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2 Segmental phenomena and their interactions: Evidence for prosodic organization and the architecture of grammar

Abstract: Various areas of segmental phonology in the Romance languages are revealing about the architecture and functioning of grammar and phonological component. This chapter presents a selection of phenomena from different Romance languages, especially Ibero-Romance, that illustrate main interactions of segmental phonology with other parts of phonology (essentially, suprasegmental features and prosodic structure), as well as with morphology and the lexicon. Specific segmental phenomena related to word frequency and loan words are also discussed.

Keywords: segmental process, suprasegmentals, prosodic domain, lexical process, post-lexical process

1 Introduction

The diversity of types of segmental phenomena in the Romance languages is revealing about the architecture and functioning of grammar and the phonological component. In this chapter we review selected phenomena from different Romance languages that illustrate the main interactions of segmental phonology with non-segmental phonology and with other parts of grammar and that exhibit disparate properties, pointing to a typology of phonological processes. Although several languages are considered, we will intentionally allude to Portuguese and non-standard dialects data whenever possible.

We will start by considering a number of segmental phenomena that are constrained by various types of suprasegmental information (section 2). We will then proceed with an illustration of processes that depend on the location of particular segments within a prosodic domain (section 3). Segmental processes that are not purely phonological, in the sense that they are not just sensitive to phonological information, are exemplified in section 4, where we inspect some of the interactions between segmental phonology and morphology and the lexicon, as well as the phonology of highly frequent words and loanwords. We conclude in section 5 with a summary of the main points addressed in this chapter.

Acknowledgement: The author gratefully acknowledges the Portuguese National Funding Agency for Science, Research and Technology (Fundação para a Ciência e Tecnologia de Portugal, FCT, project “Interactive atlas of the prosody of Portuguese”, PTDC/CLE-LIN/119787/2010).

2 Segmental phenomena and suprasegmental information

In many Romance languages, various processes illustrate the interaction between segmental and suprasegmental phonology. For instance, both the presence and the absence of word-level stress and higher levels of prominence, as well as tonal configurations constrain the realization of segments in multiple ways, as we will see in the next subsections.

2.1 Segmental phenomena in word-level stressed environments

There are many segmental effects of word-level stress in Romance languages and dialects. The diphthongization of stressed vowels is one such phenomenon, widely found across the Romance area, with varying properties across languages and varieties (cf. Loporcaro 2011a for an overview). Different types of diphthongization affecting stressed vowels occurred early on in the formation of the Romance varieties. In some cases, diphthongization was contextually determined or sensitive to syllable structure, as in French, Florentine or Neapolitan (e.g. Loporcaro 2011a).

This type of diphthongization is also active today in varieties of Portuguese spoken in Azores and Madeira and in small areas of mainland Portugal (Martins/Vitorino 1989; Segura/Saramago 1999; 2001). Examples in (1), taken from Martins/Vitorino (1989), illustrate the phonological conditioning of the process in Terceira (an island of the archipelago of Azores). The stressed vowel is either palatalized or velarized, depending on the place features of the preceding high vowel or glide, irrespective of any intervening consonants (1b–c). That the process does not apply if pretonic vowel is not high is shown in the examples in (1a). Finally, the data (1c) show that the phenomenon operates even if the conditioning pretonic vowel does not surface due to the (optional) extreme reduction of unstressed vowels.

- (1) EPor. (Terceira)
- | | | | |
|----|---------------------|-------------------|----------------------------------|
| a. | <i>a casa</i> | [e 'kaze] | 'the house' |
| | <i>é baixo</i> | [ɛ 'baʃu] | '(it) is low' |
| b. | <i>em casa</i> | [ĩ 'kjaze] | 'at home' |
| | <i>por baixo</i> | [pʰr 'bʷaʃu] | 'under' |
| | <i>estão fartas</i> | ['tẽw̃ 'fwartɛʃ] | '(they _F) are tired' |
| c. | <i>vitelo</i> | [v' tʃɛlʷ] | 'calf _M ' |
| | <i>pevides</i> | [p'vwidʲ] | 'kernel' |
| | <i>comer</i> | [k' mwer] | 'to eat' |

