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State-of-the-Article: Distributed Morphology

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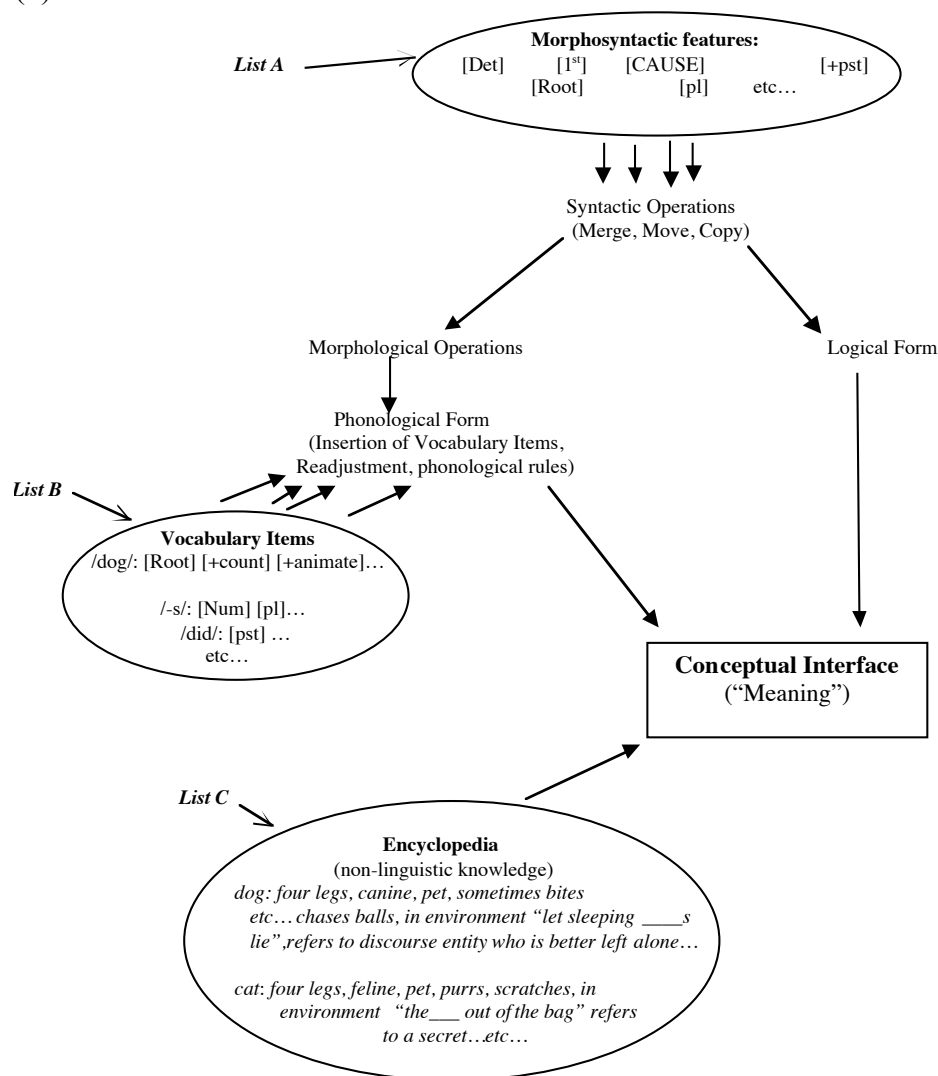
Whenever a major revision to the architecture of UG is proposed, it takes some time for sufficient work to accumulate to allow evaluation of the viability of the proposal, as well as for its broad outlines to become familiar to those not immediately involved in the investigation. The introduction of Distributed Morphology in the early 1990s, by Morris Halle and Alec Marantz, is a case in point. In the seven-year period since the first paper outlining the framework appeared, a reasonably substantial body of work has appeared, addressing some of the key issues raised by the revision. The goal of this article is to introduce the motivation and core assumptions for the framework, and at the same time provide some pointers to the recent work which revises and refines the basic DM proposal and increases DM's empirical coverage. Since the particular issues we discuss cover such a broad range of territory, we do not attempt to provide complete summaries of individual papers, nor, for the most part, do we attempt to relate the discussion of particular issues to the much broader range of work that has been done in the general arena. What we hope to do is allow some insight into (and foster some discussion of) the attitude that DM takes on specific issues, with some illustrative empirical examples.

This article is organized as follows. Section 1 sketches the layout of the grammar and discusses the division of labor between its components. The 'distributed' of Distributed Morphology refers to the separation of properties which in other theories are collected in the Lexicon, and in section 1 we elaborate on the motivation for this separation and its particulars. Section 2 explicates the mechanics of Spell-out, giving examples of competition among phonological forms from Dutch, introducing the notion of 'f-morpheme' and 'l-morpheme' and distinguishing allomorphy from suppletion with examples from English. Section 3 discusses the operations which are available in the Morphology component, addressing in turn Morphological Merger, Impoverishment and Fission, with examples from Latin, Serbo-Croatian, Norwegian, and Tamazight Berber. We also provide an illustration of the contrast between a 'piece-based' theory such as DM and process-based morphological theories. Section 4 treats the relationship of the syntax to the morphology, Separationism and its limitations, the ways in which a mismatch between syntactic terminal nodes and morphosyntactic features may arise, and the distinct types of syntax/morphology mismatches conventionally classified as cliticization. We conclude in Section 5 with an agenda for future research.

1 The structure of the grammar

There are three core properties which distinguish Distributed Morphology from other morphological theories: Late Insertion, Underspecification, and Syntactic Hierarchical Structure All the Way Down. The grammar, still of the classic Y-type, is sketched in (1) below.

(1)



Unlike the theory of LGB (Chomsky 1981) and its Lexicalist descendants, in DM the syntax proper does not manipulate anything resembling lexical items, but rather, generates

structures by combining morphosyntactic features (via Move and Merge) selected from the inventory available, subject to the principles and parameters governing such combination.

Late Insertion refers to the hypothesis that the phonological expression of syntactic terminals is in all cases provided in the mapping to Phonological Form (PF). In other words, syntactic categories are purely abstract, having no phonological content. Only after syntax are phonological expressions, called *Vocabulary Items* inserted in a process called Spell-Out. It is further worth noting that this hypothesis is stronger than the simple assertion that terminals have no phonological content: as we will see below, there is essentially *no* pre-syntactic differentiation (other than, perhaps, indexing) between two terminal nodes which have identical feature content but will eventually be spelled out with distinct Vocabulary Items such as *dog* and *cat*.

