

MORPHEMES AND MORPHOPHONOLOGICAL LOCI*

DAVID EMBICK

University of Pennsylvania

1 Introduction

Some questions in linguistics have persisted through hosts of theoretical changes. The conflict between affixless and morpheme-based theories raises questions of this type. In its contemporary incarnation, at least two significant objections that have been raised against affixless theories are that they (i) render the interface between syntax and morphology opaque, and, (ii) have serious difficulties with the analysis of blocking (e.g. Halle (1990), Noyer (1992), Marantz (1992), Halle and Marantz (1993), Embick (2000), Embick and Halle (2005), Embick and Marantz (2008)). Nevertheless, the tension between morpheme-based and affixless theories is as relevant as ever (see §3). My objective here is to develop a further line of argument in favor of morphemes, and against affixless theories; one that also opens up new questions in the study of morphophonology.

*Some of this material was discussed in my Spring 2012 seminar at Penn, and I thank the participants for a number of important comments, suggestions, and corrections. Thanks also to two reviewers for a number of detailed and helpful comments that have greatly improved the paper; I regret not having the space to address their points in full.

Non-affixal morphological alternations— that is, phonological alternations that are morphologically triggered or targeted— are often taken to provide evidence for affixless theories. In this paper I will develop an argument for the opposite conclusion. The argument is based on the observation that morphophonological changes behave as if they have a *morphological locus*: i.e. they operate in a way that is expected if they are linked directly to a morpheme that has a position (hierarchically and linearly) within a complex word, and act in a way that is (phonologically or morphologically) local to that morpheme. This aspect of non-affixal morphology is a component of a broader theory of morphophonological locality, one that is based on morphemes and the principles governing their composition into complex objects (see Embick 2010, to appear). Crucially, to the extent that the correct theory of morphophonological loci follows from a morpheme-based theory of morphology, significant generalizations about morphophonology are missed in affixless frameworks.

Ideas along these lines have been advanced in different forms in the literature. In my view, however, these points have neither been fully appreciated, nor developed in sufficient detail. In the pages that follow I will first outline a generalized theory of morphophonological loci in §2, and then illustrate difficulties for affixless theories in §3; §4 concludes.

2 A Morpheme-Based Theory of Loci

The empirical focus of this paper is on different types of evidently non-affixal alternations, of the types illustrated in (1-3).¹ German Umlaut is vowel fronting triggered by several morphemes that

¹I say “evidently” here because if autosegments can be the exponents of Vocabulary Items, then at least some of these alternations could be treated with “normal” Vocabulary Insertion (see section 3).

have nothing in common, as far as the synchronic grammar is concerned (see e.g. Lieber (1980, 1987) Kiparsky (1996); Wiese (1996a, 1996b) ; Embick and Halle (2005)):

(1)

basic	umlauted	gloss	morphosyntactic feature
lauf-en	läuf-t	‘run’	3sg present verb
Huhn	Hühn-er	‘hen’	plural
Vater	Väter-chen	‘father’	diminutive
Europa	europä-isch	‘Europe’	adjective formation
hoch	höch-st	‘high’	superlative

In the Arawakan language Terena, first person singular is realized by progressive nasalization (from left-to-right), with (simplifying somewhat) the spread stopped by obstruents, which become pre-nasalized (see Akinlabi 2011 and references cited there):

(2)

3sg	1sg	gloss
arɪne	ãĩĩnẽ	‘sickness’
emoʔu	ẽmõʔũ	‘boss’
owoku	õwõõ ⁿ gu	‘house’
ɪwuʔɪʃo	ĩwũʔĩ ⁿ ʒo	‘to ride’
takɪ	ⁿ daki	‘arm’
paho	ⁿ baho	‘mouth’

In the Ethiopian Semitic language Chaha, verbs suffixed with the third singular masculine object marker (3sgM.OBJ) show labialization of the rightmost labializable consonant (Banksira (2000), Rose (2007)). The *-n* morpheme is analyzed as a “case” affix that precedes 3sgM.OBJ,

so that the middle column is derived from $\sqrt{\text{ROOT}}$ -“CASE”-3sgM.OBJ (3sgM.OBJ position is marked with Δ):

(3)

without obj.	3sg Masc Obj.	gloss
kətəfə	kətəf ^w ə-n- Δ	‘chop’
nəkəsə	nək ^w əsə-n- Δ	‘bite’
k’əsərə	k’ ^w əsərə-n- Δ	‘erect’

My primary claim is that essential generalizations about the locality of alternations like those seen in (1-3) follow directly in a morpheme-based theory, but not in an affixless theory. An initial statement of the observation to be explained in this way is given in (4):

- (4) **Morphophonological Locus (ML):** A morphophonological rule triggered by morpheme X behaves as if the effects of the rule are local to the position of X .

The wording in (ML) assumes that there are morphologically-conditioned phonological rules: that is, that the identity of morphemes is available in the phonology, such that phonological processes may be triggered by certain morphemes, or apply to some morphemes and not to others. See §3 for some further discussion of this point.

The importance of Morphophonological Locus has surfaced in the literature in some different forms. For example, Lieber (1987), who develops a theory in which the exponent of a morpheme may be (or include) an autosegment, emphasizes that the locality of mutation processes (among which she includes German Umlaut) follows from the position of a morpheme in a complex word. Other observations along these lines can be found as well.² However, these observations have

²For example, Salanova’s (2004) study of truncation points to the role of morphemes in constraining morphophonological changes. Elsewhere in the literature, the idea that various morphophonological changes are

not, to my knowledge, been organized into a general theory that emphasizes the centrality of the morpheme for non-affixal morphology.

