

Cyclicity and stress erasure in Portuguese and Spanish

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The following article contains an analytical hypothesis seeking to explain some normally stress conditioned phenomena (Neutralization and Nasalization in Portuguese, and Diphthongization in Spanish) but which are also observed in structures in which the conditioning stress itself does not surface.

It is argued here that these phenomena can be explained within the framework developed in Halle & Vergnaud (1987) in terms of a complex interaction of cyclic stress rules with other phonological rules, which produces different results depending on whether cyclic or stress domain suffixes are present in the structure. It is also shown that the analysis needed to account for Neutralization and Nasalization in Portuguese can be extended to the facts of Spanish Diphthongization and, thus, provide a better alternative to current existing analysis of Spanish Diphthongization.

In particular, it is argued that the functioning of the Main Stress Rule (MSR) in Portuguese and Spanish is regulated by Halle & Vergnaud's Stress Erasure Convention, which plays a crucial role in the explanation of the phenomena under investigation. Cyclic reapplication of MSR causes erasure of previously assigned stress only in structures containing suffixes which are not stress domains but not in structures containing 'stress domain affixes', as claimed by Halle & Vergnaud. The results reported in the article thus lend support to the framework developed in Halle & Vergnaud, and to their proposed Stress Erasure Convention.*

1. Introduction

Halle & Vergnaud (1987) and related work (Halle 1990; Halle & Kentowicz 1991) provide evidence from a number of languages in support of a general principle regulating the functioning of cyclic stress rules that apply at the word level. According to this principle – the Stress Erasure Convention (SEC) – in the general case, stress assigned on a previous cycle is eliminated at each new pass through the cycle. Since only stress assigned on the last pass of the cyclic rules will survive at the end of the *cyclic stratum*, this is the only information about cyclic stress placement that will be available to phonological rules applying at subsequent strata.

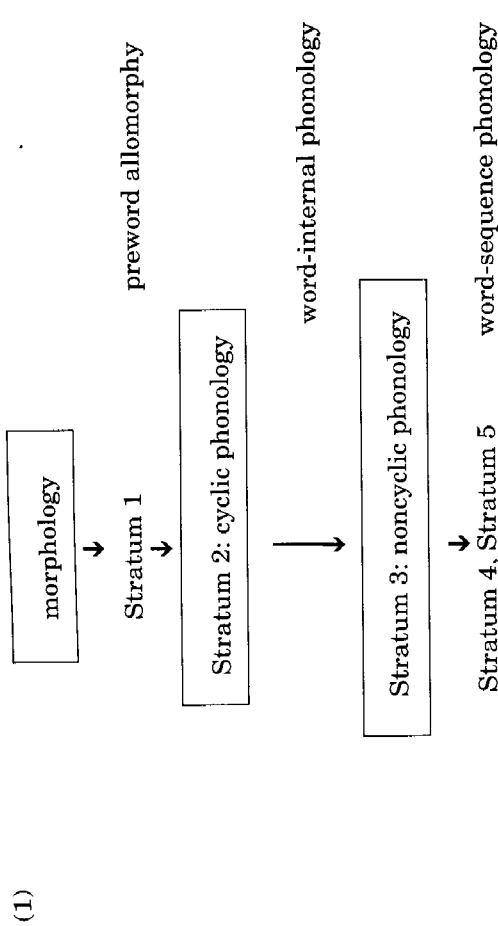
One type of relevant evidence bearing on the SEC is the existence of stress induced effects that are observed in surface structures in which the conditioning stress itself does not surface. Such cases pose potential problems for the SEC since they indicate that stress assigned in earlier

cyclic stages may be retained under certain conditions, even though they are ultimately eliminated. For the SEC to be maintained, it is necessary to show that such cases can be plausibly explained through the interaction of the SEC with other principles.

Here we shall be concerned with two such phenomena that occur in Portuguese. In this language, certain facts pertaining to Neutralization and Nasalization exhibit stress induced effects even though the conditioning stress is not present in surface structure and, hence, are of relevance to the SEC. In this article I investigate the status of the SEC in connection with the new data of Portuguese and I propose an analysis to account for these data. I then extend the analysis to account for certain well known facts of Spanish Diphthongization that have been a focal point in recent discussion concerning the SEC. I argue here that the SEC plays an essential role in the explanation of the facts of both Portuguese and Spanish and, hence, receives additional empirical support from these facts.

2. The Stress Erasure Hypothesis: Brief Review

The framework introduced in Halle & Vergnaud (1987) – henceforth HV framework – shares a number of basic assumptions with what has become known as the theory of Lexical Phonology¹ though they introduce a number of modifications. Thus, in the HV framework, as in Lexical Phonology, phonological rules are distributed into a number of modules, or *strata*. However, unlike the standard distinction made in Lexical Phonology between lexical and nonlexical strata, the HV framework distinguishes between *word-internal strata* (“phonological processes that are word-internal”, p. 77) and *word-sequence strata* (“processes that are not limited to the word but apply freely to word-sequences as well”, p. 77). Further, both such strata are assumed to be divided into a cyclic component (*cyclic stratum*) and a noncyclic component (*noncyclic stratum*). Additionally, unlike standard assumptions in lexical phonology according to which rules of morphology such as prefixation and suffixation affixation are assigned to particular phonological strata, the HV framework adopts the view that Morphology constitutes a separate module “distinct and separate from phonology. Morphology interacts with phonology in that it creates the objects on which the rules of phonology operate” (p. 78). To illustrate, under the HV framework the relevant components of grammar are organized essentially as follows:



The phonological rules that are going to be of concern here pertain to the word-internal phonology. Namely, stratum S2: cyclic phonology and stratum S3: noncyclic phonology. A fundamental difference between the cyclic stratum (S2) and noncyclic stratum (S3) is that the rules of the cyclic stratum are subject to the Principle of the Strict Cycle (cf. Mascaró 1978; Kiparsky 1985, among others), while the rules of the noncyclic stratum are not subject to this principle.

In addition, there is a basic difference between the way the rules of the cyclic and noncyclic strata behave with respect to the morphological structure of strings. As claimed in Halle & Mohanan (1985) (and reiterated in HV), in the cyclic stratum “the relevant phonological rules apply to every morphological constituent in the structure – to the basic stem ... as well as to every constituent created by morphological processes”, while in the noncyclic stratum “phonological rules [...] apply [...] only after all morphological processes” (p. 77 ff.).

To a large extent, such assumptions are motivated by the phenomenon of affixation. As is well-known, in many languages there is a basic distinction between affixes that are ‘stress-sensitive’, or *cyclic affixes*, and affixes that are ‘stress-neutral’, or *noncyclic affixes*. In English, for example, the suffix *-ity* is cyclic, as evidenced by the fact that it causes stress shift (cf. *elétric - eléctricity*), while the suffix *-ly* is noncyclic since it has no effect on stress assignment (cf. *miser - miserly*).

Now, since the presence of multiple cyclic affixes in a string causes multiple application of cyclic stress rules (e.g. the Main Stress Rule, as in English) an important question arises. What happens to stress

assigned prior to the last cyclic domain? In *SPE* (Chomsky & Halle 1968) it was assumed that stresses assigned in previous cycles were gradually reduced at each new application of the stress rule, a view now believed to be inadequate. Instead, in the HV framework it is claimed that such stresses are eliminated in accordance with a general principle – the Stress Erasure Convention (SEC). The combined effect of these assumptions can be illustrated in the informal derivation below:²

(2)	[[in[[f orm] + all] + ity]	MSR
	ó	
	ó	MSR
	o á	MSR

According to HV, the Main Stress Rule of English (MSR) belongs to the cyclic stratum. The prefix *in* is non-cyclic, while the suffixes *-al* and *-ity* are cyclic (cf. HV:81). The derivation would then proceed as follows. On the first cycle, MSR would assign stress to the noun *form*. On the second cycle MSR would assign penultimate stress to the adjective *formal*. On the next cycle, the noncyclic prefix *in-* is in the domain of the phonological rules; but since it is a noncyclic affix, no cyclic rules apply and the stress present in the structure is retained. On the final cycle the entire word *informality* is considered. Since *-ity* is a cyclic affix, MSR will assign stress to the antepenultimate syllable. Previously assigned stresses are then erased in accordance with the SEC.