Underspecification of Vocabulary Items means that phonological expressions need not be fully specified for the syntactic positions where they can be inserted. Hence there is no need for the phonological pieces of a word to supply the morphosyntactic features of that word; rather Vocabulary Items are in many instances default signals inserted where no more specific form is available.

Syntactic Hierarchical Structure All the Way Down entails that elements within syntax and within morphology enter into the same types of constituent structures (such as can be diagrammed through binary branching trees). DM is piece-based in the sense that the elements of both syntax and of morphology are understood as discrete constituents instead of as (the results of) morphophonological processes.

1.1 The Lexicalist Hypothesis and DM

There is no Lexicon in DM in the sense familiar from generative grammar of the 1970s and 1980s. In other words, DM unequivocally rejects the Lexicalist Hypothesis. The jobs assigned to the Lexicon component in earlier theories are *distributed* through various other components. For linguists committed to the Lexicalist Hypothesis, this aspect of DM may be the most difficult to accept, but it is nevertheless a central tenet of the theory. (For discussion of this issue from a Lexicalist viewpoint, see Zwicky & Pullum (1992).

The fullest exposition of the anti-Lexicalist stance in DM is found in Marantz (1997a). There, Marantz argues against the notion of a generative lexicon, adopted in such representative examples of the Lexicalist Hypothesis as Selkirk (1982) or DiSciullo and Williams (1987), using arguments from the very paper which is usually taken to be the source of the Lexicalist

Hypothesis, Chomsky's (1970) 'Remarks on Nominalization.' Marantz points out that it is crucial for Chomsky's argument that, for instance, a process like causativization of an inchoative root is *syntactic*, not lexical. Chomsky argues that roots like *grow* or *amuse* must be inserted in a causative syntax, in order to derive their causative forms. If their causative forms were lexically derived, nothing would prevent the realization of the causativized stem in a nominal syntax, which the ungrammaticality of **John's growth of tomatoes* indicates is impossible. Other lexicalist assumptions about the nature of lexical representations, Marantz notes, are simply unproven: no demonstration has been made of correspondence between a phonological 'word' and a privileged type of unanalyzable meaning in the semantics or status as a terminal node in the syntax, and counterexamples to any simplistic assertion of such a correspondence are easy to find.

Because there is no Lexicon in DM, the term 'lexical item' has no significance in the theory, nor can anything be said to 'happen in the Lexicon', and neither can anything be said to be 'lexical' or 'lexicalized.' Because of the great many tasks which the Lexicon was supposed to perform, the terms 'lexical' and 'lexicalized' are in fact ambiguous. (For a discussion of terminology, see Aronoff (1994). Here we note a few of the more usual assumptions about lexicalization, and indicate their status in the DM model:

Lexical(ized) = Idiomaticized. Because the Lexicon was supposed to be a storehouse for sound-meaning correspondences, if an expression is conventionally said to be 'lexicalized' the intended meaning may be that the expression is listed with a specialized meaning. In DM such an expression is an *idiom* and requires an *Encyclopedia Entry* (see 1.4). There is no 'word-sized' unit which has a special status with respect to the idiomaticization process; morphemes smaller than word-size may have particular interpretations in particular environments, while expressions consisting of many words which obviously have a complex internal syntax may equally be idiomaticized.

Lexical(ized) = Not constructed by Syntax. The internal structure of expressions is demonstrably not always a product of syntactic operations. In DM structure is produced both in syntax and after syntax in the Morphology component (labelled 'Morphological Operations' above). Nevertheless, because of 'Syntactic Hierarchical Structure all the Way Down', operations within Morphology still manipulate what are essentially syntactic structural relations. The syntactic component produces a representation whose

terminal elements are morphosyntactic features, which is then subject to operations such as ‘Merger Under Adjacency’, ‘Fission’ or ‘Fusion,’ accounting for non-isomorphic mappings from syntactic terminals to morphophonological constituents.

Lexical(ized) = Not subject to exceptionless phonological processes, i.e. part of ‘lexical’ phonology in the theory of Lexical Phonology and Morphology (Kiparsky 1982 et seq.). In DM the distinction between two types of phonology — ‘lexical’ and ‘postlexical’ — is abandoned. All phonology occurs in a single post-syntactic module. While Lexical Phonology and Morphology produced many important insights, DM denies that these results require an architecture of grammar which divides phonology into a pre-syntactic and post-syntactic module (see also Sproat 1985). Rather, post-syntactic Phonology itself may have a complex internal structure (Halle & Vergnaud 1987).

1.2 The status of Vocabulary Items and the lexical/functional distinction

In DM, the term *morpheme* properly refers to a syntactic (or morphological) terminal node and its content, not to the phonological expression of that terminal, which is provided as part of a Vocabulary Item. Morphemes are thus the atoms of morphosyntactic representation. The content of a morpheme active in syntax consists of syntactico-semantic features drawn from the set made available by Universal Grammar.

A Vocabulary Item is, properly speaking, a relation between a phonological string or ‘piece’ and information about where that piece may be inserted. Vocabulary Items provide the set of phonological signals available in a language for the expression of abstract morphemes. The set of all Vocabulary Items is called the Vocabulary.

- (2) Vocabulary Item schema
 signal \longleftrightarrow context of insertion

Example Vocabulary Items

- a. /i/ \longleftrightarrow [____, +plural]
 A Russian affix (Halle 1997)

- b. /n/ \leftrightarrow [____, +participant +speaker, plural]
A clitic in Barceloni Catalan (Harris 1997a)
- c. /y-/ \leftrightarrow elsewhere
An affix in the Ugaritic prefix conjugation (Noyer 1997)
- d. \emptyset \leftrightarrow 2 plu
A subpart of a clitic in Iberian Spanish (Harris 1994)
- e. /kæt/ \leftrightarrow [_{DP} D [_{LP} ____]]
Root inserted in a nominal environment (Harley & Noyer 1998a)

Note that the phonological content of a Vocabulary Item may be any phonological string, including zero or \emptyset . The featural content or context of insertion may be similarly devoid of information: in such cases we speak of the default or ‘elsewhere’ Vocabulary Item. Note that the two do not necessarily coincide — that is, a null phonological affix in a given paradigm is not necessarily the default Vocabulary Item. For example, the zero plural affix inserted in the context of marked English nouns like *sheep* is not the English default plural.

In early work in DM, Halle (1992) proposed a distinction between concrete morphemes, whose phonological expression was fixed, and abstract morphemes, whose phonological expression was delayed until after syntax. More current work in DM however endorses Late Insertion of all phonological expression, so Halle’s earlier concrete vs. abstract distinction has been largely abandoned.

