Distributed Morphology and the Syntax/Morphology Interface

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1   Introduction: The Syntax/Morphology Interface

A theory of the syntax/morphology interface is first, a theory of how 'words' and their internal structure – the traditional domain of *morphology* – relate to the structures generated by the syntax, and second, a theory of how the rules for deriving complex words relate to the rules for deriving syntactic structures. A prominent line of research in this area consists of approaches assuming some version of the *Lexicalist Hypothesis*. For present purposes, this is the claim that (at least some) words are special in ways that e.g. phrases are not, and that this 'specialness' calls for an architecture in which the derivation of words and the derivation of syntactic objects occur in different modules of the grammar (the Lexicon versus the syntax).[1] While the 'words' derived in the Lexicon serve as the terminals in the syntactic derivation, there is a sharp division between syntax and morphology according to Lexicalist approaches of this type. In this way, the interface between syntax and morphology in such a theory is *opaque* or *indirect:* there is no reason to expect the structure and composition of 'words' to relate to the structure and composition of syntactic objects in any transparent or for that matter systematic fashion.

A second line of research advances the hypothesis that 'words' are assembled by rules of the syntax. Thus the 'word' is not a privileged derivational object as far as the architecture of the grammar is concerned, since all complex objects, whether words and phrases, are treated as the output of the same generative system (the syntax). According to this view, which we assume here, the theory of the syntax/morphology interface might better be said to be a theory of (1) the primitive elements of the syntactic derivation (the traditional question of the *morpheme*); (2) the principles governing the assembly of these primitives into complex objects (the question of what structures the syntax and perhaps PF rules can derive); and (3) the manner in which phonological forms relate to the primitives and to the complex objects constructed from the primitives. Such an approach allows for a *transparent* (or *direct*) interface between syntax and morphology, because it hypothesizes that the same generative system derives all complex objects.[2] In the default case, then, the principles that govern the composition of 'words' are the same as those that govern the composition of larger syntactic objects.

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[1] There are many senses of the term *Lexical/-ism/-ist* (see Aronoff (1994) for some discussion); our focus here is on the specific architectural claim that there exists a generative Lexicon in addition to a generative syntax.

[2] Phrasing this somewhat differently, there is a sense in which there is no 'interface' between syntax and morphology on this view, since there are not two distinct domains at play; see below.

The theory of Distributed Morphology proposes an architecture of grammar in which a single generative system is responsible both for word structure and phrase structure. In particular, Distributed Morphology attempts to make precise the claim that all derivation of complex objects is syntactic. In this way, this approach has much in common with other syntactic approaches to morphology, such as those advanced by Baker (1988), Pesetsky (1995), and Borer (2004) and related work. In respect to the interface between syntax and morphology, this architecture has a clear consequence: since the only mode of combination in the grammar is syntactic, it follows that in the default case, morphological structure simply is syntactic structure. This is the primary focus of our discussion below.

For reasons of space, we will simply assume this non-Lexicalist perspective. Nevertheless, some clarifications are called for regarding this aspect of Distributed Morphology. It is often objected in discussions of non-Lexicalist versus Lexicalist analyses that the patterns analyzed syntactically in the former type of approach *could* potentially be stated in a theory with a Lexicon. This point is almost certainly correct, but at the same time never at issue. The arguments against the generative Lexicon are not arguments about generative capacity, or the formal power of the Lexicalist approach to state a pattern. Rather, they are arguments against the central thesis of Lexicalism, which is a thesis about *modularity*, and the claim that the 'word' is a special object as far as the grammar is concerned. The Lexicalist position, which posits two distinct generative systems in the grammar, can be supported only to the extent that there is clear evidence that Lexical derivations and syntactic derivations must be distinct. Ultimately this is an empirical question; all of the theories under discussion recognize objects that are "privilged", and it must then be asked whether taking the 'word' to be privileged makes correct predictions. Thus specific arguments that are intended to support the Lexicalist position must show that a particular phenomenon *must not* be treated syntactically; the demonstration that a pattern *can* be stated in a Lexicalist framework simply does not suffice. This is not an argument that the Lexicalist theory is a priori subject to more stringent burdens of proof than the non-lexicalist theory. Rather, the claim is that in the current context– where arguments have been presented that the syntactic approch makes correct predictions and the Lexicalist approach does not– it does not sharpen the issues to simply claim that a Lexicalist analysis could be appealed to.

A number of the central issues for this question are found in the area of operations on argument structure and related areas. Much of the impetus behind Lexicalist approaches to grammar stems from an interpretation of Chomsky (1970), in particular the idea (not actually advanced in that paper) that certain nominalizations must be created by rules that apply 'in the Lexicon', and not by syntacic transformation. However, as discussed in Marantz (1997), the analysis of nominalizations constitutes a case in which a Lexicalist account is forced to stipulate a pattern which follows naturally from an syntactic treatment.[3] Again, whether or not the relevant patterns could be stated in the Lexicalist approach is not a matter of great interest: clearly the necessary stipulations can be made. The question is why– all other things being equal– one would maintain separate generative systems in the face of such an argument, and given that the other functions of the Lexicon (mostly related to listing certain types of information) can easily be redistributed in the grammar (for specific proposals see §2).

Thus while much of the current discussion of morphology and syntax is framed against a Lexicalist background, it should be stressed that this is for reasons that are primarily historical, having to do with the development of the Lexicalist Hypothesis as a research program. At the same time, there is no reason to suspect a priori that the theory would be better if it contained two distinct generative

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[3]A related argument is advanced in Embick (2004), with reference to the verbal/adjectival passive distinction, a distinction which is taken in Lexicalist approaches to grammar to be the result of syntactic versus Lexical derivation.

systems as opposed to one, although general parsimony and probably the strictures imposed by the Minimalist Program (Chomsky (1993) and subsequent work) support the 'one generative system' view.[4] The move to non-lexicalist theories like Distributed Morphology is motivated by empirical arguments, and it is of course in that domain that the issues will be settled.

In the final analysis, the 'two-module' architectural stance reduces to the claim that sound/meaning connections for 'words' are derived in a way that is 'special' with respect to how the syntax derives such connections. Articulated Lexicalist approaches make a number of precise empirical predictions, some of which we take to have been disconfirmed. In conjunction with the idea that there is no conceptual argument in favor of a grammar with two generative systems, these empirical results argue in favor of the architecture in which word-formation is syntactic. We outline here the basic principles of one such syntactic approach.

2   Essentials of Distributed Morphology

The architecture of the model of grammar that we adopt here is illustrated in (1). The syntax consists of a set of rules that generate syntactic structures, which are then subjected to further operations in the derivation of the PF and LF interface levels:

(1)   The Grammar
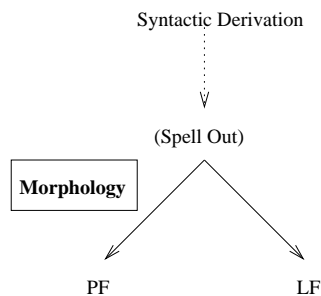
We assume that every word is formed by syntactic operations (Merge, Move). The principles of morphology are therefore to a large extent the principles of syntax, because in the default case, the morphological structure at PF is simply the syntactic structure.

Nevertheless, in more complex cases additional PF processes may modify and elaborate syntactic structure in limited ways (see §4). For example, language-specific PF requirements may force the introduction of features and terminal nodes into the syntactic structure. We use the term *Morphology* to designate the set of such processes that are relevant for word formation; correspondingly, we sometimes employ the term *morphological structure* to refer to structures that are found at the PF stage of the derivation, where 'PF' is understood as a sequential derivation that terminates in a phonological representation.[5] Thus in the syntactic approach to morphology adopted here some aspects of word formation arise from syntactic operations such as head movement, which occur in the syntax proper, while other aspects of word formation are accounted for by operations that occur on the PF branch. It is this fact that has given rise to the term *Distributed Morphology*.[6]

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[4]From the programmatic Minimalist perspective,the grammar must contain (1) a set of primitives, (2) a derivational system for combining these primitives into (a discrete infinity of) complex objects (3) an interface with the conceptual/intentional system (LF), and (4) an interface with the articulatory/perceptual system (PF). Anything beyond this, including a generative lexicon beyond a generative syntactic system, becomes suspect from this perspective.

[5]I.e. we use PF as a term for a set of operations, not just for the final output of this set of operations.

[6]For earlier overviews of this framework see Halle and Marantz (1993) and Harley and Noyer (1999).

While PF processes may be possible for certain aspects of word formation broadly construed, the important point is that such PF processes do not constitute a separate generative system for deriving words. Rather, PF processes effect modifications to the structures generated by the syntax, modifications that are limited to minor operations that manipulate nodes in a sharply constrained fashion.

2.1   PF: Minimal Requirements

The syntax generates hierarchical structures from a finite set of primitive elements. Linear ordering of nodes in this hierarchical structure is, however, plausibly a relation that is defined by operations on the PF branch (cf. Chomsky (1995:334) for some comments). Linear order is a property imposed on the syntax by the external requirement that the grammar be instantiated in real time; that is to say, the syntax must ultimately be processed via a serial interface, whether the ultimate modality is speech or gesture. Assuming that linear order is not included in the syntactic representation, PF-operations, because they are responsible for creating the interface level that mediates between syntax and the articulatory/perceptual systems, must at the very minimum be responsible for linearizing hierarchical structures. To a first approxiamation, linear order is a binary operator– represented by '*'– imposed by an operation Lin:

(2)   Lin [X Y] $\longrightarrow$ (X * Y) or (Y * X)

This relationship is one of immediate (left-)adjacency; subsequent steps concatenate terminal nodes (cf. Sproat (1985), Marantz (1984)). Other types of conditions might be imposed by distinct linearization operations, a point we discuss in §4 below.

