

Contextual conditions on stem alternations

Illustrations from the Spanish conjugation^{*}

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This paper looks at the analysis of *stem alternations*: a type of non-affixal morphological change. Alternations of this type are controversial because they look in principle like they can be analyzed either with distinct stem forms in memory, or with (morpho)phonological rules that derive alternants from a single underlying form. I argue that the locality conditions on contextual allomorphy provide an answer to part of this controversy. It is shown that certain stem alternations in Spanish verbs—diphthongization, as in e.g. *pensar/pienso* ('think'); raising, as in e.g. *pedir/pido* ('ask') – cannot be treated with stored stems, because the alternations do not occur under the locality conditions that apply to contextual allomorphy. These alternations must be treated (morpho)phonologically. The implications of this view are explored; this includes a conjecture that reclassifies different types of “morpheme specific” alternations in the grammar.

Keywords: allomorphy; alternations; morphology; Spanish; stems

1. Introduction

This paper examines the phenomenon of *stem alternation*, also called *stem allomorphy*. To a first approximation, this is a type of allomorphic alternation that is characterized by a non-affixal change. Examples of stem allomorphy are common. For instance, certain verbs in English undergo changes in the context of the

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past tense morpheme, to yield alternations like *sing/sang*, *break/broke*, *tell/told*, and so on. Or, in the Spanish conjugation, there are verb-specific alternations in stem-vowels, so that e.g. the verb *pensar* ‘to think’ has the first person present indicative form *pienso*, with a diphthong, whereas first person plural *pensamos* has a monophthong. In each of these examples, the alternation is morphological in the sense that it is triggered by a particular morpheme, or applies to certain morphemes, and not others. Moreover, which morphemes do and do not participate in the alternation is not predictable as far as the synchronic grammar is concerned.

The analysis of stem alternations is controversial because most theories make available two distinct ways in which they could be analyzed: one in which the alternants exist as separate objects in memory (this is called *Stem Storage* below), and another in which the alternants are derived by rule from a single underlying form (I will call this a *Morphophonological* analysis). The first type of analysis makes stem alternation a kind of suppletive contextual allomorphy; the second makes it part of the phonology, in the broad sense.

Both contextual allomorphy and phonological changes have independent motivation in the grammar. The pressing theoretical question is what evidence there is for treating stem alternation with one or the other mechanism. The main line of argument of this paper is that the general theory of locality in contextual allomorphy provides a decisive answer to part of this controversy. Stem storage theories treat different stems as (suppletive) contextual allomorphs. However, there is a certain type of stem alternation that is conditioned by contextual factors in a way that is impossible for contextual allomorphy. Alternations with this property cannot be treated with Stem Storage; instead, they must be treated Morphophonologically.

1.1 Stem alternations in context

As noted above, the challenges presented by stem alternations derive from the fact that there appear to be two possible means of treating them. This point is best illustrated by considering the two phenomena that exemplify the two potential analytical options.

The first phenomenon, illustrated in (1a), shows two realizations of the second person singular agreement morpheme in Latin: *-istī* in the Perfect indicative tense of the verb, and *-s* in other tenses. The second phenomenon, seen in (1b), involves the English plural morpheme, which surfaces as */s/*, */z/*, or */əz/*, in a way that is predictable from the phonology of its host:

- (1) a. Latin AGR[2SG]
 laudāv-istī ‘You (have) praised’ (perfect)
 laudā-s ‘You praise’ (present)

- b. English [PL]
 cat, cat-s (/s/)
 dog, dog-s (/z/)
 church, church-es (/əz/)

In each of (1a,b), there is an alternation in the general sense: an object that is “the same” at some level of description (Latin AGR[2 SG]; English [PL]) is expressed by distinct phonological realizations (Latin *-istī* and *-s*; English /-s/, /-z/, and /-əz/). Despite this superficial similarity, the patterns in (1a) and (1b) are analyzed differently in most theories of grammar. The class of phenomena represented by Latin AGR[2SG] involves two phono-logical realizations that are by hypothesis not related by the phonology; rather, the realizations are suppletive contextual allomorphs of AGR[2SG]. Unlike Latin AGR[2SG], the English (regular) plural realizations can be related to one another by the phonology, such that the surface realizations /s/, /z/ and /əz/ are derived phonologically from a single exponent that has the underlying form /-z/. The difference between Latin (1a) and English (1b) is thus as follows. In the Latin example, the morphology deals with two distinct objects, *-istī* and *-s*, each of which exists in memory as part of a distinct Vocabulary Item. For the English plural, on the other hand, there is one morphological object (i.e. one Vocabulary Item) at play, and its exponent has the underlying phonological representation /-z/; the distinct surface realizations of /z/ are the result of the phonology.

Suppletive allomorphy like Latin (1a) and (normal) phonological processes like English (1b) provide two clear endpoints for the study of alternations. The difficult cases are those that do not fit neatly into either of these two extremes. The English *sing~sang* and Spanish *pensar~pienso* examples are of this type. They are not part of the “normal” phonology, because the relevant processes apply only to certain morphemes (or are triggered morphologically). At the same time, though, there are reasons for being cautious about treating such alternations as suppletive allomorphy: *sing/sang* and *pens/piens* share most of their segmental material, and thus do not look like suppletive allomorphs in any obvious sense.