However, as HV point out, not all stresses assigned in earlier cycles are erased. Obviously, in the case of compounds, the original stress is maintained, despite the fact that compound words are cyclic constituents. Moreover, there are certain affixes in English (e.g. *-oid*, *-ode*; cf. *álkaloid*, *eléctrode*) which do not cause stress erasure (p. 268). (Cf. also HV: 91 for discussion of Dyari affixes).

The explanation given in HV is that the retention of stress in such cases is due to the fact that the affixed constituent itself is a 'domain' for stress rules ('stress domain' affix). Or, to use their own words, "stress erasure applies only when the affix is not a domain for the stress rules; when the affixed substring itself undergoes the cyclic stress rules, no stress erasure takes place" (p. 83). Taking this into account, HV propose the following formulation of the stress erasure convention:

(3) Stress Erasure Convention (SEC)

In the input to the rules of cyclic strata information about stress generated on previous passes through the cyclic rules is carried over only if the affixed constituent is itself a domain for the cyclic stress rules. If the affixed constituent is not a domain for the cyclic stress rules, information about stress assigned on previous passes is erased (p. 83).

As the SEC implies, in addition to cyclic and noncyclic affixes, a third class of affixes must be considered. Namely, *stress domain* affixes – i.e. affixes that are cyclic constituents in the sense that they (like 'words') have their own separate cyclic domain and receive stress in that domain during the cycle.

According to the HV framework then we have three basic kind of affixes: (a) *noncyclic affixes*, which play no role in stress placement; (b) *cyclic affixes*, which play a role in stress placement and trigger stress erasure; and (c) *stress domain affixes*, which play a role in stress placement but do not cause erasure of a stress placed in another cyclic constituent since, during the cycle, independent cyclic domains are kept separate.³

We have already discussed the behavior of noncyclic affixes and cyclic affixes within the HV framework (cf. (2) above). As for *stress domain* affixes (e.g. English suffixes such as *-oid*, *-ite*, *-ode*), HV propose an analysis in which words containing such suffixes would be treated as "consisting of two independent elements, each of which is a domain of stress rules" (p. 256).

To exemplify, the simplified derivation of a word like *molluscoid* would proceed essentially as in (4), as if there were actually two 'words' involved:

(4)	[mollusc]loid]	Cyclic stratum
	ú ó	MSR
	[mollúsc óid]	Noncyclic stratum
	ú ò	Other rules (cf. HV: 256)
	moll úsc òid	

In (4) MSR would apply on the first pass of the cycle in each of the two independent domains and assign stress separately to them. In the last pass through the cycle, however, none of the stress rules would apply (cf. p. 256), so that at the end of the cyclic stratum, we would have the form *mollúscóid*, with two primary stresses. This form would then be available to the rules of the noncyclic stratum. At the noncyclic stratum, the other rules of the Halle & Vergnaud system, in particular the non-

cyclic Alternator rule, and the Rhythm Rule (cf. p. 256) would apply to give the correct phonetic form [mollúscoid].

As a final point, let us briefly review the concept of 'cyclicity'. Although the literature contains various ways of implementing what we may call 'cyclic effects', there appears to be a 'reasonable conceptual core' (Goldsmith 1990: 249) that makes 'cyclicity' a meaningful concept. The central idea of cyclicity is that 'words' have internal constituent structure (e.g. [[form all_A ity]_N]) and that a certain class of phonological rules (cyclic rules) apply to the subconstituents of a word (cyclic domains), beginning with the innermost subconstituent and repeating the process as additional structure becomes available, until the whole word is processed.

At the moment there are at least two hypotheses concerning the implementation of the basic idea of cyclicity. One hypothesis assumes a segregation between Morphology and Phonology. According to the 'segregation' hypothesis, all the morphemes (together with information about their class) that form a word are first provided by the Morphology with the constituents properly labelled. Cyclic Phonological rules would then scan each cyclic domain, and apply as their conditions are satisfied.

This is essentially the classical SPE view, which is adopted in HV (cf. p. 78ff), although HV also introduces an important innovation: morphemes must also be represented in terms of autosegmental planes, so that the notion of cyclicity in stress assignment must take into account autosegmental charts as well (cf. p. 78ff). Essentially only stress generated on the last pass through cyclical rules are transferred to the autosegmental plane of the affix, while stresses generated on earlier passes of the cyclical rules are not (which is HV's way of implementing the SEC).

A second implementation hypothesis of cyclicity assumes that morphological word-formation rules (affixation rules) and cyclic phonological rules (e.g. stress rules) are interspersed in the cycle, which is the conception of cyclicity more closely associated with the initial development of Lexical Phonology (Kiparsky 1982a,b; cf. also Goldsmith 1990: Ch. 5 for a review). Under this 'mixed' hypothesis, morphological processes of affixation gradually introduce affixes (which are divided into blocks or 'strata'), and cyclic (or 'lexical') phonological rules apply at each new bout of affixation: Affixation/ Cyclic phonological rules/ Affixation / Cyclic phonological rules.

For presentation purposes we shall assume the concept of cyclicity adopted in the HV framework (with some simplifications). However, due to the common conceptual core underlying the various versions of cyclicity, the facts discussed in the present article are likely to have a direct bearing on the various proposals.

In addition to the question of implementation of the basic idea of cyclicity, there are various important related issues. One such an issue has to do with the concept of 'strict cyclicity', which is either assumed to constitute an independent principle (Mascaró 1978), or a particular effect of a more general principle – the Elsewhere Condition – as argued in Kiparsky (1982b). (For relevant discussion, see also Rubach 1984). Under Mascaró's formulation of the principle, besides specifying how cyclical rules apply, the principle of Strict Cyclicity would also have the effect of preventing cyclical phonological rules from applying to underived stems (with the corollary that only stems which have undergone affixation may be affected by cyclical phonological rules). However, HV argue for a modified version of strict cyclicity which prevents 'structure changing' rules from applying to underived stems, but which allows 'structure building' rules to apply in such environments (cf. p. 105).

As HV argue, English MSR must apply to underived stems in words like *sólenn*, *sólenness*. In the former example there is no affix, while in the latter the suffix *-ness* is not cyclic and there is no MSR in the noncyclic stratum of English (cf. HV: 105), so that MSR must apply to the underived stem. We shall assume HV's version of strict cyclicity here, although the facts that we discuss do not appear to have a crucial bearing on this issue.

A second related issue has to do with the question of what constitutes a proper domain for stress rules. According to a common view, cyclical stress rules apply only to 'words' (i.e. forms containing a root and accompanying affixes; for a review, see Goldsmith 1990: 249ff.). According to HV, however, 'being a stress domain is not necessarily coextensive with that of being a word' (p. 93). As they argue, affixes may turn out to be stress domains (as in Diyari; cf. p. 91), while words may cease to be stress domains (e.g. English *postman*, where the second element, the word 'man', is not treated as a stress domain; cf. p. 91). The facts discussed here will be directly relevant to this issue since we shall argue that Portuguese MSR must apply to stress domain affixes, which would support HV's claim that stress domains are not coextensive with words.

With the above as a background, we shall pass next to the discussion of the problems posed by the Portuguese and Spanish data.