In addition to linearization, operations that occur on the PF branch prepare the syntactic structure for the interface in other ways, such as by constructing prosodic domains. In this way it seems clear that PF operations violate the *Inclusiveness Condition* (cf. Chomsky 1995, 2000), a principle intended to prevent the introduction of novel material in the course of a derivation:

(3)   The *Inclusiveness Condition:* No new features are introduced by C_{HL}.

Of interest for the present discussion is the observation that operations at PF apparently do not comply with this property:

> A "perfect language" should meet the condition of inclusiveness: any structure formed by the computation (in particular, π and λ [i.e. PF/LF, de/rn]) is constituted of elements already present in the lexical items selected for N [the numeration de/rn]; no new objects are added in the course of computation apart from rearrangements of lexical properties...Let us assume that this condition holds (virtually) of the computation from N to LF... standard theories take it to be radically false for the computation to PF. (Chomsky 1995:228)

As Chomsky notes, it is ordinarily assumed that various morphophonological operations, such as those relating to syllabification, prosodic structure, and a great deal of the phonology, introduce elements not present in lexical items. In addition, the addition of phonological features to nodes at PF (*Late Insertion*; see below for details) violates this condition as well. While it appears that PF must violate Inclusiveness in at least some respects, it is also clear that PF does not have the power to add absolutely any type of feature. Thus the exact extent to which PF processes may add material to the syntactic structure is an empirical question; this is discussed further in §4.1.

Even accepting the fact that PF operations apparently violate the Inclusiveness Condition, it is important to stress that the move to Late Insertion – and to other operations performed by PF, – is

not motivated conceptually. Rather, these additions to the mechanism of PF require significant motivation, as they constitute departures from the minimal requirements on PF as an interface level.[7] A question of interest is whether these violations of Inclusiveness and other principles are forced by properties of the interface, i.e. imposed by requirements 'external' to language. For instance, the introduction of information concerning linear order by operations like LIN in (2) clearly adds information not present in the syntactic structure. However, this information is forced by the requirements of the articulatory-perceptual interface: language has a serial interface, and this requires a unique linear ordering. As such, this complication to the simplest picture has an external motivation. Whether other complications such as late insertion and the addition of other features/nodes at PF can be reduced similarly is an open question.

2.2 Primitives of the Syntax

We call the units that are subject to the syntactic operations Move and Merge *morphemes*: these are the terminal nodes of the tree diagrams ordinarily used to illustrate syntactic constituent structure. Each morpheme is a complex of features, of which there are two kinds: phonological and grammatical/syntactico-semantic. The basic inventory of syntactic terminals is divided into the *abstract morphemes* and the *Roots*:

   (4)   Terminals

       a. **Abstract Morphemes:** These are composed exclusively of non-phonetic features, such as [Past] or [pl], or features that make up the determiner node D of the English definite article eventuating as *the*.

       b. **Roots:** These include items such as $\sqrt{\text{CAT}}$, $\sqrt{\text{OX}}$, or $\sqrt{\text{SIT}}$, which are sequences of complexes of phonological features, along with, in some cases, non-phonological diacritic features. As a working hypothesis, we assume that the Roots do not contain or possess grammatical (syntactico-semantic) features.

Whereas the features that make up abstract morphemes are universal, Roots are language-specific combinations of sound and meaning. In other words, Roots are open-class, and new Roots can be added to an individual's grammar at any time. The distinction in (4) is thus related to that between the functional categories and the lexical categories.

As a general assumption, we take it that Roots never appear 'bare'; they must always be categorized by virtue of being in a local relationship with one of the category-defining functional heads (v, n, etc.; see e.g. Marantz (1995)):

   (5)   CATEGORIZATION ASSUMPTION: Roots cannot appear without being *categorized*; Roots are categorized by combining with category-defining functional heads.

In this way, Roots surface as members of the so-called 'lexical categories', traditional parts-of-speech such as Nouns, Verbs and Adjectives. However, such categories are always syntactically complex, consisting minimally of a Root and a category-defining functional head. Because Roots do

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[7]It has been suggested (see e.g. Chomsky 2001) that PF also performs movement operations like phrasal movement. We take it that it is at best inelegant to hypothesize a system in which both the syntax and PF have the ability to effect the full range of movement operations. Such a stance clearly increases the power of PF by potentially making it a second syntax as far as movement is concerned, a move that should be avoided if at all possible.

A related question is whether head movement should be considered a PF phenomenon; we assume that it is not, although the basic principles of Distributed Morphology– a piece-based theory with some late insertion– are compatible with the 'head-movement at PF' alternative (or with other alternatives in which head-movement is replaced by other operations).

not contain or possess any grammatical features, our approach does not allow *lexical decomposition*, by which we mean decomposition of the lexical vocabulary into feature complexes. While complex words – and even superficially unaffixed words such as *ox* – appear in complex syntactic structures, it is the functional structure in which Roots appear that is decomposed, not the Roots themselves.

On the other hand, abstract morphemes such as [pl] or [Past] are the (contents of the) familiar *functional categories* of syntactic theory.[8] By the end of the computations that are described here each morpheme is supplied with a set of phonological features (including the phonological null element or zero -Ø-) which serve as instructions for actions to be performed by the articulatory/perceptual system.

As noted in (4), functional heads do not have phonetic content in the syntactic derivation. We use the adjective *abstract* to designate such morphemes, and one of the basic functions of morphology is to supply phonological features to abstract morphemes. By contrast, we assume Roots to be present with all of their features throughout the derivation, with no such insertion process.[9] In this assumption we follow results from Embick (2000); see also Chomsky (2001) for some discussion.

The different morphemes in (4) are stored in a list of syntactic terminals that the learner acquires during the development of language. Thus speakers of English memorize Roots such as $\sqrt{\text{CAT}}$ or $\sqrt{\text{SIT}}$, as well as the fact that abstract morphemes such as [pl] and [past], which are drawn from a universal feature inventory, are 'active' in their language. As the primitives of syntax and hence of morphology, the items in these lists are the ultimate elements out of which words, phrases, and sentences are composed.

The lists of morphemes sketched above is fundamentally different from the lists of words or lexical items that make up the Lexicon of (some) Lexicalist approaches to morphology. The items that figure in a typical Lexicon combine a meaning with a sound. This is not true of all morphemes in the present approach. For example, abstract morphemes like [pl] or [past] are morphemes without phonetic features, and must be supplied with such features in the course of a derivation in the grammar in (1). Morphemes of this type are not found in theories in which the primitives must be *lexical items* in the traditional sense: combinations of syntactic, semantic, and morphophonological features.[10]

The move to Late Insertion amounts to accepting a version of the *Separation Hypothesis* (cf. Beard 1966, 1995). According to this hypothesis, the components of the traditional morpheme are separated from one another: that is, morphemes do not contain syntax, semantics, and phonology. Rather, the morphophonological component of the morpheme is underspecified with respect to the syntactico-semantic environments in which it appears. Theories that admit Separation in this way are non-Lexicalist, but in a sense different from the way in which 'non-Lexicalist' is used above; recall that 'Lexicalist' has many distinct senses. Some theories are called 'Lexicalist' because they assume that the primitives of the grammar must be *lexical items* in the sense defined above. It is this claim that Separation rejects. Other theories are 'Lexicalist' because, as discussed in §1, they posit a generative Lexicon. However, it is important to note that there is no necessary connection between Lexicalist-1 = 'theory with a generative lexicon' and Lexicalist-2 'theory with *lexical items*'.[11]

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[8]For this reason, we use *abstract morpheme* and *functional head* to refer to the same objects.

[9]Because Roots are not subject to late insertion, it follows that there can be no *suppletion* in the case of Roots. See Embick and Halle (forthcoming) for some discussion.

[10]Clearly the abstract morphemes are not *signs* in the sense of Saussure. Whether or not the Roots are signs in this sense is another matter.

[11]Indeed, there are theories that are lexicalist in one sense but not the other. For instance, some approaches assume the *lexical item* but not a separate generative Lexicon, e.g. Lieber (1992). For details concerning possible Lexicalist-2 approaches to underspecification and syncretism, see Noyer (2001).

A further possibility is that separation is admitted only when necessary, i.e. only for abstract morphemes that show allomorphy, but not in the general case; see Halle (1990).

For theories like Distributed Morphology that admit Separation, the mechanisms of Late Insertion must be specified; this is addressed in the next subsection.

2.3 Vocabulary Insertion

The mechanism supplying phonological features to the abstract morphemes is called *Vocabulary Insertion*. The *Vocabulary* is the list of the *phonological exponents* of the different abstract morphemes of the language, paired with conditions on insertion. Each such pairing of a phonological exponent with information about the grammatical (i.e. syntactic and morphological) context in which the exponent is inserted is called a *Vocabulary Item*.