2.1 Morphemes and Morphophonological Loci

Morphemes play a defining role in explaining Morphophonological Locus. A starting point in the theory of this effect is the idea that in a morpheme-based theory, “words” are realizations of morphemes combined into syntactic structure; I will assume that these are complex heads of the type schematized in (5):

$$(5) \quad [[[\sqrt{\text{ROOT}} W] X] Y]$$

Morphemes arranged in a structure like (5) are linearly ordered in the PF component of the grammar; this gives them a linear position with respect to each other. With this in mind, my claim is that the generalizations stated as Morphological Locus (4) are accounted for by the Morphological Locus Theorem (6):

- (6) **Morphological Locus Theorem:** A morphophonological change triggered by morpheme X is phonologically or morphologically local to X .

The rest of this section shows how (6) follows as a theorem in a theory with (i) morphemes, along with (ii) morphological and phonological locality conditions on operations.

With respect to (ii), some care must be taken to explain why (6) makes reference to both *phonological* and *morphological* locality; this is a key theme throughout this section. For the effect effected by autosegments etc. that must be either prefixal or suffixal can be found in Akinlabi (1996) (Akinlabi (2011) calls this property “directionality”). Along the lines pursued by Lieber, Wolf (2006) employs constraints that force mutations to have a locus, and argues against affixless versions of OT morphophonology on this basis.

moment, it can be seen how (6) accounts for the basics of (1-3). In the case of German Umlaut, the affixes triggering the fronting process are suffixes. Thus the fact that the process applies to the final vowel of *Europa* to derive the adjective *europä-isch*– i.e., that Umlaut applies locally “from right to left”– follows directly.³ With Terena 1sg, the change is triggered by (or is the exponent of) a prefixal agreement (AGR) morpheme: [AGR [Noun/Verb...]] (see e.g. Akinlabi 1996, 2011, Wolf 2006); this explains why nasalization has the locus that it does. Although there is no “overt” prefixal material before the verb with 1sg, there is an overt 1pl AGR prefix with vowel-initial words, and 2sg AGR is marked morphophonologically from left-to-right as well (Ekdahl and Grimes (1964)); there is thus clear motivation for prefixal AGR. Finally, the Chaha 3sgM.OBJ morpheme originates in a suffixal position, where other object morphemes occur; the fact that it labializes locally from right-to-left is therefore expected.

The MLT (6) is at the core of a morpheme-based theory’s morphophonological predictions; and, as simple as it is, it cannot be formulated straightforwardly in an affixless approach (§3). Of course, there are some different auxiliary theories that must be combined with the MLT to account for certain types of phenomena that have been noted in the literature. For example, the infixation of a morpheme will result in that morpheme not being in its locus as defined by the MLT. However, as noted by Halle (1990), infixes are prefixes or suffixes that are subsequently moved; in my view either morphologically (see Embick and Noyer (2001), Embick (2007)) or phonologically (see e.g. Halle (2001) the overview in Yu (2004)). The position of infixes is therefore expected to be local to their original position, as defined by the MLT. Effects that are perhaps similar because of their relation to phonologically-defined objects are found with reduplication

³See also Lieber (1987) and Wiese (1996a) for this point. For some discussion of the phonological locality of this process in forms like *Väter-chen* see e.g. Kiparsky (1996).

and other prosodic phenomena.⁴ Although I cannot examine these phenomena here, they highlight the importance of taking the MLT as part of a theory that incorporates both morphological and phonological representations and locality conditions.⁵

2.2 Locality

The MLT specifies that morphophonological changes have a locus. Beyond this, there must be an additional theory of the precise locality conditions under which such alternations occur. Building on earlier work (see below), I hypothesize that there are two kinds of “morphophonological” alternation in the broad sense. One is subject to *morphological* locality, which I take to be the concatenation (=immediate linear adjacency) of morphemes; the other type obeys *phonological* locality (e.g., adjacency in autosegmental representations).

As a first step, some terminology is in order. Morphophonological alternations have *triggers* (the cause of the alternation) and *targets* (the object that undergoes the phonological change). Moreover, both targets and triggers can be either *morphologically* (M-) or *phonologically* (P-) defined. M-triggers are seen in (1-3), where specific morphemes induce the change; M-targets

⁴With reduplication, this is sometimes analyzed with the idea that “heads” are targeted; e.g. Aronoff (1988). Other phenomena that are worth examining in this connection involve “augmentation” of the types seen in Classical and Modern Greek; it is also possible that *ge-* prefixation in German participles could be analyzed in these terms.

⁵In fact, morphological and phonological locality are only part of the picture. For reasons discussed in Embick (2010) with reference to allomorphy, syntactic locality (the theory of phases, Chomsky 2000, 2001; see Marantz (2000, 2007, 2012) and Embick and Marantz (2008)) also plays a role in certain morphophonological interactions. However, integrating such considerations into morphophonological theory presents numerous complications, as stressed by Lowenstamm (2010) with reference to the Level 1/Level 2 distinction in English affixes. See as well Marvin (2002, 2012).

are found when a particular set of Roots or morphemes undergo a change (while others do not) and, moreover the set cannot be defined phonologically. For example, German Umlaut applies to e.g. *laufen* run in the 3sg present tense to produce *läuf-t*; but e.g. *kaufen* ‘to buy’ does not undergo Umlaut (3sg present *kauf-t*). Or, for example, Spanish diphthongization occurs under stress, yielding alternations like *pensár* ‘to think’, *piénso* ‘think-1sg’; but it only applies to certain targets like $\sqrt{\text{PENS}}$, and not others (compare *tensor* ‘tauten’, with 1sg *tenso*).⁶ P-targets and triggers are defined in purely phonological terms, i.e., without reference to the specific morphemes involved.

