DISTRIBUTED MORPHOLOGY*

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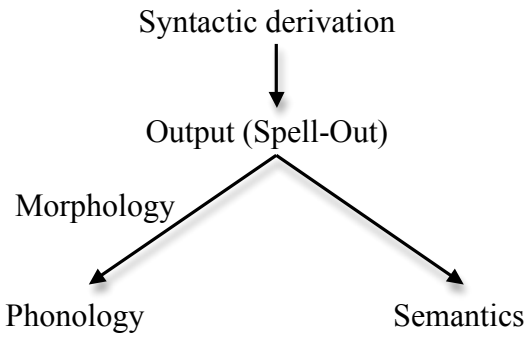
Distributed Morphology (DM) is a theoretical framework that emerged in the early 1990s. The name is introduced in Halle and Marantz (1993, 1994), with important precursors including Halle (1990), Bonet (1991), Noyer (1997), and Pesetsky (1995). At a broad level, DM represents a set of hypotheses about the interaction among components of grammar: Morphology, in DM, is (a part) of the mapping from the output of a syntactic derivation to the (input to) the phonology, as sketched in (1):[1]

(1) *Architecture*



DM is centred around two key hypotheses; both common in various parts of the literature—where DM claims novelty is in the synthesis of these two leading ideas under the architecture in (1):

(2) Syntax-all-the-way-down: The primary mode of meaningful composition in the grammar, both above and below the word-level, is the syntax. Syntax operates on sub-word units, and thus (some) word-formation is syntactic.

(3) Late Insertion / Realization: The pieces manipulated by the syntax (*functional morphemes*) are abstract, lacking phonological content. The pairing of

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[1] There are a variety of views on the relationship of Spell-Out to LF/Semantics that are consistent with the overall DM architecture. On one view, there is 'covert' syntax mapping Spell-Out to LF, on another view, overt and covert movement are interleaved, distinguished by whether a moved element is pronounced in a high or low position, and thus Spell-Out takes place after 'covert' movement. On this latter view (see Bobaljik 2002a and references therein), the representation that is the input to Morphology corresponds to LF in GB/Minimalist usage. Related to these differences is the question of whether Spell-Out applies to portions of the syntactic derivation in cyclic fashion (see Embick 2010 for discussion, and section 4.1 below).

phonological features with the terminals of the syntax (*vocabulary insertion* or *exponence*) happens post-syntactically, in the mapping from syntax to phonological form (PF).

The functions of morphology in other approaches, and of the Lexicon in particular, are in DM distributed (hence the name) over multiple points in the architecture. In particular, there is no single Lexicon, understood as at once a list of (i) the minimal meaningful units of grammar or building blocks of words, (ii) the minimal pairings of form (sound) and function (meaning), and (iii) non-compositional aspects of the meaning of words/morphemes in particular contexts. Instead, there is on the one hand a list of the syntactic atoms, manipulated by (and thus accessed by) the syntax, in the construction of complex terminal nodes. Items on this list would include features that project to a syntactic node (say [PLURAL]), and (possibly language-particular) bundles of features that constitute a single node: for example English (plausibly) groups both tense and agreement (person and number) under a single INFL node in the syntax. A second list, the Vocabulary, associates morphosyntactic features and their phonological exponents. Idiosyncratic meanings of morphemes in context (idiomaticity) is part of a third list—the Encyclopaedia—discussed in section 5.

It is a matter of observation that there are *prima facie* mismatches between the abstract nodes of the first list and the nodes that are spelled out by vocabulary items; in other words, that the correspondence between the lists is not one:one. One such mismatch is *underspecification* of vocabulary items relative to feature contrasts in the syntax. For example, in Russian, predicate adjectives (and participles) show agreement for number and gender with the subject of their clause, even, as in first and second person pronouns, where gender is not contrastive:

(4) a. ja bol'n-a I sick-FEM 'I am sick'

b. ja bolen-Ø I sick-MASC 'I am sick'

In DM, as in other realizational frameworks, such examples may be modelled by positing that the syntactic representation is fully specified, and thus that the subject position includes a gender contrast, but that the Russian Vocabulary only has items such as (5), which lacks a gender specification and thus realizes both feminine and masculine subjects. This leaves a many:one relation between the morphosyntactic and morphophonological representations, with fewer contrasts in the overt form than are present underlyingly in the syntax.

(5) [1 SG NOM] ⇔ ja

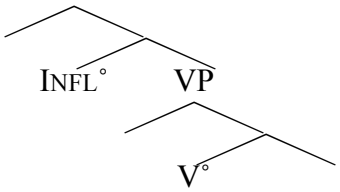
Allomorphy provides a paradigm example of the opposite situation, in which the relation between syntax and phonological realization is one:many. In German, for example, there is no reason to suspect that there is more than one nominal plural suffix in the syntax; hence plural nouns may all have the abstract syntactic representation: [[NOUN]-PL]. However, the German vocabulary provides a variety of vocabulary items that express this node, including: *-Ø, -(e)n, -e, -er* and *-s,* with or without concomitant stem changes (*readjustments*, see below).

The examples of mismatches just considered exploit the realizational nature of the framework. Other examples of mismatches arise between the syntactically motivated hierarchy or constituency and the morphophonologically evident hierarchical structure. In the development of the framework, various mechanisms have been posited to account for

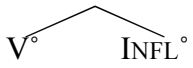
these, chiefly as operations that manipulate the output of the syntax prior to vocabulary insertion; see section 3.

For example, it is a mainstay of much syntactic theorizing building on Chomsky's influential (1957) analysis of *do*-support that the inflectional features in English head a syntactic node (INFL) that is independent of the verb, as in (6a).[2] Yet, evidently, in simple declaratives, the main verb and inflectional features form a morphological unit, as in (6b)—a verb, such as *walk-ed*.

(6) a.



b.



If (6b) is derived syntactically, for example via head movement, then the levels align. But word order contrasts, famously between French and English (Pollock 1989), have led some researchers to conclude that English lacks a syntactic head movement operation deriving (6b). Thus, main (non-auxiliary) verbs in French precede elements (adverbs, negation) that English main verbs follow, and only in a verb-movement language like French does the main (non-auxiliary) verb invert with the subject in inversion contexts. If it is indeed correct that English lacks a syntactic operation deriving (6b) from (6a), then we are faced with an instance of a mismatch: INFL° and V° do not form a constituent in the syntax, but they do form such a unit in the morphology. An important line of study within DM seeks to propose a theory of possible mismatches of this sort. For the case at hand, an operation of Morphological Merger has been appealed to. Various formulations have been offered, such as (7), based on Marantz (1989:261):

(7) *Morphological Merger*

A syntactic complementation relation: [X° YP]

may be realized in the morphology as an affixation relation:

X affixed to Y, the head of YP: [[Y] X] or [[X [Y]]

Merger in (7) reconstitutes Chomsky's *Affix-Hopping* as a morphological operation. Since English inflectional morphology is exclusively suffixing, while syntactic complementation is head-initial, combining INFL as an affix to the verb will necessarily result in a suffix, and the appearance of INFL 'hopping' across the verb.[3]

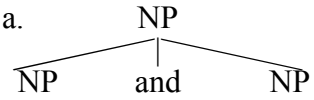
Cliticization provides related examples where again, syntactic constituency and morpho-phonological constituency are imperfectly aligned, with a hopping effect. Marantz (1989), drawing on Sadock (1985) gives the example of the Latin conjunctive clitic *=que.* Syntactically, the coordinator is presumably a head that occurs between the conjuncts,

[2] In many current syntactic analyses within the GB/Minimalist tradition, there is much additional structure as well which we may ignore for the sake of exposition.

[3] If the affixation relationship that is the output of Merger could also be Y affixed to X: [[X] Y], then Merger would be morphologically indistinguishable from Head Movement. This provides one way of thinking about proposals to recast syntactic head movement in non-syntactic terms.

either in a flat structure as in (8a), or as the head of a more articulated coordination phrase. Yet the morpho-phonological constituency does not reflect this—the coordinator *=que* occurs after the first phonological word of the last conjunct in a coordination.

(8) a.



b. [[bon-i puer-i] & [pulchr-ae puell-ae]]

c. [[bon-i puer-i] [pulchr-ae **–que** puell-ae]]
good-M.PL boy-M.PL beautiful-F.PL-AND girl-F.PL
'good boys and beautiful girls'

Embick and Noyer (2001) propose that this too involves a species of Morphological Merger. They note in particular that this is unlikely to involve syntactic movement. Not only is there no independently motivated syntactic analysis that would readily accommodate (8c), but the ordering is in some cases demonstrably dependent on phonology: if there is a preposition in the second conjunct, then *=que* attaches to the preposition when the latter constitutes a phonological word, but when the preposition is light and phonologically dependent on the word to its right, then *=que* follows both the preposition and the noun:

(9) a. circum-**que** ea loca
around-AND those places
'and around those places'

b. in rēbus-**que**
in things-AND
'and in things'

Examples of this sort not only serve to illustrate the kinds of operations posited within DM for analyzing mismatches between syntactic and morpho-phonological constituency, they also call attention to the dependency of morphological analysis on assumptions about the syntax. If English has verb movement to INFL after all, or if the Latin conjunction facts do turn out to involve syntactic movement, then the morphological operations needed would of course be different.[4] It is worth noting in this context the emerging perspective of Nanosyntax (Starke 2009, Caha 2009, Svenonius 2012), which shares the core tenets of DM in (2)-(3), but holds, in effect, on conceptual grounds that a more elegant theory would make no recourse to post-syntactic operations that alter the syntactic representation prior to vocabulary insertion. Of course, simplification of the morphological component by eliminating such operations is not an argument in and of itself, to the extent that apparent simplification in one domain may come at the expense of unwarranted complexity in the other. As theories of syntax:morphology mismatches, DM accounts are answerable to both the syntax and the morphology in justifying assumptions in both components.