As an illustration of the the nature of these Vocabulary Items, consider the formation of plural nouns in English. Vocabulary Insertion supplies phonological features to the abstract [pl] morpheme, which has combined with a noun in the syntax. We take the [pl] feature to be present on a head which is represented as # for 'Number'. The regular phonological exponent of the English plural is /-z/, and this is formally expressed by the Vocabulary Item in (6):

(6)   z $\leftrightarrow$ [pl]

The effect of (6) is to add /-z/ to that node. While Vocabulary Insertion adds phonological features to a node, we assume that it does not automatically 'delete' or 'erase' the abstract features present on that node.[12]

Among a set of Vocabulary Items specified for insertion at a particular terminal node, it will arise quite typically that more than one meets the conditions for application. Because – under normal circumstances[13] – only a single exponent may be inserted at any terminal, these Vocabulary Items can be understood to be in competition for application to that morpheme. The *Subset Principle* (7) controls the application of Vocabulary Items and resolves (most) cases of competition of this sort:[14]

(7)   **Subset Principle:** The phonological exponent of a Vocabulary Item is inserted into a position if the item matches all or a subset of the features specified in that position. Insertion does not take place if the Vocabulary Item contains features not present in the morpheme. Where several Vocabulary Items meet the conditions for insertion, the item matching the greatest number of features specified in the terminal morpheme must be chosen. (Halle 1997)

Continuing with the example (6) above, we note that the node with the feature [pl] for 'plural' in English also has the exponents *-Ø* (as in *moose-Ø*) and *-en* (as in *ox-en*). That is, while there is a single abstract morpheme [pl] in all of the plural environments in English, this morpheme has different phonological exponents whose appearance is determined by the Root in the local context of [pl].

As already observed, Vocabulary Insertion takes place in structures that have been assembled by the syntax. In the example with noun plurals, this means in a constituent containing a noun ($\sqrt{\text{ROOT}}$-*n*) and the abstract morpheme [pl]. Since [pl] is in a local relationship with the Root when Vocabulary Insertion occurs, the identity of the Root can be a contextual condition on the choice of exponent for the [pl] node. The resulting effect of such a condition is called *contextual allomorphy*,

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[12]Although it is possible in some cases that such deletion or erasure could be motivated, we assume that such additional operations have to be justified by explicit argument. See §5.2 and Noyer (1997, 1998) for some pertinent discussion.

[13]See §4.2.2 for details

[14]The Subset Principle does not resolve all cases of potential conflict. Specifically, where two Vocabulary Items are both applicable and both contain the same number of features some additional criterion must resolve the competition. Explicit stipulation of ordering (Halle & Marantz 1993) or appeal to a hierarchy of morphosyntactic features (Noyer 1997) are two possible solutions.

and its effects are reflected formally by adding to Vocabulary Items like (6) an additional condition on insertion, in the form of a list of elements associated with each contextual allomorph:[15]

(8)   [pl] $\leftrightarrow$ -en/{$\sqrt{\text{OX}}$, $\sqrt{\text{CHILD}}$, ...}＿
        [pl] $\leftrightarrow$ -Ø/{$\sqrt{\text{MOOSE}}$, $\sqrt{\text{FOOT}}$,...} ＿

The familiar notation /...＿... indicates that the rule applies only when the morpheme in question occurs in the environments specified by ...; in case of the English plural, this means that [pl] is spelled out as *-Ø* in the context of $\sqrt{\text{MOOSE}}$, and as *-en* in the context of $\sqrt{\text{OX}}$, and so on.

Each of the Vocabulary Items in (8) is more specific than that in (6), in that each contains a contextual condition on insertion in addition to referring to the feature [pl]. Thus in cases in which any of the Roots on the lists in (8) are present, [pl] is realized as *-Ø* or *-en*, and not */-z/*.

2.4 Underspecification of Vocabulary Items

Given the assumptions about Vocabulary Insertion outlined above, a *(systematic) syncretism* occurs when a single Vocabulary Item inserts the same exponent into two distinct syntactico-semantic nodes. The primary motivation for the separation of phonology from syntax and semantics in Distributed Morphology (and realizational theories of morphology in general) is that such a separation allows morphological syncretisms to be stated systematically. The basis for the systematic analysis of syncretisms lies in the fact that the phonological exponent of a Vocabulary Item is *underspecified* relative to any given context in which it is inserted. The terminal nodes that are the sites for insertion are fully specified; that is to say, they contain a full complement of syntactico-semantic features.[16] However, the Vocabulary Items that apply to these positions need not be fully specified, with the result that a single phonological exponent may appear in more than one syntactico-semantic context.

To take a simple example, consider the Person/Number prefixes for objects and subjects found in the Athabascan language Hupa (data from Golla (1970)):[17]

(9)   Subject and Object Markers

	SUBJECT	OBJECT
1S	W-	Wɨ-
2S	n-	nɨ-
1PL	dɨ-	noh-
2PL	oh-	noh-

In the plural forms, while the exponents *dɨ-* and *oh-* appear in the subject position, and distinguish first from second person plurals, the distinction is not made in the object position, where there is a single exponent, *noh-*. As noted above, the theory assumes that morphosyntactic positions are fully specified when Vocabulary Insertion takes place. The plural nodes from the example above are represented as follows:

(10)   Feature bundles

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[15] What properties of the environment are visible for contextual allomorphy– i.e. can appear as conditions in rules like those in (8)– is an empirical question. For some proposals concerning different aspects of this issue see Bobaljik (2000) and Embick (2003a).

[16] Of course, the nature and identity of such features is the topic of an active research program.

[17] The forms here are only for first and second person arguments; third person and other types of arguments are not included for the sake of clarity.

$$\text{a.} \begin{bmatrix} +1 \\ +\text{PL} \\ +\text{SUBJ} \end{bmatrix} \quad \text{b.} \begin{bmatrix} +2 \\ +\text{PL} \\ +\text{SUBJ} \end{bmatrix} \quad \text{c.} \begin{bmatrix} +1 \\ +\text{PL} \\ +\text{OBJ} \end{bmatrix} \quad \text{d.} \begin{bmatrix} +2 \\ +\text{PL} \\ +\text{OBJ} \end{bmatrix}$$

Consider now the following Vocabulary Items, which spell out the plural part of (9):

(11) a. [+1 +PL +Subj] ↔ dɨ

     b. [+2 +PL +Subj] ↔ oh

     c.   [+PL +Obj] ↔ noh

While the first and second plural in subject position are realized via distinct Vocabulary Items (11a) and (11b), realization in the plural is effected by a single Vocabulary Item, (11c). The Vocabulary Item (11c) does not refer to the features [1] or [2], and so is underspecified with respect to the feature bundles to which it applies, (10c) and (10d). The fact that the first and second plural are non-distinct in object position is systematic on this account, with the syncretism being captured via the single Vocabulary Item in (11c). Put slightly differently, there is a single *noh-*, despite the fact that this *noh-* appears in more than one plural context.

2.5   Synopsis: Architecture, Features, and Lists

To summarize the primary aspects of the approach we have presented above, all derivations are performed in the grammar in (1). In these derivations, three distinct lists are accessed. These lists are as follows:
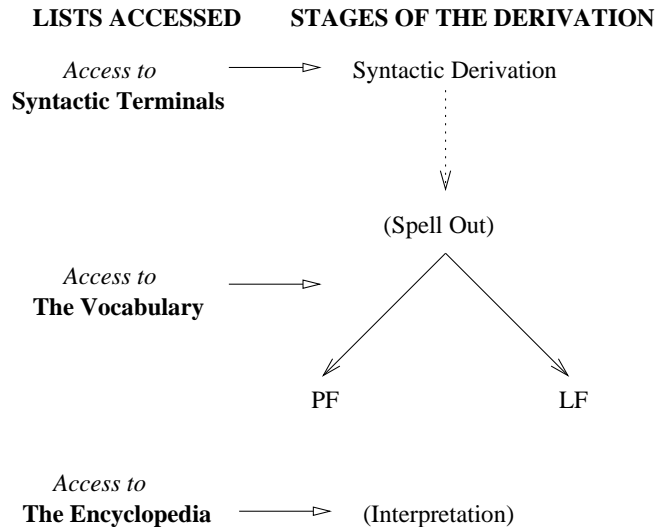
(12) LISTS

     a. **The Syntactic Terminals:** The list containing the *Roots* and the *Abstract Morphemes*.

     b. **The Vocabulary:** The list of *Vocabulary Items*, rules that provide phonological content to abstract morphemes.

     c. **The Encyclopedia:** The list of semantic information that must be listed as either a property of a Root, or of a syntactically constructed object (idioms like *kick the bucket*).

These lists are accessed at distinct stages of the derivation. Two of these lists have been discussed extensively above. Items are drawn from the list of *Syntactic Terminals* in the syntactic derivation. The *Vocabulary* is consulted at PF, and contains the rules that supply the phonological exponents to abstract morphemes.

A third list, not discussed above, is the repository for 'special' meanings, whether the meanings of Roots or of larger objects. This component, the *Encyclopedia*, is consulted subsequent to the output of PF/LF, which we abbreviate simply as "Interpretation".[18] This is represented in the modified grammar in (13):

(13)   The Grammar, with Lists

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[18]For a view on the Encyclopedia see Marantz (1997).