In these terms, Embick (2012) hypothesizes that there are two distinct types of morphophonological alternations:

- (7) a. ***Morpheme/Morpheme (M/M) Rules***: Rules that have an M-Target and and M-Trigger.
 ⇒Operate in terms of morphological locality/Cannot skip morphemes.
- b. ***Morphophonological Rules (M/P) Rules***: Rules that have either an M-Target or an M-Trigger, with the other component being phonological.
 ⇒Operate in terms of phonological locality/Can skip morphemes.

Starting with M/M-Rules, Embick (2010) builds on earlier work in proposing that contextual allomorphy—crucially, the suppletive type effected by the Vocabulary Insertion operation—requires the concatenation of morphemes. More precisely, a morpheme X can have its allomorphy determined by Y only when it is immediately adjacent to Y : i.e., when $Y \frown X$ or $X \frown Y$. Building

⁶The relationship between affixation, stress, and diphthongization in Spanish is quite complicated. For example, there are well-known cases in which certain affixes that affect stress do not affect diphthongization; see Bermúdez-Otero (2006) and references cited there, as well as Embick (2012) for some comments from the perspective of the framework discussed here.

on this proposal, Embick (2012) observes that the M/M-Rules (7a) require information about two morphemes in exactly the same way. For example, in the English past tense, the Root $\sqrt{\text{SING}}$ appears as *sang* when it is local to the past tense morpheme T[+past]. In order for this to happen, both $\sqrt{\text{SING}}$ and T[+past] have to be visible *as morphemes*, i.e., as the specific Root and morpheme that they are, in order for the change to apply.⁷ In a way that covers both M/M-Rules and contextual allomorphy, the *Morpheme Interaction Conjecture* hypothesizes that all processes referring to two morphemes as morphemes are subject to the same linear locality condition:

- (8) **Morpheme Interaction Conjecture (MIC):** PF Interactions in which two morphemes are referred to *as morphemes* occur only under linear adjacency (concatenation).

Calabrese (2012) provides a compelling analysis of a collection of effects in the Italian past tense called the *passato remoto* that illustrates the effects of concatenation in M/M-Rules. This tense shows a number of irregular verbs with stem allomorphy that is restricted to the 1sg, 3sg, and 3pl forms; (9) illustrates with a small sample of such verbs:

(9)

	inf.	1sg	2sg	3sg	1pl	2pl	3pl
(a) ‘come’	venire	vénni	venísti	vénne	venímmo	veníste	vénnero
(b) ‘move’	mwovere	móssi	mwovésti	mósse	mwovémmo	mwovéste	móssero
(c) ‘put’	mettere	mísi	mettésti	míse	mettémmo	metttéste	mísero
(d) ‘see’	vedere	vídi	vedésti	víde	vedémmo	vedéste	vídero

The 1sg, 3sg, and 3pl forms of these verbs show changes to the verb stem, whereas the rest of the person/number combinations show the stem form that is found in other tenses (cp. the infinitives

⁷Note in addition that for this to occur, the T[+past] morpheme and $\sqrt{\text{SING}}$ also have to be in the same phase-cyclic domain; see Marvin (2002) and Embick (2010) for discussion.

venire etc.). The relevant changes are triggered by the past tense morpheme T[+past], and apply only to certain verbs, making them M/M-Rules in the classification above. Calabrese shows that traditional explanations, which rely on (essentially suppletive) allomorphy driven by stress, fall short in explaining the distribution of regular and irregular stem alternants. His argument is that the irregular stem alternants are found only in the 1sg, 3sg, and 3pl because it is precisely these forms that have no theme vowel. According to this analysis, then, there are two morphological representations underlying the two type of Passato Remoto; athematic (10a) and thematic (10b):

- (10) a. Athematic $\sqrt{\text{ROOT-T[+past]}}\text{-AGR}$: 1sg mwov-s-i \rightarrow móssi
 b. Thematic $\sqrt{\text{ROOT-THEME-T[+past]}}\text{-AGR}$: 2sg mwov-e-Ø-sti \rightarrow mwovésti

The representations in (10) abstract away from certain details that play an important role in Calabrese's treatment (e.g., Tense and AGR fuse in thematic forms). The key point for present purposes is that the rules that derive irregular stem allomorphy are constrained to apply only when the Root and T[+past] are adjacent. As Calabrese demonstrates, this locality-based view accounts for stem allomorphy and a number of other morphophonological effects seen in the Passato Remoto forms in a direct and constrained way; a significant advance over alternatives in which stem choice is determined by paradigmatic structure, or global phonological properties.

Moving past M/M-rules and the MIC, for the M/P-Rules (7b) what is at issue is the idea that locality defined in terms of phonological representations may be morphologically “non-local”; i.e., may skip morphemes.⁸ Thus, even though such rules are triggered by specific morphemes, or target specific morphemes, they obey the locality conditions that apply to phonological rules. This is an

⁸Carstairs-McCarthy (1992) highlights the importance of “morphologically non-local” interactions along these lines, with an illustration from Zulu palatalization. See also Hyman et al. (2008) for some related phenomena.

important observation, as it highlights the fact that such rules are “part of the phonology”, despite their morphological conditioning.

