

The role of morpheme boundaries in Spanish glide formation¹

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Abstract

It is well known that phonological phenomena are often morphologically conditioned. From this point of view, the aim of this paper is to account for the regularities and contrasts between hiatuses and diphthongs in lexically related items in Spanish. It focuses on the factors that influence this phenomenon, analysing in detail the role of lexical stress position in relation to the morphological boundary.

The verbal paradigm of the first conjugation in Spanish displays a contrast relative to the position of the lexical stress when the stem ends in a high vowel. Present tense forms such as *cámb[ɰ]* ‘I change’ differ from the analogous forms of certain other verbs such as *ampl[i.o]* ‘I enlarge’. This glide/vowel contrast is maintained in other forms of the paradigm such as *camb[já]mos*, ‘we change’ vs. *ampl[i.á]mos* ‘we enlarge’. The high vowel tends to become a glide whenever the stress moves to the right (*ampl[ja]rémos* ‘we will enlarge’) (Cabré & Prieto 2006). On the other hand, verbal stems have regularized the position of the stress onto the final vowel (*fábrica* ‘factory’ / *fabrico* ‘I make’). Thus, we can have words such as *ámpl[ɰ]* ‘large’, which is morphologically related to *ampl[i.á]r* ‘to enlarge’ (*amplio* ‘I enlarge’) where lexical stress has moved to the right edge of the stem. Nevertheless, words such as *cámbio* ‘change’, morphologically related to *cambiar* ‘to change’ (*cámbio* ‘I change’), keep the lexical stress on the same position in related stems.

The relative uniformity of verbal paradigms contrasts with the behaviour of other morphologically related words. In nominal derived forms, the prominence effects of the primitive root stress are not transferred: (*nav[i.o]* ‘ship’, *nav[jé]ro* ‘shipping’; *man[i.a]* ‘mania’, *man[já]tico* ‘finicky’), except for deverbal forms with suffixes preceded by a thematic vowel (*conf[i.o]* ‘I trust’, *conf[i.á]nza* ‘trust’; *esqu[i.o]* ‘I ski’, *esqu[i.a]dór* ‘skier’).

Our contribution to this subject is to show the close relation between lexical stress assignment and the paradigm effects determining a hiatus or diphthong pronunciation in lexically related words. This article presents all these factors from within the Optimality Theory framework (Prince & Smolensky 1993), which easily accounts for how stressed high vowels are unwilling to lose their syllabic condition as a nucleus in the paradigm forms, while at the same time there are stems with the final high vowel lexically unstressed (Ohannesian 2004) which, without exception, are pronounced as glides.

1. Introduction

Glide formation in vowel sequences has been widely dealt with in the literature on Spanish (Navarro Tomás 1948; Harris 1983, Harris & Kaisse 1999; Roca 1997; Colina 1999; Hualde 1999, 2005; Cabré & Prieto 2006). It has been claimed that gliding tends to be blocked in the presence of a morpheme boundary and stressed high vowel in

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morphologically related words (*conf[í.á]r* ‘to trust’, *conf[í.o]* ‘I trust’; *act[u.á]r* ‘to act’, *act[ú.o]* ‘I act’) (Hualde 1999, 2005). Nevertheless Cabré & Prieto (2006) note that the stressed high vowel in nominal cases such as *val[í.a]* ‘value’ or *sangr[í.a]* ‘bleeding’ fail to block glide formation in derived forms such as *val[jó]so* ‘valuable’ or *sangr[jé]nto* ‘bloody’.

The scope of our study is limited to the behaviour as hiatus or diphthong of the rising sonority sequences in a specific morpheme boundary position, that is, all lexically related words whose stem ends in a high vowel followed by any kind of initial vowel morpheme (for example, *odi+ar* ‘to hate’, *confi+ar* ‘to trust’, *nervi+oso* ‘irritable’, *vali+oso* ‘valuable’). Specifically for this context, it is assumed that there are no glides in that position in the underlying form. So we consider all diphthong outcomes as a consequence of applying the constraint ranking that forces glide formation.

Verbal forms tend to maintain a uniform shape in the paradigm. The *-iar* (and *-uar*) verbs in Spanish are divided into two groups: verbs with the lexical stress on the final high vowel of the stem (*ampliar* ‘to enlarge’, *ampl[í.o]* ‘I enlarge’; *confiar* ‘to trust’, *conf[í.o]* ‘I trust’) and verbs with the final high vowel of the stem lexically unstressed (*odiar* ‘to hate’, *ód[ja]n* ‘they hate’; *aliviar* ‘to relieve’, *alív[ja]n* ‘they relieve’). The verbal paradigm of the first group tends to keep the hiatus forms, whereas the second group preserves the glide forms over the whole paradigm (*ampl[í.á]mos* ‘we enlarge’, *conf[í.á]mos* ‘we trust’; *od[já]mos* ‘we hate’, *aliv[já]mos* ‘we relieve’).

On the other hand, the suffixed deverbial nominal forms with a theme vowel show the same uniform outcome we have found in the verbal inflectional paradigm. Thus, *conf[í.á]nza* ‘trust’ preserves the hiatus (as in *conf[í.á]mos* ‘we trust’), whereas *camb[já]nte* ‘changing’ keeps the glide form as in any form of the paradigm, e.g. *camb[já]mos* ‘we change’. In any case, when the stress is moved further to the right all sequences are pronounced with a diphthong, as in *ampl[ja]rémos* ‘we will enlarge’ or *conf[ja]rémos* ‘we will trust’, as Cabré & Prieto (2006) have pointed out.

Concerning the position of the stress in verbs and related nominals without a theme vowel, a striking behaviour is shown: the root stress in related forms can appear in the same position (as in *cámbio* ‘change’, *cámbian* ‘they change’ or *lío* ‘confusion’, *lian* ‘they confuse’) or vary, moving the stress to the last vowel in verbal roots. Thus the final vowel is lexically unstressed in cases such as *ámpl[jo]* ‘large’ or *vár[jo]* ‘varied’, whereas the same vowel is stressed in the corresponding verbal forms *ampl[í.a]n* ‘they enlarge’ or *var[í.a]n* ‘they vary’. In these cases the stress appears on the last vowel of the verbal stem, following the general tendency of the language (e.g. *fábrica* ‘factory’, *fabrican* ‘they make’) and blocking proparoxytone forms in the present tense.

