not

govern "everything which Z governed in its original structural position" in (27b). The relevant fact to license t_Z in (27b) must be, instead, that X contains Y and, therefore, it governs everything Y governed in its D-structure position, including the head of ZP (i.e. t_Z). But X also contains Y in (27a); consequently, X governs t_Z in this configuration too, and (everything else being equal) the movement of Z directly to X is not excluded.

If this is correct, (22) not only captures the relevant thematic relations between the elements involved in the structure, but it also yields the internal structure of the complex word consistent with the general observation made by the Level Ordering Hypothesis. Observe that the analysis presented here implicitly assumes that the Level Ordering Hypothesis is accounted for by some principle applying at the phonological component and that, whatever this principle is, it is consequently responsible for filtering out some of the configurations obtained from the different orders of application of move-α in the structures at stake. The solution to some bracketing paradoxes proposed in Ormazabal (1992) will give crucial evidence supporting the claim that the principles applying at the PF component play a relevant role in determining the grammatical derivations of a syntactic unit, and it clarifies the theoretical consequences of such an assumption for the organization of the different modules of the grammar in the system.

2.2. Syntactic Distribution of Complex Words and Case Theory[44]

As discussed in section 1, morphological heads play a different role in defining the final properties of complex words with regard to their categorial features, on the one hand, and their thematic structure, on the other: while the category of the word is the same as the category of the head, its thematic structure is also mediated by the nonhead constituen of the word. Under an approach like the one presented here, this is a rather typical situation, due to the modular organization of the syntactic component, which is structured in different levels each of them constrained by a different set of principles and conditions.

If, as proposed here, complex word formation is a process that occurs in the mapping from D-structure to S-structure, at the level where the thematic relations among the syntactic elements is represented the different morphological elements will constitute independent syntactic heads. Consequently, each of them has an argument structure of its own, and the thematic result will be determined by the interaction of the thematic relations associated with each part, as has been seen in section 2.1. The final head of the complex word, thus, does not play a prominent role in this respect, other than determining the argument structure associated with its own lexical entry. The application of move-α to create the complex word, instead, will be determined by general conditions of X-bar Theory that impose some

(44) The issues presented through this subsection draw heavily on Baker's (1988) account of Grammatical Function Changing processes; in most of its extent, it is a sketch of how those mechanisms can be extended to account for the Case-relations observed in derived nominals, and several details have been ommited in the discussion. In Ormazabal 1990 I present a more detailed discussion of some topics directly related to this issue, which differs in some respects from the view presented by Baker.

conditions on the well-formedness of the final result in the operation. In particular, these conditions will require that the head which 'receives' the moved elements do not lose its categorial properties, which are required to satisfy other conditions of the syntactic component. This system has its consequences in the final organization of the complex word in that the 'receiving' head must have priority over the adjoined elements in determining the final categorial properties of the whole.

The role of the syntactic incorporation, however, does not reduce to the creation of a morphologically complex word, but the concrete result of this operation has several consequences for the resulting syntactic relations among the different elements involved: on the one hand, the traces left behind by the moved heads will guarantee that the thematic relations represented at D-structure are maintained through subsequent steps of the derivation, as required by the Projection Principle. On the other hand, the change created by the movement in the structural relations among the different heads entails a change in the government relations in the syntactic structure. As a clear consequence of this change, the mechanisms that, applying at S-structure, are sensitive to government relations and, in particular, Case-assignment, will also apply in a different way.

Baker (1988) extensively argues that the changes in the grammatical functions associated with general morphological processes like causativization or passivization are the consequence of this change in the government relations, motivated by the incorporation of a lexical head into a higher head that governs it. The same general interaction between head-movement and grammatical relations can be seen in processes that, like nominalization, also involve mechanisms of complex word formation. Consider, for instance, the distribution of the derived nominals in (28), as compared to their verbal analogous in (29), on the one hand, and atomic nouns like the one in (30), on the other:

(28) a. [John's] destruction [of the city]
b. [Columbus's] discovery [of America]

(29) a. [John] destroyed [the city]
b. [Columbus] discovered [America]