To recap, then—as a framework for grammatical analysis, DM takes a derivational stance. The derivation of a complex word begins in the syntax, which combines abstract

[4] Similar effects have been noted in Slavic, where apparently phonologically-restricted cliticization feeds syntactic movement. See Radkevich (2010) and for an analysis in which morphological cliticization is cylically interwoven with syntactic movement, see Calabrese and Pescarini (2014).

(i.e., phonology-free) pieces according to general principles. It is the output of the syntax that is then interpreted by the Morphology. A key part of the morphology, conceived of as the mapping from syntax to phonological form, is vocabulary insertion, the pairing of syntactic terminals with (possibly null) phonological underlying representations. Between these two ends of the morphological derivation, a variety of operations may apply which manipulate the representation in limited ways, including via Morphological Merger (of terminals), illustrated above. With this general outline in mind, we turn to a more refined presentation of some key elements of the theory.

1. REALIZATION AND UNDERSPECIFICATION

Late insertion, or realization, of morphosyntactic representations was discussed above in connection with (4)-(5). As in other realizational frameworks, a central role in DM is accorded to underspecification of vocabulary items. A well-worn example of underspecification is provided by the English present tense inflection (of main verbs). The English vocabulary contains the following two items, which are candidates for realizing in INFL node in (6b).[5]

(10) Vocabulary of English (fragment)

a.	[3SG, PRES]	⇔	-s
b.	[PRES]	⇔	Ø

The formal statements of vocabulary items are tantamount to rules of exponence (cf. Matthews 1972), and as such, two general principles of rule interaction are operative in their application.[6]

(11) Rules Apply

A rule applies wherever its structural description is met.

(12) Elsewhere Condition

Where more than one mutually exclusive rule may apply, (only) the most highly specified rule applies.

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[5] By convention, fragments of the vocabulary relevant to a given point are presented as a disjunctively ordered list, from most to least specific. Standard DM notation writes these as correspondence rules (⇔) relating a morphosyntactic representation to a phonological one. An alternative within DM treats these as rewrite rules, replacing syntactic features with phonological ones (i.e., with → in place of ⇔; see Halle 1990, Trommer 1999, Bobaljik 2000). The two views may differ, for example, in whether features that have been spelled out remain visible in the derivation to serve as a condition for later rules. See Bobaljik (2000) and Bonet and Harbour (2012) for relevant discussion.

[6] In Halle and Marantz (1994:276), these are grouped together under the rubric "Underspecification", and in Halle (1997), (11)-(12) are conflated into a single *Subset Principle*. Note that this is largely a matter of exposition and nomenclature: formulations such as "only vocabulary items whose specified features are a subset of the features in a given terminal node are able to [be inserted at that] node" (Harley, 2008:263) are simply elaborations of (11), but there is no contentful "subset principle" postulated beyond (11). In DM, as elsewhere, there are competing views as to the precise formulation of (12), in particular, whether "more specified" should be limited to subset-superset relations (as in Kiparsky 1973), or should include other cases, such as feature-counting (Halle 1997, Harley 2008:262).

Returning to English inflection—if the subject is, say, first person plural, then the features [1PL, PRES] will appear at the INFL node in (6b) and constitute the input to vocabulary insertion. The item (rule) in (10a) may not apply, as its structural description is not met; only (10b) is compatible with this context. On the other hand, where the subject is third person singular, both exponents in (10) are eligible for insertion, but as (10a) is more specific (a proper subset of the environments characterized by (10b)), (10a) must be inserted: *She walk-s,* and not **She walk-Ø*.

German provides a further illustration. Consider the agreement morphology in the simple past tense, illustrated in (13) (German shows separate terminal nodes for tense and agreement, unlike English):

(13) German (weak) Past Tense: *sagen* 'to say'

PERSON	SINGULAR	PLURAL
1st	sag-te-Ø	sag-te-n
2nd	sag-te-st	sag-te-t
3rd	sag-te-Ø	sag-te-n

a. [2 PLURAL] ⇔ -t
b. [PLURAL] ⇔ -n
c. [2] ⇔ -st
d. [ ][7] ⇔ Ø

A possible analysis of the agreement exponents is given in (13a-d). Note in particular that all four exponents are eligible to express the second person plural (their structural descriptions are all met in the context [2 PLURAL]), but the Elsewhere Condition correctly regulates this competition, determining a unique winner. Formally, the suffix *-en* marks only the plural, and is not sensitive to person; the impossibility of **sag-t-en* as a 2PL form is attributed to the more highly specified item *-t*, which wins the competition in that context.

The same (familiar) elsewhere logic regulates the competition among lexically conditioned allomorphs, providing a formal description of the interaction of regular and irregular affixes, as in (14):

(14) Vocabulary of English (fragment)

a. [PAST] ⇔ -t /]$_V$__ ; where V ∈ {*dream, dwell* etc.}
b. [PAST] ⇔ Ø /]$_V$__ ; where V ∈ {*run, hit, fly* etc.}
c. [PAST] ⇔ -d /]$_V$__

In the usual manner, the (intrinsic) elsewhere ordering in (14) ensures that the irregular exponents block the regular past tense exponent for verbs that are listed as irregular (whether this is formalized as a list of restrictions on the rules, as in (14), or via a diacritic). Two comments are worthy of note here. First, the vocabulary items of DM are to be understood as phonological underlying representations, subject to further phonological rules—(14c) has three phonologically predictable surface realizations: [d ~ t ~ əd].[8] Second, DM separates choice of affixal exponent from stem alternations, such as vowel changes (if any)—the latter are formally the purview of *readjustment rules* (equivalently: morphophonological rules, minor phonological rules, etc.). Readjustment

[7] An empty feature set, the elsewhere case, is consistent with any environment and thus constitutes the default realization of a given node.

[8] Many morphologists thus reserve the term 'allomorphy' in this context to alternations that must be handled by the morphology (as in (14)), and thus do not include phonologically-predictable changes, such as voicing alternations in the English past tense and plural, under this term.

rules alter the form of an underlying representation, and thus they necessarily occur after the rules of vocabulary insertion. Readjustment rules are fundamentally phonological in nature, but are restricted to apply to some, but not all, morphemes that meet their phonological description. The dissociation of readjustment rules from affixal exponents is clearest in the case of verbs that make use of both: *tell ~ tol-d*.

Elsewhere-governed competition among vocabulary-items may also be invoked to capture more abstract competitions. Adding (15) to the Vocabulary fragment is one way of capturing the fact that in English, verbs which lack an *-(e)n* participle form take the same affix (including -Ø) in the participle as they do in the simple past (*I have dwel-t / dream-t / hit-Ø / sung-Ø* ...), even though they may show a different stem alternation (readjustment).[9]

(15) PAST, PARTICIPLE ⇔ -(e)n / $]_V$__ ; where V ∈ {*write, give,* etc.}

Although the above examples are drawn from inflection, competition in DM is used to model allomorphy in derivational morphology as well. Descriptions of many languages may include an array of phonologically distinct affixes performing the same function, for example, the nominalising suffixes of English include: *-ness, -ity, -th,* etc., which combine with different ranges of adjectival stems to yield nouns. To the extent that these affixes have systematically differing syntax or semantics, then they may indeed realize distinct abstract morphemes. On the other hand, the mechanisms of the theory allow for the possibility that these all realize a single abstract morpheme, and constitute instead surface allomorphs (different exponents) of, say, a syntactic head n° which merely contributes the category feature Noun (see, e.g., Marantz 1997, Harley 2009, Embick 2010; see Lowenstamm, 2010 and Van Craenenbroeck and De Belder, in press, for an alternative conception.)

In sum, one of the pillars of DM, shared with a wide variety of competing frameworks, is the property of realization, invoking underspecified rules of exponence to provide the morphological/phonological realizations to logically prior, abstract morphosyntactic input representations. Morphology interprets, rather than projecting, syntactic structure.

It should be noted that the sense of underspecification used here refers specifically to the characterization of items in the vocabulary. Understanding vocabulary items as constituting rules of exponence, underspecification in this sense is simply the general property of rules that they may have differing levels of generality in their structural description. A separate question is whether the morphosyntactic representations that are the input to vocabulary insertion may be underspecified, that is, whether a node may lack a value for a feature that it (otherwise) bears. The distinction between the two (distinct but overlapping) senses of underspecification may be illustrated with reference to Russian nominal gender.

[9] Many approaches to morphology distinguish a *root* (the most deeply embedded morpheme) from a *stem* (the possibly internally complex element to which inflection attaches); in the word *destroying*, the prefix *de-* combines with the root √STROY, to form a stem, to which the suffix *–ing* is attached. This terminological distinction may be useful in description, but the category of stem as such has no privileged morphological status in DM. In particular, while DM recognizes domains for morphophonological interactions (see section 4.1 below), to the extent there are effects that seem to pick out the 'stem', these arise only to the extent that stems happen to coincide with other recognized domains.

