III THEORETICAL DEVELOPMENTS AT THE MORPHOSYNTAX-PHONOLOGY INTERFACE

10 ON THE TARGETS OF PHONOLOGICAL REALIZATION

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10.1 Introduction

In this chapter I synthesize and develop arguments in favor of the thesis that basic connections between sound and meaning are established at the morpheme. In terms of a theory that adds phonology to (at least some) morphemes after they have been composed into complex structures, this means that only morphemes are the targets of phonological realization. Throughout the chapter, I compare the predictions of (i) theories allowing insertion only at morphemes, versus (ii) theories that allow syntactic non-terminals to be realized as well. The argument is that the conditions of locality under which key interactions occur are those that are expected under theories of type (i) and not type (ii).

The question of what objects are realized phonologically interacts with several important questions of broader scope. Perhaps the most basic large question at issue concerns the types of representations that are responsible for generalizations about the phonological form of language (understood in the broadest possible sense). There are two types of answer to this question. The first type is that generalizations about some aspect of phonological form are statable in terms of representations that are isomorphic to the syntactic representation with which that phonological form is associated. The second type of answer is that the phonological representation is not isomorphic to the associated syntactic structure. This basic question has a long history in some domains (e.g. prosodic phonology). For example, Chomsky & Halle

Thanks to the participants at the MSPI Workshop at Stanford and at the F-MART reading group at Penn for helpful discussion; and thanks in particular to Vera Gribanova and Stephanie Shih for organizing the MSPI workshop. The author's research is supported by the Eunice Kennedy Shriver National Institute of Child Health & Human Development of the National Institutes of Health under Award Number R01HD073258.

(1968) argues that output of the syntax is not always identical to the input to the phonology, and that that there must be a theory that accounts for the departures from isomorphism that are found. In contemporary work, the theory in question is what could be called the theory of Phonological Form (PF). In much current practice, this theory subsumes a large part of what is addressed in syntactically oriented theories of morphology.

For any particular aspect of phonological form, it is an empirical question what kinds of representations (and locality conditions, ect.) are at play. The tension between morpheme only and non-terminal theories of insertion can be understood in this light. Each type of theory looks like it could be extended to two core areas in the interface between structure and form: affixation phenomena (including, in particular, the alternation between one-word and two-word expressions); and the theory of "non-affixal" morphophonological alternations like *sing*/*sang*. The empirical question that is addressed in the core of the chapter (sections 10.3 and 10.4) is whether these phenomena behave as expected if syntactic constituency alone is what explains the important generalizations in these domains. The argument is that they do not behave in that way, and that other relations beyond constituency (some hierarchical, some linear) define the important interactions. In its simplest form, this is an argument in favor of the thesis that phonological realization targets only morphemes.

A more complicated remaining question concerns whether the morphemes that are targeted for realization can be derived by combining linearly adjacent morphemes together prior to insertion. Some thoughts on this matter, concentrating on predictions that connect with locality in related phenomena, are presented at the end of the chapter.

10.2 Questions, theories, and predictions

The question of what objects are realized phonologically is one of several questions that, for practical purposes rather than logical necessity, are often addressed together in current theoretical work. To be clear about this, the question (Q1) of phonological realization is framed with reference to three others, (Q2) through (Q4), that define a range of options when combined:

(Q1) *What are the possible targets of phonological realization?* Only morphemes; some non-terminal nodes as well (e.g. Poser 1992); all syntactic non-terminal nodes (see the following).

(Q2) *The objects in memory that are used to build complex forms:* For example, morphemes (many versions of the Minimalist Program, including the version of Distributed Morphology adopted here); trees (as in Tree Adjoining Grammar, Joshi et al. 1975); and so forth.

(Q3) *The nature of the morpheme:* For example, morphemes as unstructured bundles of features; morphemes with organized feature structures; "minimal" morphemes (e.g. only one feature); and so forth.

(Q4) *The principle(s) determining the winner of competitions for grammaticality:* For example, specificity (Halle's (1997) "Subset" formulation); other types of ordering (e.g. extrinsic); feature hierarchies; competition in tableaux; "economy" conditions (e.g. words are better than phrases); and so forth.

The version of Distributed Morphology that is developed in work like Embick & Marantz (2008) has insertion only at morphemes (Q1), only morphemes in memory (Q2), and morphemes that may consist of more than one feature (Q3), and (at a minimum) specificity as a means of resolving competition (Q4). Because (Q1) through (Q4) are independent, it is possible to explore other combinations of answers. I emphasize this point about independence because there are familiar combinations of answers to (Q1) through (Q4), and these comprise different theoretical frameworks that are often compared with one another. But the fact that certain positions often co-occur (even if it is for very good reasons) does not prevent us from isolating a single Q's on its own, in order to examine it in a way that abstracts away from answers to the others. It is my goal here to achieve this kind of abstraction with respect to two possible answers to (Q1).

10.2.1 Two types of theory

With the focus on (Q1) in mind, the two positions that are examined following are as follows:

Morpheme Insertion Only (MIO): The Vocabulary Insertion (VI) operation applies only to morphemes; it cannot target non-terminal nodes.

Insertion at Non-Terminals (INT): (Redefined) VI can assign phonological representations to non-terminal nodes in addition to terminal nodes.

A prima facie advantage to adopting insertion at non-terminals is that it might provide a way of eliminating other operations from the grammar. There are two main empirical domains where there is potential for reduction. One is in the analysis of ***analytic/synthetic alternations (A/S)***: alternations between "one word" (synthetic) and "two word" (analytic) expressions of the same meaning (e.g. English comparatives: *smar-ter*, *more intelligent*; French *de* "of" and *le* "the" surfacing together as *du*). If A/S alternations could be handled with VI at non-terminals, then (at least some applications of) affixation operations could be eliminated from the grammar. A second area is in the analysis of ***morphophonological alternations (MP)***, such as the one seen in English *sing*/*sang*. If *sang* realizes a non-terminal node that dominates $\sqrt{\text{SING}}$ and T[+past],

it would be possible to eliminate morphophonological rules from the grammar, and perhaps a significant piece of the theory of allomorphy could be reduced to effects of VI.

Employing non-terminal insertion implicates a general strategy that is well-founded: reducing as much of "morphology" as possible to independently motivated operations and representations.[1] In the case at hand, it can be assumed that there is independent motivation for (i) Vocabulary Insertion, and (ii) the syntactic structure. That is, to the extent that one adopts the idea that morphology is realizational, then something like Vocabulary Insertion is required. Similarly, syntactically motivated representations of constituency are also indispensable to the theories under comparison. Regarding the latter, it is crucial for this discussion that INT make use of precisely the constituent structure that is motivated syntactically. To the extent that a syntactic structure is altered (e.g., rebracketed) prior to applying INT, the resulting locality predictions become closer to (and perhaps indistinguishable from) those of MIO. Put another way, a theory of non-terminal insertion that allows rebracketing or other manipulations of syntactic structure prior to insertion is not a theory of insertion at *syntactic* non-terminals (for some related comments see section 10.5). For this reason, attention must be restricted on the claim that it is the **unmodified** syntactic structure that provides the non-terminals that are subject to insertion in INT.

In considering the arguments for and against INT, it is important to keep in mind that both conceptual and empirical considerations are at play. Because it appears to allow for a grammar with fewer mechanisms, INT might have a conceptual advantage over MIO—at least, to the extent that this kind of accounting is taken at face value as a valid assessment of parsimony. Ultimately, both MIO and INT have to be associated with different auxiliary theories, and these additional considerations might very well have extreme consequences for the type of simplicity-assessment by mechanism-counting just mentioned. In any case, conceptual arguments about which of INT and MIO has more or less machinery provide guidelines for research, but are not decisive, and must play a secondary to questions about where the two theories differ empirically. The argument to be developed here is that MIO is superior to INT on empirical grounds, in a way that trumps (potential) conceptual concerns.

10.2.2 Predictions of MIO and INT

MIO and INT make different predictions about the conditions under which A/S and MP alternations take place.

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1. In this general vein, see Trommer (1997) for a (morpheme-targeting) attempt to reduce as much as possible to VI.