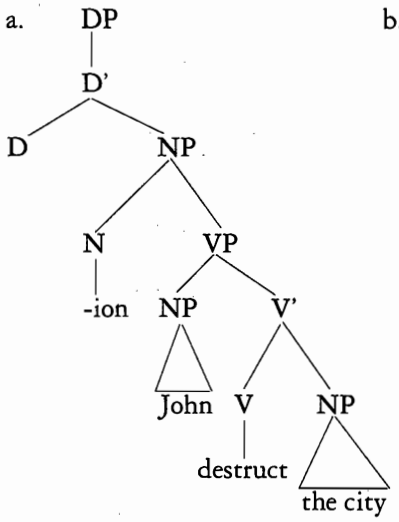
(30) [Godel's] theorem [of incompleteness]

The respective verbal elements of the pairs in (28)-(29) present the same thematic structure, independently of whether these heads stay in their original position, as in (29), or their movement yields a derived nominal. The structures differ, however, in the Case relations between the head and its complements in each case: whereas the verbal heads in (28) assign (abstract) accusative Case to their object complement, the corresponding NP-complements in (28) show up marked with genitive Case. In addition, the NP bearing the *agent* argument assigned by the head is also assigned a different Case in each configuration. In that respect, the Case-relations of the elements in (28) are identical to those present among the different constituents of the NP in (30).

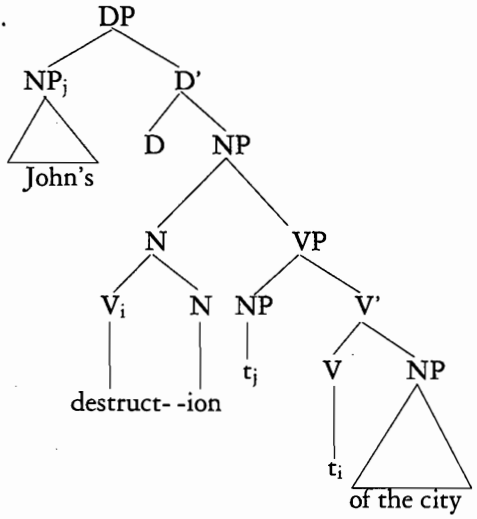
These facts must follow, under the approach presented here, as a consequence of

the change obtained in the government relations when the verbal head has incorporated into the nominal head at S-structure: according to the hypothesis proposed in section 2.1., the D-and S-structures of (28a) would be as in (31a-b) respectively:[45]

(31) a.



b.



Once again, the thematic structure of the verb *destruct-* is represented at D-structure, and preserved at other levels by the traces left in the original position by the moved elements. Case-assignment, however, is a mechanism applying at S- structure. If we assume, simplifying the problem, that head-traces cannot assign Case,[46] the NP's *John* and *the city* cannot receive Case from their head. The subject NP, on the other hand, cannot be assigned Nominative Case, since there is no INFL from which this Case can be received. Hence, in order for these NP-s not to violate the Case Filter, they must receive Case from some other source.

According to the *Head Government Corollary* discussed in section 2.1., the head N in (31b) governs not only its complement VP (and its head), but also everything which *destruct-* governed in its head position within VP, since this head is incorporated. The effect of the HGC goes beyond the licensing of the traces left behind by the incorporated head, as discussed in the previous section; it also permits for the nominal head in (31b) to govern the complements of the verb incorporated into it. In other words, this makes the VP node 'transparent' for purposes of government relations between the nominal head and the complements of V. As a consequence of this, these complements are, at S-structure, in the same relation with N as the nominal complements are with the atomic Noun in (30), and they receive

(45) I will assume, here, the DP-hypothesis without further discussion. Some of the motivations for this assumption will become clear through the discussion.

(46) See Baker (1988, sect. 3.4.3.) for arguments in favour of that claim. The evidence in this respect seems to be contradictory (see Lasnik 1981), pointing out to a difference between substitution and adjunction operations; see Ormazabal (1990) for discussion.

Case in just the same way: the *agent* argument *John's* can receive Case from the functional head D(eterminer) if it has moved to its Spec position, in the same way *Goedel's* receives genitive Case in (30). As for the *theme* argument, this element can receive Case from the nominal head that governs it, as in the case of the complement nominal *incompleteness* in (30).[47] In general, this mechanism has the apparent effect of changing the grammatical relations between the elements of the complex NP, in quite the same way processes like Noun Incorporation or Causativization show alterations of the grammatical relations in the structure that is the target of this process.