Harley & Noyer (1998a) propose an alternative to the concrete vs. abstract distinction; they suggest that morphemes are of two basic kinds: *f-morphemes* and *l-morphemes*, corresponding approximately to the conventional division between functional and lexical categories, or closed-class and open-class categories.

F-morphemes are *defined* as morphemes for which there is no choice as to Vocabulary insertion: the spell-out of an f-morpheme is deterministic. In other words, f-morphemes are those whose content (as defined by syntactic and semantic features made available by Universal Grammar) suffices to determine a unique phonological expression. One prediction is that Vocabulary Items conventionally classified as ‘closed-class’ should either express purely

grammatical properties or else have meanings determined solely by universal cognitive categories (see 2.3 for further discussion).

In contrast, an l-morpheme is defined as one for which there is a choice in spell-out: an l-morpheme is filled by a Vocabulary Item which may denote a language-specific concept. For example, in an l-morpheme whose syntactic position would traditionally define it as a ‘noun’, any of the Vocabulary Items *dog*, *cat*, *fish*, *mouse*, *table* etc. might be inserted. Note that because the conventional categorial labels noun, verb, adjective etc. are by hypothesis not present in syntax (l-morphemes being acategorial), the widely adopted hypothesis that Prosodic Domain construction should be oblivious to such distinctions (Selkirk 1986, Chen 1987) follows automatically.

1.3 The syntactic determination of lexical categories

The conjecture we have just alluded to, which we will term the *L-Morpheme Hypothesis*, (Marantz 1997a, Embick 1997, 1998a, 1998b, Harley 1995, Harley & Noyer 1998a, 1998b, Alexiadou 1998), contends that the traditional terms for sentence elements, such as noun, verb, and adjective have no universal significance and are essentially derivative from more basic morpheme types (see also Sapir 1921, ch. 5). As noted above, Marantz (1997a) contends that the configurational definition of category labels is already implicit in Chomsky (1970).

Specifically, the different ‘parts of speech’ can be defined as a single l-morpheme, or Root (to adopt the terminology of Pesetsky 1995), in certain local relations with category-defining f-morphemes. For example, a ‘noun’ or a ‘nominalization’ is a Root whose nearest c-commanding f-morpheme (or licenser) is a Determiner, a ‘verb’ is a Root whose nearest c-commanding f-morphemes are v, Aspect and Tense; without Tense such a Root is simply a ‘participle’ (Embick 1997, Harley and Noyer 1998b). Thus, the same Vocabulary Item may appear in different morphological categories depending on the syntactic context that the item’s l-morpheme (or *Root*) appears in. For example, the Vocabulary Item *destroy* is realized as a ‘noun’ *destruct-(ion)* when its nearest licenser is a Determiner, but the same Vocabulary Item is realized as a ‘participle’ *destroy-(ing)* when its nearest licensers are Aspect and v; if Tense appears immediately above Aspect, then the ‘participle’ becomes a ‘verb’ such as *destroy-(s)*. However, it is probably the case that many traditional part-of-speech labels correspond to language-specific features present after syntax which condition various morphological operations such as Impoverishment (see 3.2) and Vocabulary Insertion.

1.4 Idioms: the content of the Encyclopedia

In DM, the Vocabulary is one list which contains some of the information which in lexicalist theories is associated with the Lexicon. Another such list is the Encyclopedia, which relates Vocabulary Items (sometimes in the context of other Vocabulary Items) to meanings. In other words, the Encyclopedia is the list of idioms in a language.

The term *idiom* is used to refer to any expression (even a single word or subpart of a word) whose meaning is not wholly predictable from its morphosyntactic structural description (Marantz 1995, 1997a). F-morphemes are typically not idioms, but l-morphemes are always idioms.

(3) Some idioms

<i>cat</i>	(a fuzzy animal)
<i>(the) veil</i>	(vows of a nun)
<i>(rain) cats and dogs</i>	(a lot)
<i>(talk) turkey</i>	(honest discourse)

The notion of “idiom” in DM, obviously, embraces more than the conventional use of the term implies. Idioms in the conventional sense — that is, groups of words in a particular syntactic arrangement that receive a “special” interpretation, for example *kick the bucket*, whose meaning is roughly “die” — are represented in DM as subparts of the Encyclopedic entry for the Root (or Roots) which are involved. The Encyclopedia entry for “kick”, for example, will specify that in the environment of the direct object *the bucket*, *kick* may be interpreted as “die”. The study of conventional idioms has been an important source of evidence for locality restrictions on interpretation in DM; in particular, following the observations of Marantz (1984), the fact that external arguments are never included as part of the contextual conditioning of Roots in conventional idioms has led to the proposal whereby external arguments are projected by a separate “little-*v*” head, not by any Root, and they thus are not mentioned by Encyclopedia entries for Roots as a possible interpretive conditioner. (For an alternative, non-DM discussion of idioms, see Jackendoff 1997.)

As indicated in the schema in (1) above, the ‘meaning’ of an expression is interpreted from the entire derivation of that expression, including the information from the Encyclopedia

which is considered extralinguistic. LF does not express or represent meaning; LF is merely a level of representation which exhibits certain meaning-related structural relations, such as quantifier scope. (The relationship of the Encyclopedia to the Vocabulary is the topic of much current debate, see, for example, Marantz 1997a, Harley and Noyer 1998a).

2 Spell-Out

Spell-Out inserts Vocabulary Items (phonological pieces) into morphemes. In the unmarked case, the relation between Vocabulary Items and morphemes is one-to-one, but as we have seen, several factors may disrupt this relation (Noyer 1997), including Fission of morphemes, removal of morphosyntactic features by Impoverishment, local displacements of Vocabulary Items by Morphological Merger and post-syntactic insertion of Dissociated morphemes.

Spell-Out works differently depending on what type of morpheme is being spelled out, f-morphemes or l-morphemes. Regardless of the type of morpheme, however, Spell-Out is normally taken to involve the association of phonological pieces (Vocabulary Items) with abstract morphemes. Halle (1992) construes Spell-Out as the rewriting of a place-holder ‘Q’ in a morpheme as phonological material. This operation is normally understood as cyclic, such that more deeply embedded morphemes are spelled-out first.

2.1 Spell-Out of f-morphemes: the Subset Principle

Early work in DM was focused primarily on the spell-out of f-morphemes. In such cases sets of Vocabulary Items compete for insertion, subject to what Halle (1997) called the Subset Principle (Lumsden 1987:107 proposes a similar principle and calls it ‘Blocking.’ Halle's principle is not to be confused with the Subset Principle of Manzini and Wexler 1987, which deals with learnability issues).