1.2 The empirical question

The preceding subsection examines two different types of alternations: one phonological, and one morphological. In principle, stem allomorphy could be handled in either of these two ways; i.e. either with (morpho)phonological rules operating on a single morpheme, or with distinct morphemes in memory. These two types of theories are defined as follows, employing *sing~sang* for illustration:¹

1. The Stem Storage type of theory is most familiar in the recent theoretical context within certain Lexicalist theories (see Carstairs-McCarthy 1992 for discussion), as well as in “dual

- (MP) **Morphophonological Theory:** There is a single underlying form; surface differences are the result of (morpho)phonological rules. [i.e. $\sqrt{\text{SING}}$ is part of both *sing* and *sang*; a rule triggered by T[past] derives the latter.]
- (SS) **Stem Storage Theory:** There is suppletive contextual allomorphy; the different irregular alternants are stored in memory. [i.e. *sing* and *sang* exist as stored alternants, and are inserted in appropriate contexts.]

In this paper I put to the side conceptual arguments that have been made in favor of MP or SS theories (see Footnote 2 below). Instead, I develop a line of argument that asks under what locality conditions stem alternations take place (cf. also Kiparsky (1996)). The reasoning is as follows: if stem alternations are treated with SS, they are instances contextual allomorphy and must be subject to the locality conditions that characterize this type of alternation. Thus, a stem alternation that is triggered in a way that is impossible for contextual allomorphy cannot involve stored stems; rather, it must be treated morphophonologically.

Along these lines, Section 3 shows that there are stem alternations in Spanish that are (i) not part of the “normal” phonology, because they are restricted to apply to certain morphemes, but which (ii) do not obey the locality conditions on contextual allomorphy. The argument (which is summarized in Section 4) is that alternations of this type must be treated with MP, not SS.

The argument just outlined is partial, in the sense that it can be made for *certain* stem alternations, but not for others; for the latter type, either the MP or SS analyses could in principle work. This important point is taken up in Section 4. Section 5 offers some general conjectures about the manner in which morphological and phonological factors relate to the locality conditions under which an alternation may take place, and Section 6 offers concluding remarks.

2. Conditions on contextual allomorphy

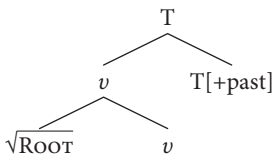
Contextual allomorphy is found when a single morpheme like T[+past] – a functional head – takes different forms depending on what is in its local environment.

route” models of morphology like Pinker and Prince (1988) and Pinker and Ullman (2002). Morphophonological theories are found (with internal differences) in early generative works like Chomsky (1957), Halle (1959), and Chomsky and Halle (1968), as well as in later works like Halle and Marantz (1993) and Embick and Halle (2005). In fact, these are only recent manifestations of the two positions; the debate between versions of these positions has been going on for a long time. See Kilbury (1976), Dressler (1985), the papers collected in Singh (1996), and Scheer (2010) for overviews and perspectives.

In English, for example, T[+past] is realized as $-\emptyset$ in the context of verbs like *hit* and *sing* (past tenses *hit- \emptyset* and *sang- \emptyset*); as $-t$ in the context of e.g. *bend* and *leave* (past tenses *ben-t* and *lef-t*); and as the “default” $-d$ elsewhere (as in *play/play-ed*, *kiss/kiss-ed*, and so on).

In the version of Distributed Morphology (Halle & Marantz 1993) that is assumed here (Embick & Marantz 2008; Embick 2010) contextual allomorphy is analyzed with the operation of Vocabulary Insertion (VI), which applies to morphemes (terminal nodes). Competition between Vocabulary Items – typically, with ordering by specificity determining the winner – yields one winner and “blocking” of less-specified Vocabulary Items. So, for example, $-t$ is inserted at T[+past] in the context of e.g. $\sqrt{\text{LEAVE}}$; as a result, the default $-ed$ is not inserted:

(2) Structure



(3) Vocabulary Items for Tense

T[+past]	↔	$-t/ ___ \{ \sqrt{\text{LEAVE}}, \sqrt{\text{BEND}}, \dots \}$
T[+past]	↔	$-\emptyset/ ___ \{ \sqrt{\text{HIT}}, \sqrt{\text{SING}}, \dots \}$
T[+past]	↔	$-d$

Contextual allomorphy can occur only under certain locality conditions. According to the theory developed in Embick (2010), allomorphic interactions are constrained by the manner in which Vocabulary Insertion operates, and by the interaction of *linear* and *cyclic* locality conditions. Three different conditions are at the center of this theory.

The first of these conditions enforces “inside out” cyclicity (e.g. Halle & Marantz 1993; Bobaljik 2000):

(A1) Insertion proceeds from the inside-out.

The ordering on insertion imposed by (A1) has consequences for the types of information (morphological or phonological) that may be referred to in Vocabulary Insertion; see below.

A second condition on allomorphy advanced in Embick (2010) (see also references cited there) specifies a linear condition on contextual allomorphy:

(A2) Contextual allomorphy requires concatenation (linear adjacency).

Concatenation is represented with \frown , such that $X \frown Y$ is read as “the terminal X is immediately left-adjacent to the terminal Y”; in these terms, (A2) holds that X may show contextual allomorphy determined by Y only when $X \frown Y$ (or $Y \frown X$).