Like many languages, Russian lacks a morphological gender contrast in the plural; as the nominative, third person pronominal paradigm in (16) illustrates.[10]

(16) Russian gender inflection (short adjectives, nominative case)

GENDER	SINGULAR	PLURAL
MASC	on-Ø	on-i
FEM	on-a	on-i
NEUT	on-o	on-i

a. [PLURAL] ⇔ -i
b. [FEM] ⇔ -a
c. [NEUT] ⇔ -o
d. [ ] ⇔ Ø

Within DM, Halle (1997) proposes to describe the Russian paradigm with the vocabulary items in (16a-d). We may assume that nominal inflectional nodes may abstractly be specified for both gender and number, hence a node may bear the specification [FEM,PLURAL]. In Halle's account, this node will be realized as *-i*, because this item is ranked highest on the disjunctive list of competing vocabulary items in (16). In contrast to the examples considered above, where the Elsewhere Condition established an intrinsic ordering among competing exponents, in Halle's analysis, the ordering of (16a) before (16b-c) is extrinsic—in essence, an arbitrary fact of Russian that needs to be learned. Alternatively, as Harley (1993), Noyer (1997) and others have suggested, the order among the exponents in (16) may be established by a feature hierarchy. Noyer (1997) posits the hierarchy PERSON > NUMBER > GENDER, which ensures that number wins out over gender when no other considerations establish order, as in the case at hand.

With or without a hierarchy, Halle's account treats the lack of gender contrasts in the plural as a contingent property of Russian grammar, a consequence of the inventory of vocabulary items in the language. Williams (1994) objects to accounts of this general type on the grounds that they fail to capture what appears to be a systemic, rather than accidental, property of Russian morphology (see also Bobaljik 2002b, Harley 2008). The syncretism seen in (16)—the lack of a gender contrast in the plural—is not merely a property of the short nominative inflectional endings, but is instead a meta-syncretism, holding of all inflectional paradigms in the language—gender is never morphologically contrastive in the plural (a pattern that is not uncommon cross-linguistically, cf. Corbett - 1991).

An alternative to using underspecified vocabulary items, as in (16), is to countenance underspecification of the morphosyntactic representations of the nodes that are the input to vocabulary insertion. Bonet (1991, 1995) argued that the morphological operations in (1) include feature-deletion rules, which she termed *Impoverishment* rules. These rules operate on fully-specified syntactic matrices, but delete features prior to vocabulary insertion, thereby yielding systematic neutralizations in surface forms.[11] Stating (17)

[10] The inflectional suffixes of these pronouns are shared with other nominal classes, including interrogative and demonstrative pronouns, nouns, short form adjectives, and the past tense (participle) inflection. An influential analysis of the masculine singular ending (surface Ø) treats it as underlyingly a *yer* vowel, which is subject to a rule of *yer*-deletion in (among other contexts) word-final position.

[11] Bonet's primary focus was Romance clitic clusters, in which combinations that are expected on the basis of the clitics that appear in isolation are (in part) replaced by unexpected clitics, drawn from elsewhere in the inventory. A famous case is the Spanish *spurious se*, in which, for example, the combination of third person accusative *lo* and third person dative *le*, yields the opaque cluster *se lo* instead of expected, but ungrammatical **le lo*. Bonet argues that many such cases can be treated by deleting features of one or the other clitic, leading to the insertion of less (featurally) marked exponents. For recent discussion, see, among

once as a general Impoverishment rule of Russian will formally describe the meta-syncretic effect: at the point of vocabulary insertion, no node will ever bear both plural and gender; underlying [FEM, PLURAL] will lose its feminine feature, and surface just as [PLURAL]. For the same reason, this account will also eliminate the need for extrinsic ordering in (16): (16a-c) will simply never compete and thus need not be ordered with respect to one another.

(17) a. GENDER → Ø / [___ PLURAL]

b. * [GENDER, PLURAL]

Noyer (1997), extending ideas of Calabrese (1995), suggests that (many such) impoverishment rules are the result of markedness constraints, such as (17b), which underlie typological generalizations (see also Nevins 2011). For example, if (17b) is a markedness constraint (which may or may not be active in a given language), but there is no corresponding *[GENDER , SINGULAR] constraint, a good portion of Greenberg's Universal 37: 'A language never has more gender categories in non-singular numbers than in the singular' (1963:112; cf. Corbett 1991:156) receives an account. Numerous interesting questions arise at this point, and further discussion of deletion operations will be taken up in section 3.3, below.

While the discussion above merely scratches the surface in many ways, the examples given touch on the major motivations for, and applications of, a realizational approach to morphology, one in which phonological exponents are associated with morphosyntactic representations after the syntactic derivation. A central role is played here by the investigation of mismatches between syntactically-motivated representations, and those observed in the morphophonological string: a variety of devices, including underspecified vocabulary items, as well as morphological operations such as Merger and Impoverishment, serve together to constitute a theory of possible mismatches.

2. SPELLING OUT SYNTAX

While many theoretical frameworks incorporate a realizational architecture, in which rules of exponence spell out the features of a morphosyntactic representation, frameworks differ significantly in the properties they attribute to that representation. A central tenet of DM, noted above, is that the starting point of the morphological (component of the) derivation is the representation that is the output of the syntax, including, potentially, internally complex X° nodes created in the syntax. This view was discussed with reference to (6) above—even a simple case such as a finite verb in English is assumed to have an internally complex hierarchical structure that is determined (in part) by the syntax: (6b).[12] Other realizational frameworks, in particular Word and Paradigm theories, explicitly deny that the morphosyntactic representation has internal syntactic structure (this view is laid out with particular clarity in Anderson 1992: Chapter 10).

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others, Nevins (2007) and Pescarini (2010).

[12] The qualification "in part" is relevant here because DM recognizes operations that manipulate the syntactic representation prior to vocabulary insertion, such as Morphological Merger. Thus, the abstract complex terminal [[verb] INFL] in (6b) may not (in English) be formed in the syntax per se (Chomsky's *narrow syntax*), but it nevertheless has an internal hierarchical structure that is a function of the syntactic representation with distinct INFL and V nodes—(6a).

Central arguments for recognizing word-internal syntactic structure (and thus composition of words in the syntax) come from two domains.

One domain, alluded to already, is the syntactic evidence for such structure, for example, the evidence from English *do*-support for an INFL node in the syntax, distinct from the verb. Similarly, many schools of thought recognize evidence for syntactic decomposition of words in examples such as (18), with a transitive verb *open* meaning (something like) CAUSE-TO-BE-OPEN. Sentences of this form are famously ambiguous (Dowty 1979, von Stechow 1996), allowing (at least) a *repetitive* reading, as in (18a), and a *restitutive* reading (18b), under which (18) is true so long as the window had been open before.[13]

(18) Leo opened the window again.

a. Leo opened the window, and he had [opened the window] before.

b. Leo opened the window, and [the window was open] before.

If adverbs like *again* modify syntactic constituents, then the restitutive reading points to a syntactic constituent consisting of the NP *(the) window* along with the stative portion of the verb (i.e., BE.OPEN) but excluding the eventive component of the verb meaning, the lower VP node in a structure like [$_{VP}$ CAUSE [$_{VP}$ BE.OPEN window]]. We return briefly to some related issues in section 5.

The other important domain of evidence for internally hierarchically structured morphosyntactic representations comes from the morphology proper, and especially from the domain of contextual allomorphy, and other (apparent) morpheme-morpheme interactions within a word. For this reason, a major object of inquiry within DM is the question in (19), continuing a research agenda laid out in one way or another in works including Williams (1981), Siegel (1978), Lieber (1982), and Carstairs (1987):

(19) Under what conditions may one morpheme (M1) condition allomorphy for (including the appearance or absence of) another morpheme (M2)?

Since syntactic features in DM may constitute (abstract) morphemes, DM would be consistent with the discovery of conditions on allomorphy that are crucially defined over hierarchical structures. Schematically, in DM, a root X associated with multiple inflectional features may have an articulated morphosyntactic representation, such as (20a), where the corresponding MSR in a Word-and-Paradigm theory would be flat, the features associated as an unstructured bundle with the lexeme X (20b):

(20) a. 

b. X [F1, F2]

In DM, then, conditions such as (structural and/or linear) adjacency, and relative closeness among features may turn out to play a key role in answering (19), where such relationships are undefined if features are unstructured. Work in DM arguing for the relevance of hierarchical structure in contextual allomorphy and other morphological

[13] In the limiting case, the window is installed open, is closed once, and then opened by Leo. In such a context, there is no repletion of an event of opening at all, merely the restoration of the window to the open state. The current literature debates whether there are additional readings, suggesting even further decomposition.

interactions includes: Bobaljik (2000, 2012), Embick (2003, 2010), Harbour (2007), and Arregi and Nevins (2012); see also Bonet and Harbour (2012) for a review. Two illustrative examples are presented here.

We begin with a fairly simple example. It is generally held (e.g., Lieber 1980, Kiparsky 1982) that morphological irregularity does not survive category changing derivation. The basic verb *fly* in English has an irregular (strong) past tense, as in (21b). But the denominal verb *fly* permits only a regular past tense *flied* (for example, in its baseball sense - 'to hit a fly ball', (21c), as well as other senses identified in the *OED*).