A first illustration of the “morpheme-skipping” effect can be drawn from Banksira (2000), using the process of labialization in Chaha (recall (3) above). This process labializes the first potential target to the left of the 3sgM.OBJ morpheme, whose position is symbolized with $-\text{ə}\Delta$ below.⁹ In the following examples, labialization affects the malefactive morpheme $-\beta$ in (11a), skips benefactive $-r$ to labialize 1sg subject $-xi$ in (11b), and skips benefactive $-r$ and 3sgM.SUBJ $-\emptyset$ in (11c) to labialize the medial consonant of the root. Note that all of these examples include a final tense morpheme $-m$ which, even though it is phonologically a possible target of labialization, is to the right of the 3sgM.OBJ morpheme, and therefore never targeted; this is a good example of Morphophonological Locus, since right-to-left labialization starts from the object morpheme, not e.g. from the right edge of the word (labialized elements are boldfaced):

(11) From Banksira (2000:284, 296-7)

a. $k\text{əf}\text{ət} -xi \quad -\beta \quad -\text{ə}\Delta \quad -m \longrightarrow k\text{əf}\text{ət} -xi -\mathbf{w} -\text{ə} -m$
 open -1SG.SUBJ -MAL -3SGM.OBJ -TNS

‘I have opened (something) to his detriment.’

b. $k\text{əf}\text{ət} -xi \quad -r \quad -\text{ə}\Delta \quad -m \longrightarrow k\text{əf}\text{ət} -\mathbf{x}^w i -r -\text{ə} -m$
 open -1SG.SUBJ -BEN -3SGM.OBJ -TNS

‘I have opened for him.’

c. $k\text{əf}\text{ət} -\emptyset \quad -r \quad -\text{ə}\Delta \quad -m \longrightarrow \mathbf{k\text{əf}^w\text{ət}\text{ə}} -\emptyset -r -\text{ə} -m$
 open -3SGM.SUBJ -BEN -3SGM.OBJ -TNS

‘He has opened (something) for him.’

⁹Banksira treats 3sgM.OBJ as $-\text{ə}U$, where the /U/ component contributes [round] and [high] features that are spread to the left. See his book for other important details concerning the phonology of labialization.

A second example of skipping morphemes can be seen in some dialects of Italian, which show a process called *metaphony*: the raising of a stressed vowel when the following syllable contains a high vowel. For an overview see Maiden (1991)), and, for the phonological change(s) effected, Calabrese (1999, 2009). In certain dialects of Italian, only schwa appears post-tonically. In some of these dialects, the second person singular agreement (2sg AGR) affix– which historically was (metaphony-triggering) *-i*, as in Standard Italian– continues to trigger metaphony; this is shown in (12) for the dialect of Ischia (the left columns show Standard Italian for comparison):

(12) Metaphony triggered by AGR (Maiden 1991:159); *cant/kand* ‘sing’

	<i>St. Italian</i>		<i>Ischia, Campania</i>	
	<i>pr. ind.</i>	<i>impf. ind.</i>	<i>pr. ind.</i>	<i>impf. ind.</i>
1sg	canto	cantavo	kandə	kandavə
2sg	canti	cantavi	kəndə	kandɛvə
3sg	canta	cantava	kandə	kandavə

There are two observations to be made here. The first is that the raising is a morphophonological change triggered by the 2sg AGR morpheme. The second is that the target of the change need not be morphologically adjacent. The imperfect indicative form *kandɛvə* consists of four morphemes: a Root, a theme vowel (underlyingly /a/), a past tense morpheme *-v*, and the 2sg AGR morpheme *-ə*: [[[√KAND a] v] ə]. The change that is effected by metaphony triggered by 2sg AGR, then, is not restricted to adjacent morphemes. Rather, it skips the past tense morpheme *-v*; that is to say, it obeys *phonological* locality, and affects the autosegmentally adjacent theme vowel.

In both the Chaha and the Ischia examples, the morphophonological change may be realized on a morpheme that is not morphologically concatenated with the trigger of the change. Rather, it is realized on an element that is phonologically local to the trigger.

2.3 Synopsis

The theory outlined in this section hypothesizes that morphophonological changes in the broad sense might be the result of rules that have distinct locality conditions: M/M-Rules, which apply to concatenated morphemes; and M/P-Rules, which operate in terms of phonological locality.¹⁰

The full range of predictions of this approach remain to be investigated. Moreover, there is more work to be done on the precise nature of integrated morphological and phonological representation, in which specific morphemes and their linear relations play a role (along the lines investigated in e.g. McCarthy (1981) and subsequent work). It should be stressed, however, that while many alternative formulations of morphophonological locality may be considered, the core fact to be accounted for is that there are *some* locality conditions that regulate the application of morphophonological alternations. That is, Morphophonological Locus must be accounted for, and theories are deficient to the extent that they allow stem-changing and other morphophonological

¹⁰It is also conceivable that certain alternations might actually be triggered in both ways. With respect to German Umlaut, a reviewer makes the important observation that while certain affixes trigger the change in a target-specific way (recall examples in 2.2 above), other affixes appear to trigger it regularly. These are called “Umlaut variable” and “Umlaut conditioning” respectively in Lieber (1987:100). One possible line to investigate is that Umlaut is an M/M rule with the former class of affixes, but an M/P rule with the latter. As the reviewer notes, further complications arise because of apparent cases of optionality in the Umlaut system. In any case, much remains to be said about this process with reference to the M/M versus M/P rule classification, but considerations of space rule out further discussion here.

alternations to be triggered in an unrestricted way. This is the essential theme of the next section, where comparisons with non-affixal theories are undertaken.