As a linear relation, concatenation (and therefore contextual allomorphy) can ignore intervening syntactic brackets. Certain nodes are invisible for the concatenation process. For example, in English past tense verb (2–3), the (phonologically unrealized) ν head does not intervene between the Root and T[+past] (Embick 2003, 2010). This allows T[+past] to be conditioned contextually by certain Roots (and vice versa; see Section 5).

Beyond (A1) and (A2), it appears that cyclic domains (phases) also impose constraints on when nodes may interact for allomorphic purposes:

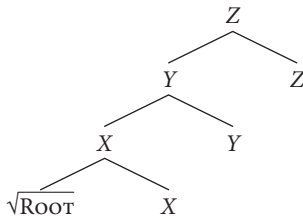
(A3) Two nodes can see each other for allomorphic purposes only when they are both active in the same cycle.

For some views on how phase boundaries (Chomsky 2000, 2001) are relevant to morphology see Embick and Marantz (2008), Marantz (2007) and the implementation in Embick (2010).

The main arguments of this paper are framed with respect to (A1,A2), (A1) in particular; the main results thus follow in any theory that incorporates this position. I include (A3) in this initial overview for completeness, and because ultimately the study of stem alternations must take into account cyclic domains as well.

Taken together, (A1,A2) constrain possible allomorphic interactions in a way that can be illustrated in (4), which shows a complex head (4a) and its linearization as a Root with suffixes (4b):

(4) a. Complex head



b. Linearization: $\sqrt{\text{ROOT}}-X-Y-Z (= \sqrt{\text{ROOT}} \frown X, X \frown Y, Y \frown Z)$

By (A1), VI occurs first at X, then at Y, then at Z. Thus, VI at X could be sensitive to either morphological or phonological features of the Root, but only to morphosyntactic features of Y; similarly, VI at Y could in principle see either phonological or morphosyntactic features of X but can look “outwards” only to morphosyntactic features of Z; and so on. In short, a node may show *inward* sensitivity to either morphosyntactic or phonological features, but it may show *outward* sensitivity only to morphosyntactic features, because outer nodes do not (by (A1)) have phonological content at that stage. An additional point is that by (A2) insertion at e.g. X could only be affected by $\sqrt{\text{ROOT}}$ or Y. The reason for this is that only the Root and Y are concatenated with X.

2.1 Extension to stem alternation

The MP and SS theories can be compared as follows. According to SS, stem alternation is analyzed as contextual allomorphy. In terms of the preceding subsection, this means that the distinct stems would have to be treated as separate Vocabulary Items competing for insertion; in essence, a $\sqrt{\text{ROOT}}$ would have different stems $\text{Stem}_1, \text{Stem}_2, \dots$, as shown in (5):²

- (5) $\sqrt{\text{ROOT}} \leftrightarrow \text{STEM}_1 / \langle \text{environment 1} \rangle$
 $\sqrt{\text{ROOT}} \leftrightarrow \text{STEM}_2 / \langle \text{environment 2} \rangle$
 \vdots

The important question with reference to hypothetical VIs like those in (5) is under what conditions the distinct stem alternants appear. By hypothesis, contextual allomorphy is subject to (A1,A2). Thus, if an alternation is conditioned by (i) a non-adjacent element; (ii) an “outer” node’s phonological properties; or (iii) a phonological property of the “word”, then it cannot be suppletive (i.e. it cannot be contextual allomorphy); rather, it has to be some sort of (morpho)phonological change.

Before looking at the specifics, a more general note is in order. This paper assumes that there are at least *some* constraints on when stem allomorphy may be triggered. The alternative to this, which I refer to as “Anything Goes”, holds that stem alternations could be triggered by any feature – or any bundle of features – anywhere in the context of the stem, in a way that does not respect any type of locality. “Anything Goes” is clearly a worst-case scenario for this part of the interface. There is no reason to assume it is correct, and I will assume below that approaches that allow reference to arbitrary bundles of features à la “Anything Goes” should be rejected.

3. Two alternations in Spanish verbs

The alternations from Spanish examined in this section are restricted to a certain class of Roots, and, as such, are not part of the normal phonology in any obvious way. This is the type of phenomenon that looks in principle like it could be

2. In most of the cases that are examined below, this means allomorphy for Roots. It therefore has to be assumed that Roots are subject to Vocabulary Insertion; see Embick (2000) for relevant discussion. One way to do this is by saying that a Root like e.g. $\sqrt{\text{SING}}$ could be realized by distinct phonological forms like *sing*, *sang*, and *sung*; see 3.1 below.

A conceptual argument against (5) is that it makes the relationship between stem alternants suppletive, so that *sing/sang* is represented in the same way as *go/went*; see e.g. Embick and Halle (2005). As mentioned earlier, I will put this type of objection to the side, however, and concentrate on the empirical predictions of theories that implement (5).

treated either with MP or with SS. The argument is that an SS treatment of these alternations does not comply with (A1,A2), because of the way in which they are conditioned by outer phonology. From this it follows that – in spite of the restriction to certain Roots or morphemes – stem storage must be rejected, in favor of a morphophonological approach.