(21) a. Superman will fly out.

b. Superman flew out. [[fly]$_V$ INFL]

c. Superman flied out. [[[fly]$_N$]$_V$ INFL]

One account of this generalization is crucially structural: in (21b), the verb and INFL are local to one another—the root conditions the zero allomorph of past tense INFL (see (14b)), while the feature [PAST] in INFL triggers a readjustment rule on the verb root. By contrast, in the denominal form (21c), additional (though unpronounced) structure intervenes between the root and the INFL node, disrupting the local relation and prohibiting morphological interactions. Only the default past tense INFL is possible, since the lexical identity of the root (equivalently, a diacritic feature of the root) is not visible to the INFL node.[14]

Keeping to well-discussed examples, another manifestation of the same concept is the difference between nominalizations and gerunds. There are many vocabulary items that express "nominalization" in English, and the choice of affix is in part lexically determined by the root/stem: *marri-age, refus-al, destruc-tion, break-Ø,* etc. On the other hand, gerunds (a species of nominalization) are always expressed by the item *-ing*: *marrying, refusing, breaking*, and never show the idiosyncratic stem changes characteristic of nominalization: note *destroy-ing*, rather than **destruct-ing*. Here again, one may propose (as Embick 2010 does) that the nominalising suffix is local to the root in the root nominalizations (hence may interact in allomorph selection), but that there is additional structure (for which there is syntactic evidence) in the gerunds, and this additional structure renders the nominalising suffix too remote from the root to show lexically-conditioned interactions.[15]

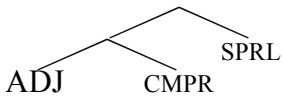
A similar invocation of structural locality conditions is used to explain a range of generalizations in the domain of adjectival suppletion in Bobaljik (2012). That work consists in part of a large, cross-linguistic survey of comparative and superlative morphology. The account makes crucial reference to the internal structure of words, prior to the application of rules of exponence, a structure that is denied under Word-and-

[14] There is a certain (but not complete) overlap between theories, such as Embick (2010), which appeal to structural locality conditions on allomorphy, in this case, some species of intervention, and theories such as Lieber (1980) and Williams (1981) in which allomorphy is extremely local, with long-distance effects achieved by feature percolation, with the intermediate node blocking percolation of features.

[15] Embick argues for a more complex theory than hinted at here, in particular, with a role to play for cyclic versus non-cyclic nodes in the structure. Embick also posits further structure beyond that in (21d-e), in particular, a category-neutral ROOT, which is syntactically the complement of category-determining nodes (denoted *n, v* etc). Only cyclic nodes intervene to disrupt locality, permitting morphological dependencies to cross some nodes.

Paradigm theories. Specifically, I argue there that (relative)[16] superlative grades of adjectives are always derived from (structurally include) the comparative grade, as in (22):

(22)



This hierarchical relationship is morphologically transparent in a great many languages as shown here, although the expression of the affixes as prefixes or suffixes is a point of cross-linguistic variation:[17]

(23)

	POSITIVE	COMPARATIVE	SUPERLATIVE	
a.	kam	kam-tar	kam-tar-in	'little' (Persian)
b.	šüa	šüan-ar	šüan-ar-ste	'pretty' (Cimbrian German)
c.	mlad-ý	mlad-ší	nej-mlad-ší	'young' (Czech)
d.	nagy	nagy-obb	leg-nagy-obb	'big' (Hungarian)
e.	nüs˚ə	ç'a-nüs˚ə	a-ç'a-nüs˚ə	'pretty' (Ubykh)

Even in languages like English where (22) is no longer synchronically transparent, evidence for the presence of a comparative node embedded in superlatives comes from patterns of root (suppletion). The overwhelmingly most common pattern (as noted for a smaller sample by Ultan 1972) has a single suppletive root shared by both the comparative and superlative degree, regardless of whether the structure in (22) is transparent or not, thus:

(24)

	POSITIVE	COMPARATIVE	SUPERLATIVE	
a.	god	bed-re	bed-st	'good' (Danish)
b.	špatn-ý	hor-ší	nej-hor-ší	'bad' (Czech)
c.	k'argi-i	u-mǰob-es-`i	sa-u-mǰob-es-o	'good' (Georgian)
d.	šig'	pɛr'-am	pɛr'-mus	'good' (Kildin Saami)
e.	kwad	nax	nax-deda	'many' (Kabardian)

The presence of the comparative node in the representation of superlatives in (22) serves not only to provide a formal account of the sharing of a suppletive root allomorph in both grades, but also to exclude a pattern like **good – better – goodest*, a pattern which is essentially unattested in the Bobaljik (2012) sample (with a few debatable counter-examples discussed there). Key here is the Elsewhere Condition. Given (22), a root allomorph specified for the context: "/ ___] CMPR" will of necessity win out over a context-free allomorph (the positive) in both the comparative and superlative structures.

Although rare, root suppletion in the superlative grade, with a root allomorph distinct from the comparative, is attested, as in Latin *bonus – melior – optimus* 'good – better – best', with distinct root allomorphs in all three grades. Regular adjectives in Latin take a

[16] Relative superlatives are those meaning 'more A than all others', for some adjective A. This term contrasts with what are sometimes called absolute superlatives, with a meaning like 'A to the highest degree' or 'extremely A'. In Italian, for example, the suffix *-issim-o/a* marks absolute superlatives (*bellissima* 'very beautiful'), while relative superlatives are periphrastic (*la più bella* 'the most [lit: more] beautiful). The discussion below refers only to relative superlatives.

[17] For sources and qualifications, as well as additional data, see Bobaljik (2012).

superlative in *-iss-imus*, which includes (a reflex or allomorph of) the comparative, spelling out each of the pieces in (22): *beat-us – beat-ior – beat-iss-imus* 'happy – happier – happiest'). But the reflex of the comparative is missing in the one case where the superlative and root appear to interact: *opt-imus, *opt-issi-imus*. This is as predicted, since the only way for ADJ and SPRL to interact is when CMPR is not a distinct head, either removed via a deletion operation, or combined with the adjectival root into a single locus of insertion (via *fusion*, or *non-terminal spell-out*, see below).[18] Smith et al. (to appear) argue that the general schema laid out in Bobaljik (2012) for adjectival grades is replicated in other morphological domains, notably suppletion in pronouns for case and number, suggesting a wider role for structural locality conditions within words.

In sum, although the details of the theory, and correctness of particular analyses, are a matter of current debate, the study of structural locality conditions, formulated over abstract, word-internal hierarchical structures, prior to, and constraining, vocabulary insertion, provides important support for the general thesis that the morphosyntactic representation is indeed internally (hierarchically) structured.[19]

3. MORPHOLOGICAL OPERATIONS

The preceding sections laid out the two key components of DM, elaborating on the assumptions in (2)-(3). In practice, of course, there are a number of other assumptions beyond (2)-(3) associated with DM. The most important of these is the assumption that there exist morphological operations which may manipulate the representation after syntax, but prior to vocabulary insertion. Two such operations, Morphological Merger and Impoverishment, were mentioned in passing above, and the literature contains proposals for a variety of other operations, which are surveyed in superficial terms here. Although there is substantial debate within DM as to what operations should be recognized, it is worth stressing that it is a leitmotif of DM that there is a fundamental systematicity to morphology—that there is order to be discovered in the apparent chaos of morphological data, and that this order is indicative of the role of universal grammatical constraints, restricting the space of possible mismatches in observed syntactic and morphophonological structure. The wealth of operations put forward within the general umbrella of DM is, from this perspective, somewhat of an embarrassment of riches. With this in mind, work within DM has sought limits to the descriptive power of the various devices, and not all authors recognize all of the operations that are surveyed below.

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[18] See also Radkevich (2010) and Moskal (2015b) for further exploration of this idea, and for evidence that suppletion quite generally affects only nodes that are contiguous with or local to the triggering feature.

[19] Evidence from word-internal locality conditions on morphological operations thus provides a more direct range of evidence for structure in morphology than does affix order, as for example in Baker's (1985) Mirror Principle effects. On the one hand, parallels between syntactic (or semantic) constituency and morphological constituency may be described on theories without internal structure by appeal to a common basis for both sorts of ordering, and hence are not a priori decisive. On the other hand, affix order often does diverge from a direct reflection of syntactically and semantically motivated constituency (see, e.g., Muysken 1981), and structure-based theories must either posit ad hoc complications of the syntax, or acknowledge mechanisms for manipulating affix order post-syntactically. In DM, the syntactic structure is the input to morphology, hence parallelism is the default, with additional operations such as templatic restrictions (Bonet 1991, 1995, Noyer 1998a), metathesis (Arregi and Nevins, 2012), and the like requiring special pleading.