For A/S, MIO theories employ mechanisms that *affix* morphemes to each other; for our purposes, affixation can be understood as the creation of a complex head. Particular MIO theories differ in terms of the mechanism(s) they posit for affixation. Many recent theories employ both hierarchically and linearly-defined operations. For example, Embick & Noyer (2001) employs hierarchically defined head movement (following many earlier approaches), as well as a *Lowering* operation defined hierarchically. For linearly-defined affixation under adjacency, that approach posits an operation called *Local Dislocation*, which is defined in terms of immediate linear adjacency (cf. "Morphological Merger" from Marantz 1988). Generally speaking, an MIO theory says that a synthetic form can be found when the constituent morphemes are local and when there is a rule that combines them into a complex head.

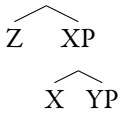
For MP, many MIO theories employ multiple mechanisms. In principle, MP alternations could be treated as either instances of (suppletive) contextual allomorphy, with VI; or they could be analyzed with morphophonological rules (phonological rules with a morphologically defined trigger or target; also known as "Readjustment Rules"). As in the case of affixation, it has been hypothesized that that linear adjacency is relevant to both contextual allomorphy and morphophonological rules. For example, contextual allomorphy is hypothesized to apply only under concatenation (Embick 2010a, and references cited there). Concatenation of morphemes is also implicated in certain morphophonological alternations, whereas for others, locality appears to be defined in terms of phonological representations; see Embick (2010b, 2012, 2013, 2014, forthcoming) for discussion.

Whereas the hypotheses about locality of interactions in MIO outlined immediately in the preceding are from my own work, a number of alternatives could be explored under the broad outlines defined by the assumption that only morphemes are realized phonologically. As long as these approaches have operations that relate morphemes in ways that involve hierarchical or linear representations that go beyond syntactic constituency, the predictions of MIO alternatives will differ from those of INT in crucial ways.

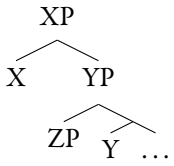
The intuition behind INT is that both A/S and MP will operate in ways that involve the features that appear on a syntactic non-terminal node, one that dominates the interacting morphemes; thus, constituency alone determines the conditions under which alternations apply. To see how this works in outline, a few assumptions are required. The first is that features percolate from terminals (i.e. morphemes) to non-terminal nodes; morphemes can interact by virtue of their features being co-present on a non-terminal node. Then, for insertion, the idea is that VI can realize features from different morphemes X and Y at a non-terminal node only when that non-terminal does not contain features from other morphemes. So, for example, X and Y in (1) could be realized "close" (= A/S: as a single word; MP: with special morphophonology),

because they are dominated by a node XP that does not dominate other material. This non-terminal node is where the "close" form is inserted by VI. Crucially, INT predicts that X and Y should not be realized in a "close" way in, for example, (2), because there is no non-terminal that could be the target for a joint realization of X/Y, because of ZP.

(1) "close" X/Y possible



(2) "close" X/Y not possible



The impossibility of "close" X/Y is predicted by INT whether ZP is linearized on the right or on the left because linearization is irrelevant to constituency. This central aspect of INT—which is crucial for comparing it with MIO—is treated in detail as the CONTAINMENT PREDICTION in sections 10.3 and 10.4 later.

10.2.3 The scope of the argument

A few words are in order concerning the scope of the argument that is developed in the following sections. The comparisons following take INT by itself—that is, in its strongest form – and ask whether important empirical phenomena behave as expected if only syntactic constituency were at play. I do not consider "hybrid" approaches, in which insertion at non-terminal nodes is coupled with different linear or other locality conditions for A/S and MP. The rationale for this is that INT is interesting to the extent that it explains some at least some of the phenomena of interest, for the reasons outlined in section 10.1: namely, if important generalizations about syntax and sound operate in terms of syntactic constituency alone, this would be an important discovery about sound/structure relations, and there would be less need for PF operations and representations of different types.

As will be seen in the following, although there are some phenomena for which MIO and INT are both capable of producing the correct results, the key interactions where the theories make different predictions always appear to go against INT and in favor of MIO. If this turns out to be true across the board, then there is no reason to consider even a weakened (=mixed with linear relations etc.) version of INT. Put slightly differently, it is always possible to assume that INT is correct, and then restrict it in various ways so that it simulates the effects of MIO and its auxiliary theories; but this would miss the point.

10.3 A/S: Word and phrases

The alternation between analytic and synthetic expressions of the same meaning is of theoretical interest because it points directly to the question of how syntax and morphology relate to one another. A number of alternations of this type have been identified in the literature. Some of these are shown in (3).

(3) a. ***English Tense/verb:*** *John play-ed the game*, **John did play the game* vs. *John did not play the game*. **John not play-ed the game* etc.

b. ***English comparative/superlative:*** *smart*, *smart-er*, **more smart* vs. *intelligent*, **intelligent-er*, *more intelligent*.

c. ***Danish definite:*** *hest-en* "the horse", **den hest* vs. **gamle hest-en* "the old horse", *den gamle hest*.

d. ***French preposition/determiner:*** *de la mère* "of the mother" vs. *du chat* "of the cat", **de le chat*; etc.

A/S alternations like those in (3) are important test cases for the question of phonological realization. For each alternation of this type, it must be asked whether the conditions under which synthetic forms are found are those expected under MIO (i.e. when head-to-head or linear locality could result in affixation); or whether such forms are found in contexts in which feature percolation yields a node that could be the target of insertion of a synthetic form, as in INT.

With respect to this question, INT makes predictions that are the same as those of another type of theory discussed in the literature—at least, as far as locality is concerned.[2] In this second type of theory, words that are derived in a Lexicon compete with phrases that are derived in the syntax, via an extension of a "blocking" mechanism of the type employed in Aronoff (1976), Kiparsky (1982), and related work; see Poser (1992) and Andrews (1990) for early theories of this type, and Hankamer & Mikkelsen (2005) and Kiparsky (2005, 2006) for recent developments. Because theories of this type allow for words and phrases to compete for the expression of the same meaning, they will be referred to collectively as *Word/Phrase Competition* (WPC) theories.

WPC and INT both extend the notion of competition for grammaticality above the morpheme. In WPC, the competition is across modules (Lexicon vs. syntax), whereas in INT, there is a single module at issue. But, as long as competition is extended to every syntactic node, the targets of phonological realization in INT are the same as the loci

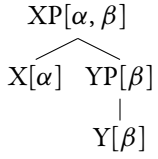
2. The restriction is that INT has difficulties with A/S that are not found in lexicalist word/phrase competition theories, having to do with underdecomposition; see footnote 11.

for word/phrase comparison in WPC, and the two make the same predictions about the locality of interactions.

10.3.1 WPC and INT in more detail

The basic idea in a theory with WPC is that both the Lexicon and the syntax both operate (at least sometimes) with the same syntacticosemantic features (like [α] and [β]). If the syntax creates a phrasal structure (4) whose percolated features are possessed by a word in the Lexicon (which could itself be simple, or derived by Lexical rules)—this is WORD_1 in (5)—then the word is employed as in (6), and the phrase (4), where X[α] and Y[β] are the separate words WORD_2 and WORD_3, is ungrammatical.

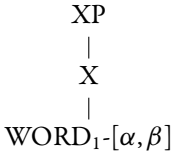
(4) Structure (phrasal)



(5) Lexical Items

WORD_1-XY[α, β]
WORD_2-X[α]
WORD_3-Y[β]

(6) Syntax of X/Y



Procedurally, this type of theory can be implemented as follows. First, at each node in the syntactic structure, the Lexicon is checked to see if there is a word that expresses the same meaning as what has been derived syntactically, where "same meaning" is defined in terms of feature content. If there is such a word, the principle for resolving competition between words and phrases has to favor the former in order for synthetic forms to beat analytic ones. A general way to do this is to appeal to a principle along the lines of (7) (see, e.g. Kiparsky 2005, 2006).

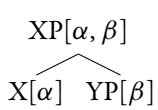
(7) Lexical Preference: When a word exists in the Lexicon and expresses [α, β], use that word instead of a phrase expressing [α, β].