3. Types of Affixes in Portuguese

In Portuguese, prefixes never affect the placement of stress in surface structures in which they occur, while suffixes normally do. As exemplified below, when suffixes such as *al*, *iza*, *ado*, *idade* appear in

words, surface structure stress changes position due to the presence of the suffix (which, in fact, attract the stress to themselves), while the presence of prefixes such as *in*, *dis*, *re* do not affect stress placement at all:

- (5) a. *fórma*, *formál*, *formaliza*, *formalizado*, *formalizado*
 'form, formal, he-formalizes, formalized, formality'
 b. *fórma*, *refórma*, *infórma*, *disfórme*
 'form, reform, inform, deformed'

To account for the facts we postulate that the Portuguese Main Stress Rule (MSR) applies in the cyclic stratum of word phonology. In addition, following the HV framework, we propose that affixes that affect stress placement such as the suffixes *al*, *iza*, *ado*, *idade* are cyclic, while affixes that do not affect stress placement such as the prefixes *re*, *in*, *dis* are noncyclic. Interaction of cyclic MSR with cyclic and noncyclic affixes in the manner reviewed in section 2 will give the correct results here.

Since prefixes are stress neutral we shall not be concerned with them here, restricting our attention to suffixes. We notice that in the case of Portuguese suffixes, an important distinction seems to obtain. On the one hand, we have suffixes such as *al*, *ado* that are generally stressed (call them Type I suffixes). On the other hand, there are some suffixes such as *ico* (call them Type II suffixes) that are generally unstressed but which, nevertheless, affect the placement of stress, since they require that stress must fall on the last syllable of the word they attach to.⁴ Examples of the latter type are given below:

- (6) a. *Ibéria* - *ibérico*; *bíblia* - *bíblico*
 'Iberia- Iberic; bible - biblical'
 b. *símbolo* - *simbólico*; *sífilis* - *sifilítico*
 'symbol - symbolic; syphilis - syphilitic'

Since both Type I and Type II suffixes affect stress placement, I will assume that they must both be treated as cyclic suffixes. The difference between them is that Type II suffixes are lexically marked as exceptional with respect to stress rules, causing MSR to place stress on the syllable immediately preceding the suffix (antepenultimate syllable), while Type I suffixes always bear stress – either because they undergo the normal application of MSR (i.e. stress is final in words ending by a consonant, and penultimate in words ending by a vowel), or because they are lexically marked to receive stress. The derivation of words containing Type I suffixes is straightforward, needing no comment (cf. English

example in (2)). The derivation of a word containing a Type II suffix, such as *sifilítico*, on the other hand, would proceed as follows:

- (7) [[sifil i(t)lítico]] Cyclic stratum
 í cycle 1: MSR
 —————
 í í cycle 2: MSR (and SEC)
 —————
 s ifil ítico

On the first cycle in the example above primary stress is assigned to the antepenultimate syllable by MSR, since the stem is lexically marked as requiring antepenultimate stress (cf. *sífilis* 'syphilis'). On the second cycle, new application of MSR places the stress on the last syllable of the preceding word, as required by the exceptional character of the suffix *ico* (which, as noted, requires that stress be always placed in the antepenultimate syllable in words containing it).

A selective list of the main cyclic and noncyclic affixes in Portuguese is provided below:

- (8) a. *Cyclic*
 i. *Type I*
 -ada (pedrada 'stone blow')
 -ado (furado 'pierced')
 -al (formal 'formal')
 -agem (ferragem 'hardware')
 -ável (cortável 'cuttable')
 -idade (debilidade 'fragility')
 -ólogo (fonólogo 'phonologist')
 -eira (bobeira 'sillyness')
 -eza (beleza 'beauty')
 -es (inglês 'English')
 -ário (bibliotecário 'librarian')
 -izar (formalizar 'to formalize')
 ii. *Type II*
 -ico (simbólico 'symbolic')
 -ulo (glóbulo 'globule')

b. *Noncyclic*

- in- (inato 'innate')
 re- (relê 'he-rereads')
 dis- (dispôr 'to dispose')

A different class of suffixes is constituted by suffixes such as the diminutive (*z)inho*, the superlative *íssimo*, the adverbial *mente*, and a few others. Since such suffixes affect the placement of stress in surface structure, one might propose that they should be treated as cyclic suffixes. However, as I argue later, evidence based on rule interaction and other considerations indicate that such suffixes are 'word-like'. That is, they act as if they constituted a separate domain (independent of the

A second, and more interesting case, is represented by words containing *ico* in which the stem stress must shift. In such cases, Neutralization applies. A good illustration is provided by words such as *c[Ó]lera* 'cholera' and the derived form *c[ol]Érico* 'choleric'. Under the plausible assumption that [O] and [E] are present in underlying representations, the derivation of the relevant form *colérico* [kolÉrico] would be as follows:

(17)	[[k OI E]r]iko]	Cyclic stratum (S2)
	Ó	cycle 1: MSR
	O É	cycle 2: MSR (and SEC)
	k OI Ériko	Noncyclic stratum
	o	Neutralization
	[kol Ériko]	

In the example above, application of MSR on the first cycle places the stress on the first vowel of the stem, since the stem is lexically marked to undergo antepenultimate stress (cf. *c[Ó]lera*). On the second cycle, the suffix *ico* is present. Since this suffix is exceptionally marked as requiring stress to fall on the last syllable of the preceding stem, MSR will apply placing the stress on the [É], while the SEC removes the stress from the [O], rendering the latter subject to Neutralization. On the noncyclic stratum Neutralization then applies to produce the correct result. Once again, we see that the SEC plays a crucial role in the explanation of the facts, since it is the elimination of the stress assigned on the first cycle by the SEC that creates the conditions for the correct application of Neutralization.

To complete the argument notice, on the other hand, that in the derivation of *colera* [kÓ]lera], unlike [kolÉrico], the stress assigned on the first cycle remains in place (there is no cyclic suffix), so that application of Neutralization this time raises the last vowel in the stem rather than the first, which now carries the main stress.

The examples in question are important for yet another reason. Notice that in the examples previously discussed, one might obtain the same empirical results by assuming that Neutralization is also assigned to the cyclic stratum, and intrinsically ordered after MSR. However, in the case of *colérico* just discussed, we see that this is not true and that Neutralization must be assigned to the noncyclic stratum, as proposed here. This is crucial here. For if Neutralization belonged to cyclic stratum, it would apply on the first cycle in (17) and neutralize the vowel [E] on last syllable of the stem to [e], since this vowel is unstressed on the

this below). Under these analytical assumptions, forms like *certeza* [sertéza], and *moleza* [moléza] would be correctly produced as follows:

(15)	a. [[sErt] eza]	Cyclic stratum (S2)
	É	cycle 1: MSR
	E é	cycle 2: MSR (and SEC)
	sErt éza	Noncyclic stratum (S3)
	e	Neutralization
	[sert éza]	
	b. [[m OI] eza]	
	O	
	O é	
	mOI éza	
	o	
	[mol éza]	

In (15) MSR first applies on the first cycle, placing the stress on the stem vowel. On the second cycle, MSR applies again, placing the stress in penultimate position and, according to the SEC, the stress assigned on the first cycle is wiped out, leaving the low vowels [E] and [O] unstressed. The Neutralization rule would then later apply in the noncyclic stratum, raising the vowels in question to [e] and [o], respectively, to produce the correct results [sertéza], [moléza]. As we see, the SEC is crucial in such examples, since it must eliminate the stress assigned to the vowel stem on the first cycle in order to allow Neutralization to apply.

Consider now Type II suffixes. In the case of Type II suffixes such as *ico/nico*, we have two cases to consider. The first case is represented by examples in which the stress assigned to the stem vowel on the first cycle does not shift. In such cases, Neutralization does not apply since the relevant vowel is stressed:

(16)	a. [[ibE]r]iko]	Cyclic stratum (S2)
	É	cycle 1: MSR
	E	cycle 2: MSR (vacuous)
	ibÉriko	Noncyclic stratum (S3)
	[ibÉriko]	Neutralization
	b. [[p Or]t]iko]	
	O	
	O	
	pÓrtiko	
	[pÓrtiko]	

In the example above, application of MSR on the first cycle stressed the vowel in the stem. Since *ico* is a cyclic suffix MSR applies on the second cycle, vacuously in this case, since the stress is already on the final syllable of the stem (as required by the lexically marked suffix *ico*). Application of Neutralization in the noncyclic stratum is correctly blocked since the relevant vowel is stressed, so that the correct forms [ibÉriko] and [pÓrtiko], with low vowels, are produced.

first cycle. Then Neutralization would apply once again, on the second cycle, this time to the first vowel on the stem, which loses its stress due to a new application of MSR (and the SEC) which shifts the stress to the last syllable in the stem. The result would then be the ill-formed *[kolérikol], with neutralization of both low vowels, instead of the correct [kolÉrikol]. The correct form here can only be obtained if we assume that Neutralization applies in the noncyclic stratum only, as hypothesized here.