In other cases, diphthongization depends on stress alone. This is the case of Spanish diphthongization, historically responsible for the widespread alternations found between [je we] and [e o] in stressed and unstressed positions, respectively (but cf. Loporcaro 2011a, 121 for the view that contextual conditioning may have preceded generalized diphthongization in Spanish). Pairs of morphologically related words are very common in Spanish, like *puedo/podemos* ‘(I/we) can’ and *puerta/portero* ‘door/doorkeeper’. Today this type of diphthongization can no longer be considered an active phonological rule in Spanish, and it seems more adequate to analyze these alternations assuming a lexical diphthong, that usually reduces (monophthongizes) in stressless position (but cf. the discussion in Albright/Andrade/Hayes 2001 and Eddington 2012). As has been widely noticed, although this type of alternations is very common in Spanish, there are also many exceptions to the reduction of the diphthong in stressless position, as in *viejito* ‘old man’ or *arriesgar* ‘to risk’ (Albright/Andrade/Hayes 2001; Hualde 2005; Eddington 2012). Hualde (2005, 193–200) reports that derived words with specific suffixes are usually associated either with the reduction of the diphthong (as *-al*, like in *dental/diente* ‘dental/tooth’) or allow for both options (stressless syllables may exhibit both reduction and the diphthong), and evaluative suffixes do not usually trigger reduction of the diphthongs.

Diphthongization triggered by stress alone is also found today in some dialects of European Portuguese (EPor), such as the varieties spoken in Oporto, Braga and other Northern regions of Portugal (e.g. Cintra 1971; Segura/Saramago 2001; Rodrigues 2002). The available descriptions report that only the mid vowels [e o] are affected (cf. the examples in 2, adapted from Segura/Saramago 2001 and Rodrigues 2002).

(2)	EPor.	<i>dor</i>	[ˈdwoɾ]	‘pain’	<i>flor</i>	[ˈflwoɾ]	‘flower’
		<i>nervoso</i>	[nirˈβwozu]	‘nervous’	<i>jogo</i>	[ˈʒwoɡu]	‘game’
		<i>quente</i>	[ˈkjēt]	‘hot’	<i>peso</i>	[ˈpjezu]	‘weight’
		<i>inocente</i>	[inuˈsjēt]	‘innocent’	<i>dizer</i>	[diˈzjeɾ]	‘to say’

Rodrigues (2002) claims that the phenomenon found in the Northern dialects of Portuguese is best analyzed as an instance of spreading of the vocalic features from the nucleus of the stressed syllable onto the preceding onset position: when the nucleus is labial, the preceding consonant acquires a labial secondary articulation, and when it is palatal, the consonants’ secondary articulation is palatal as well. It is unclear how this analysis relates to accounts of diphthongization in other Romance languages, such as Chitoran’s (2002), who treats diphthongization in Romanian as an instance of lowering of stressed vowels, and who highlights the role of a constraint pressing vowels to lower when stressed. Interestingly enough, Rodrigues (2002) mentions that in the production data she collected the phenomenon is not found when a stressed [o] is part of a falling diphthong. In the spirit of Chitoran’s approach to the phenomenon, this may be seen as a consequence of the fact that

the constraint that forces mid stressed vowels to surface as diphthongs is already satisfied when a basic falling diphthong is present.

In the Portuguese dialects where it occurs, this type of diphthongization is an active, optional, regular process, and there are no signs of contextual segmental conditioning. Furthermore, preliminary observations of data collected in Oporto region (Ermesinde and Gião), from the ongoing project *Interactive atlas of the prosody of Portuguese* (Frota 2010–2015), suggest that not only word stress but also higher-level prominence may play a role in the definition of the context that favors diphthongization, as it seems that the phenomenon is found mainly in syllables bearing phrasal-level prominence (possibly, intonational phrase prominence). The examples in (3), as produced by two speakers of Ermesinde (Oporto), illustrate this.

- (3) EPor. a. *Não vem, o teu avô?* av[wo]
 ‘Isn’t he coming, your grandpa?’
 b. *O João era mesmo ganancioso, [...] m[e]smo ... ganaci[wo]so*
 ‘João was really greedy, [...]’

To the best of our knowledge the prosodic conditions on this phenomenon remain unstudied to date. This kind of data may contribute to the understanding of possible sources for the genesis of diphthongization in Romance and in other languages as well, as aspects of the phonetics and phonology of syllables in intonational phrase nuclear position (e.g. final lengthening and pitch accent assignment) may, at least in some cases, play or have played a crucial role.¹

A phenomenon that may relate to diphthongization is the lengthening of stressed vowels. In most if not all Romance languages longer duration is a major phonetic exponent of word stress, and more so in sentence nuclear position (e.g. Delgado-Martins 1977; Frota 2000 for EPor; Recasens 1986 for Catalan; Farnetani/Kori 1990 for Italian; Ortega-Llebaria/Prieto 2007 for Spanish). Although in most of these languages lengthening has not phonologized in a certain sense (e.g. speakers are not aware of it and it is not further restricted by particular phonological conditions), phonologization has happened in Italian. Here, vowel lengthening depends not only on the presence of stress, but also on syllable structure, as it affects vowels in non-final open syllables only, as in *p[^ha:]pero* ‘duck’ and *tartar[^hu:]ga* ‘turtle’ vs. *carib[^hu:]* ‘caribou’ (Nespor/Vogel 1986/2007, 131).²

Like other Romance languages, such as Catalan, the Standard variety of EPor lacks diphthongization of either sort, but exhibits other processes that depend on

¹ Cf. Meyers (2012) for an account of word and syllable final devoicing (a phonological process also found in many languages) as the phonologization of phonetic properties that are usually present in utterance final position, with generalization to smaller prosodic domains.