Although, informally speaking, (7) makes it look as if words are better than phrases, it is more accurate to say that in this type of theory, phrases with a single terminal ("word") like (6) win over phrases with two terminals like (4).

INT is employed in early work on lexical decomposition (McCawley 1968). The basic idea behind current versions of INT (see, e.g. Neeleman and Szendrői (2007), Caha (2009) and references cited there) shares a number of properties with WPC. The features of terminal nodes are percolated up to non-terminals, as shown in (8). Then, the VI operation is formulated so that it can target non-terminal as well as terminal nodes

(for recent versions,). So, for instance, if the syntax creates (8), then the first Vocabulary Item in (9) can realize the non-terminal node XP.[3]

(8) Structure (phrasal)



(9) Vocabulary Items

a. $XY[\alpha,\beta] \leftrightarrow WORD_1$
b. $X[\alpha] \leftrightarrow WORD_2$
c. $Y[\beta] \leftrightarrow WORD_3$

As is the case with WPC, INT must incorporate a competition mechanism that ensures that the first VI (9a) takes precedence over (9b) and (9c) in order for synthetic forms to be derived. This can be done in some different ways. The guiding intuition, though, is that Vocabulary Insertion and syntactic representations—each with independent motivation—are all that is required for the analysis of A/S alternations.

10.3.2 The CONTAINMENT PREDICTION

In WPC/INT, the constituent structure of a phrase determines the possible loci of phonological realization. In order for a synthetic form to be inserted, there must be a non-terminal node that contains the features of the morphemes that are to be realized together, and that does not contain features from syntactic objects whose meaning is not expressed in the word that is competing for the realization of that node. For this reason, all of the syntactic material that is dominated by a particular node determines whether that node can be realized as a word or not.

Concretely, and in a specific form that has been discussed in the literature, this prediction of WPC/INT can be called the CONTAINMENT PREDICTION (see Embick 2007a, Embick & Marantz 2008).

(10) CONTAINMENT PREDICTION: For theories with WPC/INT, if a non-terminal node $X^\star$ dominates any syntactic material that is not

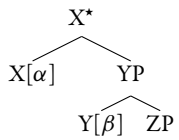
a. WPC: in the lexical item $WORD_1$-$XY[\alpha,\beta]$;
b. INT: in the Vocabulary Item $XY[\alpha, \beta] \leftrightarrow WORD_1$

then $X^\star$ cannot be realized by the special or "synthetic" form.

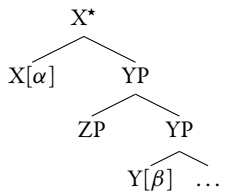
3. The way in which feature percolation takes place could be examined further, particularly with reference to assumptions about how, for example, syntactic headedness (and "labeling") work.

Some cases illustrating how CONTAINMENT works are shown in (11) through (13); the focus is on X*, and the possibility of realizing X[α] and Y[β] in a single word.

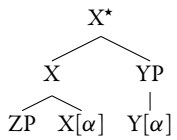
(11) No Synthetic *X*/*Y*



(12) No Synthetic *X*/*Y*



(13) No Synthetic *X*/*Y*



In each of these configurations, the first node X* to dominate both X and Y, which is the crucial one for WPC/INT, also dominates ZP. CONTAINMENT predicts that in each of (11) through (13), X* cannot be realized as a single word. For WPC, this is because no word in the Lexicon combines features of ZP along with those of X and Y. For INT, the precise nature of the problem with (11) through (13) depends on how the competition mechanism works. For instance, an INT theory that employs the Subset principle (cf. Halle 1997) could insert WORD_1 at X* in (11) through (13). This is because that node contains the features [α,β] that are referred to in the Vocabulary Item (9). However, this would result in the entire structure being pronounced as WORD_1, where the phrase ZP would not be realized phonologically at all. In a "Superset" formulation of the competition mechanism (see Caha 2009), there would be no Vocabulary Item that has a superset of the features of X, Y, and ZP because the Vocabulary would not contain Vocabulary Items for every possible ZP that could appear in (11) through (13).

In the scenarios shown in (11) through (13), MIO does not predict that synthetic forms are impossible across the board. This is because MIO does not operate in terms of containment constituency for the derivation of synthetic forms; rather, it employs affixation operations that are defined either in terms of, for example, head-to-head relations, or linear adjacency—which, depending on the particular affixation operation at play, could in principle derive synthetic forms in (11) through (13). That is, if the affixation takes place under head-movement, then Y can affix to X in (11); or, if the affixation operation is Local Dislocation, which is defined linearly, then X could affix to Y in (11) and (13), but not in (12)—if ZP is linearized on the left between X and Y. In short, MIO does allow affixation in configurations like (11) through (13); whether affixation takes place depends on how the particular affixation rule at issue works.

In the next section, the configurations schematized in the preceding (and some related ones) are illustrated in overviews of some different case studies.

10.3.3 Illustrations

There is a common theme unifying the studies that are outlined in this section: in each, it will be shown that the structures that are predicted by CONTAINMENT to disallow synthetic forms (i.e. structures like those in (11)–(13) do in fact show synthetic forms). This set of observations is a prima facie argument against WPC/INT. It is subject to possible counterarguments. The most obvious is that the material that appears to interrupt the constituency relations crucial for CONTAINMENT (ZP in (11)–(13)) is moved out of the phrase containing the non-terminal node that is the target for insertion/replacement. (A related option would be to argue that the ZPs in question are not dominated by the crucial node in the first place.) To work, this position requires the further assumption that the copies of moved material do not percolate their features to dominating nodes (cf. Caha 2009 and references cited there). Although this move might be worth considering for some of the individual phenomena to be examined, it does not appear to generalize. Moreover, this move (and related moves to be discussed later) removes empirical content from WPC/INT. This is important, because the strength of WPC/INT derives from the way in which it employs independently motivated syntactic representations. To the extent that the constituency that it requires can be manipulated on an ad hoc basis, the theory loses much of its empirical force (cf. Chomsky (1972:79) on this point with respect to McCawley's theory of phonological realization).

10.3.3.1 Danish definites

Hankamer & Mikkelsen (2002, 2005; henceforth HM) develop a WPC theory in which words "Poser block" phrases in their analysis of definite marking in Danish. With typical nouns in the language, definiteness is expressed suffixally, as shown in (14a). On the other hand, when there is a prenominal modifier, like the adjective *gamle* "old" in (15), the analytic form (15b) is grammatical, and the synthetic form (15a) is ungrammatical.

(14) a. hest-en
horse-DEF
"the horse"

b. *den hest
the horse
"the horse"

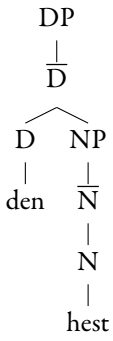
(15) a. *gamle hest-en
old horse-DEF
"the old horse"

b. den gamle hest
the old horse

HM employ a lexical rule that attaches the definite morpheme to create definite nouns like (17). This DP competes with the analytic one shown in (16). Because

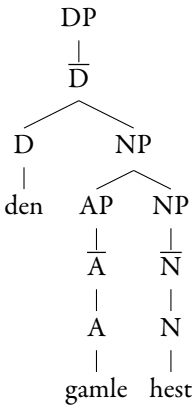
the two DPs express the same feature content, the synthetic form wins out over the analytic form, on the assumption that words are better than phrases. When there are pre-nominal adjectives, it is predicted that the word will not block the phrase, because of CONTAINMENT, so that D and N will be realized analytically (18).

(16) DP/NP



(17) Definite "Noun"

(18) Prenominal Adjective



For (16) through (18), WPC (and INT) make correct predictions. A crucial case to consider for CONTAINMENT, however, involves *post*-nominal modifiers. To see this point, it is helpful to think about how an MIO theory would account for (16) through (18). A likely direction for an analysis is that D affixes to N under adjacency; see Embick & Marantz (2008), and, for the idea that this affixation is not an instance of head movement, the two HM articles. With post-nominal material, an MIO theory employing Local Dislocation predicts that affixation of D to N should take place because D and N are adjacent. However, INT/WPC predict analytic forms, because the post-nominal material percolates its features to the DP node in the same way that it does in the pre-nominal adjective examples.