The aim of this paper is to account for the regularities in the pronunciation as hiatus or diphthong of rising sonority sequences that occur at the right stem boundary in morphologically related words. Our most significant contribution to this subject, we believe, is to show the crucial role of the stress position and the presence of the theme vowel not only in verbal paradigms but also in deverbial nominals. The uniform behaviour along the paradigm is transferred to the derived nominals (i.e. *al[í.á]r* ‘to ally’, *al[í.o]* ‘I ally’, *al[í.á]nza* ‘alliance’; *camb[já]r* ‘to change’, *cámb[jo]* ‘I change’, *camb[já]nte* ‘changing’) and contrasts with the behaviour of denominals, necessarily lacking theme vowel, which are more prone to diphthongize (i.e. *polic[í.a]* ‘police’, *polic[já]l* ‘police-related’; *nav[í.o]* ‘ship’, *nav[jé]ro* ‘shipping’). The OT framework provides us with the proper tools to analyse both paradigm effects (McCarthy 2005) and the consequences of morpheme boundaries.

The paper is organized as follows. Section 2 presents the data in groups according to the position of the lexical stress in morphologically related words. Section 3 examines

the prosodic factors that control the realization of these sequences as a hiatus or a diphthong. Section 4 accounts for the position of lexical stress in Spanish. Finally, section 5 presents a unified analysis within the OT framework of the morphological and prosodic factors that play some role in the hiatus/diphthong realization in the specific location under study.

2. The data

We present the data below in two groups according to the presence or absence of derivative suffixes. The first group comprises the nominal and related verbal forms without this type of suffix and shows the actual possibilities of the stress position (for example, *limpio* ‘clean’ – *limpiár*² ‘to clean’, *espía* ‘spy’ – *espiár* ‘to spy’). The lexically related words of the second group consist of nouns and adjectives derived through stressed suffixes (for example, *navío* ‘ship’ – *naviéro* ‘shipping’, *confío* ‘I trust’ – *confianza* ‘trust’).

2.1. Related forms without derivatives suffixes

Before grouping the lexical stress distribution of *-iar* (and *-uar*) verbs according to their nominal forms, it is important to bear in mind that Spanish verbal stems have standardized the stress position on the last stem vowel, thus blocking proparoxytones in Present tense forms. We can observe that the stress of the proparoxytone nominal forms has moved to the last vowel of the stem in related verbs, as shown in (1).

(1)	<i>fábrica</i>	<i>fabricar</i> (<i>yo fabrico</i> / * <i>fábrico</i>)
	‘factory’	‘to make (I make)’
	<i>ánimo</i>	<i>animar</i> (<i>yo ánimo</i> / * <i>ánimo</i>)
	‘courage’	‘to encourage (I encourage)’
	<i>intérprete</i>	<i>interpretar</i> (<i>yo intérpreto</i> / * <i>intérpreto</i>)
	‘interpreter’	‘to interpret (I interpret)’
	<i>homólogo</i>	<i>homologar</i> (<i>yo homólogo</i> / * <i>homólogo</i>)
	‘homologous’	‘to make something homologous (I make ...)’
	<i>lástima</i>	<i>lastimar</i> (<i>yo lastímo</i> / * <i>lástimo</i>)
	‘pity’	‘to hurt (I hurt)’
	<i>médico</i>	<i>medicar</i> (<i>yo médico</i> / * <i>médico</i>)
	‘doctor’	‘to prescribe medicine (I prescribe ...)’
	<i>réplica</i>	<i>replicar</i> (<i>yo replíco</i> / * <i>réplico</i>)
	‘retort’	‘to retort (I retort)’
	<i>cálculo</i>	<i>calcular</i> (<i>yo calcúlo</i> / * <i>cálculo</i>)
	‘calculation’	‘to calculate (I calculate)’

The nominal and verbal forms of the first group display a clear asymmetry with regard to the lexical stress position. We can obtain three different subsets of related words depending on the stress prominence of the last high vowel of the stem.

The largest subset of words keeps the final high vowel unstressed in all related stems and it is invariably pronounced as a glide. The verbs of this group do not follow the general tendency of the language and fail to shift the stress to the last stem vowel. Nevertheless, the diphthong resolution blocks antepenultimate stress in Present tense

² Regardless of orthographic conventions, the stressed syllable is marked with an accent when it is necessary to facilitate comprehension.

forms, submitting the outcome to the general rule of the language (i.e. *limpi+o* > *limp[jo]* ‘clean’, *limpi+an* > *limp[ja]n* ‘they clean’). The few verbs in this group with a final labial high vowel are always preceded by a voiced velar consonant (*fraguar* ‘to forge’, *averiguar* ‘to find out’, *atestiguar* ‘to testify’, *menguar* ‘to diminish’).

The examples in (2) illustrate both senses of derivation, that is, deverbal nouns like *odio* ‘hate’ (*odiar* > *odio*), and denominal verbs like *silenciar* ‘to silence’ (*silencio* > *silenciar*), therefore we cannot draw any general conclusions about the direction of derivation.