3 Some Pertinent Comparisons

At the outset I noted that non-affixal changes are often taken to be problematic for morpheme-based theories, and as evidence for affixless theories. The reasons for this are supposed to be clear: e.g., whereas *-ed* in the past tense *played* of *play* looks like a morpheme, the change seen in *sang* from *sing* does not; not in any obvious sense, anyway. By this last comment I mean that it is probably true that if we look only at the form *sang* (or at the forms *sing* and *sang* together), it might not be obvious why *sang* should be analyzed as containing (at least) the two morphemes $\sqrt{\text{SING}}$ and T[+past]. On the other hand, if we consider the syntacticosemantic fact that *sang* (like e.g. *play-ed*) is used for “past tense of $\sqrt{\text{SING}}$ ” only in a subset of past tense clauses in English— i.e., if we consider its relation to clausal syntax, and interactions with T-to-C movement, negation, *do*-support etc.— the need to treat *sang* as consisting of $\sqrt{\text{SING}}$ and T[+past] at some level of analysis is much clearer. On this point, see Chomsky (1957:58), which is framed with reference to Hockett’s (1954) discussion of how morpheme-based theories might handle non-affixal alternations.

In any case, although the idea that morpheme-based theories have difficulties with non-affixal alternations is familiar, explicit arguments that elaborate and develop this point are not always easy to find. Anderson (1992) provides a useful point of reference, as it is a sustained attempt to motivate and develop a theory that dispenses with morphemes (for inflectional morphology, anyway). As justification for this move, Anderson argues that “...the class of contributors to the form of complex words looks more like the set of changes made by phonological rules than it does

like a lexicon of listed word-like elements” (1992:72). Generalizing, the conclusion is that, “Since a process-based approach naturally accommodates affixation, but not vice versa, the alternative we should prefer is to explore a theory of morphological processes” (1992:68).

It is important to note that this argument concentrates on the question of whether non-affixal alternations can be reduced *in toto* to affixation. This is, in my view, somewhat misleading. What is at issue is this. In a theory with morphemes, an apparently non-affixal alternation like German Umlaut could, in principle, be treated in one of two ways: either (i) (morpho)phonologically, with a list of morphemes that trigger a fronting rule; or, (ii) via insertion of autosegments, so that, for instance, Umlaut-triggering morphemes are those whose exponents begin with the feature [-back] (see e.g. Lieber 1987). In the latter case, the need for “morphologically triggered phonological rules” is avoided; instead, morphemes plus “normal phonology” produce what look like non-affixal changes. For convenience, the generalized version of the type (ii) approach— one which replaces morphologically-conditioned phonological rules with insertion— will be referred to as a *Vocabulary Insertion Only* (VIO) theory. In these terms, Anderson (1992:68) criticizes Lieber (1987) (and others) on the grounds that while certain non-affixal alternations might lend themselves to a VIO analysis, others (subtractions, exchange rules, chain shifts) cannot be treated in affixal terms. It is for this reason, Anderson concludes, that an affixless theory is required.

It is important to note that the correctness of the VIO approach is irrelevant as far as the main argument of this paper is concerned. The reason for this is that the argument centered on Morphophonological Locus can be framed either in terms of a theory with morphologically-triggered phonological rules (as in section 2), or in terms of a theory with VIO (since the inserted autosegments etc. will have their locus in a morpheme that has a position). For the rest of this section, then, the question to be addressed is not *can all “morphological changes” in*

the broad sense be treated affixally? Instead, it is *do morpheme-based or affixless theories provide the basis for the correct theory of morphological and morphophonological locality?* The status of VIO will be left for another occasion.¹¹

I will speak generically of affixless theories in addressing the locality question, so that the argument is intended to apply to a wide range of approaches.¹² Schematically, affixless approaches

¹¹Regarding VIO for M-Triggers, Bye and Svenonius (to appear) develop something along the lines of Lieber's (1987) program (although other assumptions that they make about insertion at non-terminals might complicate the predictions about Morphological Locus; see Fn.15 below). It is not clear at this point that VIO extends naturally to all of the phenomena treated with morphologically conditioned phonological processes. Beyond the question of how all M-Triggers can be reduced to Vocabulary Insertion, a further question for VIO is how to account for the properties of *M-Targets*. Recall from section 2.2. that processes like German Umlaut and Spanish Diphthongization apply to some morphemes, and not to others. Illustrating with the latter, the morphemes undergoing this process could be identified morphologically (e.g., with diacritics, as in Harris 1969), or phonologically (by making the underlying phonological representations of diphthongizing $\sqrt{\text{PENS}}$ and non-diphthongizing $\sqrt{\text{TENS}}$ distinct, as in Harris (1985)). To the extent that "abstract" phonological solutions are not always available (or correct) for M-Targets, the theory will require phonological rules that make reference to specific morphemes.

¹²For example: there are several affixless approaches which, like Anderson, follow the lead of Matthews (1972), Aronoff (1976), and others; e.g. Pullum and Zwicky (1991) and Stump (2001). With respect to stem alternations in particular, there is also the "morphomic" approach advocated by Aronoff (1994) (also a continuation of views from Matthews (1965, 1972)), which also has connections to diachrony (e.g. Maiden (2004); see many of the papers in Maiden et al. (2011)). Many of these movements separate themselves from broader architectural questions concerning syntax, semantics, phonology etc. in such a way as to make substantial comparisons difficult (although see Embick (1998), (2000) and Embick and Halle (2005) for some discussion of Aronoff's approach).

On the more experimental side, work in the "words and rules" and related frameworks seems to assume something like Anderson's view of what it means to be formed by rule; see e.g. Pinker (1999), Pinker and Ullman (2002), and the discussion in Embick and Marantz (2005). Further afield in terms of theoretical perspective, Seidenberg and

derive the forms of words by operations that apply to representations consisting of Roots and matrices of features like (14); compare the structured complex of morphemes in (13):

(13)

$$[[[\sqrt{\text{ROOT}} \pm W] \pm X] \pm Y]$$

(14)

$$\sqrt{\text{ROOT}} \begin{bmatrix} \pm W \\ \pm X \\ \pm Y \end{bmatrix}$$

In the affixless representation in (14), all of the features are equally “close” to each other, and to the Root. This is a defining property of such a theory. With this in mind, the claim I will now develop is stated in (15):

(15) Affixless theories make no predictions about the locality of morphophonological interactions, because the MLT (or something similar) cannot be formulated in such theories.