As shown in (19), synthetic forms are found when there are post-nominal modifiers.

(19) a. gris-en med blå pletter
pig-DEF with blue spots
"the pig with blue spots"

b. *den gris med blå pletter
the pig with blue spots
"the pig with blue spots"

As H&M note, WPC can be maintained if these post-nominal modifiers are attached in a way that does not interrupt the constituency between D and N (e.g. they

could be attached very high). However, they go on to note that this argument would have to be generalized to all apparently NP-internal material, including argument prepositional phrases (PPs), where the move to a higher attachment is less well-motivated. Whether or not this move works for Danish DPs, it is not clear that it will generalize ways that extends to the other case studies examined following.

10.3.3.2 English comparative/superlative

English comparatives (and superlatives) figure prominently in Poser's (1992) discussion of word/phrase blocking, and are considered in a number of other works as well (e.g. Bresnan 2001, Kiparsky 2005, Embick and Noyer 2001, Embick 2007a). The Containment Prediction makes two predictions about the distribution of synthetic comparatives and superlatives. The first is that the synthetic forms should never be found with adjectives that take complements (or any AP-internal material). The second is that synthetic forms should never be found when the degree morpheme itself is embedded within a phrase that excludes the adjective. For MIO, on the other hand, if affixation of the degree morpheme is accomplished with an affixation operation (i.e. linear, or head-to-head), synthetic forms should be possible under these situations.[4]

For the first prediction, synthetic forms are indeed possible with the relevant APs (20).

(20) Adjectives with complements

a. Raising: John is [likeli-er [~~John~~ to win the race]]...

b. Control: Mary is [quick-er [PRO to spot counterexamples]]...

c. Transitive Adjectives: Bill is [proud-er [of his accomplishments]]...

d. *Tough*-Construction: Susan is [easi-er [to understand]]...

Unless it is shown (i) that there is no relation between the adjective and the type of complement that it occurs with, or (ii) that there is substantial evidence that all of the phrases in (20) are extraposed, these patterns provide evidence for MIO and against WPC/INT.[5]

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4. Exactly which affixation operation is at play in comparatives and superlatives is controversial; see, for example, Embick (2007a) and Matushansky (2013) for different views.

5. In point of fact, the precise prediction made by INT is that whenever there is a synthetic form, extraposition takes place. There is no compelling evidence that this is the case, however.

There are some interesting things that could be investigated in examples of the types in (20). Some speakers have the intuition that analytic forms in (20) are preferable to analytic forms of the same adjectives without complements; that is, that, for example, *Bill is more proud of his accomplishments than John* is better than *Bill is more proud than John*. This may very well be the case; however, this effect has yet to be investigated systematically.

The second prediction of WPC/INT is that synthetic forms should be impossible when the degree morpheme is contained in a phrase that excludes the adjective (an instance of (13)). In the following examples, which are adapted from Bresnan (2001), it can be seen that synthetic forms are possible in this situation, contrary to the predictions of WPC/INT ([δ] marks the base position of the comparative morpheme).

(21) a. [how much more] expensive is it?
b. [how much δ] long-er is it?

(22) a. [exactly three times more] expensive
b. [exactly three times δ] long-er

In these examples it is not possible to argue that extraposition has occurred. It would be possible to try to argue that the pre-degree components of the comparative measure phrases (i.e. [how much] and [exactly three times]) have been moved (or that they originate outside of a phrase that contains both the degree morpheme and the adjective). I am not aware of any evidence that this is the case, though.

10.3.3.3 French prepositions and determiners

Prepositions and determiners in many languages are realized together in what are sometimes called *portmanteaux*. This descriptive term refers to cases in which morphemes are realized as phonologically "compressed" relative to their independent forms. (The term *fusion* is also sometimes employed for this, but I am not using it because it has a technical meaning as well; see section 10.5). Whether or not these compressed forms are the result of a single instance of VI or the result of action in the (morpho)phonology is not always clear; there might be different answers to this question for different portmanteaux.

In the case reviewed here, from French, certain prepositions – in particular *de* "of" and *à* "to" – are realized together with the masculine and plural determiners, as shown in (23).

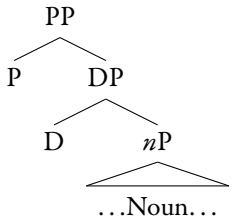
(23) Examples of Prepositions and Determiners

	"Compressed"	**Separate**	**Gloss**
(Fem.)	*	de la mère	"of the mother"
	*	à la mère	"to the mother"
	aux mères	*à les mères	"to the mothers"
(Masc.)	du chat	*de le chat	"of the cat"
	au chat	* à le chat	"to the cat"
	aux chats	*à les chats	"to the cats"

The question is whether the realization of these portmanteaux forms occurs under the conditions that are predicted by WPC/INT.

Based on CONTAINMENT, the first question to ask is with respect to the portmanteaux *du*, *au* and *aux* is whether there is a node to be realized with a single P/D exponent. If the structure of the PP is the one in (24), there is not.

(24) Structure of Prepositional Phrase



As always, it could be suggested that *n*P is moved out of the PP, so that there is a PP node that can be the target of insertion for *du* or *des*. However, this move misses several important points. This can be seen from the fact that the determiner and the following material in the *n*P are themselves capable of forming a synthetic form—or, at least, a form with a procliticized article. This occurs with vowel-initial nouns, as shown in (25), where it can be seen that the cliticization of the article onto the noun prevents the realization of *du*.

(25) a. de l'arbre "of the tree"
b. *du arbre

Evidently, then, if CONTAINMENT is to be saved by moving the *n*P out of the PP, it would have to be the case that the *n*P is moved out only when the noun is consonant-initial. This (already somewhat contrived) analysis would have to be adapted further because articles also procliticize onto vowel-initial pre-nominal adjectives, as shown in (26).

(26) a. de l'énorme chat; *du énorme chat "of the big cat"
b. *de le grand chat; du grand chat "of the great cat"

The conditions on extraposition would have to be carefully manipulated in a way that would mask the real generalization at play here, which is that P/D interaction depends on the phonological properties of the element to the right of the determiner.

I take these considerations to show that theories with CONTAINMENT do not look promising for the alternations seen in French PPs.

Some different types of MIO analyses have been extended to the facts considered previously. The fact that D can procliticize onto following elements in a way that prevents the realization of the portmanteaux is accounted for with "inside-out" cyclicity in Embick (2007b, 2010a). Beyond this effect, there are different ways of analyzing how P and D produce special form. For example, although it might be possible to employ suppletive portmanteaux (with *du* etc. inserted) after a Fusion rule (cf. section 10.5) has combined P and D into one morpheme, it might also be possible to exploit contextual allomorphy of D triggered by P, and subsequent phonological union. Looking at the differences between these alternatives requires a comprehensive look at the status of P and D (and perhaps some other heads) in phase theory (Chomsky 2001); on this theme, see Höhn (2013).

In summary, although there are serious and important questions about exactly which operations are involved in the derivation of *du*, *aux*, and *au*, the key point is that the portmanteaux do not appear under the conditions predicted by WPC/INT.

10.3.4 Locality and A/S: Summary

The CONTAINMENT PREDICTION is crucial because for A/S alternations it is the main way of distinguishing the empirical predictions of MIO from INT/WPC. In case studies like the ones discussed in this section (and others discussed in the literature), there appears to be little evidence for CONTAINMENT.

As mentioned at the beginning of this section, it is possible to neutralize the problematic predictions for INT/WPC by appealing to movement, or perhaps to alternative analyses that put potentially offending phrases in positions where they do not cause problems for the constituency required for non-terminal realization. Unless the movements in question have strong motivation, this move is untenable because it leaves the notion of "independently motivated constituent" crucial to WPC/INT devoid of content. Moreover, the question at hand is not whether INT/WPC can be insulated from their interesting predictions. The strong and important claims of INT/WPC can always be weakened in various ways (just like the predictions of any other theory could be). The question is whether A/S provides empirical support **in favor** of CONTAINMENT and the theories that incorporate in the first place; and for the reasons advanced previously, I do not believe that there is any evidence of this type. On the other hand, I think there are in fact convincing reasons to believe that affixation takes place under conditions of head-to-head and linear locality, as is the case in MIO theories.