(2)	Nominal form	Verbal form	Nominal form	Verbal form
	<i>tíbio</i>	<i>yo entíbio</i>	<i>ódio</i>	<i>yo ódio</i>
	‘lukewarm’	‘I cool’	‘hate’	‘I hate’
	<i>carícia</i>	<i>yo acarício</i>	<i>codícia</i>	<i>yo codício</i>
	‘caress’	‘I caress’	‘covetousness’	I covet’
	<i>quício</i>	<i>yo desquício</i>	<i>siléncio</i>	<i>yo siléncio</i>
	‘hinge’	‘I unhinge’	‘silence’	‘I silence’
	<i>sócio</i>	<i>yo asócio</i>	<i>envidia</i>	<i>yo envidia</i>
	‘member’	‘I associate’	‘envy’	‘I envy’
	<i>génio</i>	<i>yo congénio</i>	<i>alívio</i>	<i>yo alívio</i>
	‘genius’	‘I get along well’	‘relief’	‘I relieve’
	<i>justícia</i>	<i>yo ajustício</i>	<i>calúnnia</i>	<i>yo calúnnio</i>
	‘justice’	‘I execute’	‘calumny’	‘I slander’
	<i>própio</i>	<i>yo aprópio</i>	<i>límpio</i>	<i>yo límpio</i>
	‘own’	‘I appropriate’	‘clean’	‘I clean’
	<i>concílio</i>	<i>yo reconcílio</i>	<i>colúmpio</i>	<i>yo colúmpio</i>
	‘council’	‘I reconcile’	‘swing’	‘I swing’

The second subset behaves in exactly the opposite way, that is, the last high vowel in the stem is lexically stressed in related words (e.g. *vací+o* ‘empty’, *vací+an* ‘they empty’). As in subset (2) above, we can also find examples of both senses of derivation (e.g. *frío* ‘cold’ > *enfriar* ‘to cool’, *desafiar* ‘to challenge’ > *desafío* ‘challenge’), but this fact is not relevant for this group. Regarding the stem-final /u/, we find no correspondences (i.e. *situar* ‘to place’ > *situación*/**sitúa* ‘situation’, *evaluar* ‘to evaluate’ > *evaluación*/**evalúa* ‘evaluation’). Some examples of this group are shown in (3).

(3)	Nominal form	Verbal form	Nominal form	Verbal form
	<i>rocío</i>	<i>yo rocío</i>	<i>amnistía</i>	<i>yo amnistío</i>
	‘sprinkle’	‘I sprinkle’	‘amnesty’	‘I amnesty’
	<i>desafío</i>	<i>yo desafío</i>	<i>espía</i>	<i>yo espío</i>
	‘challenge’	‘I challenge’	‘spy’	‘I spy’
	<i>desvío</i>	<i>yo desvío</i>	<i>vacío</i>	<i>yo vacío</i>
	‘detour’	‘I divert’	‘empty’	‘I empty’
	<i>hastío</i>	<i>yo hastío</i>	<i>atavío</i>	<i>yo atavío</i>
	‘weariness’	‘I weary’	‘dress’	‘I dress up’
	<i>lío</i>	<i>yo lío</i>	<i>frío</i>	<i>yo enfrió</i>
	‘confusion’	‘I confuse’	‘cold’	‘I cool’

The third subset, shown in (4), is the smallest one. In fact, considering the small number of words that comprise it, it would appear to be merely residual. Nevertheless, it is this group that strikingly standardizes the stress position as those verbs listed in (1), because

the final high vowel is unstressed in nominal forms (e.g. *ámpli+o* - *ámpl[jo]* ‘large’) and stressed in the corresponding verbal stem (e.g. *amplí+an* - *ampl[i.a]n* ‘they enlarge’). It is tempting to say that the stress movement is due to the fact that the verbs derive from nominals and crucially not vice versa, but this is not clear in all cases (such as in *ánsia* ‘worry’ / *ansiar* ‘to long for’). It is also important to bear in mind that there are no corresponding items with the stress in the opposite position to this group, as Harris and Kaisse (1999) pointed out (e.g. **ansía* N - **ánsian* V).

(4)	Nominal form	Verbal form	Nominal form	Verbal form
	<i>ámplio</i>	<i>yo amplio</i>	<i>vário</i>	<i>yo vario</i>
	‘large’	‘I enlarge’	‘varied’	‘I vary’
	<i>pátria</i>	<i>yo repatrio</i>	<i>ánsia</i>	<i>yo ansio</i>
	‘fatherland’	‘I repatriate’	‘worry’	‘I long for’
	<i>perpétuo</i>	<i>yo perpetuo</i>	<i>continuo</i>	<i>yo continuo</i>
	‘perpetual’	‘I perpetuate’	‘continuous’	‘I continue’

2.2. Related forms with stressed derivative suffixes

The second group comprises lexically related words with stressed derivative suffixes. The striking asymmetry that this group shows consists of the different prosodic behaviour of the lexically stressed final high vowel of the stem in denominal and deverbal forms. As Cabré & Prieto (2006) pointed out, the morphological boundary does not block glide formation, neither in those cases with a lexically unstressed final high vowel of the stem (left-hand column, e.g. *pátri+a*, *pá tr[ja]* ‘fatherland’, *pátri+ót+a*, *patr[jó]ta* ‘patriot’), nor in those cases where the final high vowel of the stem is lexically stressed (right-hand column, e.g. *maní+a*, *man[i.a]* ‘mania’, *maní+átic+o*, *man[já]tico* ‘finicky’), as shown in (5). There is no difference in the glide pronunciation of the derived forms between the two columns in spite of the difference in the lexical stress position in the primitive words.

(5)	Unstressed high vowel		Stressed high vowel	
	<i>pátria</i>	<i>patr[j]ota</i>	<i>policía</i>	<i>polic[j]al</i>
	‘fatherland’	‘patriot’	‘police’	‘police-related’
	<i>ánsia</i>	<i>ans[j]oso</i>	<i>valía</i>	<i>val[j]oso</i>
	‘worry’	‘worried’	‘value’	‘valuable’
	<i>história</i>	<i>histor[j]al</i>	<i>manía</i>	<i>man[j]ático</i>
	‘history’	‘historical’	‘mania’	‘finicky’
	<i>lábio</i>	<i>lab[j]al</i>	<i>gestoría</i>	<i>gestor[j]al</i>
	‘lip’	‘labial’	‘agency’	‘agency-related’
	<i>précio</i>	<i>prec[j]oso</i>	<i>Rocío</i>	<i>roc[j]ero</i>
	‘price’	‘precious’	‘Rocío’	‘pilgrim to Rocío’
	<i>nérvio</i>	<i>nerv[j]oso</i>	<i>abadía</i>	<i>abac[j]al</i>
	‘nerve’	‘irritable’	‘abbey’	‘abbey-related’
	<i>comédia</i>	<i>comed[j]ante</i>	<i>navío</i>	<i>nav[j]ero</i>
	‘comedy’	‘actor’	‘ship’	‘shipping’
	<i>matéria</i>	<i>mater[j]al</i>	<i>María</i>	<i>mar[j]ana</i>
	‘matter’	‘material’	‘Mary’	‘Marian’
	<i>vicio</i>	<i>vic[j]oso</i>	<i>sangría</i>	<i>sangr[j]ento</i>
	‘vice’	‘dissolute’	‘bleeding’	‘bloody’