Subset Principle. ‘The phonological exponent of a Vocabulary Item is inserted into a morpheme... if the item matches all or a subset of the grammatical features specified in the terminal morpheme. 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.’

Below, we give an example from Sauerland (1995).

(4) a. Dutch strong adjectival desinences

	[-neuter]	[+neuter]
[-pl]	-e	Ø
[+pl]	-e	-e

b. Vocabulary Items

Ø	↔	[____, +neuter -plural] / Adj + ____
-e	↔	Adj + ____

In Dutch, after syntax, a Dissociated morpheme (see 3.0 below) is inserted as a right-adjunct of those morphemes which are conventionally labeled ‘adjectives.’ The Vocabulary Items above compete for insertion into this morpheme. In the specific environment of the neuter singular, Ø is inserted. In the remaining or elsewhere environment -e is inserted. The insertion of Ø in the specific environment bleeds the insertion of -e because, under normal circumstances, only a single Vocabulary Item may be inserted into a morpheme. Note that the Vocabulary Items above are not specially stipulated to be disjunctive except insofar as they compete for insertion at the same morpheme.

Note that all Vocabulary Items may compete for insertion at any node; there is no pre-insertion separation of Vocabulary Items into ‘related’ forms which may compete. However, since the insertion process is restricted by feature content, a certain collection of Vocabulary Items corresponding to the traditional notion of a ‘paradigm’ may be the set under discussion when accounting for the phonological realization of a given terminal node. In some theories certain such collections have a privileged status or can be referred to by statements of the grammar (Carstairs 1987, Wunderlich 1996). But in DM, paradigms, like collections of related phrases or sentences, do not have any status as theoretical objects, although certain regularities obtaining over paradigms may result from constraints operating during language acquisition.

2.2 Feature Hierarchies, Feature Geometries and the Subset Principle

In some cases it would be possible to insert two (or more) Vocabulary Items into the same f-morpheme, and the Subset Principle does not determine the winner. Two approaches have been proposed in DM for such cases. Halle & Marantz (1993) suggest that such conflicts are resolved by extrinsic ordering: one Vocabulary Item is simply stipulated as the winner. Alternatively, Noyer (1997) proposes that such conflicts can always be resolved by appeal to a Universal Hierarchy of Features (cf. also Lumsden 1987, 1992, Zwicky 1977 and Silverstein 1976). Specifically, the Vocabulary Item that uniquely has the highest feature in the hierarchy is inserted.

(5) Fragment of the Hierarchy of Features

1 person > 2 person > dual > plural > other features

Harley (1994), following a proposal of Bonet (1991), argues that the conflict-resolving effects of the Feature Hierarchy can be derived from a geometric representation of morphosyntactic features, according to which the Vocabulary Item which realizes the most complex feature geometry is inserted in such situations. See also section 3.2 on Impoverishment, below.

2.3 Spell-out of l-morphemes: competition, suppletion and allomorphy

For l-morphemes there is a choice regarding which Vocabulary Item is inserted. For example, a Root morpheme in an appropriately local relation to a Determiner might be filled by *cat*, *dog*, *house*, *table* or any other Vocabulary Item we would normally call a ‘noun.’ Harley & Noyer (1998a) note that it is clear that such Vocabulary Items are not in competition, as are the Vocabulary Items inserted into f-morphemes. Rather, these Vocabulary Items can be freely inserted at Spell-Out, subject to conditions of *licensing*. Licensers are typically f-morphemes in certain structural relations to the Root where the Vocabulary Item is inserted, and as outlined above, these structural relations typically determine the traditional notion of category. ‘Nouns’ are licensed by an immediately c-commanding Determiner; different verb classes, such as

unergatives, unaccusatives, and transitives each are licensed by different structural configurations and relations to various higher eventuality projections.

Marantz (1997a) discusses the interesting case of l-morphemes which undergo apparent allomorphy in different environments, such as the *rise/raise* alternation. These pose a problem in that they appear to be in competition for insertion in different environments (that is, *raise* is inserted in the context of a commanding CAUSE head, while *rise*, the intransitive and nominal variant, is the elsewhere case). They cannot be separate Vocabulary Items, however, for if they were, *raise* should be a separate verb with the properties of the *destroy* class. The absence of nominalizations like **John's raise of the pig for bacon*, however, indicate that *raise* is simply a morphophonological variant of the basic intransitive *rise* root, which is a member of the *grow* class. That is, in DM, l-morpheme alternations like *rise/raise* must not be determined by competition, as may be the case for allomorphy of f-morphemes, but rather must be the product of post-insertion readjustment rules.

DM, then, must recognize two different types of allomorphy: suppletive and morphophonological. Suppletive allomorphy occurs where different Vocabulary Items compete for insertion into an f-morpheme, as outlined in section 2.1 above. To give another example, Dutch nouns have (at least) two plural number suffixes, *-en* and *-s*. The conditions for the choice are partly phonological and partly idiosyncratic. Since *-en* and *-s* are not plausibly related phonologically, they must constitute two Vocabulary Items in competition.

Morphophonological allomorphy occurs where a single Vocabulary Item has various phonologically similar underlying forms, but where the similarity is not such that Phonology can be directly responsible for the variation. For example, *destroy* and *destruct-* represent stem allomorphs of a single Vocabulary Item; the latter allomorph occurs in the nominalization context. DM hypothesizes that in such cases there is a single basic allomorph, and the others are derived from it by a rule of Readjustment. The Readjustment in this case replaces the rime of the final syllable of *destroy* with *-uct*. (Alternatively such allomorphs might both be listed in the Vocabulary and be related by 'morpholexical relations' in the sense of Lieber 1981.)

Traditionally it is often thought that there is a gradient between suppletion and other types of more phonologically regular allomorphy, and that no reasonable grounds can be given for how to divide the two or if they should be divided at all. Marantz (1997b) has recently proposed that true suppletion occurs only for Vocabulary Items in competition for f-morphemes, since competition occurs only for f-morphemes. An immediate consequence of this proposal is that undeniably suppletive pairs like *go/went* or *bad/worse* must actually represent the spelling of

f-morphemes. The class of f-morphemes is as a result considerably enriched, but since the class of f-morphemes is circumscribed by Universal Grammar, it is also predicted that true suppletion should be limited to universal syntactico-semantic categories. Moreover, given that some independent grounds might in this way divide suppletive from Readjustment-driven allomorphy, a theory of the range of possible Readjustment processes becomes more feasible.