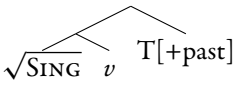
10.4 MP: Stem allomorphy

If it is assumed that the phonological form of Roots is subject to late insertion (see Embick 2010b for discussion), then another potential application of INT is in

the domain of morphophonology: the (evidently) non-affixal phonological changes brought associated with morphological features, in alternations like *sing*/*sang*. This empirical phenomenon is often called *stem allomorphy* (even though morphophonological concerns extend to non-stems—that is, to the functional vocabulary—as well).

The empirical questions at play in MP can be approached in a few steps. For purposes of illustration, consider the Root $\sqrt{\text{SING}}$, which has the present tense form *sing*, and the past tense form *sang*. I assume that the past tense form is realized in a structure that contains the past tense morpheme T[+past] (and a *v* head, on the theory assumed here) (27).

(27) sang



In a theory that derives *sang* with the use of morphophonological rules or their equivalent (*Readjustment Rules*, Halle & Marantz 1993, Embick & Halle 2005), this Root conditions the insertion of a *-Ø* exponent of T[+past] (the *v* head is also not realized overtly). In addition, a morphophonological rule triggered by T[+past] applies to $\sqrt{\text{SING}}$ to produce *sang*. This rule is triggered by T[+past] and applies to a list of Roots that includes $\sqrt{\text{SING}}$ (but not $\sqrt{\text{BRING}}$, or $\sqrt{\text{LINK}}$, etc.).

In a theory with INT it is possible to dispense with both the morphophonological part of the analysis, and with the idea that $\sqrt{\text{SING}}$ conditions insertion of a *-Ø* at T[+past]. The analysis requires the Vocabulary Items in (28), the first of which applies to the top node in (27).

(28) $\sqrt{\text{SING}}$, T[+past] ↔ sang

$\sqrt{\text{SING}}$ ↔ sing

In examples of this type, INT does with VI alone what MIO achieves with two different mechanisms—VI and morphophonological rules.

10.4.1 Containment for MP

CONTAINMENT extends to MP, although its scope in this domain is a complicated matter; see the following. Tailored to the specific concerns of morphophonology (i.e. mostly the phenomenon of stem allomorphy), its predictions are stated in (29).

(29) CONTAINMENT-MP: All morphologically triggered stem alternations should occur in configurations defined by the CONTAINMENT PREDICTION. For example, X could be realized together with the Root in (29a), but not in (29b) where Y is present:

a. X/$\sqrt{\text{ROOT}}$ co-realization ok b. X/$\sqrt{\text{ROOT}}$ co-realization not ok

As previously, the linear position of Y is irrelevant as far as CONTAINMENT is concerned.

Schematically, the predictions of CONTAINMENT can be tested when (i) there is an MP alternation that affects an element (for convenience, a Root) in a way that implicates a morpheme [X], and (ii) it is possible to introduce a morpheme Y that is lower in the representation than [X]: [[$\sqrt{\text{ROOT}}$ Y] X]. INT predicts that special stem alternants will not occur when [X] is present, because there is no node shared by the Root and [X] that excludes Y. MIO, on the other hand, predicts that special stem alternants could still occur as long as [X] and the Root are morphologically or phonologically local (e.g. linearly adjacent) in spite of Y.

One way of testing INT is by looking for cases in which the trigger and target of a morphophonological alternation are separated by an intervening morpheme. Some different examples of this type are discussed in Embick (2010b, 2012, 2013); see also Calabrese (2012), and Carstairs-McCarthy (1992) for discussion. For instance, in one of Carstairs-McCarthy's examples, Zulu palatalization, the passive morpheme *-w* triggers palatalization of non-initial consonants in the Root, so that active *bamb-a* "catch" alternates with passive *banj-wa*. This palatalization, which is not part of the "normal" phonology, occurs even when causative *-is* intervenes between *-w* and the Root, as in *banj-is-wa* "be caused to catch".

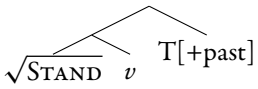
Examples of this type may or may not provide evidence against INT; it depends on what types of MP alternations INT is supposed to apply to. For example, it could be argued that the effect seen in Zulu is actually in the phonology proper, with the morphophonological change being triggered by a part of the exponent of the passive morpheme. According to this view (for convenience, an *affixation/phonology* approach), the exponent of passive is not *-w*, it is -$^{[x]}w$, where [x] stands proxy for a phonological feature that changes labials to the left. According to this analysis, the "special" stems do not need to realize a non-terminal, so that Zulu palatalization would be phonological, and thus irrelevant to to CONTAINMENT.

As long as it is assumed that VI can insert exponents that contain (or consist exclusively of) floating autosegments, the affixation/phonology approach can be applied

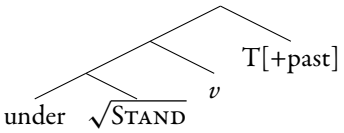
generally. Approaches with autosegmental affixes or exponents have been developed in various theoretical frameworks; see, for example, Lieber (1987), Noyer (1992), Akinlabi (1996, 2011), Mondon (2003), Wolf (2006) and Bye & Svenonius (2012) for different implementations. Many of these theories assume that only some stem alternations can be treated with affixation/phonology. The question of which cases of stem alternation can and which cannot be reduced to affixation/phonology is a difficult one because it requires a number of additional assumptions about the phonology that go beyond the scope of this discussion. This makes finding evidence in favor of INT in the domain is potentially complicated because different theories might make different claims about which stem alternations should be handled by INT, and which by the affixation/phonology method.[6] Moreover, in terms of the goals of this section, adopting the affixation/phonological approach to certain MP alternations is not an argument for INT; instead, it removes some potential test cases from its purview.

On the (rather vague) working assumption that superficially "more phonological" processes like those in Zulu can be contrasted with "less phonological" processes like those found in, for example, the English *sing*/*sang* or *mouse*/*mice*, it is at least possible to further illustrate what INT would predict if it were applied to MP. This can be done by taking one of the irregular alternations—for this I will use *stand*/*stood* rather than *sing*/*sang*—and embedding the alternating Root so that it does not form a constituent with the past tense morpheme. In (31), this is done with the prefix *under*; the unprefixed past tense is shown in (30) for comparison.

(30) stood



(31) understood



By CONTAINMENT, the prediction is that *stood* could be realized in (30) because it could spell out the highest node, whereas *stand* should be realized in (31) to yield

6. For example, Bye & Svenonius (2012) develop an affixation/phonology approach, and suggest that INT should apply to "irregular suppletive" alternations, which they illustrate with *mouse*/*mice*. But they provide no general criteria for which alternations are suppletive and which are not. This is not a problem for those authors alone, but for any attempt to draw lines between suppletion and (morpho)phonology; and it illustrates why assessing INT's claims in this domain is potentially difficult.

For a general discussion of how suppletion and (morpho)phonological alternations might be distinguished on the basis of locality considerations, see Embick (2010b, 2012).

**under-stand-ed* because there is no shared node to serve as the target for *stand*. This is incorrect. In this and a host of structurally similar cases (e.g., with the affixes like *out-* and *re-* in *out-sang* and *re-broke*), the irregular stem allomorph of the Root surfaces, contrary to what INT predicts.

In an MIO theory, the fact that the irregular allomorph is found in the (31) type stems can be analyzed on the assumption that T[+past] is linearly adjacent to the Root, and therefore local to it.[7] In principle, the change could be treated either with VI (i.e. as a case of "stem suppletion") or with morphophonological rules; see the following.

For the reasons outlined previously, the scope of the arguments presented in this section depend on which MP alternations INT is supposed to account for. If CONTAINMENT did make the correct predictions (so that we found *under-stand-ed* next to *stood*, etc.) there would be evidence in favor of INT. As it stands, INT predicts that irregular stem alternations should never be found in structures like (31), and this prediction appears to be incorrect. It would be possible to make other moves to explain why INT's predictions are not borne out. As far as this is concerned, appealing to other mechanisms to save INT is suspect to the extent that MP interactions behave in ways that are expected in an MIO theory.