² According to Gabriel/Kireva (2014a), a similar kind of lengthening is also found in Argentinean Spanish, which emerged via transfer from Italian to (the contact variety) Argentinean Spanish.

word-level stress, including /e/ centralization before palatals, illustrated in (4a) (Mateus 1975/1982, 34–35; Vigário 2003, 78–82), [j] insertion to break a hiatus when the first vowel (V1) is a /e/ in stressed position, as exemplified in (4b) (Mateus 1975/1982, 38–39; Vigário 2003, 78–82), or the so-called (verbal) vowel harmony (VH), a process that targets verbal root vowels in stressed position, which harmonize in height with the thematic vowel (TV) when it is followed by another vowel and deletes, as illustrated in (4c) (cf. the details and accounts within autosegmental and feature geometry framework in Wetzels 1991; Mateus/d’Andrade 2000, 81–86 and Matzenauer/Miranda 2005).

- (4) EPor. a. Stressed /e/ before palatal /e/ in unstressed position (vowel reduction)
- | | |
|----------------------|---------------------------|
| <i>telha</i> [ˈtɛʎɐ] | <i>telhado</i> [tʰiˈʎadu] |
| ‘tile’ | ‘roof’ |
- b. Stressed hiatus unstressed hiatus (V1 semivocalization)
- | | |
|--------------------------|--------------------------|
| <i>passeio</i> [pɛˈsɛju] | <i>passear</i> [pɛˈsjar] |
| ‘(I) walk’ | ‘to walk’ |
- c. Stressed root vowel, TV deletion, VH applies Stressed root vowel, no TV deletion, VH does not apply
- | | |
|------------------------------------|-----------------------------------|
| <i>devo</i> [ˈdevu] (dev e + u) | <i>deves</i> [ˈdɛviʃ] (dev e + s) |
| ‘(I) should’ | ‘(you) should’ |
| <i>deva</i> [ˈdeve] (dev e + a) | <i>devem</i> [ˈdɛvẽj] (dev e + m) |
| ‘(he) should _{SBJV.PRS} ’ | ‘(they) should’ |

In some cases, not only the presence of word stress, but also a specific stress pattern may correlate with particular realizations of segments. There are three processes identified in Portuguese where segments’ quality depends on types of feet. One of these processes is *Spondaic Lowering*, which is a quite general rule (with some exceptions) that consists in the lowering of stressed mid vowels in words with penultimate stress ending in closed syllable, e.g. *d[ʰ]cil* ‘gentle’, but *d[ʰ]ce* ‘sweet’ (cf. Wetzels 1992; 2006/2007). It is worth mentioning that this rule, which is shared by both the Brazilian and the European varieties of Portuguese, may be responsible for the emergence of a low nasal round vowel in EPor, a vowel that is found nowhere else in the sound system of the language. In fact, its context is so restricted that, as far as we know, phonologists have failed to notice that [õ] may occur in EPor, in the words *ontem* ‘yesterday’ and *anteontem* ‘the day before yesterday’ (there is individual variation, but for the speakers who have this vowel, it is obligatory).

The second rule, *Dactylic Lowering*, has the same result, and affects stressed vowels in proparoxytone words, e.g. *esquel[ʰ]tico* ‘skeletal’, but *esquel[ʰ]to* ‘skeleton’ (cf. Wetzels 2006/2007, 21–22). This is reminiscent to a process also found in Catalan whereby a mid vowel (/e/ or /o/) in stem final position is lowered (i.e. Cat. *carb[ʰ]o* → *carb[ʰ]nic*, *esf[ʰ]ra* → *esf[ʰ]ric*, *introduct[ʰ]o*r – *introduct[ʰ]ri* etc., cf. Mascaró 1976; 2002).