3.2. Nasalization and Cyclic Suffixes

A second interesting state of affairs is observed in Portuguese when cyclic affixes interact with Nasalization and related rules. As pointed out in Quicoli (1990), in Brazilian Portuguese there are essentially three environments where Nasalization obligatorily occurs: a) when a vowel is stressed and followed by a nasal consonant (see below); b) when a vowel is followed by a nasal in a closed syllable (e.g. f[ũ]ndo 'bottom', af[ũ]ndar 'to sink'); and c) when the vowel is followed by the palatal nasal [ɲ] (e.g. p[é]nha 'cliff', p[e]nhasco 'bluff'). The relevant case here is the first one – i.e. stress-induced nasalization – since this is the environment in which Nasalization interacts with MSR. This subcase of Nasalization is illustrated in (18):

- (18) a. f[ĩ]no - f[ĩ]nal ('fine - final')
 b. f[ũ]mo - f[u]máca ('tobacco - smoke')
 c. p[é]na - p[e]nácho ('feather - head-piece')
 d. g[ó]ma - g[o]mádo ('starch - starched')

A related phenomena is that low vowels which undergo the Nasalization rule are raised to mid-position. As a result, the seven-vowel underlying system of Brazilian Portuguese, when nasalized, reduces to five surface vowels, as shown below:

- (19) a. underlying vowels
 [-hi, -low]: i u
 [-hi, -low]: e o
 [-hi, +low]: E a O
- b. nasalized vowels
 i ũ
 ē ã õ
 - - -

To account for such facts it is necessary to postulate a rule of Nasalized Vowel Raising (see Quicoli 1990), whose effect is captured by the following segmental rule:

- (20) Nasalized Vowel Raising (NVR)
 [+syllabic] → [-low] / $\left[\frac{\quad}{+nasal} \right]$

Since NVR is conditioned by Nasalization, it must be ordered to apply after Nasalization. The effects of NVR are illustrated in (21). As a result of NVR, instead of the forms in column A, what actually surface are the forms in column B:

- (21) A B
 a. *[káma] [káma] 'bed'
 b. *[dénti] [dénti] 'tooth' (cf. Spanish *diente*)⁶
 c. *[fónti] [fónti] 'fountain' (cf. Spanish *fuenta*)

In light of the discussion above, let us now examine the behavior of Nasalization and NVR with respect to affixation.

Consider first the interaction of Nasalization with Type I cyclic suffixes such as *al*, *ada*. As shown below, stressed induced Neutralization and NVR do not apply in forms containing Type I cyclic suffixes:⁷

- (22) a. ban[á]na, ban[a]nal, ban[a]náda
 'banana, banana grove, banana paste'
 b. ch[á]ma, ch[a]máda
 'call 3 sg., roll call'

We propose to account for the facts as follows. Recall, we are assuming that MSR applies in the cyclic stratum and that Type I suffixes are cyclic suffixes. To account for the Nasalization facts in question we need only postulate now that Nasalization and NVR are assigned to the noncyclic stratum. To illustrate the proposal, a form such as *bananal* 'banana grove' would be derived as follows:

- (23) [[ban an] al] Cyclic stratum (S2)
 á cycle 1: MSR
 — cycle 2: MSR (and SEC)
 — cycle 3: MSR (and SEC)
 [ban an ál] Noncyclic stratum (S3)
 — Nasalization
 — NVR
 [ban an ál]

Here, application of MSR on the first cycle places the stress on the vowel preceding a nasal consonant, but since Nasalization is not cyclic

nothing happens at this stage. On the second cycle, new application of cyclic MSR places the stress on the suffix, while the SEC causes the elimination of the stress assigned on the previous cycle. When the form enters the noncyclic stratum, Nasalization cannot apply since the vowel preceding the nasal consonant is not stressed. As we see, the SEC plays a crucial role here, since elimination of the stress assigned on the previous cycle is necessary to correctly prevent application of Nasalization.

It is also clear from the above example that Nasalization must be assigned to the noncyclic stratum. For, if Nasalization were cyclic, it would apply on the first cycle in (23) and incorrectly nasalize the stressed stem vowel on that cycle, producing the incorrect form *[ban.ã]váll. To derive the correct form [bananá], Nasalization must be assigned to the noncyclic stratum, as hypothesized here.

Let us now consider Nasalization effects in forms containing Type II cyclic suffixes such as *ico/nico*. As we see from the examples below, in words in which the stem stress does not 'shift' the stem vowel undergoes Nasalization and NVR:

- (24)
- Brit[ã]nia - brit[ã]nico 'Britain - British'
 - tit[ã] - tit[ã]nico 'Titan -Titanic'
 - maç[õ]n - maç[õ]nico 'free-mason - masonic'
 - cl[õ]ne - cl[õ]nico 'cone - conic'
 - fara[ó] - fara[ó]nico 'pharaoh - pharaoh-style'

Such examples are unproblematic since the stress assigned during the cyclic stratum stays in place and is, therefore, available at the noncyclic stratum, so as to correctly trigger Nasalization/NVR.

A second situation is represented by words containing Type II suffixes in which the stem stress must shift due to the presence of the suffix. This case is illustrated by examples such as the following:

- (25)
- át[ol]mo - at[õ]mico 'atom - atomic'
 - tét[al]no - tet[ã]nico 'titanus - tetanic'
 - [ã]nimo - [a]n[õ]mico 'animus - pertaining to the spirit'

As we recall, the stress 'shift' observed in such examples results from a cyclic application of MSR on the second cycle due to the presence of the Type II suffix, which causes the stress to fall on the last syllable of the word that it attaches to. Now, when the stress shifts to a vowel followed by a nasal consonant, as in (25), this creates the conditions for a later application of Nasalization and NVR in the noncyclic stratum.

Such rules would then apply, correctly nasalizing (and, when applicable, raising) the stress vowels to account for (25). The effect of our analysis can be illustrated in the following derivation:

- (26)
- [[an im] iko]
 á

 a í

 [an im iko]
 í

 [an im iko]
- Cyclic stratum (S2)
 cycle 1: MSR
 cycle 2: MSR (and SEC)
- Noncyclic stratum (S3)
 Nasalization

In (26) above, application of MSR on the first cycle assigns stress to the initial vowel in the stem (which is lexically marked for antepenultimate stress; cf. *ânimo* 'animus'). However, the presence of the Type II cyclic suffix triggers a second pass through the cycle. Application of MSR on the second cycle then places the stress on the final vowels of the stem (as required by the suffix), and the SEC eliminates the stress assigned on the previous cycle. Since, due to the SEC, information about stress assigned on the previous cycle is lost, when Nasalization applies later in the noncyclic stratum it nasalizes only the vowel containing the last surviving stress, so that the correct results are produced.

To conclude this section, we have shown here how MSR, Neutralization and the complex Nasalization/NVR interact in an interesting way, displaying distinct effects depending on the type of suffixes involved. We have argued that the Neutralization and Nasalization effects observed in the data can be plausibly explained under the assumptions that Portuguese MSR is assigned to the cyclic stratum, while rules such as Neutralization and the complex Nasalization/NVR are assigned to the noncyclic stratum. Moreover, the explanation given here is contingent on the existence of the SEC, since the correct results can only be obtained if stress assigned on a previous cycle is erased at each new cyclic application of MSR.