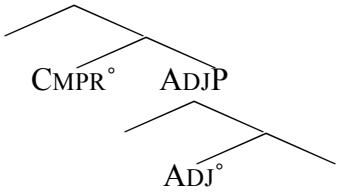
3.1.Regrouping operations

One family of morphological operations alters the constituency after the syntax, but prior to vocabulary insertion. An operation of this sort is Morphological Merger, discussed above. Note that Merger creates a morphological word out of elements that do not, together, form a complex X˚ in the syntax. Morphology may be dependent on syntactic structure, but this does not require that all word formation happens "in the syntax". Cliticization, mentioned above as well, has a similar effect, but rather than combining two heads (X˚ nodes), cliticization typically combines an X˚ element with a linearly adjacent word or phrase, yielding a less tightly phonologically integrated combination. A general question, not specific to DM, is the issue of the demarcation between clitics and affixes, as well as the degree of syntax involved in cliticization. Rebracketing under adjacency (an operation posited in other theories, see Sproat 1985, Williams 2003) is also invoked within DM (see Radkevich 2010) to alter constituency relations, but not linear order, internal to a complex X˚, for example: [[X Y] Z] → [[X] Y Z]. The effects of rebracketing come into play in their interaction with assumptions about locality, and in particular, about possible contexts for portmanteau morphology (see below). For one view of a typology of operations that combine distinct heads, see Embick and Noyer (2001); for a debate of some of the specific analyses presented there, see Hankamer and Mikkelsen (2005) and Katzir (2011).

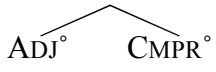
3.2.Fusion and portmanteaus

Merger and the related operations just mentioned rearrange the (terminal) nodes of the syntax, but do not alter their number. Given the syntactic structure (25a), Merger may apply, yielding (25b)—a synthetic expression: *smart-er*—or Merger may fail to apply, yielding a periphrastic expression: *more intelligent*. Either way, the adjectival root and the comparative node each constitute a distinct locus of vocabulary insertion.

(25) a.



b.



There are, however, cases in which two nodes in the syntax appear to correspond to a single overt exponent with no internal morphological segmentation possible. Thus, alongside bi-morphemic *smart-er, bett-er*, we find *worse* as the comparative of *bad*. It is of course possible that *worse* is really *worse-Ø*, with a lexically conditioned Ø comparative exponent alongside the suppletive root (parallel to the analysis of *fly – flew* in (21b)). On the other hand, DM provides for the analysis of portmanteau morphology (Matthews's 1972 *cumulative exponence*) via the operation of *fusion* (Halle and Marantz 1993:116). Fusion combines two sister nodes into a single X˚, with the features of both input nodes, but no internal structure. A fused node reduces the number of terminals, providing for but a single locus of vocabulary insertion.

Embedded within a theory that involves strict locality conditions on morphological operations, the two treatments of *worse*—reciprocally conditioned allomorphy and fusion—make potentially distinct predictions about morpheme-morpheme interactions. This was mentioned above, in connection with the Latin superlative: after fusion, the

adjectival root is local to the superlative morpheme in (22), in a way that it would not be without fusion; treating *worse* without fusion, but with a zero comparative allomorph would not alter locality relations.[20]

3.3.Deletion

Nodes and features may also be deleted by *impoverishment* rules, exemplified in (17) above. Impoverishment rules delete features from a morphosyntactic representation, prior to vocabulary insertion, with the result that impoverishment yields surface neutralization of underlying contrasts, for example, suppressing gender contrasts in the plural or for local (first and second) persons. Noyer (1997) suggests that impoverishment rules may be motivated as repairs, affecting representations that violate markedness conditions (such as (17b)), potentially drawn from a universal markedness hierarchy. Noyer also suggests that feature hierarchies determine the particular repair to a given markedness statement. Thus, if the combination *[FEM, PL] is excluded, it is FEM that will delete, due to the hierarchy NUMBER > GENDER. Others argue that such deterministic approaches are too constrained, and the there is variation, even among closely related languages, that is best seen as alternative patterns of deletion in response to a single, shared markedness constraint. Arregi and Nevins (2012), for example, note that the combination of markers for first and second person arguments in the Basque auxiliary is systematically avoided, but that different dialects of Basque use different strategies in such contexts. The variation may be modelled as differences in what feature or features are deleted as repairs in response to the same markedness condition. Arregi and Nevins argue moreover that deletion operations may target either individual features or an entire node (see also Halle and Marantz 1993). In the former case, the result is the insertion of a less marked exponent, possibly, though not necessarily, phonologically null; in the case of deletion of an entire node (which they term *obliteration*), the result is the failure of any exponent to be inserted.

In the standard formulation, impoverishment rules are deletion rules, and hence the output is a representation that is underspecified for feature values (in (17a), lacking gender). Noyer (1998b), drawing on evidence from Nimboran, contends that this view is too restrictive, and that persistent redundancy rules insert the unmarked value of a feature when impoverishment deletes a marked value. If masculine is the unmarked gender, then deleting feminine yields masculine. Calabrese (2011) extends this further still, claiming that the input to vocabulary insertion is never formally underspecified, and that the only underspecification that should be countenanced is in rules of exponence, such as (5).

Impoverishment is a powerful device, but it has less formal descriptive power than *Rules of Referral* (Zwicky 1985, Stump 1993) which are in essence rules that may change any combination of features into any other combination—an 'anything goes' approach. In other words, impoverishment allows for the characterization of only a proper subset of the syncretic patterns allowed by rules of referral. DM thus typically starts from the more restrictive theoretical position, in which observed typological generalizations are explained within the theory (certain patterns are formally unstatable), where theories such

[20] See Chung (2007, 2009) for additional elaboration of the Fusion operation, and arguments that Fusion rules may be cyclically interleaved with vocabulary insertion. See Radkevich (2010) for proposals to recast Fusion as insertion directly at the higher node in a structure like (25b). Insertion at complex terminals is also proposed in Neeleman and Szendrői (2007) and Caha (2009), among others. The combination of rebracketing and fusion (or rebracketing and non-terminal insertion) is in many respects equivalent to the operation of Spanning proposed in Williams (2003) and more recently in Svenonius (2012) and Merchant (2015).

as Paradigm Function Morphology (Stump 2001) must seek explanations for observed typological patterns outside the morphological system.

As an empirical matter, there are numerous challenges to the claim that syncretism is fundamentally modelable as underspecification or neutralization by impoverishment. See Baerman et al. 2005 for a large survey, including numerous cases which they contend cannot be modelled in this manner. On the other hand, many apparent counter-examples have turned out to be susceptible to alternative analyses (including accidental homophony in the limiting case). Two illustrative cases are considered here.

Person-marking (pronouns, agreement) constitutes a well-defined, closed class, amenable to cross-linguistic comparison. In a large survey, Cysouw (2003 and related work) argues that there are statistical trends (some patterns are significantly more common than others), but that no pattern is impossible. Others have looked at the same domain and found that the empirical domain is best described by a theory that does draw on a universal inventory of features, with neutralization (underspecification) as the primary source of syncretism, but with recognition of a minor role for (synchronically) accidental homophony (see, among others, Bobaljik 2008, Pertsova 2011, Sauerland and Bobaljik 2013, Harbour to appear). To some extent, what matters is being able to distinguish between syncretism as a property of the grammar of a language, and accidental homophony. Syncretism (1PL=3PL) in the German (weak) past tense was considered in (13) above, and an underspecification account was considered. The corresponding person marking in the present tense differs from the past in having an additional instance of identity, here between the affial markers of 3SG and 2PL:

(26) German (weak) Past Tense: *sagen* 'to say'

PERSON	SINGULAR	PLURAL
1st	sag-(e)	sag-en
2nd	sag-st	sag-t
3rd	sag-t	sag-en

Should the theory accommodate this identity of form as an instance of syncretism? It is difficult to see how to model both the 3SG=2PL identity and the 1PL=3PL identity simultaneously using the device of impoverishment. An alternative is to treat the exponents of 3SG and of 2PL as distinct instances of *–t*, with no formal relation between them—homophony, but not syncretism. In this particular case, a range of evidence has accumulated pointing to a qualitative difference here: the identity that is expressible as impoverishment (1PL=3PL) is represented in German speakers' grammars (it is meta-syncretic and participates in identity effects in ellipsis and resolution of disjuncts, for example), while the surface identity that is not representable as ellipsis (3SG=2PL) fails to show these properties and is accidental (see Albright and Fuß 2013 for an overview of approaches to syncretism, including discussion of the German facts).

Peculiarities of Chukchi (ckt, Chukotko-Kamchatkan) inflection provide a different kind of challenge to the claim that impoverishment is the primary driver of syncretism. Simplifying: transitive verbs in Chukchi are typically marked by a prefix agreeing with the (ergative) subject and a suffix agreeing with the (absolutive) object (see (27a-b)). Certain combinations of subject and object (in certain moods) depart from this pattern. An example is given in (27c). Although the clausal morphosyntax (e.g. case-marking) is transitive, the verb shows an intransitive morphological form: the agreement morphology

(both prefix, here null, and suffix) are those for a 3SG intransitive subject, and in addition, the verb bears a prefix that normally marks the *antipassive* (a form of derived intransitive).[21]

(27) a. ɣəm-nan ɣət tə-ɬʔu-ɣət
I-ERG you.SG(ABS) 1SG.SUB-see-2SG.OBJ
'I saw you.'

b. ərɣə-nan ɣəm ne-ɬʔu-ɣəm
they-ERG me(ABS) 3.SUB(TR)-see-1SG.OBJ
'They saw me.'

c. ə-nan ɣəm Ø-**ine**-ɬʔu-ɣʔi
he-ERG I (ABS) 3SG.SUB(INTR)-**AP**-see-3SG.SUB
'He saw me.' (Skorik 1977: 44-45)

In the indicative mood, "spurious" antipassive forms such as (27c) (the name is from Halle and Hale 1997) are obligatory for a subset of inverse contexts, in which the object outranks the subject on the person hierarchy. Spencer (2000) contends that the Chukchi data shows the insufficiency of Impoverishment and requires instead more powerful, arbitrary feature-changing rules. Specifically, it is easy to see how an impoverishment rule, such as (28) (perhaps a repair for a filter banning certain inverse configurations) would yield an apparently intransitive form in the morphology, from an underlying transitive morphosyntactic representation, consistent with DM. But, Spencer argues, it is hard to see how deletion of features would yield the spurious addition of an extra morphological piece, namely, the antipassive.