3.1 Diphthongization

The alternation between simple vowels and diphthongs in Spanish – referred to as *diphthongization* – is item-specific, in the sense that certain verbs with /o/ and /e/ stem vowels alternate (6a), while other verbs with the same vowels do not undergo the alternation (6b). The present indicative forms of two verbs are shown in (6c):³

- (6) Diphthongization and listedness
- Diphthongization: *pensar* ‘think’, *poder* ‘be able to’, *tender* ‘hang’, *sentar* ‘sit’
 - No Diphthongization: *tensar* ‘tauten’, *poner* ‘put’, *podar*, ‘prune’ *rentar* ‘yield, rent’
 - Present Indicative forms for *pensar* and *tensar*

p/n	<i>pensar</i>	<i>tensar</i>
1s	pi <u>en</u> so	te <u>n</u> so
2s	pi <u>en</u> sas	te <u>n</u> sas
3s	pi <u>en</u> sa	te <u>n</u> sa
1p	pensamos	ten <u>s</u> amos
2p	pensá <u>i</u> s	ten <u>s</u> á <u>i</u> s
3p	pi <u>en</u> san	ten <u>n</u> san

The fact that diphthongization is not found in all verbs with /e/ and /o/ vowels in the Root is responsible for the tension between MP and SS analyses. Harris (1969), for instance, develops an analysis of the former type, whereas Hooper (1976) (probably) argues for the latter.

In the framework of Section 2, treating diphthongization with stem storage SS requires an analysis with stem allomorphs *pens* and *piens* of the Root $\sqrt{\text{PENS}}$. A provisional analysis with competing stems is shown in (7), where ENV₁ and ENV₂ are abbreviations for the hypothetical contextual specifications for these two stem allomorphs:

- (7) $\sqrt{\text{PENS}} \leftrightarrow \text{pens}/_ENV_1$
 $\sqrt{\text{PENS}} \leftrightarrow \text{piens}/_ENV_2$

3. The alternation typically involves /e~ie/ and /o~ue/. According to the standard description, there are a few verbs with underlying /i/ that alternate, such as *adquirir* ‘acquire’, and maybe one verb with stem /u/ that diphthongizes (*jugar* ‘to play’).

As noted above, Vocabulary Items like those in (7) are available in any theory that allows late insertion for (at least the phonology of) Roots.

The crucial aspect of (7) is what determines whether one or the other VI is used; i.e. what must be specified in the ENVs in order for the correct distribution of stems to be derived. The standard view is that the alternation is conditioned by stress. As can be seen in (8), the diphthong occurs when the stem vowel is stressed, and otherwise the simple vowel is found ((8) departs from orthographic practice by marking the stress in all forms):⁴

(8) Forms of *pensar* 'to think'

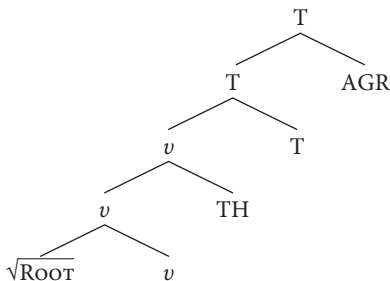
	1s	2s	3s	1p	2p	3p
pr. ind.	piénso	piénsas	piénsa	pensámos	pensáis	piénsan
pr. subj.	piénse	piénses	piénse	pensémos	penséis	piénse
pret.	pensé	pensáste	pensó	pensámos	pensastéis	pensáron
impf.	pensába	pensábas	pensába	pensábamos	pensábais	pensában

Although only four tenses are shown in (8), the pattern according to which the diphthong occurs under stress is exceptionless in the verbal system.

The fact that stress determines the distribution of alternating diphthongs in this way has direct consequences for the comparison of SS and MP theories. This is because sensitivity to stress along the lines seen in (8) requires information about stress placement that is not available when insertion at the Root node would have to take place in the SS theory.

Concretely, the verb forms shown in (8) are realizations of the complex head structure (9), which consists of a ν head, a TH(eme) node, a Tense node, and an AGR(eement) node (Oltra-Massuet 1999; Oltra-Massuet & Arregi 2005):

(9) Verbal structure



4. For stress in the Spanish verb see Oltra-Massuet and Arregi (2005) and references cited there.

The choice between *pens-* versus *piens-* at the Root node requires reference to the position of stress in the entire word. The realization of stress in turn requires insertion at the outer nodes (*v*, TH, T, AGR). This scenario is ruled out by (A1), which holds that insertion at the Root node must precede insertion at outer nodes.⁵

This argument against SS relies on the idea that diphthongization is phonologically determined. For this reason, it is worth considering an alternative that employs the VIs in (7), but with contextual conditioning by morphosyntactic features, not phonology. In principle, nothing in (A1,A2) prevents outward-looking contextual allomorphy, as long as it is conditioned by morphosyntactic (and not phonological) features on local nodes (see Embick 2010 for examples). And, if diphthongization could be treated morphosyntactically, it would not provide an argument against stem storage. In the case at hand, however, there is little motivation for a morphological treatment. Given only the present tense verb forms in (8), the non-diphthongized stem form could be restricted to first and second person plural environments (there are various ways in which this could be done). But, such an analysis fails to account for the broader generalization that alternating diphthongs occur under stress elsewhere in the language (in nouns, adjectives, etc.):

- (10) *viéjo* ‘old’, *vejéz* ‘age’
niéve ‘snow’, *nevádo* ‘snowy’
miél ‘honey’, *melóso* ‘like honey’
Venezuéla ‘Venezuela’, *Venezoláno* ‘Venezuelan’

The fact that the same phonological factor regulates the alternation in verbs, nouns, and adjectives points to the same conclusion: this alternation is phonologically determined.⁶

Different types of (morpho)phonological analyses of diphthongization could be given in the framework developed here. One factor that complicates the analysis

5. In addition to this, there is no sense in which the choice would be determined by the properties of a morpheme concatenated with the Root, as required by (A2).