The controversial distinction between derivational and inflectional (Anderson 1982) has no explicit status in DM. However, the distinction between f-morphemes and l-morphemes perhaps captures some of the intuition behind the derivational/inflectional distinction, although certainly not all f-morphemes would normally be considered ‘inflectional’. DM also distinguishes between syntactic and non-syntactic (dissociated) morphemes, although again this distinction has no straightforward analogue in the derivational/inflectional debate.

3 Manipulating structured expressions: morphological operations

In DM any given expression acquires at least two structural descriptions during its derivation. In a morphophonological description, an expression’s phonological pieces (its Vocabulary Items) and their constituent structure are displayed. In a morphosyntactic description, an expression’s morphemes and their constituent structure are displayed.

(6) The expression *cows*:

Morphosyntactic description: [Root [+plural]]

Morphophonological description: [kaw+ z]

The morphosyntactic structure of an expression is generated by several mechanisms. Syntax, using conventional operations such as head-movement, plays a major role in constructing morphosyntactic structures, including ‘word’-internal structure. But in addition, DM employs several additional mechanisms in a post-syntactic component, Morphological Structure.

First, morphemes such as [passive] or [case] (in some instances, see Marantz 1991) which, by hypothesis, do not figure in syntax proper, can be inserted after syntax but before Spell-Out. These morphemes, which only indirectly reflect syntactic structures, are called

Dissociated morphemes. For a full exposition of the mechanism of Dissociated morpheme insertion, see Embick (1997).

Second, the constituent structure of morphemes can be modified by Morphological Merger, which can effect relatively local morpheme displacements.

3.1 Merger

Morphological Merger, proposed first in Marantz (1984), was originally a principle of well-formedness between levels of representation in syntax. In Marantz (1988, 261) Merger was generalized as follows:

Morphological Merger. At any level of syntactic analysis (d-structure, s-structure, phonological structure), a relation between X and Y may be replaced by (expressed by) the affixation of the lexical head of X to the lexical head of Y.

What Merger does is essentially ‘trade’ or ‘exchange’ a structural relation between two elements at one level of representation for a different structural relation at a subsequent level. (Rebracketing under adjacency is also proposed and discussed at length in Sproat 1985.)

Merger has different consequences depending upon the level of representation it occurs at. Where Merger applies in syntax proper it is essentially Head Movement, adjoining a zero-level projection to a governing zero-level projection (Baker 1988). Cases of syntactic Lowering may be a type of Merger as well, presumably occurring after syntax proper but before Vocabulary Insertion (e.g. the Tense to verb affixation in English (see Bobaljik 1994) or perhaps C-to-I lowering in Irish (McCloskey 1996).

The canonical use of Merger in Morphology is to express second-position effects. Embick & Noyer (1999, to appear) hypothesize that where Merger involves particular Vocabulary Items (as opposed to morphemes), the items in question must be string-adjacent; such cases of Merger are called *Local Dislocation*. Schematically Local Dislocation looks like this:

- (7) Local Dislocation:
 $X [Y \dots] \rightarrow [Y + X \dots]$

In Local Dislocation, a zero-level element trades its relation of adjacency to a following constituent with a relation of affixation to the linear head (peripheral zero-element) of that constituent. (Local Dislocation has also received considerable attention outside of DM from researchers working in Autolexical Syntax (Sadock 1991).)

For example, Latin *-que* is a second-position clitic which adjoins to the left of the zero-level element to its right (* represents the relation of string adjacency; Q represents dissociated morphemes):

(8) Latin *-que* placement

Morphological structure:	[[A Q] [N-Q]]	[cl	[[A-Q]	[N-Q]]]	
Vocabulary insertion:	[[<i>bon i</i>]	[<i>puer i</i>]]	[- <i>que</i>	[[<i>bon ae</i>]	[<i>puell ae</i>]]]
Linearization:	[[<i>bon*i</i>]	* [<i>puer*i</i>]]	* [- <i>que*</i>	[[<i>bon*ae</i>]	* [<i>puell*ae</i>]]]
Local dislocation	[[<i>bon*i</i>]	* [<i>puer*i</i>]]	* [[[<i>bon*ae</i>]* <i>que</i>]	* [<i>puell*ae</i>]]]	
	good-nom.pl	boy-nom.pl	good-nom.pl-and	girl-nom.pl	
	‘Good boys and good girls’				

By hypothesis, Prosodic Inversion (Halpern 1995) is a distinct species of Merger at the level of PF, and differs from Local Dislocation in that the affected elements are prosodic categories rather than morphological ones.

For example, Schütze (1994), expanding on Zec & Inkelas (1990), argues that the auxiliary clitic *je* in Serbo-Croatian is syntactically in C, but inverts with the following Phonological Word by Prosodic Inversion at PF (parentheses below denote Phonological Word boundaries):

(9) Serbo-Croatian second-position clitics

Morphological structure after Spell-Out	[<i>je</i>	[_{VP} [_{PP} <i>U ovoj sobi</i>]	<i>klavir</i>]]
Parse into Phonological Words	<i>je</i>	(<i>U ovoj</i>)	(<i>sobi</i>) (<i>klavir</i>)
Prosodic Inversion		((<i>U ovoj</i>)+ <i>je</i>)	(<i>sobi</i>) (<i>klavir</i>)
		In this AUX	room piano
		‘In this room is the piano’	

The positioning of the clitic cannot be stated in terms of a (morpho)syntactic constituent, since *U ovoj* ‘in this’ does not form such a constituent. Embick & Izvorski (1995) specifically argue that syntactic explanations, including those involving remnant extraposition, cannot reasonably be held accountable for this pattern.

However, it should be emphasized that the extent to which Local Dislocation and Prosodic Inversion are distinct devices in the mapping to PF remains controversial, with many researchers seeking to reduce the two to a purely prosodic or a purely syntactic mechanism.

3.2 Impoverishment

Impoverishment, first proposed in Bonet (1991), is an operation on the contents of morphemes prior to Spell-Out. In early work in DM, Impoverishment simply involved the deletion of morphosyntactic features from morphemes in certain contexts. When certain features are deleted, the insertion of Vocabulary Items requiring those features for insertion cannot occur, and a less specified item will be inserted instead. Halle & Marantz (1994) termed this the ‘Retreat to the General Case’.