LISTS ACCESSED   STAGES OF THE DERIVATION

Access to ⟶ Syntactic Derivation
Syntactic Terminals

(Spell Out)

Access to ⟶
The Vocabulary

PF   LF

Access to
The Encyclopedia ⟶ (Interpretation)

In this revised architecture, information that is included in the Lexicon of Lexicalist approaches is accessed at distinct stages of the derivation. Crucially, these lists are not generative; the only generative component of the grammar is the syntax.

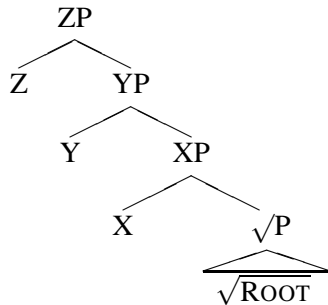## 3   A Transparent Interface between Syntax and Morphology

In its essence the Distributed Morphology approach to morphology is syntactic. As a consequence of the architecture of the grammar, in the simplest case, morphological structure and syntactic structure are the same. Because there is no Lexicon in which complex objects are assembled according to rules distinct from the rules of syntax, the generation of all complex forms must be performed in the syntax. PF processes add information to the structure that is derived in the syntax, in the form of morphologically relevant operations such as Vocabulary Insertion, but beyond this (and the PF mechanisms discussed in §4) the structure of words is syntactic structure.

If this hypothesis is correct, then– strictly speaking– there is no syntax/morphology 'interface'. Words and phrases are assembled by the same generative system, and there is thus no sense in which words must 'interface' with the syntax; rather, they are derived by the rules of syntax (with PF understood as operating on the output of the syntax). Thus while we may continue to use term 'syntax/morphology interface' to refer to a range of issues that connect with the traditional domain of 'morphology' or 'word formation', such as the strucure of complex heads, inflection, etc., this is a *façon de parler* given the theoretical context that we assume, and not a theoretically-motivated partition of linguistic phenomena. There is no definable domain– e.g. the 'word'– that can be singled out as the subject matter for morphology on any principled basis. This result, though it runs contrary to some intutions, should not be surprising. There is no reason to suspect that our intuitive or traditional notions like 'word' should correspond in any way to a natural class of objects in the theory of grammar. Rather, these pre-theoretic notions are replaced by a theory of primitives (e.g. Roots and abstract morphemes), a theory of relevant structures (e.g. 'syntactic terminal', 'complex head', 'phrase'), and explicit claims about derivational mechanics. While, for example, complex heads and phrases may show different morphophonological properties, these differences do not imply that they must be constructed in different modules, any more than the fact that DPs and TPs have different properties is an argument for two distinct modules for assembling those objects.

Concerning the specific derivational mechanics at play in 'word formation' broadly construed, we assume that in the normal case, complex heads are created by the syntactic process of head

movement. A complex head created by head movement in the structure in (14) has the form $\sqrt{\text{ROOT}}$-X-Y-Z, assuming that these functional heads are linearized on the right, i.e. as suffixes:

(14)　Example structure

```
              ZP
            /    \
           Z      YP
                /    \
               Y      XP
                    /    \
                   X     √P
                        /‾‾\
                       √ROOT
```

In principle, each of X, Y, or Z could be linearized as a prefix or a suffix. Head movement in the structure (14) is therefore capable of producing Z-Y-X-$\sqrt{\text{ROOT}}$, Z-$\sqrt{\text{ROOT}}$-X-Y, and so on.

Using the uniformly suffixal case for illustration, the reason that the derived word has the structure $\sqrt{\text{ROOT}}$-X-Y-Z and not $\sqrt{\text{ROOT}}$-Y-X-Z (for example) is syntactic. Head movement operates in terms of successive adjunction, and the only possibility for syntactic head movement is to create (15) from movement in (14):[19]

(15)　Complex Head

```
              Z
            /    \
           Y      Z
         /   \
        X     Y
      /‾‾\
    √ROOT  X
```
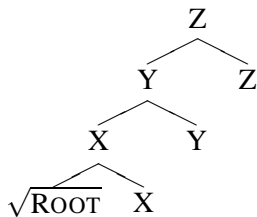
The internal structure of the word– i.e. the complex head (15)– faithfully recapitulates the syntactic structure. The linearization of such complex heads is constrained by the hierarchical structure. Thus in cases in which the functional heads are linearized in the same direction, the order of the affixes *mirrors* the syntactic hierarchy of projections. This pattern is the basis for the *Mirror Principle*, often taken as a condition on how syntactic structure and morphological structure relate to one another (cf. Baker 1985, 1988). In our terms, however, it is misleading to speak of the Mirror Principle as a *condition* on (relationships between) representations; rather, the Mirror Principle amounts to the *observation* that word-internal structure mirrors syntactic structure. In other words, because these effects are derived from the architecture of the theory, as presented in (1) above, Distributed Morphology has in fact no need to state the Mirror Principle as a principle of the grammar.

The generalization that is expressed by the Mirror Principle is empirically very robust, a fact that has important architectural consequences. An approach with a Lexicon in which complex words are derived, or an affixless view of morphology in which there simply are no pieces (e.g. Anderson 1992), is forced to stipulate the effects of the Mirror Principle (see Halle & Marantz 1993 for discussion).

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[19]This is the standard conception of head movement, derivative of work by Travis (1984) and Baker (1988), and much subsequent research.

Nevertheless, there are special cases in which the attested order of morphological elements is not equivalent to the order that is expected on syntactico-semantic grounds; that is to say, the relationship between syntactic structure and morphological form is more complex than the picture outlined above predicts. An analysis of such data may proceed along two lines. One possibility is that the syntactic structure that predicts the non-occurring morphological form has been misanalyzed. Because it maintains the simplest interaction between syntax and morphology, this option represents the null hypothesis.

The other option is that the syntactic analysis is correct, and that the surface order does in fact seem to contradict what syntactic movement alone would predict. In such cases, and in the case of true 'syntax-morphology mismatches' more generally, we assume that one of the primary tasks of morphological theory is to identify the set of PF operations that are responsible for these deviations from the default case. Although this option weakens the theory by allowing PF to alter syntactic structures, it does so in a way that maintains the most direct possible correspondence between syntactic and morphological (i.e. PF) structures.

4 PF Processes: Syntax Morphology Mismatches

While much research in the syntax/morphology interface is devoted to the study of mismatches of the type mentioned above, it is essential to emphasize that this study is only meaningful against the background of a theory in which syntax/morphology connections are by default transparent.

Faced with such mismatches, research within Distributed Morphology aims to isolate and identify these PF readjustment processes, and to identify the conditions under which these processes apply. By admitting such operations at PF, the approach is flexible enough to analyze cases in which such mismatches arise. At the same time, admitting such operations does not abandon the central architectural premise of the theory, namely that syntactic structure and morphological structure are, in the default case, the same. It must be stressed that the operations that apply at PF are minimal readjustments, motivated by language-particular requirements. Unlike the syntax, which is a generative system, PF is an interpretive component, and the rules that alter syntactic structures do not apply freely. Rather, each rule is triggered by a language-specific requirement that must be learned by speakers of that language.

4.1 'Ornamental' Morphology: Insertion of Nodes/Features

Assuming that syntax provides the input to semantic interpretation, it follows naturally that all properties which are essential to semantic interpretation– all 'interpretable' features– are present in syntax. Because the mapping to PF does not delete featural information, all such features are present at PF. Nevertheless, while all morphemes and interpretable features are present at PF, not all morphemes that are found at PF are necessarily present in the syntactic derivation. Specifically, depending on language-specific well-formedness requirements, certain morphemes are added at PF. Such morphemes are never essential to semantic interpretation, since the derivation diverges onto PF and LF branches prior to the insertion of these morphemes. Thus, we speak of the reflexes of any morphemes inserted at PF as being *ornamental*: they merely introduce syntactico-semantically unmotivated structure and features which 'ornament' the syntactic representation.

Because ornamental morphology has an overt effect at PF, the requirements which eventuate in the insertion of 'extra' material are, although language-specific, sufficiently tranparent that speakers of the language may infer them without special difficulty during acquisition.