6. There is a set of *prima facie* exceptions in which an alternating diphthong is found without being stressed on the surface. This is found with evaluative morphology like diminutives; e.g. *viéjo* ‘old (person)’, cp. *vejéz* ‘age’; but diminutive *viej-ít-o* ‘old (person)-DIM’ (see discussion and references in Halle et al. (1991)). It appears, however, that this exceptionality is part of a larger generalization about the status of (certain types of) diminutives; see Bachrach and Wagner (2006) for a morphophonological treatment of some related phenomena in Brazilian Portuguese, and for additional discussion of the syntax of such morphemes Wiltschko and Steriopolo (2007) and de Belder et al. (2009).

In addition, the behavior of diphthongization with different derivational morphemes is an important topic, but goes beyond the scope of this paper.

of diphthongization is that, in addition to there being non-alternating simple vowels (recall that e.g. *tensar* does not diphthongize, while *pensar* does), there are also non-alternating diphthongs in the language: e.g. *frecuénto* ‘I frequent’, *frecuentó* ‘s/he frequented’; *Viéna* ‘Vienna’, *vienés* ‘Viennese’ (Harris 1985:32). Thus, the Roots and morphemes that have alternating vowels have to be distinguished from the Roots and morphemes that do not. In principle, the relevant distinction could be made either phonologically (by positing distinct underlying representations for alternating and non-alternating segments) or morphologically (i.e. diacritically).

For example, Harris (1985) represents alternating diphthongs as phonologically special, with two timing slots, only the first of which is linked to a vowel. In this analysis, the empty position is associated with a vowel when it is in the rime of a stressed syllable, yielding a diphthong; if this association does not occur, a simple vowel surfaces (see also Inkelas et al. 1997).

On the other hand, theories in which phonological rules can make reference to the identity of particular morphemes – as I assume to be possible here – make the other option available. The alternating morphemes can be diacritically specified to undergo diphthongization (or monophthongization, if it is assumed that the diphthong is underlying). After stress is calculated in the word, certain morphemes (like $\sqrt{\text{PENS}}$) are subject to diphthongization if stressed, with the rule (or rules) making reference to $\sqrt{\text{PENS}}$ or a diacritic it bears.⁷

The difference between the phonologically-special and morphological diacritic approaches connects with a larger debate between theories that appeal to phonological exceptionality (or prespecification) on the one hand, versus theories employing morpheme-specific phonology (morphological or lexical diacritics on rules) on the other. This question – and some related questions about the structure of the phonology – go beyond the scope of the present discussion.⁸

7. With respect to the “morphological” analysis, it is important to note that the theory that I assume here still allows Roots like $\sqrt{\text{PENS}}$ to be visible as *Roots* when the stress of the whole word is calculated. In terms of the fleshed out version of (A3) of Section 2 (see Embick 2010), the verbs that have been examined to this point, which have the structure in (9), are contained within one cyclic domain. In other words, there is no “Bracket Erasure” (or equivalent) within (9); as a result, the Root still exists as a morphological object, and can be referred to as such, when the morphophonology reaches the outermost morpheme in (9). When the stress in the entire word is calculated, it is known whether e.g. $\sqrt{\text{PENS}}$ or $\sqrt{\text{TENS}}$ is present, and whether or not there is stress on the potentially alternating vowel. A diphthongization rule that has morphological conditioning can apply at that stage to produce the correct results.

8. On this theme, my view is that having phonological operations make reference to specific morphemes or features is unavoidable.

The important conclusion from this initial argument is that the distribution of stem alternants provides an argument against the SS theory.

3.2 “Raising”

Spanish verbs of Conjugation III (the *-ir* conjugation) show an alternation that is often referred to as *raising*; this is because in diachronic terms it involves the raising of mid vowels. As will be shown below, the “raising” alternation is better viewed as the result of a lowering or dissimilation rule in the synchronic grammar, as originally proposed by Harris (1969); for consistency of reference, however, I retain the term *raising verbs* for this class.