Regarding MIO-based locality, I have explored the idea that stem allomorphy is not a single phenomenon, and that there are different grammatical mechanisms at play in different types of stem alternation broadly construed (Embick 2010b, 2012, 2013, forthcoming). One such mechanism is contextual allomorphy, although, for reasons that I cannot discuss here, extending suppletion is in general a move that should be treated with caution (see e.g. Embick & Halle 2005 and Embick 2010b for pertinent discussion). Beyond suppletive contextual allomorphy, morphologically conditioned phonological rules also appear to play a major role in deriving stem alternants. The papers of mine just cited immediately above follow the lead of Kiparsky (1996) in partitioning stem and other alternations based on the locality properties that they exhibit. This work suggests that there might be two types of morphophonological rules in the broad sense: one type that operates only under concatenation (as is also hypothesized for suppletive contextual allomorphy), and one type that respects phonological conditions on locality (see also Calabrese 2012). Although these specific hypotheses will stand or fall on their own, as long as generalizations about morphophonological locality involve representations that go beyond syntactic constituent structure, there is evidence for MIO and against INT.[8]

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7. The *v* morpheme here, which has no overt realization, appears to be transparent for interactions between the Root and T[+past]. There are different ways of implementing this transparency effect.

8. An important question concerns how to compare theories with morphologically-triggered or targeted phonological rules on the one hand, with theories that take the "affixation/phonology" approach that is sketched in section 10.4.1.

10.4.2 Two further points

Adopting INT for morphophonology leads to two additional consequences of interest. While theses consequences are not about locality, they point to some further issues that must be taken into account when comparing INT and MIO.

The first consequence derives from the way in which INT inserts special stem allomorphs at non-terminal nodes. If stem allomorphy is treated in this way, then exponents of dominated nodes that trigger allomorphy are not expected to co-occur with stem allomorphy. Illustrating with reference to *sing*/*sang* in (27), if *sang* realizes the top node in (27), the point is that there could be no overt realization of T[+past] because T[+past] is realized at the top node along with the Root.[9]

Generally, then, INT produces the prediction (32).[10]

(32) (No) Double Marking: Special stem allomorphs of a Root triggered by a feature [X] should not co-occur with an independent realization of [X] (or any morpheme between [X] and the Root).

Irregular stem alternants sometimes occur with no overt realizations of the morphemes that trigger the stem change: *sing*/*sang* is an example of this type. However, the literature contains extensive discussion of a number of examples of double-marking where an irregular stem alternant co-occurs with an overt affix. In the English verbal system, double-marking is found both with irregular and regular exponents of Tense and Aspect (the latter in participles).

(33) Double marking

a. Irregular affix: break, broke, brok-en; freeze, froze, froz-en; drive, drove, driv-en; think, though-t

b. Regular affix: tell, tol-d; sell, sol-d; do, di-d

Or, for instance, German verbs like *geben* "to give" show a morphophonological effect in which the stem vowel changes in certain person/number combinations, in a way that accompanies an overt affix (cf. e.g. 3sg form *gib-t*, where the change in the stem vowel is triggered by 3sg Agr, which is itself realized as *-t*).

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9. Because *sang* is inserted at a node that dominates $\sqrt{\text{Sing}}$ and T[+past], it also follows that no morphemes in between the Root and T[+past] could be spelled out individually when the highest node is realized by the allomorph *sang*.

10. The same predictions about double-marking are made by theories that employ Fusion for stem allomorphy, such as Siddiqi (2009).

As far as I am aware, double-marking of this type (where a stem change accompanies an overt affix) is not particularly uncommon cross-linguistically. It plays an important role the theoretical literature because it is central to the argument that piece-based affixation is different in kind from morphophonology, an significant part of the theory of blocking (cf. Halle & Marantz 1993 on Anderson 1992).

How to interpret double-marking with respect to CONTAINMENT-MP depends again on the line between alternations that can be reduced to affixation/phonology, and those that cannot because the phonological solution of section 10.4.1 could in principle be applied in instances of double-marking as well. One consequence of implementing that solution in this domain is that there is a proliferation of Vocabulary Items. For example, in addition to the Vocabulary Item that inserts *-en* for the participial morpheme (presumably Aspect) in English, in the context of, for example, $\sqrt{\text{BEAT}}$, there would have to be another Vocabulary Item that inserts $\text{-}^{[x]}en$ in the context of $\sqrt{\text{BREAK}}$, where [x] stands proxy for the material that induces the stem change in the phonology. More generally, there would have to be further Vocabulary Items of this type for every different stem change that accompanies *-en*, along with further items for the changes that accompany *-ed*, *-t*, and *-Ø*. Whether or not this move has evidence in its favor—it seems on the face of it to be difficult to reconcile with the idea that the Vocabulary should be kept minimal whenever possible—it is once again a defensive move, not one that provides evidence for INT.

Another move to save INT would be to hold that all of the putatively double-marked forms are in fact monomorphemes. This would make, for example, all of the past tense and participle forms in (33) suppletive, monomorphemic stem allomorphs, whose phonological overlap (e.g., the shared material in *break* and *broken*, or the relationship of the *-en* in *beaten* to that in *broken*) is an accident in the synchronic grammar. On its face, this move goes against one of the main tenets of DM: the hypothesis that the grammar involves *full decomposition*, a guiding intuition behind the theory which is also active in experimental research into the mental representation of linguistic objects (cf. Embick & Marantz (2005), Stockall & Marantz (2006), Marantz (2013) for experimental perspectives). Theoretical and experimental investigation of evidence for and against "whole-word" storage is an ongoing topic of active research. My view is that there is evidence in both domains suggesting that full decomposition should not be abandoned, although it goes beyond the scope of this discussion to motivate this position further.[11]

11. On the theme of whole-word storage, a further question for INT—which connects with the discussion of A/S alternations previously—concerns *regular* morphological expression. In short, if INT is used for A/S, then there is underdecomposition with all affixation.

As an illustration, consider the English comparative examples from section 10.3. With INT, a single node is targeted with a synthetic form like, for example, *smarter*. This means that in the Vocabulary

10.5 MIO, linear adjacency, and "derived" morphemes

One issue that remains to be addressed concerns exactly what it means to restrict Vocabulary Insertion to morphemes. In particular, it can be asked whether the morpheme targets of VI can be derived from other morphemes, or, alternatively, whether VI can see and target multiple morphemes for simultaneous realization. In the context of this discussion, extending insertion to derived morphemes introduces the possibility that the targets of sound/meaning connections are potentially different from the primitive objects of computation; for this reason, this possibility should be treated with caution.

A specific proposal for deriving morphemes is introduced in Halle & Marantz (1993), who employ an operation of *Fusion* that creates a single morpheme out of two, prior to VI. Assuming that this is possible under linear adjacency (concatenation), a rule of this type is shown schematically in (34):

(34) $[X]^\frown[Y] \longrightarrow [X,Y]$

When (34) applies, there is a single target for VI—the derived morpheme [X,Y] – rather than two separate morphemes. This means that a Vocabulary Item specified for [X,Y] wins the competition for the composed morpheme over items that spell out [X] and [Y] individually. It is for this reason that Fusion is well suited for portmanteau expression, in which otherwise expected exponents of individual morphemes are blocked. With respect to the question introduced at the beginning of this section, a theory with Fusion rules restricts Vocabulary Insertion to morphemes, but morphemes may be derived by putting the contents of two morphemes together prior to insertion.

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of English, *smarter* must beat *smart* for insertion at nodes that dominate both $\sqrt{\text{SMART}}$ and [cmpr]. Crucially, *smart* and *smart* are the exponents of two distinct VIs.

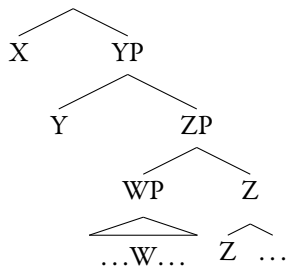
Because it analyzes A/S in this way, INT cannot say that the /er/ in comparative forms is the realization of a [cmpr] morpheme. Thus, this analysis says that *smarter* is a suppletive comparative allomorph of *smart*. A consequence of this view is that similar suppletive pairs exist for all adjectives that form synthetic comparatives in English (triples, when superlatives are included). Importantly, this analysis also says that it is an accident that all alternating forms have comparatives and superlatives that end in *-er* and *-est*.