By contrast, suffixed deverbal forms with theme vowel preserve (or can preserve among conservative speakers) the differences we observed in the paradigm forms, preserving either diphthong or hiatus pronunciation depending on the stress position of the related stems. Thus the examples in the left-hand column in (6) show a pronunciation with hiatus (among conservative speakers, as noted by Cabré & Prieto 2006) because of the lexically stressed final vowel of the verbal stem (e.g. *vari+ár* – *var[i.á]r* ‘to vary’, *vari+ánte* – *var[i.á]nte* ‘variant’). On the other hand, the diphthong is obligatory in the examples in the right-hand column due to the lack of lexical stress on the final high vowel of the verbal stem (e.g. *cámbi+ár* – *camb[já]r* ‘to change’, *cámbi+ánte* – *camb[já]nte* ‘changing’).

(6)	Possible hiatus <i>esqu[i.á]ble</i> (cf. <i>esqu[i.á]r</i>) ‘suitable for skiing’ (‘to ski’) <i>var[i.á]nte</i> (cf. <i>var[i.á]r</i>) ‘variant’ (‘to vary’) <i>desv[i.á]ble</i> (cf. <i>desv[i.á]r</i>) ‘divertible’ (‘to divert’) <i>conf[i.á]nza</i> (cf. <i>conf[i.á]r</i>) ‘trust’ (‘to trust’) <i>al[i.á]nza</i> (<i>al[i.á]r</i>) ‘alliance’ (‘to ally’)	Obligatory diphthong <i>camb[já]nte</i> (cf. <i>camb[já]r</i>) ‘changing’ (‘to change’) <i>irrad[já]nte</i> (cf. <i>irrad[já]r</i>) ‘irradiant’ (‘to irradiate’) <i>acuc[já]nte</i> (cf. <i>acuc[já]r</i>) ‘pressing’ (‘to press’) <i>desprec[já]ble</i> (cf. <i>desprec[já]r</i>) ‘worthless’ (‘to scorn’) <i>med[já]nte</i> (<i>med[já]r</i>) ‘through’ (‘to intervene’)
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3. Prosodic factors

On the basis of the examples given above, the pressure of the paradigm forcing a uniform pronunciation is mainly derived from the stress position of the stem. The prosodic prominence of the stem is crosslinguistically accepted (Beckman 1998) in opposition to the prosodic weakness of the inflection suffixes. Therefore the stress prominence pressure of the stem has to be higher than the stress prominence pressure of the inflection. The examples in (7) clearly display the effects of the different prominences of the two stress positions. When the stressed high vowel belongs to the stem, it yields a prominent effect over the paradigm, blocking glide formation, whereas the stressed high vowel of a suffix is more prone to become a glide when the stress is moved to the right. For example, the Imperfective Past tense of *temer* ‘to fear’ *tem+i+a* – *tem[i.a]* (3ps) becomes *tem+i+ó* – *tem[jó]* in Perfective Past tense. We are aware that the morpheme analysis of such verbs may be partially unaccepted,³ but the opposite outcomes of the two columns below are very clear.

(7)	<i>v[j]o</i> (<i>ver</i>) ‘s/he saw’ (Inf.) <i>d[j]o</i> (<i>dar</i>) ‘s/he gave’ (Inf.) <i>mid[j]ó</i> (<i>medir</i>) ‘s/he measured’ (Inf.) <i>hir[j]ó</i> (<i>herir</i>) ‘s/he hurt’ (Inf.) <i>tem[j]ó</i> (<i>temer</i>)	versus	<i>r[i]ó</i> (<i>re.ír / rí.o</i>) ‘s/he laughed’ (Inf. / 1IPsg.) <i>l[i]ó</i> (<i>li.ár / lí.o</i>) ‘s/he confused’ (Inf. / 1IPsg.) <i>desv[i]ó</i> (<i>desvi.ár / desví.o</i>) ‘s/he diverted’ (Inf. / 1IPsg.) <i>al[i]ó</i> (<i>ali.ár / alí.o</i>) ‘s/he allied’ (Inf. / 1IPsg.) <i>conf[i]ó</i> (<i>confi.ár / confí.o</i>)
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³ Alcobá (1999) considers the tense morpheme /jó/ of *temió* different from the theme vowel /i/ of *temía*.

‘s/he feared’ (Inf.)	‘s/he trusted’ (Inf. / 1IPsg.)
<i>cog[j]ó (coger)</i>	<i>vac[i]ó (vací.ár / vací.o)</i>
‘s/he caught’ (Inf.)	‘s/he emptied’ (Inf. / 1IPsg.)

The stress prominence pressure of the stem over the paradigm forms is nevertheless subject to another prosodic factor in addition to the stress position of a specific word: the distance between the beginning of that word and the location of the rising sonority sequence. The stress prosodic prominence of the stem decreases as the distance between the beginning of the word, the place of morpheme boundary and the stress position grows. Thus we can observe in (8) that the diphthong pronunciation is generalized when the distance between these three places is large enough. Thus the greater the distance, the greater the tendency to pronounce a diphthong (Cabré & Prieto 2004, 2006).