(28) $$\begin{bmatrix} \text{AGR} \\ \text{Subj}: 3sg \\ \text{Obj}: 1sg \end{bmatrix} \rightarrow \begin{bmatrix} \text{AGR} \\ \text{Subj}: 3sg \end{bmatrix}$$

Bobaljik and Branigan (2006) take up Spencer's challenge, and suggest that the facts are consistent with Impoverishment after all. Keeping in mind that DM is a realizational theory, the appearance of antipassive morphology (whether spurious, or a true antipassive) must be treated as a realization of a particular terminal in a specific morphosyntactic configuration. Bobaljik and Branigan argue that the spurious antipassive (after the application of impoverishment) shares with the true antipassive the property of an underlyingly transitive syntactic configuration (the verb has a logical object) but with only the features of a single argument in the agreement node. Taking this configuration to trigger the occurrence of the *-ine-* vocabulary item, Bobaljik and Branigan demonstrate how deletion of features may be consistent with the appearance of seemingly 'extra' exponents, once properties of the morphosyntax as a whole are taken into consideration.

[21] Despite the surface similarity between the third person transitive subject prefix *ne-* and the antipassive *-ine-*, the two prefixes are clearly distinct: they are different elements in other moods, for example, and occupy different linear positions in the verb relative to other morphology, such as the future prefix *r-*. In some varieties, there is a second, suffixal, antipassive, which is also spuriously used with some subject-object combinations. See the literature cited for further details.

3.4.Epenthesis? Autonomous morphological conditions

Much work in DM stresses parallels across grammatical modules—for example, the role of syntactic locality conditions in explaining morphological patterns, or the interaction of morphology and phonology (for recent monograph-length studies, see Embick 2010, Bobaljik 2011, Arregi and Nevins 2012). Just as deletion operations are common in phonology, another common process is epenthesis—the addition of structure not in the underlying representation in order to meet surface (universal or language-particular) well-formedness conditions. Various studies within DM have argued for epenthesis-like operations in morphology as well: the addition of terminal nodes post-syntactically, prior to vocabulary insertion. Halle and Marantz (1993) suggested that agreement morphemes were to be treated in this way—not present in the syntax, but appended, in the morphology, to designated functional nodes from the syntax, such as T[ENSE] (the modern name for INFL in (6)); Noyer (1997) also makes use of morphological epenthesis, arguing for language particular *autonomous morphological structure* conditions, which must be met. A special case of the addition of nodes at morphological structure, in Noyer's presentation, is feature *fission*, in which a single node in the syntax is split into two nodes in the morphological representation, in some instances leading to apparent cases of extended exponence (multiple expression of a single feature).

One use of morphological epenthesis that has been suggested within DM is for the theme vowels characteristic of many Indo-European languages. These have been a particular focus of inquiry in Slavic and Romance, and recent work has identified analogous elements in Bantu (Monich 2015). For example, Oltra-Massuet and Arregi (2005) argue that stress in the Spanish verbal system can largely be reduced to the fairly simple generalization that stress falls on the vowel most closely preceding the T° node, once certain assumptions about the internal morphosyntactic structure of the verb are recognized. Their analysis includes theme vowels (possibly null), added in the morphology to every syntactic functional head; in the simple case of the infinitive, the theme vowels (TV) are those indicative of conjugation class, as illustrated in (29):

(29)	a.	cant-a-r	sing-TV-INF	'to sing'
	b.	tem-e-r	fear-TV-INF	'to fear'
	c.	part-i-r	leave-TV-INF	'to leave'

In analyzing the conjugation of Spanish (and related languages) the theme vowels are treated as elements distinct from both the root (which governs their selection) and the more peripheral morphemes with which they combine (such as infinitive *-r*). In more complex forms, involving additional internal syntactic complexity, there will be multiple theme vowels, one per syntactic head. The present imperfective indicative has the (partial) morpho-syntactic structure (30a), to which theme vowels and an agreement node are epenthesized (30b), yielding the form (30c) after vocabulary insertion and stress assignment:

(30)	a.	[[√SING	*v*]$_v$	T]$_T$			
	b.	[[√SING	*v*-TV]$_v$	T-TV]$_T$	-AGR		
	c.	cant-	Ø	á	b	a	-mos

The conditional, they argue (on semantic and cross-linguistic grounds) is even more complex morphosyntactically, essentially composed of a (modal-like) future and a (past) Tense node (31a), with accordingly three theme vowels (31b-c):

(31) a. [[[√SING *v*]$_v$ F]$_F$ T]$_T$
b. [[[√SING *v*-TV]$_v$ F-TV]$_F$ T-TV]$_T$ -AGR
c. cant- Ø a r í Ø a -mos

There is no evidence for a Theme Vowel head or Theme vowel phrase (let alone three of them in the conditional) in the syntax, yet they are evidently present in the surface morphological form. The presence and distribution of theme vowels thus appears to be a purely morphological requirement of these languages, and is a clear candidate for the kind of operation of morphological epenthesis discussed here.

Note that like Halle and Marantz (1993), Oltra-Massuet and Arregi (2005) suggest that Agreement nodes are also epenthesized in the morphology, and do not constitute heads in the syntax, with language-particular conditions playing a role in their distribution.[22] For example, the conditional in (31) has a series of clausal functional nodes (here F and T), but only the higher of these is associated with an agreement node in the morphology. The morphologically complex future and conditional structures such as (31) show parallels with compound tenses, such as the compound future of French—see the alternation in (32), with the *-r-* of the conditional possibly the same vocabulary item as the *-r* of the infinitive, and in both cases, only a single agreement node.

(32) a. je chant-er-ai.
1SG sing-R-1SG ‘I will sing’

b. je v-ais chant-er.
1SG go-1SG sing-INF ‘I will sing’

In other languages, compound tense constructions involve agreement on multiple verbal heads. Ibibio (ibb, Niger Congo) shows multiple agreement both in compound tenses (33a) and where the tense/aspect morphology is part of the morphological word with the verb (33b-c), examples from Baker and Willie (2010:100-101, 109):

(33) a. N-sʌk n-yem ebot odo.
1SGS-AUX 1SGS-seek goat the
‘I am looking for the goat.’

b. ŊŋinI i-k-i-yem Emem.
1PL 1PLS-PAST2-1PLS-seek Emem
‘We were looking for Emem.’

c. utom se ŋŋin i-ma[a]-i-k[e]-i-nam.
work that 1PL 1PLS-PAST1-1PLS-PERF-1PLS-do
‘work that we had already done’

These examples, like others discussed above (see (6), (25)), reinforce the parallels between syntactic (analytic) and morphological (synthetic) structure that DM calls to the fore. Here, we note that agreement may (as in Ibibio) but need not (as in Romance) be attached to multiple functional heads. It is orthogonal to the characterization of

[22] This is not a core assumption of DM—the overall DM architecture does not depend on agreement nodes being added in the morphology, and is also compatible with agreement nodes (or features) being present in the syntactic representation.

agreement whether these functional heads are part of the same morpho-phonological word as the verb root.[23]

In sum, the DM toolkit contains a range of operations that describe failures of a one:one correspondence—between the syntactic output representation and the phonological representation. Analyzing such mismatches is the meat-and-potatoes of DM morphological analysis, although there are debates within DM about the proper formulation of many of these operations. Standing above the individual debates is the question of how much of this powerful machinery is actually needed, and which operations may be reduced to which others, without loss of empirical coverage, with the goal on the horizon being, of course, a theory of possible morphosyntactic mismatches.

4. MORPHOLOGY, SYNTAX, AND THE DIVISION OF LABOUR

DM focuses attention on the nature of the relationship between syntax and morpho-phonology. As such, numerous questions of the division of labour between the various components come under scrutiny in this approach, including questions that go beyond the study of word internal form (the traditional purview of Morphology). Obviously, the questions to be asked will differ depending on the theory of syntax that is assumed. In practice, much of DM assumes a GB/Minimalist syntax, and issues of the following sort are thus considered within the sphere of DM:

4.1.Spell-Out Domains

In most versions of DM, the mapping from syntax to morphology is conceived of in derivational terms, with a significant role for cycles. In practice, cyclicity is manifest in two ways. One understanding of cyclicity is the idea that vocabulary insertion (exponence) proceeds within a complex X˚ from the root (or most deeply embedded X˚ node) outwards. Bobaljik (2000) argues that this assumption makes predictions about how information at one node may be accessed in the course of operations applying at other nodes. In essence: if vocabulary insertion is a process that converts morphosyntactic representations into morphophonological representations node-by-node, then at any given point in the derivation, nodes that have already undergone exponence will have only morphophonological information while nodes that have yet to undergo exponence will lack such information, containing only morphosyntactic information. In this way, cyclicity enforces conditions on possible rule contexts: rules operating at a given node may be sensitive outwards only to morphosyntactic information and inwards only to morphophonological information, all else being equal. Bobaljik (2000) provides empirical evidence from the Chukotko-Kamchatkan languages that support this perspective.