4. Stress Domain Suffixes in Portuguese

In section 3 we analyzed the behavior of Neutralization and Nasalization/NVR in forms containing Type I and Type II cyclic suffixes. We now discuss a very different state of affairs involving Neutralization and Nasalization that is observed in forms containing certain suffixes such as the diminutive suffix (z)inho,⁹ the superlative suffix *íssimo*, the adverbial suffix *mente*, and a few others.

First, we notice that in words containing (z)inho type suffixes the low vowels [E, O] do not undergo Neutralization even though they do not carry the main stress in surface structure:

- (27) a. cErtínho 'a little bit right'
b. mOlínho 'a little bit soft'

- (28) a. cErtaménte 'certainly'
b. mOleménte 'softly'

- (29) a. cErtíssimo 'very right'
b. mOlíssimo 'very soft'

Second, stress induced Nasalization and NVR apply, despite the fact that the affected vowel is not the bearer of primary stress, Compare:

- (30) a. ban[ã]nínha 'little banana'
b. bac[ã]níssima 'very elegant'
c. bac[ã]naménte 'elegantly'

A selective list of suffixes displaying the unexpected pattern with respect to Neutralization and Nasalization is give in (31):

- (31) - mente sOménte, bac[ã]naménte; 'only, elegantly'
-(z)inho/a mOlínho, bac[ã]nínha; 'softie, elegant'
-íssimo/a mOlíssimo, bac[ã]níssimo; 'very soft, very elegant'
-(z)ão pEzão, bac[ã]nãõ; 'big foot; big elegant one'
-oide mOlÓide, bac[ã]nÓide; 'sissy, elegantoid'
-ice modErnice, bac[ã]níce; 'modern-like; elegant-like'
-ismo modErnismo; hum[ã]nismo; 'modernism, humanism'
-ista mOdísta; t[é]nista; 'fashion designer, tennis player'

The question now is how zinho-type suffixes are to be analyzed. Recall, under the HV framework, suffixes can be classified as belonging to three categories: a) cyclic, b) noncyclic, and c) stress domains. Since zinho-type suffixes affect the placement of stress – in fact, they can actually receive main stress – I assume that they cannot be analyzed as noncyclic suffixes (but see Section 6 for discussion). The two remaining alternatives is to treat zinho-type suffixes either as cyclic suffixes or as stress domain suffixes.

Suppose one were to analyze zinho-type suffixes as cyclic suffixes. It is easy to see, however, that the cyclic hypothesis would give all the incorrect results here. Assuming that MSR is cyclic and involves the

SEC, while Neutralization is noncyclic, we see that such an analysis cannot account for the facts of Neutralization. Compare:

- (32) a. [[sErt]iño] b. [[mOl]iño] Cyclic stratum (S2)
É Ó cycle 1: MSR
E í O í cycle 2: MSR (and SEC)
s Ert iño m Ol iño Noncyclic stratum (S3)
e o NEUT
*[sert iño] *[mol iño]

As shown in (32), application of MSR on the second cycle in accordance with the SEC would cause the elimination of the stress previously assigned to the stem vowels ([E], [O], respectively) on the first cycle. Since the stem vowels would be unstressed, Neutralization would then incorrectly apply to produce the incorrect forms *[sertiño], *[moliño].

Likewise, the cyclic hypothesis in question would give the incorrect results in the case of Nasalization and NVR, as shown below:

- (33) [[bak an]iña] Cyclic stratum (S2)
á MSR
a í MSR (and SEC)
[bakan iña] Noncyclic stratum (S3)
— í Nasalization
NVR
*[bakan iña]

In the example above, application of cyclical MSR in accordance with the SEC on the second cycle would delete the stress on the stem vowel. As a result, at the noncyclic stratum, when stressed induced Nasalization is operative, the stem vowel is not stressed and cannot be nasalized, thus producing the ill-formed *bac[ã]nínha instead of the correct bac[ã]nínha.

A third proposal – the one we shall adopt here – is to assume that the suffixes in question are stress domain suffixes in the sense of the HV framework. Now we see that the facts in question can be correctly accounted for.

Consider first Neutralization. Under the assumption that the suffixes in question are stress domains, the stem and the suffix would each constitute a separate domain for stress placement, yielding the results illustrated in (34):

mid-vowels when they are stressed (the problem of distinguishing the mid-vowels that undergo diphthongization from those which do not, as in the analyses cited, will not concern us here). The effects of this rule are illustrated in (41):

- (41) pensámos (1 pl.) piénso (1 sg.) 'to think'
 soltámos (1 pl.) suélto (1 sg.) 'to release'

The Diphthongization rule is affected by the type of affixes present in the word. Thus, consider the alternations in the forms derived from fuerte 'strong' in (42):

- (42) a. fortaléza 'fortress'
 b. fuerteménte 'strongly'
 c. fuertecíto 'little fort'

In (42a) Diphthongization does not apply, as expected, since the stem vowel is not stressed. However, in (42b-c), Diphthongization applies even though the stem vowels are not stressed in surface structure.

Elaborating on an earlier analysis by Harris (1969: 125-126), Halle & Vergnaud (1987) proposed to account for words such as fuertemente and fuertecito in terms of the HV framework by assuming that the Spanish MSR rule, applying in accordance with the SEC, is assigned to the cyclic stratum and that "the rule of diphthongization is also assigned to the cyclic stratum and is ordered after the rule that assigns main stress" (p. 94). To illustrate, according to the analysis given in HV, the relevant steps in the derivation of such words can be informally illustrated as follows:

- (43) a. [[forte]c ito] b. [[forte|m ente] Cyclic stratum
 ó MSR
 wé Dipht
 — we — é MSR
 — — — Dipht
 [fwertecíto] [fwerteménte]

However, given the other assumptions of HV's own analysis, it is clear that such a proposal is not viable, since it will also give incorrect results elsewhere. To see this, notice first that Spanish suffixes such as al, eza are 'stress sensitive' suffixes:

- (44) réy, réal, realéza ('king, royal, royalty')

Since al and eza affect stress placement, according to HV's analysis they should also be analyzed as cyclic affixes (cf. HV: 79ff). But this would now have negative consequences for HV's analysis of Spanish since Diphthongization would incorrectly apply to words containing such suffixes, as shown below:

- (45) [[fort] al] eza (Cyclic stratum)
 ó MSR
 wé Dipht
 — we á MSR
 — — — Dipht
 — a é MSR
 — — — Dipht
 * [fwertal éza]

In other words, since in HV's analysis of the Spanish facts MSR and Diphthongization are both cyclic, both would apply on the first cycle and incorrectly cause the stem vowel to diphthongize, so that the only possible output here is the incorrect *fwertaleza instead of the correct fortaleza.

Under my proposal, this problem would not arise. Assume that Spanish suffixes such as cito, mente, ísimo, like their Portuguese counterparts, are 'stress domain' suffixes. We can now readily account for the Diphthongization facts by assuming that Spanish MSR is cyclic, while Diphthongization is noncyclic. Under these assumptions, in a word such as fuertemente stress cyclically assigned to the stem vowel will not be erased by the SEC since the stem and the suffix are in separate stress domains. Since the stem vowel remains stressed during the cyclic stratum, it will still be available at the noncyclic stratum so as to trigger noncyclic Diphthongization. To illustrate, the derivation of fuertemente would be essentially as follows:

- (46) [[forte|m ente]] Cyclic stratum (S2)
 ó MSR
 — — —
 [f órte m énte] Noncyclic stratum (S3)
 wé Dipht
 [fwérte ménte]

To complete the derivation is necessary to posit (as was the case in Portuguese) that a rule of Conflation of the type already discussed would apply later in the noncyclic stratum eliminating all but the rightmost stress in a word.