(8)	<i>l[i]ár</i>	<i>l[i]arémos (lí.o)</i>
	‘to confuse’	1pp Future (1ps Present)
	<i>pal[i]ár</i>	<i>pal[j]arémos (palí.o)</i>
	‘to mitigate’	1pp Future (1ps Present)
	<i>desvar[j]ár</i>	<i>desvar[j]arémos (desvarí.o)</i>
	‘to talk nonsense’	1pp Future (1ps Present)
	<i>f[i]ár</i>	<i>f[i]arémos (fí.o)</i>
	‘to rely’	1pp Future (1ps Present)
	<i>conf[i]ár</i>	<i>conf[j]arémos (confí.o)</i>
	‘to trust’	1pp Future (1ps Present)
	<i>desconf[j]ár</i>	<i>desconf[j]arémos (desconfí.o)</i>
	‘to distrust’	1pp Future (1ps Present)

4. The position of the stress

Spanish stress is limited to the last three syllables of the word, i.e. what is known as the three-syllable window (Harris 1983, Roca 1988, 2005, among others). Depending on the position of the stress, words are classified into oxytones (*canción* ‘song’, *hindú* ‘Hindu’), paroxytones (*casa* ‘house’, *árbol* ‘tree’) and proparoxytones (*sábana* ‘sheet’, *régimen* ‘diet’). Nevertheless, stress assignment does not work in the same way in all cases, and this question has been widely discussed in the literature (Harris 1983, Roca 1988, Hammond 1995, Oltra & Arregi 2005). We assume here the analysis of Ohannesian (2004), who establishes three accentual patterns in Spanish, according to the number of syllables between the right edge of the stressed syllable and the right edge of the stem. The stress position is conditioned by morphological categories, namely, by the stem and prosodic word boundaries in the unmarked pattern. In marked and ultramarked cases, lexical marks determine the stress position, as shown in (9).

The morphological structure of nominals⁴ consists of a stem that can be followed by a word marker or terminal element⁵ (Harris 1991), as in *cas+a* ‘house’, or an epenthesis realized as *e* when the stem ends in a non-permitted coda, as in *madr+e* ‘mother’. Finally, there are some words with neither terminal element nor epenthesis, as in *canción* ‘song’ or *café* ‘coffee’. The Spanish accentual patterns are presented schematically in the following table:

⁴ We use *nominal* to mean all non-verbal items, i.e. all words that are able to bear a word marker.

⁵ A *word marker* or *terminal element* (TE), following Harris (1991), is that element which only appears at the right-hand edge of a word in its singular form and may not be followed by any suffix except a plural marker. Such elements may be made up of any of the five vowels, either alone or followed by *s*, or *-s* itself.

(9)

Patterns	Syllables between the right edge of the stressed syllable and the right edge of the stem	Lexical marks		Classification according to the stress position
unmarked			<i>ca<u>s</u>a, ma<u>d</u>re</i>	paroxytones
			<i>ca<u>n</u>ci<u>ó</u>n, hi<u>n</u>dú</i>	oxytones
marked	σ	last vowel of the stem	<i>sá<u>b</u>ana, lú<u>g</u>ubre</i>	proparoxytones
			<i>á<u>r</u>bol</i>	paroxytones
ultramarked	σσ	two last vowels of the stem	<i>r<u>é</u>gim<u>e</u>n, ó<u>m</u>icr<u>o</u>n</i>	proparoxytones

As we can see in (9) the last vowel of marked stems and the last two vowels of ultramarked ones have a lexical mark of zero or null prominence (underlined vowels): *árbol* ‘tree’, *sában-a* ‘sheet’, *lúgubr-e* ‘lugubrious’, *régimen* ‘diet’. These marked vowels cannot be stress bearers⁶.

The unmarked pattern contains words in which the right edge of the stressed syllable coincides with the right edge of the stem. If the word ends in a terminal element or epenthesis it will be paroxytone (*casa, madre*); if the word lacks these elements, it will be oxytone (*canción, hindú*). The marked pattern includes words with just one marked vowel between the right edge of the stressed syllable and the right edge of the stem. The presence of a terminal element or epenthesis yields proparoxytones (*sábana, lúgubre*), whereas the absence of such elements results in paroxytones (*árbol*). The ultramarked pattern is formed by words with two marked vowels between the right edge of the stressed syllable and the right edge of the stem (*régimen*). All the words belonging in this group are proparoxytones.

The analysis of stress assignment we present is based on a combination of alignment constraints (McCarthy 1993) with a faithfulness constraint (Prince & Smolensky 1993). The alignment constraints account for morphological categories such as stems or words intervening in the stress assignment, whereas the identity constraint imposes faithfulness to vowel prominence marks.

Leaving aside the constraints that are not relevant for our purposes in this paper, the first alignment constraint ALIGN FOOT RIGHT PROSODIC WORD RIGHT, defined in (10), keeps the foot as far as possible to the right edge of the word, while the second constraint, ALIGN STRESS RIGHT STEM RIGHT, defined in (11), favours the coincidence of the stressed syllable with the stem.

⁶ For a detailed discussion of the advantages of lexical marking of unstressed vowels instead of tonic vowels, see Ohannesian (2004).

- (10) ALIGN FOOT R PRWD R
The right edge of the foot has to coincide with the right edge of the prosodic word
- (11) ALIGN STRESS R STEM R
The right edge of the stressed syllable has to coincide with the right edge of the stem.

An identity constraint FAITHFULNESS VOWEL PROMINENCE imposes faithfulness to vowel prominence marks. This constraint must be ranked above both alignment constraints. FAITHFULNESS must be respected because the language gives priority to conserving the underlying form over respecting alignment, which is what the unmarked pattern does.

- (12) FAITHFULNESS VOWEL PROMINENCE
The output must respect the vowel prominence marks of the input.

These statements yield the hierarchy of constraints shown in (13):

- (13) FAITHFULNESS VOWEL PROMINENCE >> ALIGN FOOT R PRWD R >> ALIGN STRESS R STEM R⁷

The tableau in (14) shows an example of the unmarked pattern. Stems are given between square brackets and feet between parentheses. The candidate b) respects neither foot nor stress alignment constraints. Candidate c) violates the stress alignment constraint.

(14)

[cascabel]	FAITH VOWEL PROMINENCE	ALIGN FOOT R PRWD R	ALIGN STRESS R STEM R
a. ↗ [casca(bél)]			
b. [(cásca)bel]		*!	**
c. [cas(cábel)]			*!