Observe that, if the analysis sketched through this section is in the right track, it also answers the question of whether complex word formation is a process that takes place between D-structure and S-structure or in the mapping from S-structure to PF: if, contrary to what I have been assuming so far, the second alternative was the correct one, the verbal element would have not incorporated into the nominal head at S-structure, i.e. at the level where Case is assigned. If this was the case, we would expect the verbal element to behave like any other transitive verb with regard to Case-theory, consequently assigning accusative Case to its complements. On the contrary, in order for the NP-complement to receive genitive Case, the nominal head *-ion* must have governed it, a requirement that only can be satisfied if the verbal head has already incorporated.

2.3. Lexical Insertion

A natural question to ask at this point is what motivates the head-movement in the Incorporation processes we have considered so far. With regard to derivation, a syntactic constraint on affixes to be necessarily bound has been generally assumed in virtually all the approaches in the literature. From this point of view, affixes in all languages are specified as such in their subcategorization frame. Some principle of Morphology, such as Baker's (1988) *Stray Affix Filter*, ensures that these bound morphemes attach to some word, and the structure where they appear is ruled in:[48]

(32) *Stray Affix Filter*: *X if X is a lexical item whose morphological subcategorization frame is not satisfied at S-structure. (Baker 1988: 140).

Although with some of the affixes we have considered through the paper that seems to be the case, in the generality of cases it is not clear whether the affixal character of morphemes in general is the cause or the consequence of some deeper properties of the items. To take an example, the morphematic status of causative verbs in a large number of languages seems to be the reflex of a more general

(47) Observe that this analysis requires assumptions about Genitive Case quite different from the ones claimed in other works on the topic (see, for example Chomsky 1986).

(48) See also Lasnik's (1981) S-structure morphological condition on affixes. Baker's concrete formulation of the filter depends, in a large extent, on the model of morphology he is defending and, consequently, it can vary from theory to theory. As he observes, however, all theories that intend to explain the boundness of affixes in strict morphological terms must include some principle like (54).

property of these verbs not only in those languages but also in languages like English or Spanish where, without being affixes, these verbs show a very particular behavior. On the other hand, the few verbal affixes existing in this second group of languages are mainly causative ones, as discussed in section 1. The general properties underlying these processes however, are not clear to me at this point.

With regard to the incorporation of the complement-head in compounding, the question is related to a more general issue that equally affects all current approaches to morphology, independently of the place where morphological processes are supposed to take place: the main question here is not exclusively what motivates the movement in those cases where compounding is an alternative in the languages, but also what prevents it from happening in those other cases where the corresponding compound is impossible. To put it in less theory-internal terms, the main question of morphology, as of syntax, is on what grounds the gaps in the paradigm of word formation can be explained independently. As far as I know, all theories of morphology to date are too strong, in that the mechanisms and principles postulated to explain the general properties of word formation processes allow the generation of too many other entities that are not allowed in the language.

Within the lexicalist hypothesis, this problem of overgeneration can partially be corrected by appealing to the idiosyncratic character of the information contained in the lexical component (and in concrete to the difference between the 'conditional lexicon' and the 'actual lexicon'). This solution, however, requires a considerable dose of stipulation and it is not especially interesting with regard to its explanatory power, as we have been arguing.

Reducing the generative power of the system in a syntactic model of morphology, on the other hand, is a matter of restricting the morphological component by means of independent motivated principles of the grammar. Based on some systematic gaps in the paradigm of verbal compound formation in various languages, I present in Ormazabal (1990) the guidelines of how the interplay of different syntactic principles can conspire to narrow the excessive power of the system.

Assuming that to be in the right track, a related question concerns the interaction of the different components of the grammar. In particular, two main questions seem of crucial importance: first, when and how lexical insertion applies to the syntactic component, and, second, what the nature of the phonological component is and how it interacts with the other components of the grammar.