Finally, the third phenomenon that may be observed only in words with a particular stress pattern applies nearly without exception in EPor. In this case, the lowering rule targets stressless non-high vowels, when they appear in paroxytone words, in word-final syllables closed by consonants other than *-s*, as in *repórt[ɛ]r* ‘journalist’ and *séni[c]r* ‘senior’ (Vigário 2003, 85–89). Notice that in the latter case, reference to the unstressed status of the vowel, the (right edge of the) prosodic word and syllable composition is sufficient to describe the context of the rule and hence, here, reference to the foot seems unnecessary, synchronically.

One may wonder why a particular stress pattern should impact on segments’ quality. As pointed out by Wetzels (1992), both *Spondaic* and *Dactylic Lowering* apply in contexts of exceptional stress distribution. And an exceptional stress pattern is also involved in the third type of lowering, which affects posttonic vowels in paroxyton words. In fact, as we will see further below, lowering of non-high stressless vowels in EPor seems to relate to exceptions to the application of more or less general phonological rules in other cases as well.

Word stress may affect the realization of segments inside words, as in the cases mentioned above, but it can also span word sequences. This is the case of *raddoppiamento sintattico*, a well-known phenomenon whereby a word-initial consonant is lengthened if preceded by a word ending in a stressed vowel and followed by a non-nasal sonorant (e.g. Nespor/Vogel 1986/2007; Repetti 1991; Loporcaro 1997; Passino 2013, and references therein). The examples in (5), taken from Nespor/Vogel (1986/2007, 167), illustrate the application of this process.

- (5) It. a. *Avrà t[:]rovato il pescecane.*
 ‘He must have found the shark.’
 b. *La gabbia è g[:]ià c[:]aduta.*
 ‘The cage has already fallen.’
 c. *È appena passato con tre c[:]ani.*
 ‘He has just passed by with three dogs.’

Similarly, the realization of stressed elements may be affected by phonological material in adjacent words, as in the case of the progressive assimilatory diphthongization found in Terceira, mentioned above. As shown by the examples in (6), taken from Martins/Vitorino (1989, 333–334), the preceding high vowel or glide that will define the exact articulation of the glide to emerge and the target stressed syllable may belong to different words.

- (6) EPor.
 a. *para ir dando* > [pə i ‘ðjəd̪u] ‘in order to be giving’
 b. *tem muitos* > [tẽj ‘mjũt̪u] ‘(s/he) has many’
 c. *com os pés* > [kuf ‘pweʃ] ‘with the feet’
 d. *sete escudos* > [‘set j̃‘kjuð̪u] ‘seven escudos’ (former Portuguese currency)

2.2 Segmental phenomena in unstressed environments

So far, we have seen examples of segmental processes that target word stressed positions. However, Romance languages also exhibit many segmental processes that crucially operate in unstressed environments. These include vowel reduction, semivocalization, vowel deletion and vowel merger.

Vowel reduction/neutralization in stressless positions is responsible for many alternations in Romance languages vocalic systems. For example, in several Italian dialects the vowels /ɛ/ and /ɔ/ are only found in stressed position, as neutralization to [e] and [o] applies in unstressed position (e.g. Saltarelli 1970; Nesp/or/Vogel 1986/2007; Krämer 2009, and references therein). A partially similar pattern obtains in Brazilian Portuguese (BPor), where a distinction must be made between pretonic and posttonic positions (cf. 7; Câmara Jr. 1970; Wetzels 1992; Bisol/Magalhães 2004).

(7) Stressless vowel system in BPor

Pretonic position		Posttonic position non-final		Posttonic final	
[i]	[u]	[i]	[u]	[i]	[u]
[e]	[o]	[e]	—		
	[a]		[a]		[a]

Vowel reduction in other Romance languages is however more extreme. This is the case of Catalan, with some variation across different dialects (e.g. Bonet/Lloret 1998, 32–39; Wheeler 2005, 52–77), and especially, of EPor, where non-high palatal vowels not only centralize but also raise, becoming [i] instead of [e] or [ə], as in Catalan.

Specifically, in EPor, a tonic system with the vowels /i e ε a u o ɔ/ (and in specific contexts also [ɐ]) is reduced to [i i ɛ u], both in pretonic and in posttonic position (in verbs, /i/ is also reduced to [i] word-finally, but in non-verbs there are a number of words with exceptional stress pattern showing final [i], such as *táxi* ‘taxi’ or *júri* ‘jury’).