A possible response to this argument would be to hold that only A/S alternations that result in non-transparent portmanteaux should be treated with INT. This move restricts the scope of INT (because other mechanisms of affixation would have to be introduced for polymorphemic synthetic alternants). Moreover cases like the French prepositions discussed in section 10.3, which are arguably portmanteaux, do not appear to behave as predicted by INT.

It should be noted that unlike what was seen in section 10.3 with A/S, where WPC and INT make the same predictions, the difficulty with underdecomposition applies to INT, but not to WPC. In WPC, it can be argued that affixed forms are created in the Lexicon out of two pieces, so that, for example, *smart* and *smarter* need not be treated as suppletive allomorphs.

Taken at the level of detail advanced thus far, theories with Fusion are the same locality-wise to theories that allow strings of linearly adjacent morphemes to be simultaneously realized by Vocabulary Insertion. For this, consider first (35).

(35) Structure



Assuming that simultaneous realization of multiple morphemes requires linear adjacency, the morphemes *X* and *Y* could be realized by a single application of VI, but *Y* could not be realized together with *Z* because of linearly intervening WP: for reference, theories that allow this type of insertion will be called *Generalized Insertion under Adjacency* (GIA).

In GIA, the insertion mechanism has to see adjacent morphemes X, Y, and so forth, simultaneously, to realize them with a single phonological exponent (see the following). In a theory with Fusion, X, Y, and so forth, are visible together because they are combined into a single derived morpheme. As long as Fusion is allowed to apply iteratively, GIA and Fusion make essentially the same predictions about the locality conditions under which several morphemes can be realized at the same time. The difference is that Fusion is explicit about how two morphemes are simultaneously realized as one because it puts them together, whereas GIA as developed to this point is vague about how simultaneous visibility is represented. The similarities of Fusion and GIA suggest that it would be possible to formalize an operation that realizes morphemes simultaneously in a way that does not involve separate steps of Fusion followed by VI. However, because my concerns here are with locality—and because Fusion and GIA are the same as far as that goes—I will not develop this point in detail here.

Referring to Fusion and GIA these together as "Multiple Realization," there are two main points to be made in connection with the main goals of this chapter. These are framed here as foci for future discussion.

The first point is that there is still some uncertainty as to whether Multiple Realization is needed in the first place. It has been pointed out in different places that the *effects* of Fusion (typically, as mentioned previously, "portmanteau" realization) can be achieved with other mechanisms; for example, contextual allomorphy, deletion of morphemes, zero realizations, and so on (see e.g. Trommer 1997, Williams 2003).

A comprehensive and conclusive overview of Multiple Realization versus alternatives must be undertaken as an initial step in this area, in order to determine whether it is needed in the first place.

If some type of Multiple Realization is preferable to alternatives, there are further questions about the types of representations and operations that it involves. Here connections with other phenomena may lead to interesting questions. For example, it was previously in this section that immediate linear adjacency (=concatenation) is a natural locality condition to investigate for Fusion (and GIA as well). Concatenation is also hypothesized to constrain contextual allomorphy (Embick 2010a). With this in mind, we could consider a strong hypothesis, which is that morphemes are visible to each other—whether for allomorphy or for Fusion—only when they are concatenated. From this connection, it can be seen that looking carefully at whether contextual allomorphy and Multiple Realization obey the same locality conditions would shed light on the fine details of the representations implicated in phonological realization. In turn, this would allow for the investigation of alternate formalizations of Vocabulary Insertion; in principle, as mentioned previously, formalizations that eliminate Fusion rules per se and reduce as much as possible to the insertion mechanism and the representations it operates on (extending the intuition of Trommer 1997).

In summary, much remains to be explored concerning the Multiple Realization of linearly adjacent morphemes. This section has outlined some specific points that will play a role in future work in this area. On a more general front, the implications of Multiple Realization under adjacency connect directly with the questions introduced at the very beginning of the chapter: if something like this is needed, then it is a further argument that important generalizations about phonological form are not stated in terms of syntactic constituent structures, but in terms of PF representations that are derived from them.

10.6 Conclusions

The preceding sections compare two theories of phonological realization. The first type are theories that restrict Vocabulary Insertion to morphemes (MIO). This kind of theory requires operations beyond Vocabulary Insertion to account for different phenomena: analytic/synthetic alternations, portmanteaux, stem changing, contextual allomorphy, and so on. On the other side are theories with constituency-based non-terminal insertion (INT), which appear to offer a way of handling the relevant phenomena without operations beyond Vocabulary Insertion. By expanding the scope of competition for realization above the morpheme, the promise is a reduction of the operations that are required in morphology and morphophonology, because independently needed VI and syntactic constituent structures do the majority of the work.

MIO and INT make different predictions about the locality conditions under which the interactions of interest might be found. The predictions deriving from MIO implicate linear and hierarchical relations among morphemes, and also locality in phonological representations. The main predictions of INT derive from constituency, in a way that is directly stated in the CONTAINMENT PREDICTION. Allowing Vocabulary Insertion to target non-terminals makes a number of attendant predictions for both analytic/synthetic and morphophonological alternations: predictions about double-marking and possibilities for decomposition in particular. In all of the domains that I have examined, there are some phenomena that are compatible with either MIO or INT; but in the crucial cases where the theories make different predictions, MIO's predictions are correct, and INT's are incorrect. In all of these, it is possible to incorporate additional assumptions to neutralize INT's incorrect predictions; but these moves reduce the empirical scope of INT without providing evidence for it. By their nature, these moves show that much of the work in an INT theory would have to be done by auxiliary theories that go beyond Vocabulary Insertion—much as is the case with MIO—which means that INT's claims on the "conceptual" high ground are at best unsteady. Crucially, I have argued in addition that there is little evidence in favor of the auxiliary views forced by INT, whereas there is substantial evidence in favor the auxiliary hypotheses concerning locality that were adduced in the preceding discussion of MIO above.

For these reasons, I believe that there is clear evidence in favor of the idea that phonological realization is restricted to morphemes.

A number of different proposals are currently being developed concerning the hierarchical and linear representations implicated in morphophonology broadly construed. A unifying idea that is central to the approach outlined here is that the surface complexity of morphology and morphophonology is the result of the interaction of a number of distinct systems of computation and representation (syntactic constituents, cycles, linear relations, phonological representations, etc.), each of which must be understood in its own right. Put slightly differently, the main finding embodied in this research program is that there is real substance and texture to the theory of PF: the morphology and morphophonology of the world's languages show properties characteristic of several distinct (but derivationally related) types of syntactic and phonological locality, not the characteristics of a single type of locality condition.

The idea that there might not be a single mechanism responsible for "morphology" in the sense addressed in this chapter may have conceptual significance. For example, it makes this part of language look like systems that have been studied in other cognitive domains. A lot of discussion in the literature has taken to assessing findings of this type on the basis of their putative conceptual interest. But in and of itself this not a negative finding, nor it is a positive one. It is a theoretical proposal based on empirical arguments,

one that provides a clear and concrete foundation for further work that either supports or opposes it.

References

Akinlabi, Akinbiyi. 1996. Featural affixation. *Journal of Linguistics* 32:2, 239–289.

Akinlabi, Akinbiyi. 2011. Featural Affixes. In Marc van Oostendorp, Colin J. Ewen & Elizabeth V. Hume (eds.), *The Blackwell companion to phonology*, 1945–1971. Malden, MA: John Wiley and Sons.

Anderson, Stephen. 1992. *Amorphous morphology*, Cambridge: Cambridge University Press.

Andrews, Avery. 1990. Unification and morphological blocking. *Natural Language and Linguistic Theory* 8, 507–557.

Aronoff, Mark. 1976. *Word formation in generative grammar*, Cambridge, MA: MIT Press.

Bresnan, Joan. 2001. Explaining morphosyntactic competition. In Mark Baltin & Chris Collins (eds)., *Handbook of contemporary syntactic theory*, 1–44. Malden, MA: Blackwell.