An example of the marked pattern is shown in (15) and in (16) we present an example of the ultramarked pattern. Candidates a) from (15) and (16) are optimal because they respect the faithfulness constraint at the top of the hierarchy. Candidates b) and c) are ungrammatical in spite of the fact that they respect alignment constraints.

(15)

[sabãn]a	FAITH VOWEL PROMINENCE	ALIGN FOOT R PRWD R	ALIGN STRESS R STEM R
a. ↗ [(sábã)n]a		*	*
b. [sa(báñ)a]	*!		

⁷ The hierarchy ALIGN FOOT R PRWD R >> ALIGN STRESS R STEM R prevents undesirable outputs in verbal forms, like *cántamos – [(cánt)amos], stressed at the right edge of the stem cant-. By contrast, the correct form cantámos - [can(t)ámos] fulfils the foot alignment but not the stress alignment constraint.

(16)

[regim <u>en</u>]	FAITH VOWEL PROMINENCE	ALIGN FOOT R PRWD R	ALIGN STRESS R STEM R
a. φ [(r <u>é</u> gi)m <u>en</u>]		*	**
b. [re(<u>g</u> im <u>en</u>)]	*!		*
c. [regi(<u>m</u> én)]	*!		

In verbal forms, the morphological structure determines the stress position that yields a regular and predictable stress. As Harris (1987:64) says, “There is no such thing in Spanish as an idiosyncratically or irregularly stressed verb form. Each inflectional paradigm has a characteristic fixed stress pattern that admits no variation, however minimal, among individual lexical items.”

Following Alcoba (1999), verbal tenses belong to one of the following three groups in terms of the stress position: Present, Past and Future. Whereas the latter two have columnar stress⁸, Present tenses (Indicative Present, Subjunctive Present and Imperative) do not: persons 1, 2, 3 and 6 stress the last vowel of the stem (*canto* ‘I sing’, *cántas* ‘you sing’, *cánta* ‘(s)he sing’, *cántan* ‘they sing’; *cánte* (1/3ps Subj. Present), *cántes* (2ps Subj. Present), *cánten* ‘3pp Subj. Present’; *cánta* ‘2ps Imp.’ and persons 4 and 5 stress the syllable following the stem (*cantámos* ‘we sing’ *cantáis* ‘you sing’; *cantémos/cantéis* ‘1/2pp Subj. Present’; *cantád* ‘2pp Imp.’).

Thus, the verbs of first conjugation listed in (4) (e.g. *amplío*) and (1) (e.g. *fábrico*)⁹ have regularized stress position regardless of the presence of lexical marks and in violation of the faithfulness constraint. This is in contrast to the verbs listed in (2) such as *cambio* or *fraguo*, because forms such as *cámb[jo]*, *cámb[ja]*s, *cámb[ja]* contradict the given generalization.

The presented data display a set of asymmetries. First, verbs grouped in (2) respect the lexical mark (*cámbi-o*) whereas the verbs grouped in (4) violate faithfulness in order to standardize their paradigm (*ámpli-o_A* *amplí-o_V*). Second, the pronunciation of unstressed high vowels of verbs grouped in (2) surfaces always as a diphthong (*camb[já]mos* / **camb[i.á]mos*), whereas the verbs grouped in (3) or (4) can display either a hiatus or a diphthong pronunciation depending on the speaker’s idiolect: *ampl[i.á]mos* / *ampl[já]mos*. Third, nominal items derived from verbs with a theme vowel preserve their verbal pronunciation tendencies, such as *camb[já]nte* / **camb[i.á]nte* vs. *var[i.á]nte* / *var[já]nte*. On the other hand, nominals derived from non-verbal items have lost the prominence position and always diphthongize: *histór[ja]* / *histor[já]l* vs. *polic[i.a]* / *polic[já]l*.

Our goal is to account for these phenomena and give an explanation for the lack of a subset like **ampl[i.o]_A* / **ampl[jo]_V*, a gap which is not accidental.

5. Analysis

The conditions that control glide formation are prosodic in essence and they are combined with positional prominence and morphological factors, as Cabré & Prieto (2006), Hualde

⁸ Past tenses stress the theme vowel: *cantába*, *cantábamos*; future tenses stress TAM (Tense, Aspect, Mood) morphs: *cantaré*, *cantaría*.

⁹ Italian displays the three-syllable window in nominal items and preserves the noun stress marks in verbs: *fábrica* ‘factory’ / *fábrico* ‘I make’, *tránsito* ‘transit’ / *tránsito* ‘I pass’, *cácolo* ‘caculation’ / *cácolo* ‘I calculate’, *ábito* ‘habit’ / *ábito* ‘I inhabit’, etc. and can even have preproparoxytonic stress in verbal 3rd plural person: *fábricano*, *tránsitano*, *cácolano*, *ábitano*. In the Italian case, the faithfulness constraint takes priority over alignment constraints.

(1999) and Colina (1999) have demonstrated. One of these conditions concerning the obligatory realization as diphthong or hiatus or their incidental fluctuations is ONSET. ONSET is responsible for the gliding of a high vowel adjacent to another vowel.

- (17) ONSET
Each syllable must have an onset.

One of the prosodic factors intervening in this question is stress assignment. The tableau (18) shows the position of ONSET in relation to the stress-related constraints. *Vaci.o* ‘I empty’ is a verb belonging to the subset presented in (3), that is, verbs the final vowel of whose stem is stressed, blocking glide formation, although it is favoured by ONSET.

(18)

vaci+o	ALIGN FOOT R PRWD R	ALIGN STRESS R STEM R	ONSET
a. φ [va(cí).o]			*
b. [(vácj)o]		*!	
c. [(váci)].o	*!	*	*

Verbs like *cambiar* present their stem’s final high vowel marked as non-tonic. The following tableau shows the decisive role of the faithfulness constraint, in order to permit diphthongization. As shown in (18) and (19), ALIGN FOOT R PRWD R becomes irrelevant for these cases because ALIGN STRESS R STEM R is enough to reject candidates c. Therefore, we will leave aside ALIGN FOOT R PRWD R in the following tableaux.