At the same time, notice that the problem faced by Halle & Vergnaud's analysis with respect to words such as *fortaleza* can now be overcome. Unlike *cito*, *mente*, *esimo*, which are stress domain suffixes, the stress sensitive suffixes *al*, *eza* would be analyzed as cyclic suffixes. Assuming as before that Spanish MSR is cyclic and applies in accordance with the SEC, while Diphthongization is noncyclic, the derivation of *fortaleza* would be accomplished as shown in (47):

(47)	[[[fort]al]eza] ó — o á — a é — [fort al éza] — [fort al éza]	Cyclic stratum (S2) cycle 1: MSR cycle 2: MSR (and SEC) cycle 3: MSR (and SEC) Noncyclic stratum (S3) Dipht	
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Here cyclic applications of MSR (coupled with the SEC) would give at the end of the cyclic stratum the form [fortaléza], which would be the input to noncyclic rules. Since the stress assigned to the stem vowel has been removed within the cyclic stratum due to the SEC, noncyclic Diphthongization would not be able to apply, so that the correct form *fortaleza* is derived, as desired.

Again, as we see, the SEC plays a crucial role in the explanation of the Spanish examples. Unless the stress assigned on a previous cycle is eliminated at each new application of cyclic MSR, as shown in (47), we would not be able to account for the facts at hand.

To conclude, the Diphthongization effects in Spanish – like the previous effects involving Neutralization and Nasalization in Portuguese – can also be accounted for in terms of our analysis. Under the assumption that Spanish suffixes *cito*, *mente*, and *esimo* (like their Portuguese counterparts) are stress domain suffixes, while *al* and *eza* are cyclic suffixes, application of MSR (obeying the SEC) and Diphthongization will correctly account for the facts. If the analysis advanced here can be maintained it provides additional empirical support for the SEC, which plays a central role in the explanation of the Spanish facts.

6. Alternative Analyses: Brief Discussion

Up to this point we were concerned with the construction of an analytical hypothesis to account for some empirical effects involving Portuguese Neutralization and Nasalization, and Spanish Diphthongization. In this section we shall briefly discuss some plausible alternatives.

A first alternative can be construed along the lines of the analysis initially given for Spanish diphthongization in Harris (1983). Harris proposed to account for the differences in words such as *fuerte*, *fortaleza*, *fuertecito* ('strong, fortress, little fort') in terms of a crucial difference between cyclic and noncyclic stress assignment (pp. 86-87). Thus, according to Harris's analysis suffixes such as *al*, *eza* are 'associated with noncyclic stress' (cf. pp. 86-87; 94), while *cito*, *mente*, *esimo* are 'associated with cyclic stress'; cf. pp. 86-87; 94). To illustrate the proposal, the segmental effects observed in a word like *fortaleza* would be accomplished essentially as follows (but see Harris's work for the full details):

(48)	[fort+ al+ eza] é [fort al éza]	Non-cyclic stress
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According to Harris's analysis, stress in such words would be assigned noncyclically (p.87), so that there would be only one stress assigned to the whole word. Since the stem vowel in [fort] is unstressed, Diphthongization cannot apply, so that the correct *fortaleza* would be produced.

On the other hand, the derivation of a word such as *fuertecito* 'little fort,' would involve cyclic stress and the segmental aspects of the derivation would proceed essentially as illustrated in the informal derivation below (but see Harris 1983: 25 for full details):

(49)	[[forte]c ito] ó wé — wè í — [fwèrtécito]	(first cycle) Cyclic stress Dipht (second cycle) Cyclic stress Dipht
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Since the word in (49) would now have two cyclic domains, there would be two passes through the cyclic rules. On the first cycle stress

would be placed on the stem vowel, which is then diphthongized. New application of cyclic stress on the second cycle would place the stress in the suffix vowel (which, according to Harris's analysis, would cause the reduction of the previously assigned stress to secondary stress; cf. p. 125), so that the correct form *fuertecito* would be derived (cf. Harris 1983: 86-87; 90-95; 125-129 for details).

Although the analysis above has merit, it also faces a number of problems. First, it is necessary to assume that Spanish MSR must apply both cyclically and noncyclically, which seems to be an unnecessary duplication.

Second, the analysis in question assumes that suffixes such as *al* and *eza* are "associated with noncyclic stress" - i.e. 'noncyclic suffixes' in the sense of the HV framework. However, this is difficult to maintain at the present context. As noted in (44), such suffixes are 'stress sensitive' and, thus, in light of subsequent work (cf. Halle & Mohanan 1985; Halle & Vergnaud 1987: 79ff; Halle, Harris & Vergnaud 1991) they ought to be analyzed as 'cyclic suffixes' rather than as 'noncyclic suffixes,' as the analysis in question must crucially assume.

But, if *al* and *eza* are analyzed as cyclic suffixes, given the fact that the analysis in question assumes also that suffixes of the *cito* class are cyclic, the analysis would no longer be able to distinguish the two types of suffixes and, hence, it would not be able to account for the Diphthongization effects. This is so since the same analytical assumptions that are needed to produce *fuertecito* would also give the incorrect **fuertaleza* instead of *fortaleza*, which we leave for the reader to verify.

Similar problems would arise if the proposal above were extended to account for the Portuguese Neutralization and Nasalization effects. Since Portuguese *al* and *eza* (like their Spanish counterparts) are stress sensitive suffixes, they would have to be analyzed as 'cyclic suffixes'. If the analysis in question were to assume that *zinho* (like Spanish *cito*) is also a cyclic suffix, it would not be possible to account for the divergent patterns involving Neutralization and Nasalization associated with such suffixes.

As we recall, none of these problems would arise under my analysis, in which the divergent patterns are accounted for in terms of a crucial distinction between cyclic vs. stress domain suffixes.

A second alternative, which was already alluded to, can be construed along the lines of the analysis of Spanish diphthongization suggested in Halle & Vergnaud (1987), referred to as HV here. Halle & Vergnaud proposed to account for the Diphthongization effects in Spanish as follows. First, they assume that Spanish MSR is assigned only to the cyclic stratum (p.94). Next, to account for the diphthongization effects in words such as *fuertecito*, *fuertísimo*, Halle & Vergnaud as-

sumed that "the rule of Diphthongization is assigned to the cyclic stratum and is ordered after the rules that assigns main stress" (p.94).

Under these assumptions, the analysis in question would give the right results in the case of *fuertecito*. However, since *al* and *eza* are 'stress sensitive' suffixes in the sense of their analysis, Halle & Vergnaud would have to analyze these also as cyclic suffixes. As a result the analysis in question would also not be able to account for the Diphthongization effects.

This is easy to see. Suppose, Diphthongization is cyclic and ordered after MSR, as Halle & Vergnaud suggest. This would give the correct results in the case of *fuertecito*. But it would also give incorrect results since it would produce the incorrect **fuertaleza* instead of *fortaleza*, just like in the previous proposal based on Harris' analysis (cf. discussion of examples (43) and (45)). (See also Harris 1989: 345ff for relevant criticism of Halle & Vergnaud's analysis in this regard).

In view of such negative results, one might propose to assign Diphthongization to the noncyclic stratum. But this move would just reverse the problem. Now the analysis would be able to derive the correct *fortaleza* but it would not be able to block the incorrect form **fortecito* instead of the correct *fuertecito*, as shown below:

(50)	a.	[[forte]c ito]	b.	[[[fort]al]e za]	Cyclic stratum (S2)
		ó		ó	MSR
		o		o	MSR
		:		a	MSR
		:		é	MSR
		[forte c íto]		[fort al éza]	Noncyclic stratum (S3)
		—		—	Diphth
		*[forte cíto]		[fort al éza]	

The derivation of *fortaleza* in (50b) would be unproblematic. However, in (50a) application of MSR (in accordance with the SEC) on the second cycle would cause the elimination of the stress in the stem vowel, precluding later application of noncyclic Diphthongization. As a result the analysis would produce the incorrect **fortecito*, instead of *fuertecito*.

Again, we note that similar problems would arise if we attempted to extend the proposal in question to Portuguese. If Portuguese *zinho* is analyzed as a cyclic suffix, given that *al* and *eza* must also be cyclic suffixes, there would be no way to account for the differences involving Neutralization effects in pairs such as *m/Olínho* - *m/olléza* ('soft - softness'), or Nasalization effects in *ban[a]nál* - *ban[ã]nínha* ('banana grove - little banana').