Comparison with the theory of §2 is important for understanding (15). Take, for concreteness, an instantiation of (13)/(14) in which W is Aspect, X is Tense, and Y is Agreement; this is the typical structure of a verb in many languages. Assume further that these are suffixes: $\sqrt{\text{ROOT}}$ -ASP-TNS-AGR. The theory of section 2 says that in complex tenses, in which there are overt realizations Aspect and Tense, a morphophonological rule triggered by e.g. 1pl AGR might not be able to affect the Root. If it is an M/M-rule, then it is predicted that no change to the Root will be possible, period, because such rules require the concatenation of morphemes. If the change is

Gonnerman (2000) and Hay and Baayen (2005) are representative examples of approaches that seek to eliminate morphemes in more radical ways.

effected by an M/P rule, then it could only affect the Root if the exponents of Aspect and Tense are not themselves phonological targets (or phonological blockers) of the change.¹³

The point of (15) is that these types of predictions cannot be made in a theory that eliminates morphemes. There are at least two ways of making this position precise, corresponding to two different ways of analyzing non-affixal changes in affixless theories.

A first type of analysis employs *stem insertion*. Anderson's (1992) treatment of irregular inflection and stem allomorphy holds that e.g. *sang* is a (suppletive) allomorph ("stored stem") of $\sqrt{\text{SING}}$; the [+past]-specified stem *sang* beats the default stem *sing* when $\sqrt{\text{SING}}$ is bundled with T[+past].¹⁴ Stem insertion has serious problems with blocking, as discussed by Halle and Marantz (1993). The further point raised by (15) is that it makes it impossible to formulate a local theory of Morphophonological Loci: since all of the features are equally local in representations like (14), any feature (or any subset of features in a representation like (14)) could potentially trigger stem allomorphy of a "non-affixal" morphological type. The idea that certain changes cannot occur because of the distance between the trigger and target cannot be formulated. Thus, in this approach, there are not expected to be any effects of morphophonological locality in language.¹⁵

¹³If the M/P rule is iterative, it could apply to intervening Aspect and Tense, and the Root as well.

¹⁴The same kind of stem insertion could be at the heart of Maiden (2004) and related treatments of stems, although it is difficult to tell, since an insertion mechanism is not specified.

¹⁵This argument also applies to approaches like Siddiqi (2009), which treats stem allomorphy of the *sing/sang* type by *fusing* nodes in structures like $[[\sqrt{\text{SING}} \nu] \text{T}[+\text{past}]]$; this creates representations like (14) prior to Vocabulary Insertion. Some theories that allow insertion of phonological material at non-terminal nodes are subject to this argument as well (see Bye and Svenonius (to appear) for references), to the extent that the relevant non-terminals contain feature bundles like (15).

A second way of reasoning through (15) is as follows. Theories like Anderson's (e.g. Stump 2001, although it differs in other ways) use blocks of rules to spell-out feature bundles like the one in (14). In Anderson's formalization, these *word formation rules* (WFRs) are phonological rewrite rules. So, for example, the plural of an English noun like *dog* is formed by taking the representation *dog*[+pl] and rewriting it with the rule $/X/+pl \rightarrow /Xz/$ that adds */z/*. Suppose now that rather than treating non-affixal changes with stem insertion, as discussed above, such changes were treated with rewriting rules. Again, the question is as follows: if all features are equally close to the Root and to each other in representations like (14), then why should morphophonological changes ever show any sort of locus? The representation in (14) makes any potential interaction among features possible, thus allowing every conceivable trigger/target interaction. So, "local changes" could be analyzed by manipulating how the rule blocks are ordered. Letting B_W , B_X , and B_Y be rule blocks realizing *W*, *X*, and *Y*, it would be possible to say that the feature *Y* triggers a change that applies to the output of B_W and B_X to the Root by stipulating the block order (i) B_W , (ii) B_X , and (iii) B_Y . But this order in no way follows from (14), where, as stressed above, all features are equally close to each other. Thus, it would also be possible to order a block $B_{y'}$ sensitive to *Y* first (since *Y* and the Root are visible to each other in (14)), such that changes triggered by the *Y* feature would apply to the Root even when there are overt reflexes of *W*, *X*, and *Y* in that order. More generally, the morphosyntactic representation (14) does not place any constraints on the order of morphophonological rule blocks, making any set of interactions possible. In short, affixless theories may manipulate rule blocks to account for local alternations, but only because they allow for completely non-local alternations as well.

Another way of making this point is as follows. In an affixless approach that employs rewrite rules, such rules are not expected to have the locality properties of phonological rules, because

they are morphological; i.e., triggered by features in representations like (14). But since there are no morphemes, they do not have morphological locality properties either. Anderson (1992:45-6) seems to be aware of this issue, but does not, in my view, sufficiently acknowledge its implications, viz. the predicted absence of any locality effects in morphophonology.

In summary, to the extent that extremely non-local effects of the type outlined above are not found, then “non-affixal” changes are problematic for affixless theories. Given the observations about Morphophonological Locus outlined above, the burden of proof must be on advocates of the affixless theories to show either (i) that there are in fact radically non-local morphophonological changes in the world’s languages, or that (ii) there is a straightforward way of accounting for morphophonological locality in an affixless theory.