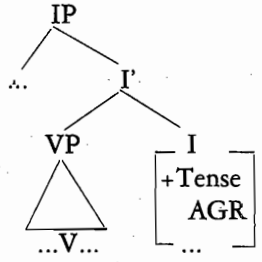
Consider first the question of lexical insertion in a system where productive morphological processes take place in the syntactic component. In this hypothesis, the lexicon is viewed as a mere list of morphemes, unanalyzable words, etc. each of them containing a lexical entry that specifies all the idiosyncratic information associated with the item.[49] If that is correct, an interesting hypothesis of lexical inser-

(49) Notice that this assumption by no means entails that all "complex" words are generated in the syntactic component. It rather implies that all words listed in the lexicon are structurally atomic; consequently, this component has no need of a computational device of word formation that generates (or checks) the complex words of the language. See Ormazabal (1992) for discussion.

tion would be one in which there is a direct mapping from lexical insertion of both semantic and subcategorization frames and phonological information to D-structure. Thus, each morpheme or word would be inserted under its corresponding node in the Phrase-structure. In the mapping from D-structure, the transformational component will "manipulate" these independent heads, and create the complex word, in order to satisfy the differenr general principles applying at subsequent levels of the grammar.

A careful consideration of the nature of lexical entries, however, suggests a different approach. The existence of inflected irregular forms in all languages constitutes a serious challenge to this organization of the grammar (and, for that matter, to any approach that considers inflectional morphology as part of the syntactic, rather than lexical, component).[50] To take an example, it is clear that pairs like *voy/fui* in Spanish or its English analogous *go/went* cannot be derived syntactically from one another in either direction.[51] Observe, however, that if lexical insertion takes place at D-structure, the element V+INFL is not even a constituent at this level, since that combination is the consequence of head-movement (affix hopping) in the mapping from D-structure to S-structure. Before this movement takes place, each element is thus the head of a different projection:

(33)



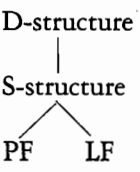
Consequently, when the lexical items are inserted at D-structure, the irregular form cannot be inserted in any concrete syntactic node. Some checking mechanism has to be allowed then that identifies a node corresponding to an irregular (and listed) form after the transformational component has applied (i.e. at S-structure) and that removes the already inserted phonological information of the node, recoverring it with irregular one. Such a modification, however, seems both "ad hoc" and quite implausible.

Nevertheless, there is an alternative that seems more plausible and in agreement with the general approach outlined in this paper. Consider the organization of the grammar as proposed within the general frameword I am assuming here:

(50) This has been assumed by the vast majority of works on morphology, even within the lexicalist hypothesis, with very few exceptions such as Lapointe (1979), Selkirk (1982), or Di Sciullo & Williams (1987).

(51) This is even more obvious in the Spanish pair, where the two forms happen to derive historically from two different Latin verbs whose paradigms emerged in one single verb at some stage of the evolution to Romance languages.

(34)



If D-structure is the level where the thematic structure of the sentence is represented in accordance with the subcategorization frame of lexical items and X-bar Theory, the phonological "shape" of these lexical items is not relevant at that level. Suppose, then, that only the lexical information referring to the (abstract) set of syntactic features is present at D-structure, and only after move-α has applied the phonological information of lexical items becomes accessible. If this is correct, lexical insertion of phonological features can take place after S-structure and before the mapping between this level and PF. Lexical mechanisms, thus, consist of two complementary operations that check the syntactic frames between each node and the lexical entry and, when they match totally, insert the phonological features from the lexical entry to the node. As a consequence, in the mapping from S-structure to PF the phonological operations (phonological rules) apply to the structure, according to the general principles that constrain this component. This modular organization of the grammar permits that the phonological component have access to the different structural configurations derived in the syntactic component. Moreover, it also allows the principles and conditions of PF to restrict the power of the whole system by imposing independent and general constraints to the possible derivations obtained through previous levels of the system.

If tenable, the resulting model is both simpler and conceptually more unified. Several questions still arise as to how we can capture the large amount of variation observed across languages in the types of morphological processes each of them allow, and the concrete semantic and phonological properties the processes show. A more detailed analysis of these differences from a transformational view will, no doubt, raise new questions and problems that did not even arise in a lexicalist approach to morphology. But these questions, I believe, are also of a greater linguistic interest.

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