First, it is not clear that the stress rules in Spanish (or Portuguese) must apply both cyclically and noncyclically, as HHV assume, which seems an unnecessary duplication. Under my analysis, as we have seen, the same data can be plausibly explained in terms of the same general principles (particularly the SEC) by assigning the rules placing main stress in Spanish and Portuguese to the cyclic stratum only.

Second, notice that the reason why HHV must assume that stress rules must also apply in the noncyclic stratum (S3) in Spanish is that HHV treat *ísimo* and *cito* as noncyclic suffixes. Their argument, as is clear from the derivation of *buenísimo* above, is essentially that since such suffixes are noncyclic and stress rules must apply to them, stress rules must apply also in the noncyclic stratum, which is when such noncyclic suffixes are visible.

However, the analysis of *ísimo* and *cito* (and their Portuguese counterparts) as noncyclic suffixes is quite problematic, and goes contrary to basic assumptions of the HV framework. As argued initially in HV, cyclic suffixes (e.g. English *-ity*, *-ic*, *-al*) are stress-sensitive and affect the placement of stress in the words containing them, while noncyclic suffixes (e.g. English *-ness*, *-hood*, *-ly*) are normally stress-neutral in the sense that they are normally unstressed and do not affect the placement of stress in the words containing them. Now, Spanish *ísimo* and *cito* (and their Portuguese counterparts) do not behave at all like known noncyclic suffixes. They do affect stress placement – in fact, they can be stress bearer – which seems to be *prima facie* evidence against treating them as noncyclic suffixes, thus posing a problem for the analysis given in HHV.

Under my proposal, *ísimo* and *cito* (and their Portuguese counterparts) are treated as stress domain suffixes, which receive stress through the operation of cyclic stress rules within their own stress domain, so the same problem does not arise.

Third, notice that to account for Spanish Diphthongization under the HHV analysis is not sufficient to treat *ísimo* and *cito* as noncyclic and to posit stress rules in both the cyclic and noncyclic strata. It is also necessary to crucially order the rules in the noncyclic stratum S3, with the rule of Diphthongization ordered crucially before the noncyclic stress rules. This is crucial since if the noncyclic stress rules were to apply before Diphthongization, the Conflation rule of the HHV system would eliminate the stress from the stem vowel, bleeding Diphthongization, so as to produce incorrect forms such as **bonísimo* instead of *buenísimo*. But there appears to be no principled reason for the ordering in question, which seems to require stipulation.

Under my proposal, the cyclic stress rules must apply before noncyclic Diphthongization, but this ordering follows from the theory of

of Conflation “deletes the stress on the stem syllable” (p. 147) to produce the output [bwenísimo].

Consider now the informal derivation of *bondad* according to HHV’s analysis:

(56)	[[bon]dad] ó	S2 cyclic phonology Cyclic stress	Cyclic stress
	o á		
	[bond ád]	S3 noncyclic phonology Dipht	Dipht
	ó	Noncyclic stress	Noncyclic stress
	o á	Conflation	Conflation
	[bond ád]		

According to HHV’s analysis, the suffix *-dad* is cyclic. On the first cycle at the S2 stratum cyclic stress rules place the stress on the stem vowel [bón], as before. But since *-dad* is a cyclic suffix, on the second cycle at the S2 stratum a new application of the cyclic stress rules places stress in the suffix vowel and the SEC erases the stress in the stem vowel. Later, at the noncyclic stratum S3, noncyclic Diphthongization will not be able to apply since the stem vowel is not stressed, so that the correct output [bondád] is produced (cf. HHV: 147). For completeness sake, as HHV note, reapplication of the stress rules at the noncyclic stratum S3 would again place stress on the first syllable (as was done in the cyclic stratum S2) cycle but this stress is eliminated by Conflation (p. 147).

As HHV note, the removal of stress due to the SEC in the case of *bondád* is necessary in order to bleed Diphthongization and, hence, “provide direct support for the need for the SEC” (HHV: 147). Notice that the analysis in question could also be extended to account for the facts of Portuguese Neutralization and Nasalization by assigning Neutralization and Nasalization to the noncyclic stratum S3, and ordering them before the noncyclic stress rules.

Evidently, there are many similarities between the analysis given in HHV and the analysis advocated here. In particular, both analyses share essentially the same general framework, and both proposals are in agreement with respect to the crucial explanatory role played by the SEC. But there are, nevertheless, some important empirical differences between the two proposals in the way they handle the data of Spanish diphthongization and in the way they can be extended to account for the additional data of Portuguese Neutralization and Nasalization. These differences, as I will now argue, provide evidence for preferring my analysis over the analysis given in HHV.

the cycle, which requires that cyclic rules apply before noncyclic rules.

Similar problems arise when we attempt to extend the HHV analysis to the facts of Portuguese Neutralization and Nasalization. To account for the Portuguese data under the HHV analysis it would be necessary to treat *zinho* and *íssimo* as noncyclic suffixes, and to assume that stress rules apply both cyclically and noncyclically. In addition, it would be necessary to impose a crucial extrinsic ordering among the rules assigned to the noncyclic stratum (S3). Thus, to account for pairs such as m[ol]éza 'softness' and m[ol]ímho it would be necessary to assume that Neutralization is ordered before the noncyclic stress rules. Likewise, in order to account for pairs such as ban[al]na 'banana grove' and ban[á]ninha 'little banana' it would be necessary to assume that Nasalization is also ordered before the noncyclic stress rules. Otherwise, if the noncyclic stress rules applied first, the Conflation rule of the HHV system would eliminate the stress from the stem vowel, leading to incorrect results here.

However, again, there appears to be no principled reason for ordering Neutralization and Nasalization before the noncyclic stress rules. Moreover, the fact that stress sensitive rules such as Spanish Diphthongization, and now Portuguese Neutralization and (stress induced) Nasalization are triggered only by the cyclic stress rules, but not by the proposed noncyclic stress rules – which are ordered after all such processes and are, therefore, irrelevant to them – does raise questions about the empirical motivation for postulating noncyclic stress rules in Spanish and Portuguese, since the latter do not generalize to other facts.

Although the facts above pose a problem for HHV's analysis, they do not constitute problems for the my analysis. Under my proposal, the main stress rules (MSR) are assigned to the cyclic stratum only, while rules like Nasalization, Neutralization, and Spanish Diphthongization are assigned to the noncyclic stratum. The only ordering necessary is that between cyclic MSR and the noncyclic stress sensitive rules in question, but such ordering follows from the theory of the cycle. Since there is no noncyclic MSR, the problem of ordering such a rule with respect to the others in the noncyclic stratum does not arise.

To conclude the section, in the above discussion we have contrasted the analysis developed here with existing alternatives. Under my proposal, suffixes such as Portuguese *íssimo*, *zinho*, *mente* (and their Spanish counterparts) constitute stress domain suffixes – distinct from both noncyclic and cyclic suffixes. It was shown that under this hypothesis it is possible to provide a plausible explanation for a significant range of phenomena involving Neutralization and Nasalization in Portuguese, and Diphthongization in Spanish in terms of the system of

hypotheses embodied in the HV framework – particularly the SEC. During the discussion it was argued that the analysis presented here overcomes a number of problems faced by the various alternatives and provides a better account for the facts considered here.

7. Conclusion

In the discussion above I proposed an analysis to account for some stress conditioned effects involving Neutralization and Nasalization in Portuguese, and Diphthongization in Spanish, which are observed in surface structures even though the conditioning stress itself does not surface.

As argued here, the facts of Portuguese and Spanish that we have examined can be plausibly accounted for within the framework proposed in Halle & Vergnaud (1987). As demonstrated, the facts can be explained in terms of a crucial interaction of cyclic stress rules and specific phonological rules (Neutralization, Nasalization in Portuguese; Diphthongization in Spanish), which produce different results depending on the type of suffixes (cyclic vs. stress domain suffixes) that are present in the structure.