Agreement (AGR) nodes present a common example of the type of morphemes added after syntax. We assume that the structure of the clause contains Tense (and in some cases Aspect) nodes with

interpretable features, but no AGR projections in the syntax (see Iatridou (1990), Marantz (1992), Chomsky (1995) for some motivations for this position.) At the same time, the morphosyntactic structure of verbs in many languages contains a piece that is clearly representative of an AGR node. Consider, for example, the Latin Imperfect 1PL form of the verb *laudō* 'praise', which, to a first approximation, has the pieces in (16); 'TH' is for the Theme position; 'TNS' is for Tense, 'AGR' for Agreement:

(16)   laud-ā-bā-<u>mus</u>
       ROOT-TH-TNS-AGR

       'We were praising'

The underlined piece *-mus* here is an exponent of an AGR node. However, the syntactic structure for (16) involves no AGR node, in accordance with the assumption that we outlined above:[20]

(17)   Structure for (16)
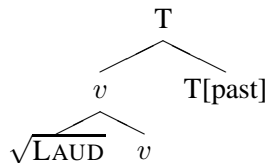
The AGR node is added to Tense in accordance with a morphological requirement in Latin an AGR node must appear on (among other things) finite Tense:

(18) $T_{finite} \longrightarrow$ [T AGR]

The rule (18) introduces an AGR node, resulting in the structure (19). This node, which possesses the features of the subject [1 pl], is subsequently spelled out as *-mus* (in (19) we have added a Theme position TH as well):

(19)   Structure for *laudābāmus*
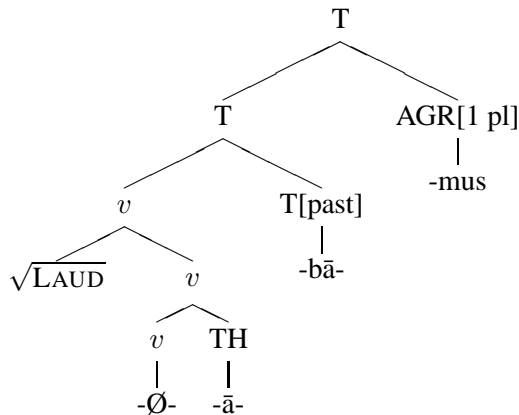
Crucially, the process that adds the AGR node applies at PF, prior to Vocabulary Insertion.[21] Structurally, we assume that this type of process has the properties of adjunction.

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[20]It also contains no Theme node position for the *-ā-* that characterizes verbs of the first conjugation; see below.

[21]For the manner in which the AGR node acquires the Person/Number features of the subject, see below.

Addition of nodes in this way introduces one kind of syntax/morphology mismatch, in the sense that there are more positions in the morphological (PF) structure than there are in the syntactic structure. A further, and closely related, kind of mismatch involves the introduction of *features* at PF. The primary mechanism introducing features at PF is Vocabulary Insertion, where the phonological features of Vocabulary Items– i.e. the exponents– are added to abstract morphemes. Beyond this operation, there are in addition cases in which PF rules add non-phonological features which then have an impact on Vocabulary Insertion.

One example of this type involves morphological case features, which, while absent in syntax according to an assumption we adopt here, are inserted at PF and then condition the choice of Vocabulary Items expressing case. For instance, Latin nouns are found in Nominative, Genitive, Dative, Accusative, Vocative, and Ablative forms. The Declension I noun *femina* 'woman' is used to illustrate these cases in (20):[22]

(20)   Case forms for a Latin noun

|	SINGULAR	PLURAL
NOMINATIVE	femina	feminae
GENITIVE	feminae	feminārum
DATIVE	feminae	feminīs
ACCUSATIVE	feminam	feminās
VOCATIVE	femina	feminae
ABLATIVE	feminā	feminīs

We take it that the forms in (20) are structurally composed of a Root and a nominalizing head n, along with a number head #. The # head contains the features [±Pl], for singular and plural number:

(21)   Structure of Nouns
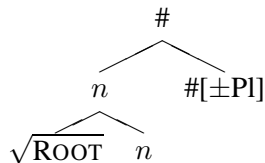
At PF, a theme node TH is added to n; this TH node is realized as the traditional Theme Vowel, which, in Declension I, is *-a-*:

(22)   Structure of Nouns, with TH position
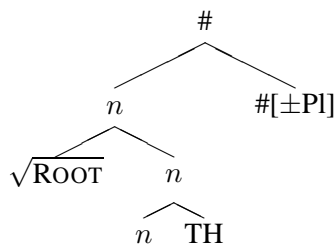
The structure in (22) does not contain morphological case features. Instead, we assume here that each of the different cases of the noun is formally represented by a complex of abstract features. We present in (23) an illustration of this type of decomposition, that of Halle (1997):

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[22]For a treatment of the Latin Declension see Halle and Vaux (1998).

(23)   Latin Case Decomposition (Halle 1997)

	NOM.	ACC	GEN.	DAT.	ABL.
Oblique	-	-	+	+	+
Structural	+	+	+	+	-
Superior	+	-	-	+	+

We put aside the important question of how the values of the different features are determined.[23] For the purposes of the present discussion we note that while case features of the type presented in (23) might refer to properties of syntactic structures, the features themselves are not syntactic features. These features are added to nodes at PF under specific conditions; they do not figure in the syntax (narrowly defined).[24]

Syntactically, nouns like those in (20) appear within DPs. At PF, case features are added to DPs (or to their D heads), based on the syntactic structure that the DP appears in (see Marantz (1992) and McFadden (2004) for some proposals concerning such rules):

(24)   D $\longrightarrow$ D[case features]

These features are then copied onto hosts in the DP like the Noun we have examined above. In Latin, case and number are realized in the same position. One possibility is that the case features are added directly to the # node, as in (25):[25]

(25)   Addition of case features
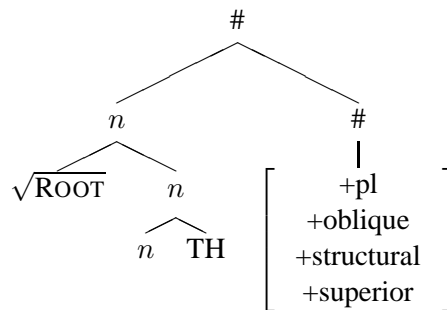
While much remains to be said about case features and the rules that are responsible for agreement within DPs, the point of this example is the status of the case features themselves. These features are added at PF, and are not present in the syntactic derivation.

Summarizing the discussion to this point, there are instances in which both morphemes and features that are not present in the syntax are inserted by rules of PF. These ornamentations of the syntactic structure introduce redundancy into the PF expression but do not eliminate or alter information which is crucial for semantic intepretation.

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[23]The nature of the case features required for spelling out nominal inflections has been an active topic of research since Jakobson (1936). As Halle (1997) stresses, some motivation must be given for the features in a decomposition like that in (23). Without strong criteria for what constitute possible features, it would be possible to stipulate a feature decomposition that provides the required natural classes. But unlike phonological features, the features involved in such a decomposition would have no independent status.

[24]For a recent discussion of the relationship between syntactic Case features and morphological case features see McFadden (2004).

[25]Another possibility is that a case node is added to the structure, and fused with the # node. In either case, the point is that features not present in the syntax are introduced into the representation.

Employing terminology from Embick (1997,1998), we refer to material (features or terminal nodes) added in the PF component as *dissociated*, a term which emphasizes that such material is an indirect reflection of certain syntactic morphemes, features or configurations, and not the actual spell-out of these.

(26) a. **Dissociated Features:** A feature is *dissociated* iff it is added to a node under specified conditions at PF.

b. **Dissociated Nodes:** A node is *dissociated* iff it is added to a structure under specified conditions at PF.[26]

Nodes that are featureless get their features through contextually-determined rules, referred to as 'agreement' or 'concord' processes. Regarding such concord processes, it is important to note that the copying of features at PF might have a different status from the introduction of features:

(27) a. **Feature Copying:** A feature is present on a node X in the narrow syntax is copied onto another node Y at PF.

b. **Feature Introduction:** A feature that is not present in narrow syntax is added at PF.

Because syntactico-semantic features must be visible at PF for the purposes of Vocabulary Insertion, holding that an operation at PF can copy these features does not constitute a large departure from the simplest model of syntax/morphology interactions. Feature Introduction, on the other hand, results in the introduction of (non-phonological) features that are not present in the syntactic derivation at all – a significant extension of the simplest model – and should therefore be treated with caution. The introduction of case features in the examples above constitutes a case of feature introduction. As a working hypothesis, it has been suggested that only features irrelevant to semantic interpretation, that is, features that are not *interpretable*, can be introduced at PF (Embick 1997, 2000). This point about feature type and the distinction between copying and introduction in the first place clearly relate to the question concerning PF and the *Inclusiveness Condition* raised in §2.1 above.

To summarize, our approach acknowledges four types of features. In line with standard treatments of features in the syntax, we assume that the syntax manipulates nodes containing both *uninterpretable* and *interpretable* features (cf. Chomsky 1995 and subsequent work.) We take it that this division is one between features that have no semantic interpretation, e.g. EPP features or their equivalent, and those that do: our abstract morphemes, that is, the contents of functional heads. The grammar also makes reference to *diacritic* features, arbitrary features that must simply be memorized as belonging to particular Roots (and perhaps exponents/abstract morphemes as well). Features relating to Conjugation or Declension class are features of this type. Such features are relevant for morphological spell out, but do not have any semantic interpretation. A fourth type of feature was introduced immediately above. Because many languages show discrete pieces in morphology that evidently do not correspond to heads present in the syntactic derivation, it has been proposed that nodes and feaures are added at PF by language-specific rules. The alternative– requiring that all pieces be syntactic– is a stronger position since it admits no non-syntactic pieces at all. However, this alternative would require the presence of functional heads in the syntax that possess no semantic content, an undesirable move inasmuch as it complicates the syntactic derivation with objects that play (by hypothesis) no role in syntax or semantics.[27]

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[26]Evidently dissociated nodes may be assigned both to entire complex heads (*M-Words*) and to terminals within a complex head (*subwords*) (see Embick and Noyer 2001).

[27]A related view is expressed as a minimalist desideratum by Chomsky (2001:43 fn. 12) "Functional categories lacking semantic features require complication of phrase structure theory ... a departure from good design to be avoided unless forced." It remains to be seen if there are clear empirical reasons forcing the exclusion (or inclusion) of such features in the syntax.