The raising phenomenon is seen in verbs like *pedir* ‘to ask’, which has e.g. 1s present *pid-o*, with stem /i/, but e.g. 1pl present *pedimos*, with stem /e/. Almost all of the verbs of Conjugation III that show an /e/ vowel in the infinitive alternate with /i/ in this way; (11) illustrates with further forms of *pedir*.⁹

(11) Forms of *pedir*

	1s	2s	3s	1p	2p	3p
pr. ind.	pid o	pid es	pid e	pedimos	pedís	pid en
pr. subj.	pid a	pid as	pid a	pid amos	pid áis	pid an
pret.	pedí	pediste	pid ió	pedimos	pedisteis	pid ieron
impf.	pedía	pedías	pedía	pedíamos	pedíais	pedían
impf. subj.	pid iera	pid ieras	pid iera	pid iéramos	pid ierais	pid ieran
fut	pediré	pedirás	pedirá	pediremos	pediréis	pedirán
cond	pediría	pedirías	pediría	pediríamos	pediríais	pedirían

The phonological and morphological solutions in the text share certain properties, and could incorporate some common assumptions. For instance, as discussed by Halle et al. (1991) and others, in terms of a theory with cyclic versus non-cyclic phonological rules, diphthongization is part of the non-cyclic phonology (Harris 1989 argues for this point against Halle and Vergnaud’s (1987) cyclic analysis of the rule). In terms of the model assumed here, one way to implement this is by saying that the rule(s) that result in diphthongization apply when the boundary of the entire word is reached; that is, at an M-Word boundary, in the sense of Embick and Noyer (2001).

These assumptions are important when further cases beyond the verbs are taken into consideration (diminutives, category-changing derivations, compounds), but I will not examine the matter further here.

9. There are a few exceptions, i.e. verbs with stem /e/ in the infinitive but no /i/ forms: e.g. *agredir* ‘attack’, *transgredir* ‘transgress’, *sumergir* ‘submerge’ are listed in Malkiel 1966:472; Harris 1969:115 lists *divergir* ‘diverge’ and *concernir* ‘concern’ as well.

In addition to the /e/~i/ alternation, there are a few verbs in which /o/ alternates with /u/ in the same way.

There is no rule of the normal phonology that would raise /e/ to /i/.¹⁰ The apparent irregularity of the phonological process relating /e/-stems and /i/-stems (along with the fact that the alternation is restricted to verbs of Conjugation III) makes the alternation a prime candidate for stem storage.¹¹

As can be seen in (11), the distribution of alternants is complicated. In terms of morphosyntactic features, the environments are as follows:

- (12) a. *ped*: 1 and 2 PL present indicatives; non-third person preterites; all imperfects, futures, and conditionals.
 b. *pid*: 1, 2, 3 SG, and 3 PL present indicatives; all the present subjunctives; all the imperfect subjunctives; 3s and 3p preterites.

All of the verbs in the raising class alternate in exactly the same way as *pedir*, with one further complication. A subset of the raising verbs (e.g. *mentir* ‘to lie’) also show diphthongization. With verbs of this latter type, diphthongs appear in exactly the expected forms (i.e. those where the stem vowel is stressed).¹²

The factors that determine the distribution of *ped* and *pid* in (11) do not appear to be morphosyntactic: there is no coherent set of tense, mood, or person/number features that could be referred to in conditioning one of the alternants. Thus, if the distribution of stem alternants had to be stated in a way that did not refer to the phonology, the only conceivable treatment would be one in which the environments taking each stem form are simply enumerated; reference to bundles of features in this way amounts to “Any-thing Goes” (see Section 2).

An analysis that makes reference to morphosyntactic features thus looks very unpromising. Moreover, it is unmotivated: just as with Diphthongization, there is a phonological generalization about the /e/~i/ alternation. Building on Harris (1969), it can be treated as a Dissimilation process, in which underlying /i/ is lowered when the following syllable contains /i/. This is stated as Dissimilation in (13):¹³

- (13) Dissimilation: $i \rightarrow e/_{(C)}i$
 <for the specified class of Roots>

10. For some relevant historical discussion of raising processes in Spanish see Malkiel 1966.

11. Harris (1969:115) treats the alternation with a “minor rule” that is lexically restricted. Linares et al. (2006) use the exceptions of the kind noted in the text as evidence for the irregular nature of the alternation, in spite of the fact that there are very few verbs with unchanging stem /e/ in Conjugation III. For a developmental angle on these verbs see Mayol (2007).

12. Thus *mentir* ‘to lie’ has three different surface alternants, as seen in e.g. 1s indicative *miento*, 1p indicative *mentimos*, 1p subjunctive *mintamos*.

13. The /i/ that triggers Dissimilation has to be a nucleus; in e.g. 3s past *pidió* it is a glide.

A simple way of encoding which Roots are undergoers is by marking the Roots subject to Dissimilation rule diacritically (or by restricting the rule to Conjugation III verbs, and marking the non-undergoers as exceptions). In the same way that the analysis with underlying /e/ has some exceptions (see Footnote 9), the analysis with underlying /i/ and Dissimilation must make use of Root-specific information. In fact, the analysis with underlying /i/ has more Root-specific exceptions to Dissimilation than there would be to a Raising rule; e.g. *vivir*, *vivo*, *vivimos*; *escribir*, *escribo*, *escribimos*; etc.

Putting these points together, a (morpho)phonological analysis of the Raising verbs is straight-forward, as long as it is acknowledged that the phonological process can be Root-specific. And, if the alternation is treated with a phonological trigger in this way, then it cannot be stem storage: by (A1) reference to outer phonological material is not possible in Vocabulary Insertion.

In sum, the “Raising” verbs look like a typical candidate for stem storage (morpheme-specific alternation), but do not show the locality conditions that apply to suppletive contextual allomorphy. This alternation must be treated morphophonologically, not with stem storage.