In particular, it was shown that the cyclic rules assigning main stress in both Spanish and Portuguese (MSR) are regulated by Halle & Vergnaud's Stress Erasure Convention (SEC), which plays a crucial role in the explanation of the phenomena investigated here. Cyclic reapplications of the Main Stress Rule (MSR) in Portuguese and Spanish cause erasure of previously assigned stress only with cyclic suffixes. With stress domain suffixes, which constitute separate cyclic domains independent of the rest of the word containing them, stress assigned to the stem by cyclic MSR is not erased, and remains available to the rules applying in the noncyclic stratum. The existence of stress domain suffixes in Portuguese and Spanish thus support the claim made by Halle & Vergnaud that stress domains are not restricted to words, but also include suffixes.

Though no exhaustive analysis of affixation and the way affixes interact with phonological rules has been attempted, the analysis given here provides a plausible account for an interesting range of facts of Portuguese and Spanish. To the extent that this analysis can be maintained, the facts of Portuguese and Spanish investigated here constitute empirical evidence in favor of the framework developed in Halle & Vergnaud (1987), and in favor of the Stress Erasure Convention (SEC) as a general principle of grammar.

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Footnotes

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1 For the basic concepts of this theory, see Kiparsky (1982a; 1982b; 1985), Halle & Mohanan (1985), Rubach (1984) and references cited there. For a recent review, see Goldsmith (1990: Ch 5).

2 For ease of presentation, here and throughout the article I will use traditional derivation notation to illustrate the effects of cyclic and noncyclic rules, since this is readily translatable into the various frameworks and does not appear to have any material affect on the conclusions drawn here. There is, however, good evidence that stress requires a metrical approach (Hayes 1981; Harris 1983; Halle & Vergnaud 1987) and will assume this here.

3 In a subsequent article on the subject Halle, Harris and Vergnaud (1991) refer to cyclic vs. noncyclic affixes and also to cyclic vs. noncyclic constituents. Thus, *-al*, *-ity* are said to form cyclic constituents, whereas *-ness*, and *-less* are said to form noncyclic constituents. Stems — the innermost constituent of a word — are also cyclic constituents (p. 142). The rules in the cyclic stratum apply to each cyclic constituent of a word; the rules in the noncyclic stratum apply after all passes through the cyclic rules are completed, and 'apply exactly once to the entire word, regardless of the number of noncyclic affixes in the word, including the case of words with no noncyclic affixes.' (p. 142). This is essentially what we assume here.

4 This suffix is not to be confused with the diminutive *ico* (e.g. *burríco* 'little ass'), which is a Type I suffix. A point to be considered is that since *ico* is never stressed, one might wish to argue that it is a noncyclic suffix, contrary to the what I propose in the text. However, as we discuss later in connection with Neutralization and Nasalization, the stress assigned to the stem in words such *sifíltico* must be eliminated in the derived form encompassing the suffix such as *sifíltico*. I take the elimination of the stem stress in such forms to be due to the fact that such suffixes undergo a new cyclic application of MSR, so that the stem stress is eliminated by the SEC. Under these assumptions, *ico* must be a cyclic suffix, which is the position adopted here. I am indebted to an anonymous reader for criticism in this section.

5 In addition to the rules reproduced in the text, Halle, Harris & Vergnaud (as in the HV analysis) also assume a rule of Conflation, which eliminates multiple stress, thus guaranteeing that Spanish (and, in our case, Portuguese) words emerge from word-level phonology (i.e. strata S2 and S3) with a single stress. A will assume that Conflation is a very late, noncyclic, operation since it must apply after the rule of

Diphthong Formation in Portuguese (cf. note 9). For specific discussions of Portuguese Stress, see Leite (1974), Lopez (1979), and Major (1985).

6 The Spanish examples here are simply hints. It is not obvious from such examples that the underlying vowels here are the low vowels [E], [O], as assumed. Arguably these could be vowel matrixes unspecified for the feature 'low'. However, that NVR also applies to underlying [O] is clear from examples such as *faráo* - *farãonico* ('pharaoh - pharaohnic'); cf note 7 below. Also relevant are the facts of vowel harmony discussed in Quicoli (1990).

7 Caution must be taken not to confuse the various dialects of Brazilian Portuguese in this regard. To be sure, there is a common dialect spoken in parts of São Paulo State in which the pronunciation of a word like *banana* is [bãˈnãˈnã], suggesting that, in this dialect, all that is required for nasalization is the presence of a following nasal consonant. The data of the dialect in question are not germane to the issue discussed here. The facts in the text are all from the 'official dialect' of Brazilian Portuguese (i.e. the one used in the school system, formal media, and in educated speech).

8 Examples such as *fará(Ó)* vs. *fará(ó)nico* are interesting for other reasons as well. As we can see from *faráo*, the final vowel is the low [O]. The fact that the final low vowel [O] is raised to [o] once it is nasalized in *farãonico* provides additional evidence for the existence of the rule of Nasalized Vowel Raising that we are assuming here (cf. also Quicoli 1990).

9 The distribution of *zínho/inho* (and their feminine counterparts *zínha/inha*) is rather complicated. Pedagogical grammars (cf. Cegalla 1977: 96 for one) suggest that the choice of allomorphy is conditioned by stress and by properties of the final syllable. In my own estimation, it seems that the form *zínho* occurs with (a) words ending by a final stressed vowel (*café* - *cafézínho* 'coffee'; *tatú* - *tatuzínho* 'armadillo'); (b) words ending by a vowel but containing antepenultimate stress (e.g. *lâmpada* *lampadazínha* 'lightbulb'; *câmara* - *camarazínha* 'chamber'); (c) words ending by a final sonorant consonant, including underlying nasal consonant related to surface nasalized vowels (e.g. *papel* *papelzínho* 'paper'; *túnel* - *tunelzínho* 'tunnel'; *maçã* - *maçãzínha* 'apple'). The form *ínho*, on the other hand, occurs with words that normally take the regular penultimate stress, whose stem ends by an underlying obstruent (though this is often masked by the introduction of the suffixes for gender). Examples of the latter include *vaca* - *vaquinha* 'cow'; *bonito* - *bonitinho* 'pretty'. I will assume, quite tentatively, that the underlying form of the suffix is */ziño/*, and that the initial consonant *'z'* is deleted when it is preceded by an obstruent.

10 To complete the derivation other noncyclic rules must apply. Thus, Nasalization applies, nasalizing the stressed vowel in the suffix, and a rule of Final Vowel Raising (Quicoli 1990) raises the unstressed final vowels in such structures to produce the final phonetic forms [sɛɾtĩnũ] and [mOĩnũ]. The same is true for the examples given in (35) below which must also undergo Nasalization and the rule of Final Vowel Raising to produce the actual phonetic forms [sɛɾtamé̃nũ], [mOlemé̃nũ]. But these details are not relevant to the point under discussion, and need not concern us here.

11 It is not clear whether the stress in the stem vowel in such cases is eliminated by a rule of Conflation (or something like it), as assumed in the text, or reduced to secondary stress. An interesting problem in this regard is posed by minimum pairs such as *paizínho* [paizĩnũ] 'little father' (affectionate) vs. *paizínho* [paizĩnũ] 'little country', which derive from *pai* [páy] 'father' and *país* [país] 'country', respectively. One might argue that the presence of the secondary stress in the 'i' of 'little country' prevents it from becoming a glide, which accounts for the phonetic differences involved. Alternatively, one may assume that the rule of Diphthong Formation in Portuguese applies before Conflation eliminates the stress from the stem vowel. The

matter of secondary stress in Portuguese requires further study. For now I will tentatively assume that the Conflation hypothesis is to be preferred.

¹² As the learned reader will recall, the stem and the theme vowel in verbs form a single constituent, as argued persuasively by Harris (1983: 52-55) in connection with Spanish forms such as *desdén* 'disdain (noun)' vs. *desdén* 'he-disdains'. I assume that the same holds for Portuguese verbs, where identical facts obtain.

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