(19)

cambi+o	FAITH VOWEL PROMINENCE	ALIGN FOOT R PRWD R	ALIGN STRESS R STEM R
a. φ [(cám.bj)o]			*
b. [cam(bí).o]	*!		
c. [(cámbi)].o		*!	*

As we have just pointed out, the verbs grouped in (3) and (4), e.g. *vaciar* or *ansiar*, can present a uniform pronunciation of the raising sonority sequences throughout the paradigm, even in forms where the high vowel is unstressed. By contrast, verbs belonging to the subset listed in (2), like *cambiar*, are always pronounced with a diphthong: *camb[já]mos* / **camb[i.á]mos*. Thus, as noted, the paradigm uniformity arises as another factor to determine diphthong or hiatus pronunciation.

To account for this effect, we have to resort to a new constraint, which concerns paradigms, namely, the optimal paradigm (McCarthy 2005). In this type of constraint, the competing candidates are the whole paradigms themselves.

- (20) OP_{MAX_v}
All forms belonging to one paradigm must be realized in a uniform way.

The ranking of OP_{MAX_v} in the hierarchy is equivalent to that of FAITH VOWEL PROMINENCE, as illustrated by candidates b. and c. in tableau (21), which exemplifies verbs with lexically marked stems. Candidate d. shows the decisive role of ONSET in glide formation.

(21)

cambi-	OPMAX _v	FAITH VOWEL PROMINENCE	ALIGN STRESS R STEM R	ONSET
☞ a. cámbjo, cambjár, cambjába, cambjámos			* * * *	
b. cambi.o, cambi.ár, cambi.ába		*!	* *	* *
c. cámbjo, cambi.ába	*!		* *	*
d. cámbi.o cambi.ába			* *	*! *

OPMAX_v is obeyed when all forms present either diphthongs or hiatuses. In the subset of verbs represented by *cambiar*, the correct candidate forms a diphthong, and ONSET decides the optimal candidate, as we can see in tableau (21). On the other hand, in the case of verbs like *confiar* or *ampliar*, without accentual lexical marks, ALIGN STRESS R STEM R prefers the candidate that stresses the high vowel, because it stays on the right-hand edge of the stem, as we can see in (22). This tableau represents verbs of not only type (3) (*confiar* - *confío*) but also type (4) (*ampliar* - *amplío*).

(22)

confi-	OPMAX _v	FAITH VOWEL PROMINENCE	ALIGN STRESS R STEM R
a. ☞ confío, confi.ámos, confi.ába			* *
b. confío, confjámos, confjába	*!		* *
c. cónfjo, confjámos, confjába			* * *!

The term paradigm includes strictly, and obviously, all the different inflectional forms belonging to the same word. When deverbal nominals, i.e. nouns or adjectives derived from verbs, display a theme vowel, their behaviour relative to the high vowel is similar to that of verbs which are morphologically related: *esqu[i.o]* / *esqu[i.á]ble* vs. *cám.b[jo]* / *cam.b[já]ble*. In the same way, deverbal nominals keep the high vowel whether as a hiatus (e.g. *esqu[i.o]*, *esqu[i.á]mos*, *esqu[i.á]ble*) or as a diphthong (e.g. *cámb[jo]*, *camb[já]mos*, *camb[já]ble*). This correspondence is reinforced in comparison with nouns or adjectives derived from other nouns or adjectives and consequently lacking a theme vowel¹⁰: *polic[i.a]* / *polic[já]l* vs. *histór[ja]* / *histór[já]l*, where the derived nominal is

¹⁰ Although following Aronoff 1994 the theme vowel has an equivalent function and nature to nominal word markers, we distinguish the two functional elements for the following reasons (see Alcoba 1999 for more details): whereas word marker's presence is reserved only to non verbal unities, theme vowels appear in verbs and also in nominals derived from verbs; while word markers are always unstressed, the thematic vowel can be stressed: *cantába* 'I / s/he sang' (stressed TV) versus *cantaré* 'I / s/he will sing' (unstressed TV),

pronounced as a diphthong independently of the high vowel condition of the primitive noun. These facts demonstrate that, at least in the pronunciation of raising sonority sequences, we must extend the scope of paradigmatic effects to deverbals. This is due to the presence of the theme vowel, which these kinds of nominals share with verbs that are morphologically related with them. The following tableaux include deverbals: (23) displays verbs listed in (2) and (24) those listed in (3) and (4).

(23)

cambi-	OPMAX _v	FAITH VOWEL PROMINENCE	ALIGN STRESS R STEM R	ONSET
a. [☞] cámbjo cambjába cambjábale			* * *	
b. cambí.o cambi.ába cambi.ábale		*!	* * *	* * *
c. cámbjo cambi.ába cambjánte	*!		* * *	* *
d. cámbi.o cambi.ába cambi.ábale			* * *	*! * *

(24)

confi-	OPMAX _v	FAITH VOWEL PROMINENCE	ALIGN STRESS R STEM R
a. [☞] confí.o, confi.ába, confi.ábale			* *
b. confí.o, confjába, confjábale	*!		* *

In summary, *-iar/-uar* verbs and their related nominals behaviour in terms of diphthong or hiatus pronunciation is coherent in the verbs presented in (2), where stress marks are fully respected (*cámb[jo]_N*, *cámb[jo]_V*), and in group (3), which lacks stress marks (*vac[i.o]_A*, *vac[i.o]_V*). Verbs in (4), quantitatively minor and residual, regularize verbal stress position (*ámpl[jo]_A* *ámpl[i.o]_V*). Despite their scarcity, they follow the general tendency of the verbs to regularize their paradigms, as was shown in (1) (e.g. *fábrica*, *fabríco*).

Otherwise there is no subset opposite to *ámpl[jo]_A* *ámpl[i.o]_V*, that is, of verbs with stress marks lexically related to nouns lacking the same mark (**vac[i.o]_A* **vac[jo]_V*). The pressure of analogical forms acts so strongly on verbs that it forces a violation of faithfulness. Therefore, this hypothetical subset would run counter to the general tendency of the language, in the sense that nominal forms are more prone to submit to lexical marks than verbal forms are.

cambiáble ‘changeable’ *cambiador* ‘changer’. Finally, a deverbal can have both markers: *cansa_{TV}ncio_{TE}* ‘tiredness’. Concerning to the special status of theme vowel, see also Harris (1987:66).