4. Interim summary

The last section looks at two stem alternations in Spanish verbs. These are both prime candidates for stem storage because they implicate specific morphemes, or, more neutrally, something beyond the normal phonology. The argument is that these alternations cannot be treated with stem storage, because of the locality relations between the elements undergoing and triggering the change: that is, in each case, the stem alternation is triggered in a way that cannot be contextual allomorphy in a theory with (A1–3). As noted above, the argument makes particular use of (A1), because it involves sensitivity to outer phonological properties; (A2) may be implicated as well.

Another way of stating the general conclusion is this: morphological or lexical conditioning does *not* require storage of alternants. Rather, at least some alternations that are morpheme-specific in the relevant way must be treated as part of the (morpho)phonology. This conclusion, though important, is partial; this is because other stem alternations in the informal sense are not subject to this line of argument. For example, a stem alternation that looks outwards to non-phonological information could still be treated with Stem Storage, as long as it respects (A2–3). Consider e.g. English *long/length*, *strong/streng-th*. Here, the stem change is (presumably) triggered by an outer morpheme, not its phonology. Locality-wise, i.e. by (A2–3), this could be treated as a case of contextual allomorphy, with e.g. *long* and

leng as suppletive allomorphs; or, it could be treated morphophonologically. The locality-based argument does not apply.

On the general point that morpheme-specificity does not necessarily require storage, the results of this paper agree strongly with Kiparsky (1996). Kiparsky rejects the idea that morphological conditioning is necessary or sufficient for determining the nature of an alternation, and argues that “There are both purely phonologically conditioned morpholexical alternations [=phonologically conditioned allomorphy; DE], and conversely, morphologically conditioned phonological rules” (1996: 16). The perspective that Kiparsky advances is quite similar to the one outlined above: in particular, the fact that an alternation is morphologically conditioned does not necessarily make it a case of stored allomorphs. Rather, the defining criteria that distinguish alternations with storage from those that are morphophonological have to do with “...the nature of the alternation, *the locality relation between the focus and the triggering context*, and the relationship of the process to other rules of the system” (1996: 17; my emphasis). A number of details about the analysis do not look the same in Kiparsky’s lexicalist model as they do in the syntactic approach assumed here, and there are other differences (with respect to e.g. productivity) as well; but the overall emphasis of Kiparsky’s argument, which concentrates on locality of conditioning, is exactly on target.

5. A Question and a conjecture

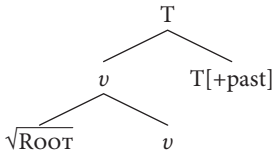
This paper argues against the idea that morphological conditioning forces an analysis with storage of alternants. However, in this section I will suggest further that while morphological conditioning does not determine the status of an alternation in terms of SS or MP, it is perhaps relevant to the locality conditions that apply to an alternation. After framing the question of whether phonological versus morphological conditioning involves distinct locality domains, I present a set of predictions that can be deployed to investigate this aspect of phonological form.

A key factor in the arguments from Spanish verbs in Section 3 is that the stem alternations are triggered by *outer* phonological properties. This, for the reasons described in Section 2, is not possible for suppletive contextual allomorphy in a theory in which (A1) applies to Vocabulary Insertion. At the same time, there are other types of stem allomorphy (in the descriptive sense) which do not have a phonological trigger or target in this sense. The alternations found in the English past tense are of this type. Particular Roots like $\sqrt{\text{SING}}$ or $\sqrt{\text{BREAK}}$ undergo changes in the context of particular morphemes like T[+past], to yield alternations like *sing/sang* and *break/broke*. In my view, the observation to be emphasized is that

this type of alternation requires reference to two morphemes *as morphemes*, i.e. not as phonological objects.

The effects of locality in this kind of alternation can be approached in a few steps; to begin with, I assume that the structure underlying the past tense forms is as follows:

- (14) Structure of past tense



As discussed in Section 2, the ν head does not intervene linearly between the Root and T[+past] when ν is not realized phonologically.¹⁴ When Vocabulary Insertion at T[+past] occurs, this node is concatenated with the Root: $\sqrt{\text{ROOT}} \hat{\ } \text{T}[+\text{past}]$. This allows T[+past] to see the Root for its allomorphy (recall (3) above). Importantly, this means that all of the stem changes in English past tense (and participial) forms occur under concatenation. So, in the same way that T[+past] can see the concatenated Root for the purposes of its allomorphy, the Root is also concatenated with T[+past]. The derivation of *sang* is thus as follows:¹⁵

- (15) derivation of *sang*
- a. Structure: $[[\sqrt{\text{SING}} \nu] \text{T}[+\text{past}]]$
 - b. Linearization/Pruning: $\sqrt{\text{SING}} \hat{\ } \text{T}[+\text{past}]$
 - c. Vocabulary Insertion: $\sqrt{\text{SING}} \hat{\ } \text{T}[+\text{past}, -\emptyset]$
 - d. Stem change: $\text{sing} \rightarrow \text{sang} / __ \hat{\ } \text{T}[+\text{past}, -\emptyset]$

(The last line is shorthand for the process(es) changing the rime of $\sqrt{\text{SING}}$ in the context of T[+past]).