4 Conclusions and Further Directions

The basic claims of this paper are that (apparently) non-affixal morphological changes (i) have a Morphophonological Locus in a word that determines where they apply, and (ii) that the correct theory of such Morphophonological Loci follows from a morpheme-based theory, but cannot be derived in an affixless view. Within the general framework of assumptions that I have adopted here, there are different approaches that can be taken towards the locality of morphophonological operations. At a minimum (and putting to the side the question of reducing everything to Vocabularly Insertion), there are M/P-Rules that show the locality conditions characteristic of phonological operations. Such rules connect with important developments in generative phonology, in which morphologically-conditioned phonological rules are treated with other “normal” phonological rules (Halle 1959 and related work). For reasons that connect with the type of information found in

(suppletive) contextual allomorphy, I hypothesized further in section 2 that there might be another type of rule, the M/M-Rules, which, because they make reference to the identity of two morphemes as morphemes, require morphological concatenation.

There are many additional topics to be addressed in a more comprehensive theory of morphophonology. Fundamental representational questions about how morphological and phonological information is accessed in the PF component connect with other substantive questions about the division of labor between Vocabulary Insertion and the phonology (leading, for example, to the question of how much “non-affixal” morphology can be reduced to the former). Whatever specific directions these latter lines of investigation go, the general point that defines the present work is that the morpheme is indispensable for understanding how syntax, sound, and meaning are connected in language. In this I echo Halle (1990), a paper that has launched so much productive work because of its insistence that the morpheme in all of its dimensions must be at the heart of morphological theory.

References

- Akinlabi, Akinbiyi. 1996. Featural affixation. *Journal of Linguistics* 32:239–289.
- Akinlabi, Akinbiyi. 2011. Featural affixes. In *The Blackwell companion to phonology*, ed. Marc van Oostendorp, Colin J. Ewen, and Elizabeth V. Hume, 1945–1971. John Wiley and Sons.
- Anderson, Stephen. 1992. *Amorphous morphology*. Cambridge: Cambridge University Press.
- Aronoff, Mark. 1976. *Word formation in generative grammar*. Cambridge, MA: MIT Press.

- Aronoff, Mark. 1988. Head operations and strata in reduplication: A linear treatment. *Yearbook of Morphology* 1:1–15.
- Aronoff, Mark. 1994. *Morphology by itself: Stems and inflectional classes*. Cambridge, MA: MIT Press.
- Banksira, Degif Petros. 2000. *Sound mutations: The morphophonology of Chaha*. Philadelphia/Amsterdam: John Benjamins.
- Bermúdez-Otero, Ricardo. 2006. Morphological structure and phonological domains in Spanish denominal derivation. In *Optimality-theoretic studies in Spanish phonology*, ed. Fernando Martínez-Gil and Sonia Colina, 278–311. Amsterdam: John Benjamins.
- Bye, Patrik, and Peter Svenonius. to appear. Non-concatenative morphology as epiphenomenon. In *The morphology and phonology of exponence*, ed. Jochen Trommer. Oxford: Oxford University Press.
- Calabrese, Andrea. 1999. Metaphony revisited. *Rivista di Linguistica* 10:7–68.
- Calabrese, Andrea. 2012. Allomorphy in the Italian Passato Remoto: A Distributed Morphology analysis. Ms., University of Connecticut.
- Carstairs-McCarthy, Andrew. 1992. *Current morphology*. London: Routledge.
- Chomsky, Noam. 1957. *Syntactic structures*. The Hague: Mouton.
- Chomsky, Noam. 2000. Minimalist inquiries: The framework. In *Step by step: Essays on minimalist syntax in honor of Howard Lasnik*, ed. Roger Martin, David Michaels, and Juan Uriagereka, 89–156. MIT Press.

- Chomsky, Noam. 2001. Derivation by phase. In *Ken Hale: A life in language*, ed. Michael Kenstowicz, 1–52. Cambridge, MA: MIT Press.
- Chomsky, Noam, and Morris Halle. 1968. *The sound pattern of English*. New York: Harper and Row.
- Ekdahl, Muriel, and Joseph E. Grimes. 1964. Terena verb inflection. *International Journal of American Linguistics* 30:261–268.
- Embick, David. 1998. Voice systems and the syntax/morphology interface. In *MITWPL 32: Papers from the UPenn/MIT roundtable on argument structure and aspect*, ed. Heidi Harley, 41–72. MITWPL.
- Embick, David. 2000. Features, syntax and categories in the Latin perfect. *Linguistic Inquiry* 31:185–230.
- Embick, David. 2003. Locality, listedness, and morphological identity. *Studia Linguistica* 57:143–169.
- Embick, David. 2007. Linearization and local dislocation: Derivational mechanics and interactions. *Linguistic Analysis* 33:303–336.
- Embick, David. 2010. *Localism versus globalism in morphology and phonology*. Cambridge, MA: MIT Press.
- Embick, David. 2012. Contextual conditions on stem alternations: Illustrations from the Spanish conjugation. In *Proceedings of Going Romance 2010*, ed. Irene Franco, Sara Lusini, and Andrés Saab, 21–40. Philadelphia/Amsterdam: John Benjamins.