At this point, it is important to bring up the few verbs ending in *-cuar* (*adec[wá]r* ‘to adjust’, *evac[wá]r* ‘to evacuate’, *lic[wá]r* ‘to liquefy’) which ought to be pronounced like *cámb[jo]*. Nevertheless, the actual pronunciation is regularized as *adec[ú.o]*, *evac[ú.o]*, *lic[ú.o]* ‘1ps Ind. Present’, in a clear case of the emergence of the unmarked stress position.

We have also seen that deverbals preserve the syllabic condition of the high vowels whether as hiatuses (e.g. *esquí* / *esqu[i.á]ble*, or as diphthongs (e.g. *cámb[jo]* / *camb[já]ble*). Once again, the tendency of the verbal paradigm towards uniformity is transferred to deverbals through the theme vowel. By contrast, denominals cannot inherit the effects of stress prominence from either the primitive stem or its paradigm uniformity. Thus only the prosodic constraints can account for the result, yielding the diphthong as the general form: *polic[í.a]* / *polic[já]l* vs. *histór[ja]* / *histor[já]l*.

With the conditions presented so far (OPMAX_v, FAITH VOWEL PROMINENCE >> ALIGN FOOT R PRWD R >> ALIGN STRESS R STEM R >> ONSET), we account for the distribution of diphthongs and hiatuses in the great majority of output forms. Still, these requirements do not explain the distance-to-stress effects we saw in (8). In general, all hiatus contexts become glides when stress moves to the right. As Cabré and Prieto (2004, 2006) pointed out, there is a tendency to reduce the length of the pretonic sequence once the distance between the beginning of the word and the stress position is increased. Following Cabré & Prieto (2006), we account for this general tendency through the constraint PROSODIC PROMINENCE, which summarizes the interaction of the prosodic factors that dominate glide formation: word stress position, word initial position and stem length. PROSODIC PROM brings together three prominence conditions that apply to syllables in terms of acoustic perception: a) syllables in stressed position are more prominent (i.e. more noticeable) than syllables in unstressed position; b) syllables in word initial position are more prominent than syllables in non-initial position; and c) syllables in short stems are more prominent than syllables in longer stems. The prominence level of a given syllable is obtained through a computation of these three pairs of prominence levels. If the resulting syllabic prominence is high, glide formation will be blocked, if it is low, the outcome will be a diphthong. In general, blocking of glide formation is only possible when these three prominent conditions apply to the same syllable.

If we take some examples from the verbal paradigms such as those in (25), it is clear that PROSODIC PROM dominates OPMax_v. Glide formation applies when the stress is away from the word-initial position in spite of the fact that the stem’s high vowel is stressed in some forms of the paradigm. Note that in cases such as *fí+o* ‘I rely’ the word-initial position coincides with the stressed vowel of the stem as well as the morphological boundary, so the prominence level will be very high in the whole paradigm and hiatus the predictable result. Conversely, in cases such *desconfí+ár* > *desconf[já]r* ‘to distrust’ the stress position is far from the word-initial position, so the prominence level will be very low and diphthong the predictable result, except for those paradigm forms where the stress is on the stem’s high vowel (e.g. *desconfí+o* > *desconf[i.o]* ‘I distrust’). The tableau in (26) exemplifies different lengths of verbal paradigms and shows that the constraints below OPMax are irrelevant.

(25)	<i>fí</i> ‘I rely’ <i>confí</i> ‘I trust’ <i>desconfí</i> ‘I distrust’	<i>fíamos</i> 1pp Ind. Present <i>confíamos</i> 1pp Ind. Present <i>desconfíamos</i> 1pp Ind. Present	<i>fiarémos</i> 1pp Future <i>confiarémos</i> 1pp Future <i>desconfiarémos</i> 1pp Future
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(26)

	PROSODIC PROM	OPMAX _v
a. φ fi.o / fi.ámos / fi.arémos		
b. fi.o / fi.ámos / fjarémos	*!	*
c. fi.o / fjámos / fjarémos	*!	*
a. φ confi.o /confi.ámos / confjarémos		*
b. confi.o /confi.ámos / confi.arémos	*!	
c. confi.o /confjá.mos / confjarémos	*! *	*
a. φ desconfi.o / desconfjámos / desconfjarémos		*
b. desconfi.o / desconfi.ámos / desconfi.arémos	*! *	
c. desconfi.o / desconfi.ámos / desconfjarémos	*!	*

The constraint hierarchy that accounts for the results of rising sonority sequences at the stem boundary in lexically related words is summarized in (27).

(27) PROSODIC PROM >> OPMAX_v, FAITH VOWEL PROMINENCE >> ALIGN FOOT R
PRWD R >> ALIGN STRESS R STEM R >> ONSET

6. Conclusion

This paper has offered a unified account of the process of glide formation in rising sonority sequences at the stem boundary of lexically related words in Spanish. Our analysis has shown that the interaction of stress assignment with the other prosodic factors already analyzed in previous works (Navarro Tomás 1948; Colina 1999; Hualde 1999, 2005; Cabré & Prieto 2006) permits more general statements about the behaviour of *-iar/-uar* verbs and lexically related words. Regarding the morpheme boundary, we have established the crucial role of the theme vowel in the parallelisms between verbs and deverbal nominals (e.g. *camb[já]r - camb[já]nte*, *var[i.á]r - var[i.á]nte*), a situation that cannot be found when nominals are derived from other nominal forms (e.g. *nav[i.o] - nav[jé]ro*).

In summary, we have argued that the presence or absence of the theme vowel in morphologically related items and the lexical stress position are the two main factors that influence the pronunciation as hiatus or diphthong of those sequences. In addition, we claim that the OT framework offers us a simple and natural analysis to account for all these complex and varied data.

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