(10) Adjectival suffixes in Norwegian (Sauerland 1995)

STRONG	[-neuter]	[+neuter]
[-pl]	∅	-t
[+pl]	-e	-e

WEAK	[-neuter]	[+neuter]
[-pl]	-e	-e
[+pl]	-e	-e

In Norwegian, there is a three-way distinction ($t \sim e \sim \emptyset$) in adjectival suffixes in a ‘strong’ syntactic position, but in the ‘weak’ position one finds only *-e*. By hypothesis, it is not accidental that the affix *-e* is the Elsewhere affix in the strong context, and also appears everywhere in the weak context. Sauerland (1995)’s Impoverishment analysis of the weak paradigms captures this insight. He proposes the following set of Vocabulary Items:

(11) Norwegian Vocabulary Items

/t/ \longleftrightarrow [____, -pl +neut] / Adj + ____
 Ø \longleftrightarrow [____, -pl -neut] / Adj + ____
 /e/ \longleftrightarrow elsewhere / Adj + ____

In the weak syntactic position, a rule of Impoverishment applies, deleting any values for gender features:

(12) Impoverishment

$$[\pm\text{neuter}] \rightarrow \emptyset$$

Impoverishment thus guarantees that neither the Vocabulary Items *t* nor Ø can be inserted, since both require explicit reference to a value for [±neuter]. Insertion of the general case, namely *-e*, follows automatically.

As we have noted above, in Bonet's original proposal (1991) and in several subsequent works (Harley 1994, Harris 1997a, Ritter & Harley 1998), morphosyntactic features are arranged in a feature geometry much like phonological features, and Impoverishment is represented as delinking. Consequently, the delinking of certain features entails the delinking of features dependent on them. For example, if person features dominate number features which in turn dominate gender features, then the Impoverishment (delinking) of number entails the delinking of gender as well:

(13) Impoverishment as Delinking

$$\begin{array}{c}
 2 \\
 \perp \\
 \text{pl} \\
 | \\
 \text{f}
 \end{array}
 \rightarrow
 \begin{array}{c}
 2
 \end{array}$$

Noyer (1997) rejects the use of geometries of this sort as too restrictive, and proposes instead that Impoverishments are better understood as feature-cooccurrence restrictions or filters of the type employed by Calabrese (1995) for phonological segment inventories. For example, the absence of a first person dual in Arabic is represented as the filter *[1 dual], and a Universal

Hierarchy of Features dictates that where these features combine, because [dual] is a number feature and [1] is a (hierarchically higher) person feature, [dual] is deleted automatically. Calabrese (1994) and (1996) further expand this idea. The use of feature geometries in DM remains an unresolved issue at this time, but Feature Hierarchies, whether geometric or not, ensure that normally more marked feature values persist in contexts of neutralization.

Feature-changing Impoverishment, which as a device has approximately the same power as Rules of Referral (Zwicky 1985b, Stump 1993), has in general been eschewed in DM. However, Noyer (1998a) discusses cases where feature-changing readjustments seem necessary. It is proposed that such cases always involve a change from the more marked value of a feature to the less marked value and never vice versa.

3.3 Fission and Feature Discharge

Fission was originally proposed in Noyer (1997) to account for situations in which a single morpheme may correspond to more than one Vocabulary Item. In the normal situation, only one Vocabulary Item may be inserted into any given morpheme. But where Fission occurs, Vocabulary Insertion does not stop after a single Vocabulary Item is inserted. Rather, Vocabulary Items accrete on the sister of the fissioned morpheme until all Vocabulary Items which can be inserted have been, or all features of the morpheme have been *discharged*. A feature is said to be discharged when the insertion of a Vocabulary Item is conditioned by the presence of that feature.

However, Noyer (1997) argues that features conditioning the insertion of a Vocabulary Item come in two types. A Vocabulary Item *primarily expresses* certain features in its entry, but it may be said to *secondarily express* certain other features. This distinction corresponds (approximately) to the distinction between primary and secondary exponence (Carstairs 1987). Only features which are primarily expressed by a Vocabulary Item are discharged by the insertion of that Item.

For example, in the prefix-conjugation of Tamazight Berber, the AGR morpheme can appear as one, two or three separate Vocabulary Items, and these may appear as prefixes or as suffixes:

(14) a. Tamazight Berber Prefix Conjugation. *dawa* ‘cure’

	singular	plural
3m	<i>i-dawa</i>	<i>dawa-n</i>
3f	<i>t-dawa</i>	<i>dawa-n-t</i>
2m	<i>t-dawa-d</i>	<i>t-dawa-m</i>
2f	<i>t-dawa-d</i>	<i>t-dawa-n-t</i>
1	<i>dawa-γ</i>	<i>n-dawa</i>

b. *Vocabulary Items*

/n-/	↔	1 pl
/-γ/	↔	1
/t-/	↔	2
/t-/	↔	3 sg f
/-m/	↔	pl m (2)
/i-/	↔	sg m
/-d/	↔	sg (2)
/-n/	↔	pl
/-t/	↔	f

Some features in the above Vocabulary Item list are in parentheses. This notation denotes that the Vocabulary Item in question can be inserted only if the parenthesized feature has already been discharged, whereas the features which are not in parentheses cannot already have been discharged if insertion is to occur. For example, *-m* can be inserted only on a verb to which *t-* ‘2’ has already been attached. Parentheses are thus used to denote features which are secondarily expressed by a Vocabulary Item, while ordinary features — those which a Vocabulary Item primarily expresses — are not parenthesized.

In a fissioned morpheme, Vocabulary Items are no longer in competition for a single position-of-exponence, i.e. for the position of the morpheme itself. Rather, an additional position-of-exponence is automatically made available whenever a Vocabulary Item is inserted (see Halle 1997 for a slightly different view).

A form like *t-dawa-n-t* ‘you (fem pl) cure’ has three affixes, *t-*, *-n*, and *-t*. The affixes are added in an order determined by the Feature Hierarchy. Hence *t-* ‘2’ is added first, then *-n* ‘plural’, and finally *-t* ‘feminine.’ (In the feature-geometric approach of Harley and Ritter (1998),

fission detaches subtrees of the feature geometry and realizes them as separate affixes, giving much the same effect).

In a form like *n-dawa* ‘we cure’ there is but one affix. By discharging the feature ‘1’, the insertion of *n-* ‘1 pl’ prevents the subsequent insertion of *-γ* ‘1’. This illustrates that two Vocabulary Items can be disjunctive not by competing for the same position-of-exponence, but rather by competing for the discharge of the same feature. Such cases are termed *Discontinuous Bleeding*.

3.4 Morphological processes and the predictions of a piece-based theory

DM is piece-based inasmuch as Vocabulary Items are considered discrete collections of phonological material and not (the result of) phonological processes (as in Anderson 1992). Nevertheless Readjustment can alter the shape of individual Vocabulary Items in appropriate contexts. Two factors thus distinguish DM from process-only theories of morphology.