4.2 Operations on Nodes

Certain additional operations occuring prior to spell-out may complicate the direct reflection of syntactic structure in the phonological forms which interpret this structure. *Impoverishment* (for an intial formulation see Bonet (1991)) eliminates features from morphemes prior to Vocabulary Insertion and creates certain types of systematic syncretisms. *Fission* occurs concomitantly with spell-out and permits the insertion of more than one Vocabulary Item at a single syntactic terminal.

4.2.1 Impoverishment

As discussed in §2.4 the same exponent may be inserted into several morphosyntactically distinct morphemes when the Vocabulary Item introducing this exponent is *underspecified* in its context of insertion. Moreover, the principled ordering of Vocabulary Items in the competition for insertion (§2.3) ensures that the exponents in less specified items will acquire a default or 'elsewhere' distribution. Such distributions are typically not natural classes of categories, but are instead all the categories remaining after exponents with more specific contexts of insertion have been inserted.

    Impoverishment allows for the expression of further systematic syncretisms. When Impoverishment occurs, a feature of a morpheme is deleted in a specific context; after deletion the morpheme in question escapes the insertion of any Vocabulary Item requiring that feature. The effects of Impoverishment are usually seen when in some particular circumstance a category fails to exhibit the expected exponent but instead exhibits a default exponent. This gives the effect of forms which 'appear to be what they are not'.

    A simple example of Impoverishment can be seen in the substantival declension of classical Arabic (Haywood & Nahmad 1965). Arabic nouns and adjectives inflect for three cases (nominative, genitive and accusative) and for definiteness. We will make use of the following two features to express this three-way distinction:

(28)   Case features for Arabic

	NOM.	ACC.	GEN.
Oblique	–	–	+
Superior	+	–	–

Examples of the two types of declension of interest here are given below.

(29)   Some Arabic declensions

	NOM. INDEF.	GEN. INDEF.	ACC. INDEF.	NOM. DEF.	GEN. DEF.	ACC. DEF.
rajul- 'man'	-u-n	-i-n	-a-n	-u	-i	-a
rijāl- 'men'	-u-n	-i-n	-a-n	-u	-i	-a
hāšim- 'Hashim'	-u-n	-i-n	-a-n			
hārūn- 'Aaron'	-u	-a	-a			
madāʔin- 'cities'	-u	-a	-a	-u	-i	-a

    In the ordinary or 'triptote' pattern of declension, as in *rajul-* 'man', *rijāl-* 'men', and *hāšim* 'Hashim', all three case forms have distinct suffixes and indefiniteness is expressed by the addition of *-n*. (Note that proper names are normally declined as indefinites in Arabic.) The following vocabulary items, competing for insertion in the Case morpheme, introduce the exponents for these suffixes.

(30)   a. u   ↔   [+superior]

       b. i   ↔   [+oblique]

       c. a   *elsewhere*

Definiteness is expressed by:

(31)   n   ↔   [–definite]

(32)   Ø   *elsewhere*

In certain so-called 'diptote' substantives, such as *hārūn-* 'Aaron' or *madāiʔin-* 'cities', the three cases are expressed by only two distinct affixes when the noun is indefinite.[28] Specifically, the genitive *-i* does not appear but is replaced by *-a*, normally the default suffix used in the accusative. In addition, diptote nouns systematically lack the indefinite *-n* seen in triptotes. Both types of exceptional behavior involve a loss of distinctions and a replacement of more specific exponents by default ones *-a* and *Ø*. To permit diptotes to escape insertion of unwanted *-i* and *-n* the grammar must contain Impoverishment rules deleting the features which condition the insertion of these exponents:[29]

(33)   Arabic Diptote Impoverishment

       a. [+oblique] ⟶ Ø / [diptote] + _____ + [–definite]

       b. [–definite] ⟶ Ø / [diptote] + case/number + _____

Once the values [+oblique] and [–definite] are removed, neither *-i* nor *-n* can be inserted, and default *-a* and *Ø* are inserted instead.

The declension of weak adjectives in Old English provides a slightly more complex example of Impoverishment:

(34)   Old English Weak Adjectival Declension

til- 'good'	MASC SG	NEUT SG	FEM SG	PLURAL (all genders)
NOM.	til-a	til-e	til-e	til-an
ACC.	til-an	til-e	til-an	til-an
GEN.	til-an	til-an	til-an	til-ra
DAT.	til-an	til-an	til-an	til-um

Clearly the suffix *-an* has an elsewhere distribution: it appears in the direct (nominative and accusative) cases of the plural, the oblique cases of the masculine and neuter singular, and all but the nominative case of the feminine singular. On the other hand, the suffixes *-a*, *-ra* and *-um* have very specific contexts of insertion. Leaving aside the suffix *-e* for the moment, the Vocabulary Items for the remaining suffixes are clearly:[30]

(35)   a. um ↔ [+structural +superior +oblique +plural]

---

[28]Although certain generalizations, some exceptionless, exist regarding whether a given stem will be diptote or triptote, in many cases the choice is unpredictable. For example, the proper name *hind-* can inflect diptote or triptote (Haywood & Nahmad 1965:384-88). Regardless of how predictable the diptote property is, however, it remains clear that the diptotes as a class must be marked with a diacritic class feature of some kind. The feature [diptote] is used here for this purpose.

[29]Note that these rules must apply in the order shown since [–definite] deleted by the second rule is part of the conditioning environment for the first rule, a counterbleeding ordering relation. This ordering is however a principled one inasmuch as (33a) refers to a more specific environment than (33b).

[30]The case features used here are the same as those used in the Latin example above.

    b. ra ↔ [+oblique +plural]

    c. a ↔ [–oblique +superior masculine]

    d. an ↔ (elsewhere)

Because *-an* is specified for no features, it is inserted only in contexts where the more specified affixes *-um, -ra* and *-a* are not.

The distribution of *-e* illustrates the effects of Impoverishment in the grammar. Specifically, note that *-e* appears in the nominative in the feminine, but in both the nominative and the accusative in the neuter. The systematic syncretism of the nominative and accusative forms is not, however, unique to this declension but is a pervasive pattern throughout the inflection of Old English. To treat this pattern as a mere accident of the vocabulary items would miss the generalization that the neuter direct cases are never distinct. To express this systematic neutralization of distinction, an Impoverishment rule deletes the property [–superior] from the neuter case-number morpheme:

(36)   [–superior] $\longrightarrow \emptyset$ / [neuter —-]

When a feature is deleted by Impoverishment two possible scenarios result, depending on the markedness status of the features. We assume that the grammar contains markedness statements expressing the default values for various morphosyntactic features. Among such statements Old English will contain the following:

(37)   a. [   ] $\longrightarrow$ [+structural]

       b. [   ] $\longrightarrow$ [–oblique]

       c. [–oblique] $\longrightarrow$ [+superior]

These markedness statements serve to evaluate the complexity of a given case category, and define the nominative case as the least marked.

When unmarked values are deleted by Impoverishment, no further process occurs and the morpheme in question remains unspecified for the deleted feature. However, when a marked value is deleted, markedness rules automatically supply the unmarked value in its place (Noyer 1996). Thus, when (36) deletes [–superior] from the neuter case suffix, (37c) immediately supplies the default value [+superior]. Effectively, the neuter accusative morphemes are reduced in markedness, becoming identical to nominative morphemes.[31]

The existence of these independently necessary markedness statements and Impoverishment rule now makes the distribution of the suffix *-e* entirely normal:

(38)   e ↔ [+superior +structural –plural]

Because *-a* is inserted in the nominative masculine singular, *-e* appears in the remaining nominative singular categories, viz. the feminine nominative singular and neuter nominative singular, *which now includes the accusative*. If Impoverishment had not taken place, the final elsewhere *-an* would be incorrectly inserted into the neuter accusative (just as it appears in all other accusative contexts).

In sum, systematic syncretisms arise either through underspecification of Vocabulary Items and the ordering of Vocabulary Items in the competition for insertion, or through Impoverishment rules

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[31]Elsewhere in Old English the neuter singular forms are usually distinct from masculine and feminine and exhibit a special *-t* suffix. In the strong adjectival inflection, however, the neuter forms – both accusative and nominative – are identical to the masculine nominative singular; the masculine accusative singular has a specific affix *-ne*. Thus there is no evidence from inflectional patterning to suggest that the nominative case is more marked than accusative.

expressing pervasive neutralization of distinctions such as the nominative:accusative opposition in the Old English neuters, or the accusative:genitive opposition in the Arabic diptotes. When Impoverishment rules delete marked feature values, markedness statements insert unmarked values. Viewed most generally, Impoverishment expresses a *retreat to the general case*, that is, the expression of a category in the same manner as a less marked one.[32]

4.2.2 Fission

Under normal circumstances each morphosyntactic terminal (morpheme) has a single phonological reflection or 'piece' at PF; that is to say, a single node is subject to the application of a single Vocabulary Item. To capture this generalization directly, Halle (1990) proposed that an abstract morpheme originates syntactically as an ordered pair (F, Q) where F is a matrix of morphosyntactic features and Q is a placeholder for the exponent to be inserted at PF. The effects of Vocabuary Insertion are illustrated in (39), where /x/, /y/, /z/ are phonological exponents:

(39)   Normal Circumstances

syntax $[\,[\,(F_1, Q) \quad (F_2, Q)\,] \quad (F_3, Q)\,]$
                         $\Downarrow$ $\Downarrow$ $\Downarrow$
PF $(((\,F_1, \text{/x/})\,{*} \quad (F_2, \text{/y/}))\,{*} \quad (F_3, \text{/z/}))$

Positional blocking follows automatically on this model because each morpheme's Q can be replaced by at most one exponent. Inversely, because each morpheme's Q must be replaced by at least one exponent, provision is made for 'final' elsewhere affixes whose distribution can be understood only as a residue of cases not covered by more specific Vocabulary Items.