With this view of English stem changing at hand, the question that can be posed is whether there is a general difference in kind between the following two types of alternations:

- (16) Types of Alternation
- a. **Type 1:** Alternations that involve a combination of morphological and phonological information; i.e. in which either the target or the trigger is identified in only phonological terms.

14. Embick (2010) discusses a Pruning operation that deletes null nodes in the relevant way. There are some other options for analyzing this “transparency effect” that appeal to more general properties of Root/category relations, but I will not dwell on them here.

15. For concreteness (15) assumes that the stem changing rule occurs after VI at T[+past]. It can be assumed for convenience that Pruning of ν occurs after VI inserts $-\emptyset$ at that node.

- b. **Type 2:** Alternations that refer only to morphemes qua morphemes; i.e. where both the trigger and target are specific morphemes (or Roots).

The reasoning is as follows. The concatenation condition (A2) on contextual allomorphy says that morphemes must be concatenated in order to be visible to each other. In the light of what is observed with the changes to stems of the *sing/sang* type, it is possible that (A2) is a specific manifestation of a more general principle that subsumes both contextual allomorphy and the Type 2 alternations in (16). This more general principle is stated as the conjecture in (17):

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

The intuition behind the MIC is that the information type that is referred to in the structural description of an alternation determines the locality conditions under which the alternation takes place. When morphemes have to interact as morphemes, they must be concatenated in order to see each other. On the other hand, when phonological representations are referred to in an alternation, the locality conditions that apply are phonological in nature – i.e. need not respect concatenation of morphemes – but rather respect phonological locality.

Investigating the MIC is at the heart of the research program that is advanced in this paper. If the MIC turns out to be correct, then there are two different kinds of rules responsible for *stem alternations* in the informal sense (i.e. the descriptive term *stem alternation* covers more than one grammatical phenomenon). One type (the one seen in the Spanish case studies) is truly *morphophonological* in nature, and a second type (illustrated with the English past tense) requires reference to two morphemes. The two types of alternation are defined in (18), which replaces (16):

- (18) **Revised Rule Typology**
- a. ***Morphophonological Rules:*** Phonological rules in which either the trigger, or target, but not both, is morphological. *Expected to occur under locality conditions characteristic of phonological representations; NOT (A2).*
 - b. ***Morpheme/Morpheme Readjustments:*** Rules that change the form of one morpheme when it is in the context of another morpheme, in which both the trigger and the target are referred to as particular morphemes. *Expected to occur under locality conditions characteristic of morphological representations; i.e. under concatenation (A2).*

If (18) is on the right track, many further questions can be posed concerning the ordering and interaction of different rule types (as envisioned by Kiparsky 1996).

Crucially, though, it remains to be seen first whether the MIC holds when additional case studies are taken into account.¹⁶

6. Conclusions

The main claims of this paper are centered on the tension between MP and SS analyses of stem alternation, and on what empirical (not conceptual) arguments can be advanced in favor of one view versus the other. A primary claim is that this tension cannot be resolved in the absence of a general theory of the locality conditions under which allomorphic changes take place.

With this particular emphasis in mind, the analysis of stem alternations must be situated against the theory of locality that applies to the Vocabulary Insertion operation, which I assume to be based on (A1–3). The reason for this is that an SS theory with stored stems treats these stems as suppletive allomorphs; as such, the locality conditions on stem allomorphy are expected to be identical to those found for the contextual allomorphy found in Vocabulary Insertion more generally.

The case studies from the Spanish conjugation that are examined in Section 3 illustrate a type of alternation that is a typical candidate for stem storage (because of Root- or morpheme-specificity). But the locality conditions under which these alternations take place are not compatible with (A1–3). Because these alternations do not obey the same locality conditions as (suppletive) contextual allomorphy, it is concluded that at least this type of stem alternation cannot be treated with stem storage. Instead, an analysis that makes use of (morpho)phonological rules operating on a single underlying form is required. The particular arguments of this paper are centered on (A1), and the idea that outer phonology cannot be referred to for contextual allomorphy at an inner node. The (A1)-based argument against SS can be formed for some instances of stem allomorphy – like those from Spanish – but does not apply to stem allomorphy, for reasons outlined in Section 4. As a point for ongoing research, it is suggested in Section 5 that stem alternations in the descriptive sense might actually be two distinct phenomena in the grammar: a *Morphophonological* type, which operates in terms of phonologically-defined representations, and a *Morpheme/Morpheme* type, which operates in terms of the concatenation of morphemes. The idea that concatenation is required for all

16. A further consequence of (18) is that it might force a reexamination of phonologically conditioned suppletive allomorphy (see e.g. Paster (2006)), where Vocabulary Insertion makes reference to phonological information.

interactions in which two morphemes must see each other as morphemes is stated as the Morpheme Interaction Conjecture (MIC).

As pointed out in the introduction, the analysis of stem alternations has played an important role in many theoretical models since the early twentieth century, and is also central to the more recent flurry of activity that has come to be known as the “past tense debate” (e.g. Marslen-Wilson & Tyler (1998)). Whatever is made of the full range of conclusions discussed in these domains, it is a striking fact that prior work on this topic devotes very little attention to the locality conditions that restrict allomorphic interactions. This paper shows why locality considerations must come to the front of this discussion, and provides a preliminary framework for further investigation of this part of the interface between structure and sound.

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