[23] Harris (2009), analyzing a particularly rich array of examples like (33b-c) from Batsbi (bbl, Nakh-Dagestanian), claims that such "exuberant exponence" of agreement is claimed "not to exist" (p.268-272) in DM and is deeply problematic for the framework. This appears to rest on a misreading of the assertion in Halle and Marantz (1993:138) that (in the general case) each "syntactic or morphological node" receives a single exponent. In the cases at hand, we are dealing with multiple agreement nodes in the morphosyntactic representation (whether added via epenthesis, or underlyingly present), each of which receives a single exponent, just as in (33a); compare Halle and Marantz's (1993:145) analysis of Potawotami (pot, Algonquian), which Harris is reacting to, in which the features of a single argument are indeed shared among multiple agreement nodes, added post-syntactically.

The other notion of cycle is as designated domain, reminiscent of phases in current syntactic theories. The approaches to locality mentioned in section 2 largely incorporate cycles in this latter sense: on this understanding, it is not the case that each node constitutes a cycle (i.e., of rule application). Instead, certain nodes are specified as defining privileged domains that encapsulate information in a way that material in one domain has only limited effects on material in another domain (cf. D'alessandro and Scheer, to appear).

Moskal (2015a,b) provides a straightforward illustration of this type of reasoning. A prominent idea within the DM literature (see section 5, and especially Harley 2014) is that open-class lexical items (nouns, verbs) consist of at least a root and a category-defining functional morpheme. Thus the noun *dog* is at least bi-morphemic, with the structure: [[√DOG] *n*], where *n* is a nominalizing morpheme that establishes the category of the word. A common hypothesis is that such category-defining nodes establish locality domains (see especially Embick 2010). This assumption in large part derives the effect that inflectional allomorphy does not survive category-change (see (21), above). Now, Moskal suggests that the closed class, functional vocabulary lacks the root+category structure that characterizes the open-class vocabulary. An immediate consequence is that domain-sensitive locality restrictions should then play out differently between, say, pronouns and nouns, or between auxiliaries and main verbs. And this is exactly what Moskal finds. In a large survey of suppletion, she finds a striking asymmetry between pronouns, which commonly supplete for case, and nouns, which strikingly fail to do so. Her explanation is that the *n* node in nouns establishes a word-internal domain boundary, and that root allomorphy can therefore not be conditioned by information (such as case) that is too far outside this domain. Since pronouns lack the √ROOT+*n* structure, they have no such domain and thus no such restriction.

The idea of privileged nodes defining cyclic domains thus seems to have currency in syntax (phases), morphology, and phonology. A currently active research question is the inter-relatedness among the domains in the various components. Clearly the cleanest hypothesis would be that the same domains are (potentially) relevant in all three grammatical components—in that sense we would only need to provide one answer to the question of why certain nodes, and not others, establish domains. An intriguing line of research, illustrated by Newell and Piggott (2014), has returned to phonological alternations at morpheme juncture, looking for evidence for the alignment of morphosyntactic and phonological domains within the complex word. For example, they find that hiatus avoidance (a pressure to avoid heteromorphemic VV sequences) may be resolved differently depending on whether the two morphemes are within a single syntactic phase, or span a phase boundary. Other researchers have found a less perfect mapping among domains in the various components – for a recent survey and proposal for a weaker connection between syntactic and phonological domains, see D'Alessandro and Scheer (in press).

4.2.Linearization and copies

Since DM trades in operations that manipulate the syntactic representation as part of the mapping to phonological form (see above), DM's morphological operations have the potential to interact with other operations that are held to be a part of Spell Out in the GB/Minimalist architecture. For example, one prominent line of thought holds that the syntactic representation properly represents only hierarchical, i.e., constituent, structures, with precedence relations among the constituents not a part of this "narrow" syntax (see, e.g., Marantz 1983). On such approaches, post-syntactic algorithms determine linear ordering relations among the syntactic nodes. See Kayne (1994) and Fox and Pesetsky (2005) for two influential proposals. Relatedly, one view of syntactic "movement" is that

a single syntactic element may be represented in more than one location in the syntactic structure, either via "copies" in a chain (Chomsky 1995 et seq) or via Multidominance representations (e.g., Gärtner 1999, among others). In the typical case, an element that is so represented is nevertheless pronounced only a single time in a given domain, but the determination of which copy to pronounce (or which position to pronounce the element in) may be made post-syntactically (see, e.g., Nunes 2004). In Bobaljik (2002a), I gave arguments that linearization at the phrase level (syntactic headedness), the pronunciation/copy-choice algorithms, and Morphological Merger, do indeed interact in non-trivial ways, providing an account of Holmberg's Generalization effects in Germanic Object Shift that relates an apparent syntactic condition on word order alternations to the morphological conditions on the post-syntactic creation of complex words (inflected verbs) that are also at work in the analytic/periphrastic alternation of English *do*-support contexts discussed above.

Other work investigating the interaction of DM's morphological operations with the post-spell out operations posited elsewhere in the literature includes Embick and Noyer (2001), Embick (2010), and Arregi and Nevins (2012). With reference to the Latin cliticization example mentioned in (8), Embick and Noyer (2001) focus on the idea that grouping operations like Merger may apply before or after linearization, but with a different range of effects. Cliticization examples, like Latin *=que* must apply after Linearization, since their effects depend on knowing what the "first word" in a particular domain is, whereas purely structural regroupings may apply before Linearization. These operations in turn may interact with cyclic spell-out (see fn. 4).

Relatedly, within the realm of Linearization of syntactic structure, Noyer (1997) argues that linear order among terminal nodes need not be exhaustively determined even at the point of vocabulary insertion, and that vocabulary items may carry idiosyncratic specifications as either prefixes or suffixes. That is, a single node in the morphosyntactic representation of a single language may be sometimes realized as a prefix and sometimes realized as a suffix, as a function of that element's feature content. Noyer applies this to cases of apparent discontinuous bleeding—competition effects between prefixes and suffixes in the Afroasiatic conjugation. Thus, in Tamazight (Berber), the first person plural is marked by a prefix *n-*, but the first person singular is marked by a suffix *-ɣ*, which Noyer takes to be competing exponents of a single agreement affix.[24]

4.3.Case and Agreement

Another facet of the spelling out of syntactic structure covered under the broad umbrella of the DM literature is the signalling of syntactic relations, such as in the morphological categories of case and agreement. It is well established that the distribution of case and agreement is in part a function of syntactic configuration. Under the DM architecture in (1), there are at least two ways in which morphology (the surface forms of words) may be influenced by syntactic context. On the one hand, the features that are expressed as case, agreement etc. may be distributed (e.g., assigned/checked) in the syntax itself, subject to realization in the morphology. For example, the syntax may be responsible for assigning an [ACCUSATIVE] feature to a direct object, which then may or may not receive a language-particular realization. A syntactic Case Theory of this sort dominated much of GB and (early) Minimalist theorizing for two decades, starting with Chomsky (1981). On the other hand, since Morphology governs the relation between syntactic and phonological representations, the DM architecture allows for the possibility that an operation may be sensitive to syntactic structure, perhaps even defined over such a

[24] See Banksira (2000) for an analysis of Chaha and for some discussion of competing proposals.

structure (c-command, government—AGREE in Minimalist terms), yet that operation may not be a part of the syntax per se, but rather a part of the algorithms that map the output of the syntax onto a phonological representation. A useful analogy is perhaps to rules of phrasal phonology or sandhi phenomena, which are phonological in nature, but defined with reference to syntactic structure.

Marantz (1991) exploits this aspect of the architecture in (1), arguing that case and agreement—the morphological categories we have evidence of—should be seen in these terms as well. Marantz's emphasis is on the failure of the morphological case categories (nominative, accusative, etc.) to align with the categories of a GB/Minimalist-style Case Theory. A striking example of such a misalignment is drawn from the seminal work of Zaenen, Maling and Thráinsson (1985) on "quirky" case Icelandic. Icelandic nominals show all of the hallmark distributional properties and alternations that are accounted for by Case Theory in Chomsky (1981), including the "Exceptional Case Marking" configuration (where the subject of a non-finite clause, otherwise obligatorily unpronounced, may be an overt nominal when the infinitive is the complement of a verb like *believe*). Yet, in Icelandic, the distribution attributed to Case Theory can only be appreciated by abstracting away from the actual case borne by the nominals. GB's abstract nominative (essentially, finite subject) can be realized as any of the four morphological cases in Icelandic (nominative, accusative, dative or genitive), while conversely, the distribution of morphologically nominative nominals (or those with any other case) required them to be analysed as abstractly nominative in some contexts, but abstract accusatives in others. Pushing further, Marantz argues that when the morphological distribution of case (and agreement; see also Bobaljik 2008) is factored out of the syntax, little is left of the Case Theory of GB as a syntactic theory of argument licensing, and thus, that recognizing the distinct roles of syntax—in argument licensing, and morphology—in the surface realization of syntactic representations, allows for a simplification of (aspects of) both components of grammar.[25] In a related vein, Bhatt and Walkow (2013) exploit the possibility that agreement may be part of the post-syntactic component to make sense of asymmetries in sensitivity to linear order in conjunct agreement in Hindi.