First, since Readjustment can affect only individual Vocabulary Items and not more than one Vocabulary Item at once, it is predicted that ‘process’ morphology is always a kind of allomorphy (see also Lieber 1981). For example, Marantz (1992) shows that truncation applies to (Papago) O’odham verb stems to produce a separate stem allomorph; it does not affect more than one Vocabulary Item at once.

Second, since processes produce allomorphs but do not directly ‘discharge’ features, it is common for an allomorph to have several contexts of use. For example, in O’odham the truncated verb stem allomorph has several functions, including but not limited to its use in the perfective form, and the property of perfectivity is primarily expressed in another morpheme, namely an affix on the syntactic auxiliary. It is therefore incorrect to directly equate truncation and the perfective; rather, truncation applies to verb stems which appear in the perfective. This conception of stem allomorphy conforms to the viewpoint of Lieber (1981).

Since process-morphology can in principle apply to any string, regardless of its morphological derivation, it is predicted in that theory that a language could mark the category Plural by deletion of a final syllable, regardless of whether that syllable consisted of one or several discrete phonological pieces. Consider ‘Martian’ below:

(15) *Singular and plural nouns in the pseudo-language ‘Martian’*

singular	plural	
takata	taka	‘earthling’
takata-ri	takata	‘earthling-genitive’
laami	laa	‘antenna’
jankap	jan	‘flying saucer’
jankap-ri	janka	‘flying saucer-genitive’
zuuk	lorp	‘canal’
zuuk-ri	zuu	‘canal-genitive’
yuun-i	yuu	‘antenna waving’
merg-i	mer	‘canal digging’
merg-i-ri	mergi	‘canal digging-genitive’

In ‘Martian’, nominalizations can be formed from nouns stems by addition of the suffix (-i) and genitives with the suffix (-ri). Regardless of the derivation of a noun, the plural is always either a truncation of the last syllable of the singular, or suppletive (*zuuk* ~ *lorp*). The truncated form never occurs anywhere else except in plurals. Number marking has no other expression than truncation.

The ‘Martian’ rule of plural formation is easy to express in a process-morphology: instead of adding an affix, one simply deletes the final syllable. In DM however, this language could never be generated, because processes like ‘delete the final syllable’ could only be expressed as Readjustments (or morphological relations) which affect individual Vocabulary Items.

4 Syntax and morphology

As noted in section 1.0 above, DM adopts a strictly syntactic account of word-formation; structuring of the morphosyntactic feature primitives is performed by the syntactic structure-forming operations. Features which will eventually be realized as a subpart of a phonological word are treated no differently from features which will eventually be realized as an autonomous word. The phonological realization of features is accomplished by a distinct set of operations at Insertion and afterwards. That is, DM adopts a variety of Separationism.

4.1 Separationism

Separationism characterizes theories of morphology in which the mechanisms for producing the form of syntactico-semantically complex expressions are separated from, and not necessarily in a simple correspondence with, the mechanisms which produce the form ('spelling') of the corresponding phonological expressions. The Lexeme-Morpheme Base Morphology developed by Robert Beard (e.g. Beard 1995) is another example of a Separationist model, but differs principally from DM in its endorsement of the 'lexeme' as a privileged unit in the grammar.

Theories endorsing Separationism are attractive because (a) they allow similar syntactico-semantic forms to be realized in quite different ways phonologically and (b) they permit polyfunctionality of phonological expressions: a single phonological piece (e.g. the English affix *-s*) might correspond to a set of distinct and unrelated syntactico-semantic functions.

Theories endorsing Separationism, on the other hand, are unattractive for exactly the same reasons as above: when unconstrained, they fail to make any interesting predictions about the degree to which syntactico-semantic and phonological form can diverge. See Embick (1997), (1998a), (1998b) for a discussion of how Separationism could be constrained in DM.

4.2 Morphosyntactic features and terminal nodes

In the early 1990s some linguists looked on with apprehension at the 'explosion' of INFL and the increasing elaboration of clause structure. It is worth noting that the DM does not necessarily entail a complex clausal architecture simply because morphosyntactic features are manipulated by the syntax. In DM, because dissociated morphemes can be inserted after Syntax, not every morpheme need correspond to a syntactic terminal. Rather it remains as always an open question what the set of syntactic terminal types is and how these relate to the morphophonological form of an utterance. In addition, Fission of morphemes during Spell-out in some cases allows multiple phonological pieces to correspond to single morphemes, further obscuring the morphosyntactic structure. Nevertheless, these departures are considered marked options within a grammar, and therefore are assumed to require (substantial) positive evidence during acquisition.

4.3 Theta-assignment

Most work in DM does not recognize a set of discrete thematic roles. Instead, following the insights of Hale & Keyser (1993), (1998), thematic roles are reduced to structural configurations. For example, Harley (1995) proposes that ‘Agent’ is the interpretation given to arguments projected into the specifier of Event Phrase (see also Travis 1994 on ‘Event Phrase’, and Kratzer 1996 for related ideas). ‘Theme’ corresponds to the interpretation given to any argument projected as a sister of Root. Unlike Hale & Keyser (1993), however, DM does not differentiate between an ‘l-syntax’ occurring in the Lexicon and a regular ‘s-syntax.’ Both are simply one module, Syntax. See also Marantz (1997a).

Such an approach is not necessarily entailed by the DM model, however. One could imagine a model in which there were different types of [Root], corresponding to the verb classes of the world’s languages, which assigned different sets of theta roles to elements in certain structural relations to them. What is not possible, in DM, is for one type of [Root] to be mapped onto another via a pre-syntactic lexical operation.

4.4 The phonology/morphology/syntax connection: clitics

‘Clitic’ is not a primitive type in DM but rather a behavior which an element may display. Conventionally, clitics are said to ‘lean’ on a ‘host’; this sort of dependency relation of one element on another manifests itself differently depending on what the element is and where its dependency relation must be satisfied. Hence there is no coherent class of objects which can be termed clitics; instead morphemes and Vocabulary Items may show a range of dependencies.

‘Leaners’ (Zwicky 1985a) are Vocabulary Items which cannot form Phonological Words by themselves but whose morphemes have no other special displacement properties. For example, the English reduced auxiliary *-s* (from *is*) ‘promiscuously’ attaches to any phonological host to its left (Zwicky & Pullum 1983):

(16) *Leaners*

The person I was talking to’s going to be angry with me.

Any answer not entirely right’s going to be marked as an error.

Selkirk (1996) analyzes prosodically dependent Vocabulary Items as either free clitics (adjuncts to Phonological Phrases), affixal clitics (adjuncts to Phonological Words) or internal clitics (incorporated into Phonological Words). These options are shown schematically below:

(17) *Types of phonological clitics*

ϕ [= phrase boundary, ω [= word boundary

ϕ [... free clitic ϕ [ω [host]...]