- Embick, David, and Morris Halle. 2005. On the status of *stems* in morphological theory. In *Proceedings of going romance 2003*, ed. T. Geerts and H. Jacobs, 59–88. Amsterdam/Philadelphia: John Benjamins.
- Embick, David, and Alec Marantz. 2005. Cognitive neuroscience and the English past tense: Comments on the paper by Ullman et al. *Brain and Language* 93.
- Embick, David, and Alec Marantz. 2008. Architecture and blocking. *Linguistic Inquiry* 39:1–53.
- Embick, David, and Rolf Noyer. 2001. Movement operations after syntax. *Linguistic Inquiry* 32:555–595.
- Halle, Morris. 1959. *The sound pattern of Russian*. The Hague: Mouton.
- Halle, Morris. 1990. An approach to morphology. In *Proceedings of NELS 20*, 150–184. GLSA.
- Halle, Morris. 2001. Infixation versus onset metathesis in Tagalog, Chamorro, and Toba Batak. In *Ken Hale: A life in language*, ed. Michael Kenstowicz, 153–168. Cambridge, MA: MIT Press.
- Halle, Morris, and Alec Marantz. 1993. Distributed Morphology and the pieces of inflection. In *The view from building 20: Essays in linguistics in honor of Sylvain Bromberger*, ed. Kenneth Hale and Samuel Jay Keyser, 111–176. Cambridge, MA: MIT Press.
- Harris, James W. 1969. *Spanish phonology*. Cambridge, MA: MIT Press.
- Harris, James W. 1985. Spanish diphthongization and stress: A paradox resolved. *Phonology Yearbook* 2:31–45.
- Hay, Jennifer, and Harald Baayen. 2005. Shifting paradigms: gradient structure in morphology. *Trends in Cognitive Sciences* 9:342–248.

- Hockett, Charles F. 1954. Two models of grammatical description. *Word* 10:210–131.
- Hyman, Larry, Sharon Inkelas, and Galen Sibanda. 2008. Morphosyntactic correspondence in Bantu reduplication. In *The nature of the word: Essays in honor of Paul Kiparsky*, ed. Kristin Hanson and Sharon Inkelas, 273–309. Cambridge, MA: MIT Press.
- Kiparsky, Paul. 1996. Allomorphy or morphophonology? In *Trubetzkoy's orphan*, ed. Rajendra Singh and Richard Desrochers, 13–31. Amsterdam/Philadelphia: John Benjamins.
- Lieber, Rochelle. 1980. The organization of the lexicon. Doctoral Dissertation, MIT.
- Lieber, Rochelle. 1987. *An integrated theory of autosegmental processes*. Albany: State University of New York Press.
- Lowenstamm, Jean. 2010. Derivational affixes as roots (phasal spellout meets english stress shift). Ms. Université Paris-Diderot and CNRS.
- Maiden, Martin. 1991. *Interactive morphology: Metaphony in Italy*. London and New York: Routledge.
- Maiden, Martin. 2004. Morphological autonomy and diachrony. *Yearbook of Morphology* 137–175.
- Maiden, Martin, John Charles Smith, Maria Goldbach, and Marc-Olivier Hinzelin, ed. 2011. *Morphological autonomy: Perspectives from Romance inflectional morphology*. Oxford University Press.
- Marantz, Alec. 1992. What kind of pieces are inflectional morphemes? Paper presented at the Berkeley Linguistics Society.

- Marantz, Alec. 2001. Words and things. Handout, MIT.
- Marantz, Alec. 2007. Phases and words. In *Phases in the theory of grammar*, ed. S. H. Choe et al. Seoul: Dong In Publisher.
- Marantz, Alec. 2012. Locality domains for contextual allomorphy across the interfaces. In this volume.
- Marvin, Tatjana. 2002. Topics in the stress and syntax of words. Doctoral Dissertation, MIT.
- Marvin, Tatjana. 2012. Is word structure relevant for stress assignment? This volume.
- Matthews, Peter H. 1965. The inflectional component of a word-and-paradigm grammar. *Journal of Linguistics* 1:139–171.
- Matthews, Peter H. 1972. *Inflectional morphology; a theoretical study based on aspects of Latin verb conjugation*. Cambridge: Cambridge University Press.
- McCarthy, John J. 1981. A prosodic theory of nonconcatenative morphology. *Linguistic inquiry* 12:373–418.
- Noyer, Rolf. 1992. Features, affixes, and positions in autonomous morphological structure. Doctoral Dissertation, MIT.
- Pinker, Steven. 1999. *Words and rules: The ingredients of language*. Perseus Books.
- Pinker, Steven, and Michael Ullman. 2002. The past and future of the past tense. *Trends in Cognitive Sciences* 6:456–463.

- Pullum, G.K., and A.M. Zwicky. 1991. A misconceived approach to morphology. In *Proceedings of the West Coast Conference on Formal Linguistics*, Vol. 10, 387–398.
- Rose, Sharon. 2007. Chaha (Gurage) morphology. In *Morphologies of Africa and Asia*, ed. Alan S. Kaye, Vol. 1, 403–428. Winona Lake, Indiana: Eisenbrauns.
- Salanova, Andrés Pablo. 2004. Subtractive morphology in Mëbengokre. Ms., MIT.
- Seidenberg, Mark S., and Laura M. Gonnerman. 2000. Explaining derivational morphology as the convergence of codes. *Trends in Cognitive Sciences* 4:353–361.
- Siddiqi, Daniel. 2009. *Syntax within the word: Economy, allomorphy, and argument selection in Distributed Morphology*. Amsterdam/Philadelphia: John Benjamins.
- Stump, Gregory. 2001. *Inflectional morphology: A theory of paradigm structure*. Cambridge University Press.
- Wiese, Richard. 1996a. Phonological versus morphological rules: On German umlaut and ablaut. *Journal of Linguistics* 32:113–135.
- Wiese, Richard. 1996b. *The phonology of German*. Oxford University Press.
- Wolf, Matthew. 2006. For an autosegmental theory of mutation. In *University of Massachusetts occasional papers in linguistics 32: Papers in Optimality Theory III*, ed. L. Bateman, M. O’Keefe, E. Reilly, and A. Werle. Amherst: GLSA.
- Yu, Alan. 2004. The morphology and phonology of infixation. Doctoral Dissertation, University of California at Berkeley.