As illustrated in the preceding paragraphs, the scope of the DM literature encompasses not only topics that sit comfortably within the common understanding of Morphology (inflection, derivation, syncretism, exponence). In light of DM's primary nature as a theory (or family of theories) of the overall architecture of grammar, proposals within DM do not only have effects within morphology proper, but potentially interact with the syntax and the phonology. As regards syntax in particular, DM's architecture opens questions about the division of labour among the components, leaving much of Morphosyntax up for grabs.

5. ROOTS AND THE ENCYCLOPAEDIA

Before closing, there is one further question of the division of labour among components deserving of special mention in light of the significant attention it has received in the (broadly) DM-related literature. This is the scope of lexical decomposition in the syntax, and associated questions about the representation of argument structure and of *roots*—the most deeply embedded morphemes in the open class, content vocabulary such as nouns and verbs. It is impossible in the space remaining to do any sort of justice to this large

[25] For arguments regarding aspects of case licensing that appear to be syntactic, see Wurmbrand (2006) and Legate (2008), and on agreement, Béjar (2003) and Baker (2010).

topic, but the following remarks will, I hope, serve to illustrate why this topic is of particular interest within DM.

Word-formation in DM is (primarily) syntactic, and syntax is subject to compositional interpretation. If one structure properly embeds another, then (all else being equal) the larger structure should inherit (syntactic, semantic, and morphological) properties of the embedded structure. For example, if the causative member of a causative-inchoative alternation (as in (34)) embeds (the relevant portion of) the corresponding inchoative, then properties such as the entailment relation holding from (34a) to (34b) are part of the model.

(34) a. The farmer grew tomatoes. $[_{vP}$ NP v $[_{VP}$ V NP $]$ $]$
b. Tomatoes grew. $[_{VP}$ V NP $]$

Nominalizations have been widely discussed from this perspective in the DM literature, returning to themes originally raised in Chomsky (1970) (see Marantz 1997, Harley and Noyer 2000, Harley 2009). The basic question is why some nominalizations (in particular, some *-ing* gerunds, such as (35a)) appear to inherit verbal properties (allowing accusative complements and adverbial modification), while others (such as (35b)) lack any discernable verbal syntax. In DM, the fact that *marri-age* contains *marry* is a syntactic fact, hence the question of why *marry*'s syntactic (e.g., verbal) properties are not inherited wherever it appears.

(35) a. [Kate('s) quickly marrying William] was prompted by …
b. [Kate's quick marriage to William] was prompted by …

Chomsky (1970) argued essentially that differences of this sort were structural (see section 2, above; see Marantz 1997 for a discussion of this reading of Chomsky 1970). While gerundive constructions are derived from the verb (and thus contain verbal morphosyntax), "nominalizations" such as (35b) are derived directly, on Chomsky's proposal, from a root, such as √MARRY, which is neutral as to syntactic category, but which is associated with lexical meaning, including argument structure. Pesetsky (1995) and especially Marantz (1997) update Chomsky's proposal, introducing the notation of category-neutral root √ROOT, along with category-defining heads (terminal nodes) in the syntax. The verb *marry* is thus [[√MARRY] *v*], while *marriage* is the spell-out of [[√MARRY] *n*]. At the limit, as mentioned above, even the simplest of words (from the lexical classes) have an internal syntactic structure: *dog* is structurally [[√DOG] *n*], where *n* is a syntactic terminal that established the category feature: Noun.

A key argument for this view, presented in Chomsky (1970) and drawn out in Pesetsky (1995) and Marantz (1997) runs on two premises. First, the morphologically irregular nominalizations are limited to root nominalizations (section 2 discusses this from the perspective of structural locality conditions on allomorphy). Second, lexical decomposition is syntactic, and the causative member of the causative-inchoative alternation involves a phonologically null CAUS head (*v* in (34a)) in the syntax. Together, these assumptions entail that only the inchoative member of a pair such as (34) can be subject to a root nominalization. Famously, *The farmer's growth of tomatoes* therefore lacks a reading corresponding to a nominalization of (34a). The irregular nominalising affix *-th* can only be conditioned by the root when the root and affix are syntactically local to one another; this in turn is possible only if the nominalizing affix selects the structure in (34b), but is not possible when the nominalizer is separated from the root by the head that introduces the external argument, as in (34b), which head is nevertheless

needed for the relevant interpretation. The only nominalization of (34a) that is possible is a gerund: *the farmer('s) growing tomatoes…*[26]

A question often asked in the context of the proposal for category-neutral roots is why we cannot simply freely use any root in any context, for example, why the root *arrive* unlike *grow* or *melt*, fails to participate in the causative-inchoative alternation in (34), or why there is, at least to a first approximation, no verb *to cat*. A closely related question is why root-derivations often have apparently idiosyncratic (restrictions on) meaning: *transmission* in the automotive sense, seems only tenuously connected to the meanings of the root √TRANSMIT evidenced in that root's verbal occurrence: *(to) transmit*.

One aspect of this question has been addressed in part already, and is independent of the particular formalisms of DM. Since the causative-inchoative alternation involves a syntactic decomposition with a (possibly null) head *v*-*CAUS*, then some restrictions on the distribution of roots in this frame may be attributable to the selectional (i.e., combinatorial) restrictions borne by this (abstract) syntactic head (whether these restrictions are syntactic or semantic in nature). If there are fine-grained differences among types of V (and thus types of root), that are syntactically represented (for example distinguishing internally-caused change of state from others, see Levin and Rappaport-Hovav 1995), then the failure of *arrive* to be used transitively (**The courier arrived the letter*) is a combination of the syntactic fact that *v*-*CAUS* only occurs with certain sub-categories of V, and the root *arrive* is not of the right (sub)-category to combine with *v*-*CAUS* (or more accurately, if roots, like other morphemes, are subject to Late-insertion, then the exponent *arrive* does not spell out the type of V that combines with *v*-*CAUS*).[27]

Other aspects of this question may turn on the nature of conventionalized aspects of meaning. There is likely no grammatical (syntactic, semantic) explanation for the absence of a verb *to cat* in English (compare: *to ape, to dog*). DM would predict it to be possible in principle, but it is apparently absent (at least for many speakers).[28] DM treats knowledge about the lexicon, and knowledge of actual use, in a grammatical repository—the *Encyclopaedia*—separate from the vocabulary and the list of syntactic atoms. The Encyclopaedia includes knowledge of idioms, arguably represented as knowledge of individual roots in context. In the Encyclopaedia, one could posit that √KICK takes on the special meaning 'die' in the context of √BUCKET (which in turn, is devoid of meaning in the context of √KICK). From this perspective, as Marantz (1995) argued, all (content) words are in effect phrasal idioms, but with idiosyncratic definitions restricted to a syntactically defined context: the first (syntactic) phase in which the root occurs (cf. Ramchand 2008). But just as roots do not have special idiosyncratic meanings in all lexical contexts (the root √PUNCH takes on no special meaning in the context of √BUCKET), so too may individual roots fail to lack a specified meaning in a particular grammatical context: the root √CAT happens to find a conventional definition in the

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[26] Subsequent work in this vein has argued that the simple distinction between root nominalizations and larger structures is too blunt (see Harley 2009, responding to challenges from Borer 2003, for example), but the general tack of the DM revival of Chomsky (1970) remains. Refinements lie in the amount of syntactic structure posited within words, and in the understanding of the locality conditions on the interpretation of such structure: in particular, restrictions on the domain of idiosyncratic meaning and irregular pronunciation. For a sceptical evaluation of the argument from *growth*, see Müller and Wechsler (2014).

[27] See Kramer (2015), among others, for related questions about associating roots with gender-bearing *n* heads in the nominal domain.

[28] Indeed, meanings for a verb *to cat* are listed in the *OED*. For relevant discussion of category-neutral roots from a psycholinguistic perspective, see Barner and Bale (2002, 2005).

context [[__] *n*] but lacks a conventionalized meaning in the context [[__] *v*]. Grammatically, [[√CAT] *v*] is well-formed, but speakers of English must use cues from context to interpret the nonce coinage.

6. SUMMARY

In sum, DM at its core comprises a framework of assumptions for thinking about the grammar as a whole and the interaction of its parts. The Morphology part of the name stresses an emphasis on facts traditionally seem as the purview of morphology—the shape of words. The Distributed part of DM highlights the contention that the grammatical knowledge of (pieces of) words is not monolithic, but enters the grammatical computation at various points in various ways. The traditionally conceived Lexicon is replaced by three lists:

(36) i. a list of the abstract morphemes that are the building blocks of syntax,
ii. a list of vocabulary items that spell out (morpho)-syntactic structures, and
iii. a list of the idiosyncratic meanings of individual pieces in particular contexts.

Key to the theory are the assumptions that syntax is the primary engine of composition—i.e., that word-formation is part of the syntax—and that morphology is realizational, specifically post-syntactic. Beyond these broad assumptions, the overall architecture of the theory opens various possibilities for the analysis of particular arrays of data. The success or failure of the theory as a whole requires embedding the specific analyses within a larger theoretical framework encompassing assumptions about the workings of other components of the grammar.

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