ϕ [... ω [affixal clitic ω [host]] ...]

ϕ [... ω [internal clitic + host] ...]

English leaners are typically free clitics, according to Selkirk, but other languages exploit other options. For example, Embick (1995) shows that, depending on whether they undergo head movement or are simply ‘leaners,’ Polish clitics behave phonologically as either affixal clitics (allowing their host to undergo word-domain phonology), or as internal clitics (preventing their host from undergoing word-domain phonology on its own).

Second-position clitics, illustrated for Serbo-Croatian in section 3.1 above, are Vocabulary Items which undergo either Local Dislocation or Prosodic Inversion with a host.

Finally, the term ‘clitic’ is sometimes used to describe syntactically mobile heads, typically Determiners, such as certain Romance pronominals on some accounts. In such cases the dependency relation or special behavior is a syntactic property of a morpheme. In many cases the Vocabulary Items which are inserted into these morphemes also show either phonological dependency as leaners or additional peculiarities of position via Local Dislocation or Prosodic Inversion. See Harris (1994), (1997a) and Embick (1995) for case studies.

5 An agenda for future research

The research program envisioned by Distributed Morphology encompasses a great many aspects of the theory of grammar. Thus, the agenda for future research with which we conclude here touches upon what we feel are some of the most pressing questions in contemporary syntactic and morphological work. We have divided the agenda into three headings.

5.1 Syntactic categories and the architecture of grammar

As noted, DM denies that syntactic categories necessarily stand in any simple relation to traditional parts-of-speech such as nouns and verbs; moreover, DM denies that syntactic categories stand in any simple relation to phonological words. Thus, as is also the case with much work in Minimalist syntax, the DM research program demands a reassessment of the inventory and bases for syntactic categories. Related questions include the following. First, the ramifications of the L-morpheme Hypothesis (according to which open-class Vocabulary Items always instantiate the same syntactic category) point to the need for continued study of so-called ‘mixed’ categories and the cross-linguistic validity, if any, of traditional part-of-speech labels in universal syntax. Second, how do these categories relate to universal semantic primes and to what extent do certain types of ‘derivational word-formation’ manipulate such primes? This topic is explored extensively in the work of Robert Beard (e.g. Beard 1995), but has not yet been properly incorporated into the DM model. Third, DM hypothesizes that syntax manipulates only categories defined by features made available by Universal Grammar. This leads to the question of whether language-specific features (such as gender or form class) are present in the syntax at all, or whether such features are unavailable in syntax proper and are supplied for purposes of spell-out and agreement only through Vocabulary Insertion after syntax (for discussion, see Embick 1998b).

As Aronoff (1994) has most persuasively argued, morphology requires the manipulation of form classes and stem types whose relation to syntactic properties or configurations is not direct, but mediated by a complex mapping. DM adopts this Separationist position by positing a component of Morphology after syntax which provides for this mapping. Nevertheless, an important question for future work is whether this mapping is constrained by any interesting universal principles (Embick 1997).

Along with the research program of Hale & Keyser (1993, 1998), DM does not recognize the assignment of theta-roles by ‘lexical items.’ Thus, research in DM continues to explore whether theta-roles may be dispensed with as primes of the theory and replaced by a configurational definition of argument roles.

Properties of the Encyclopedia and its relation to grammatical well-formedness raise additional important issues. Marantz (1997b) for example has suggested that (phrasal) idioms cannot extend beyond the Event (v) projection, but it remains an open question how the Encyclopedia effects this constraint on semantic interpretation. A related question concerns the

distinction between what are conventionally termed ‘productive’ and ‘non-productive’ processes. The earliest work in generative morphology such as Halle (1973) postulated a Dictionary which effectively licensed the use of expressions formed by non-productive word-formation rules. The question of whether the DM Encyclopedia can or should perform this licensing function, or how, if at all, expressions formed by ‘non-productive’ mechanisms of the grammar are to be specially treated, is currently under investigation.

5.2 Spell-out

A number of researchers in DM have accepted the traditional view that morphosyntactic features have markedness properties or are aligned into hierarchies of various sorts. Open questions — which DM in fact shares with all theories of morphology — currently include what the set of universal morphosyntactic features is and what, if any, are their universal markedness properties, as well as how these are structured in representation (e.g. in a geometry, in a list, or in some other way).

Spell-out of morphemes may be conditioned by properties in nearby morphemes, and so an important issue is the syntagmatic (locality) constraints on spell-out, that is, how close structurally a morpheme has to be to another to influence the other’s spell-out. Similarly, opinion remains divided as to whether the outcome of a competition of Vocabulary Items for positions may be settled by means of a hierarchy of features or can be stipulated.

Finally, not all morphemes are present in syntax proper, but some are purely morphological, *reflecting* syntactic configurations or properties. Which morphemes, then, are inserted after syntax and what kind of limitations are placed on morpheme-insertion?

5.3 Operations

Impoverishment, Fission and Morphological Merger are the chief novel operations proposed in DM for the Morphological component, and questions remain open about each.

Is Impoverishment constrained to reduce markedness only, and if not, does it differ fundamentally from Rules of Referral (Zwicky 1985b, Stump 1993)? What are the syntagmatic (locality) constraints on the operation of Impoverishment? Is the mechanism of morpheme fission, in which positions are automatically generated as needed for the insertion of features, really necessary, and if so, under what circumstances do morphemes undergo fission? How

many types of Morphological Merger are there and how do they differ? Can Merger be reduced to a purely syntactic or purely phonological mechanism?

In the realm of morphophonology, Marantz's conjecture that true suppletion is limited to f-morphemes prompts a search for non-stipulative criteria dividing suppletion from Readjustment. Once cases of true suppletion are factored out, the possibility arises for an interesting theory of Readjustment allomorphy based on the degree of relatedness between allomorphs necessary for these to be acquired as variants of the same Vocabulary Item.

6.0 Conclusion

We have presented DM's primary theoretical assumptions, provided some concrete illustration of the implementation of certain of its mechanisms, and announced an agenda for future research. Although we have touched on a large array of topics in current morphological theory, we cannot claim to have fully elucidated the advantages of DM relative to its competitors, nor have we exhausted the historical bases for many of its tenets. Instead, we hope that our exposition will provide the groundwork for an informed discussion of DM's contribution to the theory of grammar. Interested readers should consult the following bibliographies of representative works within DM as well as important alternative approaches to the issues that stimulated the DM research program.

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