Nevertheless, exceptions to this one-to-one relation are not infrequent. Specifically, there are numerous cases in which a single morpheme appears to 'split' into several independent pieces, a phenomenon we refer to as morpheme *fission*. The verbal conjugation from San Mateo Huave (isolate, Mexico; Stairs and Hollenbach (1981)) illustrates such splitting:[33]

(40)   Huave verbal conjugation: present (atemporal) tense of *-rang* 'make, do'

	[–pl]	[+pl]
1	s-a-rang	s-a-rang-an
12	a-rang-ar	a-rang-aac
2	i-rang	i-rang-an
3	a-rang	a-rang-aw'

The verb forms above consist of a verbal root (here *rang*) prefixed by a theme vowel *i* in the second person, *a* elsewhere, and various prefixes and suffixes expressing person and number. Of particular interest here is the distribution of *-an*, which appears as a default marker of plural where

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[32]The present discussion has concentrated on the Impoverishment of morphological case features, i.e. dissociated features in the sense of §4.1. Interpretable features and diacritic features may also be subject to Impoverishment. For example, Noyer 2004 explores cases in which syncretisms across inflectional classes result from Impoverishment of inflectional class features. Whether Impoverishment operates in the same manner for all varieties of features remains to be investigated.

[33]Apostrophe indicates secondary palatalization; 1 = first person exclusive, 12 = first inclusive, 2 = second person, 3 = third person. The feature [plural] is used here for simplicity; because 12 [–plural] is minimally 2 and 12 [+plural] minimally 3 individuals, it would be more correct to characterize the 'plural' categories as non-restricted, that is, being one more in cardinality than the corresponding restricted ones

not pre-empted by more specific *-aac* in 12 and *-aw'* in 3. Remarkably, where these more specific suffixes express person properties, no person marking appears in the prefix position; instead the prefix is simply null (followed by the theme vowel *a-*). Inversely, where the suffix is the default *-an* and thus expresses no person properties, the prefix position expresses these person properties instead: *s-* in the first person exclusive, and in the second person a floating [–back] feature which ablauts the theme vowel to *-i*.[34] Thus, we see that person properties are expressed either in the prefix position or in the suffix position but not in both at once.

Two modifications of the theory are required to derive this blocking across string positions. First, more than one Vocabulary Item must apply to a single AGR morpheme. Second, some mechanism must ensure that once a feature of AGR has been referred to by a Vocabulary Item, it must become unavailable for spell-out at the other string position. Operationally several options exist for obtaining these effects (see Halle (1997) and Noyer 1997). For present purposes we will simply assume that Vocabulary Insertion does not rewrite the placeholder Q in each terminal, but rather cyclically constructs a phonological 'image' of the syntactic structure by mapping each terminal to one or more exponents. This is illustrated schematically in (41), where Greek letters stand for abstract features, and elements in slashes are phonological exponents:

(41)

syntax	[[X	Y]	Z]
	$\Downarrow$	$\Downarrow$	$\Downarrow$
PF image	((X[α, /x/] *	Y[β,/y/]) *	Z[γ, δ, /a/, /b/])

While the syntactic structure provides the skeletal framework for the PF image, the mapping between syntactic positions and PF positions need not be one-to-one in every instance. Each terminal (X, Y, Z) above could in principle have more than one exponent as its phonological image; in this particular example, the abstract morpheme Z has two phonological exponents as its phonological image. The ordering and hierarchical relations among these sets of pieces is determined by the hierarchical structure of the syntactic terminals. Thus in the ultimate linearization of (41), exponents inserted into Z must either be left- or right-adjacent to the entire (X * Y) complex.

Returning to the analysis of (40), we assume that the Huave verbal forms in (40) have the hierarchical structure shown in (42):

(42)   Hierarchical Structure
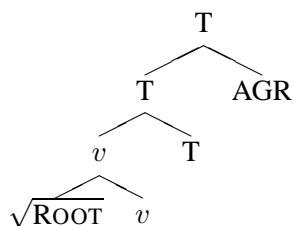
As discussed above, exponents of AGR appear both prefixally and suffixally in the verb. At the same time, for the purposes of blocking the prefix and suffix positions are not independent of each other– application of a highly specified Vocabulary Insertion can result in the appeareance of a suffix, but no prefix (e.g. 12 Pl and 3 Pl). We take it that this effect derives in part from the manner in which the structure in (42) is linearized. Because Tense has no overt exponent in this example, we ignore it for the purposes of linearization. The head v, where we assume that the Theme Vowel appears, is linearized as left-adjacent to the Root:

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[34]Here *i-* replaces expected *e-* by a general rule raising word initial front vowels.

(43)   ($v * \sqrt{\text{ROOT}}$)

The special property of AGR in Huave is that it is linearized with the requirement that it be adjacent to ($v * \sqrt{\text{ROOT}}$). However, the operator defining this relationship specifies merely immediate adjacency, not immediate left-adjacency like the '*' operator. We notate this with '$\circledast$':

(44)   (($v * \sqrt{\text{ROOT}}$) $\circledast$ AGR)

While (44) requires that any exponent of AGR must be immediately adjacent to ($v * \sqrt{\text{ROOT}}$), it is compatible with either a prefixal or suffixal realization, since both would be immediately adjacent ($v * \sqrt{\text{ROOT}}$). A consequence of the manner in which this relation is defined is that there can be at most one affix position on each side of the $v *$ ($\sqrt{\text{ROOT}}$); if there were two, one AGR position would not be adjacent to the relevant object, i.e. would violate (44). Insertion of exponents into AGR thus proceeds until at most two exponents are inserted (see the discussion of 'featural blocking' immediately below), subject to the further requirements imposed by (44). The ultimate linearization of AGR exponents with respect to ($v * \sqrt{\text{ROOT}}$) then depends on the exponents in question; these are inherently specified as being either prefixal or suffixal, as seen in the Vocabulary Items in (45):

(45)   Exponents of *AGR*

-aac	$\leftrightarrow$	[+I +you +pl]
-ar	$\leftrightarrow$	[+I +you]
s-	$\leftrightarrow$	[+I]
[–back]-	$\leftrightarrow$	[+you]
-aw'	$\leftrightarrow$	[–I –you +pl]
-an	$\leftrightarrow$	[+pl]

In this way, linearization operations apply successively; initial operations impose weak constraints of adjacency like that represented by $\circledast$, while later operations derive the final left-right order based on properties of exponents.

Two types of blocking effects are seen in these data: featural and positional.

In featural blocking, the spell out of a feature at one position prevents the spell out of that same feature again even when in another string position. For example, insertion of *-aac* in the 12 plural not only pre-empts the insertion of *-ar, -an* and *-aw'* at the position immediately to the right of the (image of the) v-$\sqrt{\text{ROOT}}$, i.e. at the suffix position, but also pre-empts the insertion of *s-* and [–back] at the prefix position. To derive this variety of blocking, we require that once a feature has conditioned the insertion of a Vocabulary Item, it is marked as *discharged*. Because Vocabulary Insertion may not again discharge the same feature, disjunctivity effects may occur across string positions.[35] For example, the insertion of *-ar* in the 12 singular discharges [+I] and [+you]; all remaining Vocabulary Items mentioning these feature values automatically become unavailable for insertion, regardless of string position.

Positional blocking occurs where the insertion of one Vocabulary Item prevents the insertion of another at the same string position: this is the familiar variety of disjunction which motivated the Q placeholder. Where several distinct string positions may be filled by the phonological image of a morpheme, however, positional blocking is no longer automatic: in principle Vocabulary Items will be inserted continuously until all features are discharged or no Vocabulary Items remain. Positional blocking may, however, arise when linearization requirements like that imposed on AGR in (44) prevent more than one exponent from appearing on the same side of the v-$\sqrt{\text{ROOT}}$ complex.

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[35]Discharged features may, however, continue to condition Vocabulary Insertion, but only where the Vocabulary Item's structural description does not require an undischarged feature. This provision provides the flexibility to capture cross-positional blocking without requiring it in every instance.

In sum, fission processes present a last complication to the direct one-to-one mapping between syntactic terminals and phonological pieces. To derive both positional and featural varieties of blocking we have proposed that spell out does not directly replace string positions occupied by syntactic terminals but rather constructs a phonological image of the syntactic structure by introducing one or more Vocabulary Items for each syntactic terminal, discharging morphosyntactic features of the syntax in the process. While this move represents a relaxation of the prediction that morphological structure is simply syntactic structure, it is a minimal departure inasmuch as the phonological image of the syntax contains only further ramification of the constituent structure already built prior to spell out.