Bye, Patrik, & Peter Svenonius. 2012. Non-concatenative morphology as epiphenomenon, In Jochen Trommer (ed.), *The morphology and phonology of exponence*, Oxford: Oxford University Press.

Caha, Pavel. 2009. *The nanosyntax of case*. Tromsø, Norway: University of Tromsø dissertation.

Calabrese, Andrea. 2012. Allomorphy in the Italian passato remoto: A Distributed Morphology analysis. *Language and Information Society* 18. 1–75.

Carstairs-McCarthy, Andrew. 1992. *Current morphology*, London: Routledge.

Chomsky, Noam. 1972. Some empirical issues in the theory of transformational grammar. In Stanley Peters (ed.), *Goals of linguistic theory*, 63–130. Engliwood Cliffs, NJ: Prentice-Hall.

Chomsky, Noam. 2001. Derivation by Phase. In Michael Kenstowicz (ed.), *Ken Hale: A life in language*, 1–52. Cambridge, MA: MIT Press.

Chomsky, Noam, & Morris Halle. 1968. *The sound pattern of English*. New York: Harper and Row.

Embick, David. 2007a. *Blocking effects* and analytic/synthetic alternations. *Natural Language and Linguistic Theory* 25(1). 1–37.

Embick, David. 2007b. Linearization and local dislocation: Derivational mechanics and interactions. *Linguistic Analysis* 33(3-4). 303–336.

Embick, David. 2010a. *Localism versus globalism in morphology and phonology*, Cambridge, MA: MIT Press.

Embick, David. 2010b. Stem alternations and stem distributions. Manuscript, University of Pennsylvania. http://www.ling.upenn.edu/~embick/stem-ms-10.pdf. (June 6, 2016.)

Embick, David. 2012. Contextual conditions on stem alternations: Illustrations from the Spanish conjugation. In Irene Franco, Sara Lusini & Andrés Saab (eds.), *Proceedings of Going Romance 2010*, 21–40. Amsterdam: John Benjamins.

Embick, David. 2013. Morphemes and morphophonological loci. In Alec Marantz & Ora Matushansky (eds.), *Distributed Morphology today: Morphemes for Morris Halle*, 151–166. Cambridge, MA: MIT Press.

Embick, David. 2014. Phase cycles, ϕ-cycles, and phonological (in)activity. In Sabrina Bendjaballah, Noam Faust, Mohamed Lahrouchi & Nicola Lampitelli (eds.), *The form of structure, the structure of form: Essays in honor of Jean Lowenstamm*, 271–286. Amsterdam: John Benjamins.

Embick, David. Forthcoming. On the distribution of stem alternants: *Separation* and its limits. In Ricardo Bermúdez-Otero & Ana Luís (eds.), *The morphome debate: Diagnosing and analyzing morphomic patterns*. Oxford: Oxford University Press.

Embick, David & Morris Halle. 2005. On the status of *stems* in morphological theory. In Twan Geerts, Ivo van Ginneken & Haike Jacobs (eds)., *Proceedings of Going Romance 2003*, 59–88. Amsterdam: John Benjamins.

Embick, David & Alec Marantz. 2005. Cognitive neuroscience and the English past tense: Comments on the paper by Ullman et al. *Brain and Language* 93(2). 243–247.

Embick, David & Alec Marantz. 2008. Architecture and blocking. *Linguistic Inquiry* 39(1). 1–53.

Embick, David & Rolf Noyer. 2001. Movement operations after syntax. *Linguistic Inquiry* 32(4). 555–595.

Halle, Morris. 1997. Distributed Morphology: Impoverishment and fission. *MIT Working Papers in Linguistics* 30. 425–449.

Halle, Morris & Alec Marantz. 1993. Distributed Morphology and the pieces of inflection. In Kenneth Hale and Samuel Jay Keyser (eds.), *The view from building 20: Essays in linguistics in honor of Sylvain Bromberger*, 111–176. Cambridge, MA: MIT Press.

Hankamer, Jorge & Line Mikkelsen. 2002. A morphological analysis of definite nouns in Danish. *Journal of Germanic Linguistics* 14(2). 137–175.

Hankamer, Jorge & Line Mikkelsen. 2005. When movement must be blocked: A response to Embick and Noyer. *Linguistic Inquiry* 36(1). 85–125.

Höhn, Georg F. K. 2013. Contextually conditioned allomorphy and the Basque locative: Spelling out the Basque extended nominal projection. In Martin Kohlberger, Kate Bellamy & Eleanor Dutton, (eds.) *ConSOLE XXI: Proceedings of the 21st Conference of the Student Organization of Linguistics in Europe (8-10 January 2013, Potsdam)*, 146–170. Leiden: Leiden University Centre for Linguistics.

Joshi, Aravind K., Leon S. Levy, & Masako Takahashi. 1975. Tree adjunct grammars. *Journal of Computer and System Sciences* 10(1). 136–163.

Kiparsky, Paul. 1982. Lexical morphology and phonology. In Linguistic Society of Korea, (ed.), *Linguistics in the morning calm: Selected essays from SICOL-1981*, 3–91. Seoul: Hanshin.

Kiparsky, Paul. 1996. Allomorphy or Morphophonology? In Rajendra Singh & Richard Desrochers (eds.), *Trubetzkoy's Orphan*, 13–31. Amsterdam: John Benjamins.

Kiparsky, Paul. 2005. Blocking and periphrasis in inflectional paradigms. In Geert E. Booij & Jaap van Marle (eds.), *Yearbook of Morphology 2004*, 113–135. Dordrecht: Springer.

Kiparsky, Paul. 2006. Grammaticalization as optimization. Manuscript, Stanford University.

Lieber, Rochelle. 1987. *An integrated theory of autosegmental processes*. Albany: State University of New York Press.

Marantz, Alec. 1988. Clitics, morphological merger, and the mapping to phonological structure. In Michael Hammond & Michael Noonan (eds.), *Theoretical morphology*, 253–270. San Diego: Academic Press.

Marantz, Alec. 2013. No escape from morphemes in morphological processing. *Language and Cognitive Processes* 28(7). 905–916.

Matushansky, Ora. 2013. More or better: On the derivation of synthetic comparatives and superlatives in English. In Alec Marantz & Ora Matushansky (eds.), *Distributed Morphology today: Morphemes for Morris Halle*, 59–78. Cambridge, MA: MIT Press.

McCawley, James. 1968. Lexical insertion in a grammar without deep structure. In Bill Darden, Charles-James N. Bailey & Alice Davison (eds.), *Papers from the fourth regional meeting of the Chicago Linguistics Society* [CLS] 4. 71–80. Chicago: University of Chicago Press.

Mondon, Jean-François. 2003. Distributed Morphology and Old Irish. Philadelphia: University of Pennsylvania master's thesis.

Neeleman, Ad & Kriszta Szendrői. 2007. Radical pro drop and the morphology of pronouns. *Linguistic Inquiry* 38(4). 671–714.

Noyer, Rolf. 1992. *Features, affixes, and positions in autonomous morphological structure*, Cambridge, MA: MIT dissertation.

Poser, William J. 1992. Blocking of phrasal constructions by lexical items. In Ivan Sag & Anna Szabolsci (eds.), *Lexical matters*, 111–130. Stanford, CA: CSLI.

Siddiqi, Daniel. 2009. *Syntax within the word: Economy, allomorphy, and argument selection in Distributed Morphology*. Amsterdam: John Benjamins.

Stockall, Linnea & Alec Marantz. 2006. A single-route, full decomposition model of morphological complexity: MEG evidence. *Mental Lexicon* 1(1). 85–123.

Trommer, Jochen. 1997. Morphology consuming syntax' resources: Generation and parsing in a Minimalist version of Distributed Morphology. Manuscript, University of Potsdam.

Williams, Edwin. 2003. *Representation theory*, Cambridge, MA: MIT Press.

Wolf, Matthew. 2006. For an autosegmental theory of mutation. In Leah Bateman, Michael O'Keefe, Ehren Reilly & Adam Werle (eds.), *University of Massachusetts Occasional Papers in Linguistics [UMOP] 32: Papers in Optimality Theory III*, 315–404. Amherst: GLSA.