4.3   Movement in the PF Derivation

A further type of mismatch between syntax and morphology involves cases in which the morphological structure is one that seems to have been derived from the syntactic structure via a movement operation. The types of movement operation that we assign to the PF branch are extremely limited in nature; they are local readjustments, not syntactic movements in the true sense.

A general process for resolving mismatches of this type is the device of *Morphological Merger*, introduced in Marantz (1984) and developed in a number of subsequent investigations (for instance Marantz (1988), also Bobaljik (1994) and Embick and Noyer (2001)). The original idea behind this operation is that mappings between different levels of grammatical representation are constrained to obey certain relationships, although some relationships can be 'traded' for others. For example, under certain conditions a relationship of linear adjacency like (X * Y) could be converted into an affixation relationship, Y-X, which could (potentially) reverse the original linear order. Marantz's formulation allows for Merger to operate either in terms of linear order or in terms of hierarchical structure, a position that is maintained in the approach to Merger presented in Embick and Noyer (2001).

In terms of the operations that comprise the PF derivation, a basic distinction depends upon whether an operation applies in the pre-Vocabulary Insertion structure, or in the structure after Vocabulary Insertion and Linearization have taken place. In terms of this basic distinction, there are two points at which Merger can operate: prior to linearization, in which case it operates in terms of hierarchical structures, or after linearization, in which case it is defined in terms of linear adjacency:

(46)   Two Operations at PF

   a. **Before Linearization:** The derivation operates in terms of hierarchical structures. Consequently, a movement operation that applies at this stage is defined hierarchically. This movement is *Lowering*; it lowers a head to the head of its complement.

   b. **After Linearization:** The derivation operates in terms of linear order. The movement operation that occurs at this stage, *Local Dislocation*, operates only in terms of linear adjacency, not hierarchical structure.

An example of Lowering is found in the movement of Tense in English to the verb, as mentioned above. This type of movement skips intervening adverbials (the hallmark of a process that is defined hierarchically), as shown in (47), where t marks the original– syntactic– position of Tense:

(47)   John t quickly play-ed the trumpet.

The rulethat derives (47) is stated as follows:[36]

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[36]Further aspects of this rule, and its interaction with *do*-support, are discussed in Embick and Noyer (2001).

(48) **Lowering:** T lowers to v

Assuming that the adverb is adoined to vP, the resulting structure is one in which T[past] has been lowered to the head of vP, i.e. to the head of its complement (the Root moves to v in the syntax, prior to Lowering). The tree in (49) illustrates the vP for (47) after the Lowering operation has applied (for simplicity, the trace of the subject DP has been omitted):

(49) vP for (47)
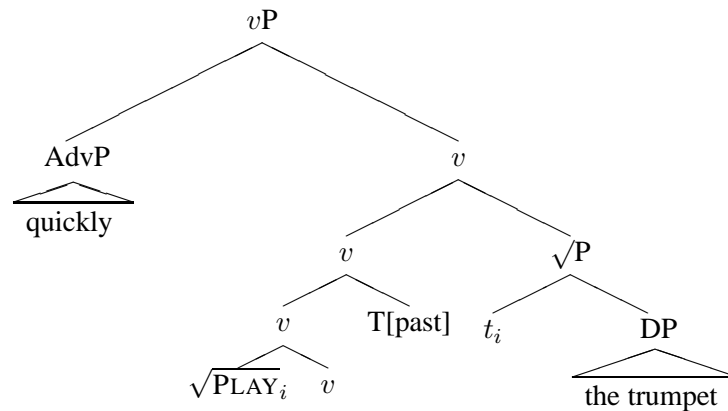
Lowering can skip intervening material like adverbs because it is defined in hierarchical terms: it lowers a head to the head of its complement.

The other post-syntactic movement process, Local Dislocation, is unlike Lowering in that it makes reference to linear adjacency rather than to hierarchical structure. Under specified conditions, this operation effects affixation under adjacency, which can potentially reverse the order of the elements involved:

(50) *Local Dislocation:*

X * Y $\longrightarrow$ Y-X

Operations of this type sometimes occur within complex heads, where hierarchically defined operations like head-movement or lowering are not relevant. For example, in Huave (Huavean, spoken in Mexico), the reflexive affix *-ay* appears directly before the final inflectional affix of a verb, if any. Consider the following examples (Stairs and Hollenbach 1981; Reflexive affix bold-faced):

(51) a. s-a-kohč-**ay**
          1-TH-cut-REFL
          'I cut myself'

      b. s-a-kohč-**ay**-on
          1-TH-cut-REFL-PL
          'We cut ourselves'

(52) a. t-e-kohč-**ay**-os
          PAST-TH-cut-REFL-1
          'I cut (past) myself'

      b. *t-e-kohč-as-**ay**
          PAST-TH-cut-1-REFL

(53) a. t-e-kohč-as-**ay**-on
          PAST-TH-cut-1-REFL-PL
          'We cut (past) ourselves'

    b. *t-e-kohč-**ay**-os-on
        PAST-TH-cut-REFL-1-PL

We take it that this pattern derives from a morphological well-formedness condition that applies to complex verbs in Huave:

(54)   Refl must precede post-Root X, X a non-Root node

When no Xs are linearized following the Root, no operation applies. When the Root is followed by at least one inflectional affix, a Local Dislocation operation applies.

Although *-ay* directly follows the root and precedes *-Vs* '1st person' in (52a), *-ay* 'reflexive' follows *-Vs* '1st person' in (53a).[37] We can account for these facts by assuming that *-ay* is structurally peripheral to the verb+inflection complex, but undergoes a Local Dislocation to left-adjoin to the rightmost inflectional affix:[38]

(55)   a. (((s-a-kohč) * on) * **ay**) $\rightarrow$ ((s-a-kohč) * **ay**+on)

       b. ((((s-a-kohč) * as) * on) * **ay**) $\rightarrow$ (((s-a-kohč) * as) * **ay**+on)

In this way, the REFL exponent shows a 'second-position' effect at the right edge of the verb, with respect to any other discrete pieces that are present.

4.4 Summary

The operations discussed in this section are means of accounting for what appear to be mismatches between syntactic structure and morphological structure, where by the latter we mean the structure that appears at PF. In many cases of apparent mismatches, there is an analytical tension betweeen modifying (and perhaps complicating) the syntactic analysis on the one hand, and positing a PF operation that modifies the syntactic structure on the other. As a general conceptual point, the strongest hypothesis is that PF is sharply constrained in its power to modify the syntactic structure. Given this, a syntactic analysis must be considered the default option, all other things being equal. This is the assumption that allows for the most direct connection between syntactic structure and morphological structure.

In cases in which a syntactic analysis seems arbitrary, unmotivated, or unduly complex, PF operations of the type that we have outlined above have been appealed to. Two points must be emphasized with respect to these operations. First, they are only appealed to in instances in which the syntactic analysis is unworkable. Second, they arise only as departures from the ideal case, in which the syntactic structure is not significantly altered at PF.[39]

5 Concluding Remarks

The approach to the syntax/morphology interface that we have provided here is based on the idea that there is a single generative component– the syntax– responsible for the construction of complex

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[37]The 1st person suffix shows an alternation *-as*∼*-os*∼*-iəs*.

[38]We have simplified some of these structures for expository purposes. For instance, according to one view, rebracketing applies prior to the local dislocation of cases in this type, so that (55a) goes through two steps:

   (i)   (((s-a-kohč) * on) * **ay**) $\xrightarrow{rebracketing}$ ((s-a-kohč) * (on * **ay**)) $\xrightarrow{local\ dislocation}$ ((s-a-kohč) * **ay**+on)

An alternative would be to say that the process is defined in terms of a concatenation relationship instead of adjacency.

[39]Some additional questions worth examining concern the nature of PF requirements. A working hypothesis is that such requirements are motivated by properties of the input to the learner that are readily visible as 'well-formedness' requirements, but the precise manner in which such conditions are stated has yet to be determined.

objects. According to this approach, syntactic structure serves as the skeleton on which all complex forms are based. In the default case, these structures are linearized, and the abstract morphemes are subject to Vocabulary Insertion. In more complex cases, language-specific PF rules perform minimal alterations to the syntactic structure in the ways outlined above. These PF operations are introduced to account for cases in which there are "mismatches" between syntactic structure and morphological structure, or, more precisely, between the syntactic strucure and the structure that is relevant for further computations in the construction of PF.

An additional point to be stressed concerns how our approach stands in relation to other treatments of morphology, in particular those that hold that word-formation is 'special' and distinct from syntax. As discussed above, in light of the direct comparisons that have been made between syntactic and Lexical approaches to morphology, the burden of proof on Lexicalist theories of grammar in the following way: it does not suffice in any particular instance to show that a phenomenon could be stated in a Lexicalist architecture. Rather, what is required is a demonstration that a pattern *must* be stated in such an architecture, i.e. that the syntactic approach misses crucial generalizations. We are aware of no arguments of this type that withstand scrutiny. It remains to be seen exactly how the syntactic approach can be implemented across the wide range of phenomena traditionally thought of as being the domain of the syntax/morphology interface; but there is no reason to suspect at present that the syntactic approach cannot be extended in this way. Further empirical investigation in terms of the framework outlined above promises to sharpen the issues and our understanding of how a number of different aspects of linguistic competence relate to one another.

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