Wetzels (1992) analyzes vowel neutralization in unstressed position in BPor within the framework of autosegmental phonology (Goldsmith 1976) and feature geometry à la Clements (1991). According to Wetzels, neutralization involves the delinking of aperture tiers (in the case of PB, [+open 3], which is under the Aperture node, together with [+open 1] and [+open 2]. Posttonically, labial vowels also undergo delinking of [+open 2], thus surfacing more reduced. For the neutralization of unstressed vowels in EPor, the same general approach to vowel reduction as delinking of [open] tiers may be adopted, but delinking is nevertheless in general more extreme (cf. also Bisol/Magalhães 2004 and Miglio 2005 for different proposals within Optimality Theory).³

³ Vowel reduction is also present in some varieties of Spanish, presumably due to language contact, as in Mexican Spanish (Lope Blanch 1963), Andean Spanish (Delforge 2008), and Bulgarian Judeo-Spanish (Gabriel/Kireva 2014b).

There are several remarkable issues related to vowel reduction in EPor. One of these refers to the contexts where VR does not apply, as there are quite a number of contexts where the absence of (full) VR is regular (Mateus/d'Andrade 2000, 134–136; Vigário 2003, 67–72, 85–88, 92–99). These depend essentially on the prosodic position of stressless vowels (e.g. stressless vowels that are prosodic word initial, as well as in syllables closed by lateral or glide, and at the end of prosodic words that are non-final in a morphological compound, cf. Vigário 2003 and section 4.3, below, for details).

The absence of VR may also be unpredictable, dependent of specific lexical items. As pointed out in Vigário (2003, 68–69), exceptions to VR are a property of words rather than morphemes, since the same morpheme may behave regularly with respect to VR or exhibit exceptional behavior, as the stem vowel in *velhote* [ve'ʎot] 'old man' vs. *velhice* [vi'ʎis] 'oldness' (cf. *velho* ['veʎu] 'old').

True exceptions to VR always involve lowering in EPor or at least basic low vowels, as it seems that there are no cases of mid vowels /e o/ involved in true exceptions to VR. Thus, (i) although we cannot say that stressless vowels always undergo VR, we may state that in EPor the mid vowels [e o] are not found in unstressed position (unless in specific prosodic positions, where VR regularly does not apply, like in word initial position, as in *ocupar* 'to occupy', or when the vowel is part of an underlying diphthong, as in *louvar* 'to pray', or part of a syllable closed by lateral, as in *moldar* 'to shape'); and (ii) exceptions to VR (which always surface as low), just like regular VR application (where raising affects mid and low vowels) implies the neutralization of mid and low vowels. As far as we know, these generalizations have not been noticed in previous work on EPor phonology.

Two other common processes apply in the Romance languages only in unstressed environments: V1 semivocalization and vowel deletion. The first one consists of the gliding of the first of two vowels when the V1 is high, within and across words (e.g. Bisol 1992; 2003 for BPor; Hualde 1999 for Spanish; Frota 2000 for EPor; Cabré/Prieto 2005 for Catalan; Chitoran/Hualde 2007 for Romanian and several other Romance languages). The second process only applies regularly across words, although in particular morphological environments it is also found inside words (e.g. in verbs, the theme vowel deletes when it is followed by another vowel, as in *am* *a* + *o* > *amo* 'I love'; a similar analysis is also proposed in Bermúdez-Otero 2006 for stem final vowels in derivational contexts in Spanish). One of the most interesting aspects of V1 semivocalization, vowel deletion, and also vowel merger, is the way these processes may be constrained by word and/or phrase-level prominence, as we will see in the next section.

2.3 Effects of word- and phrase-level prominence on segmental phenomena

Segmental phenomena that target unstressed vowels are often sensitive to word- and phrase-level prominence.

For example, in languages like Spanish and Romanian and within the word, distance relative to stress has been reported to affect the probability of V1 semivocalization in pretonic positions (Hualde 1999; Simonet 2005; Chitoran/Hualde 2007). Similarly, in Catalan word initial high vowels have been shown not to semivocalize if word stress closely follows (i.e. if it is no more than two syllables away, cf. Cabré/Prieto 2004). Still inside words, in languages like BPor, EPor and Catalan high vowels followed by another vowel in posttonic position obligatorily surface as glides. In this group of languages, while semivocalization is in general optional pretonically, it is obligatory in posttonic position, as in *família* ‘family’ (d’Andrade/Viana 1994; Frota 2000; Mateus/d’Andrade 2000; Cabré/Prieto 2004; Simonet 2005).⁴

When V1 and V2 belong to different words, phrase-level prominence may also determine whether semivocalization may apply or not. For instance, according to Frota (2000, 83–95) in EPor V2 stress blocks semivocalization under stress clash conditions, as in (8), where both Word 1 and Word 2 bear phonological phrase (ϕ) level prominence, and the two stressed syllables would be strictly adjacent if semivocalization applied (here, and where relevant in this chapter, capitalizing signals word-stressed syllables).

- (8) EPor. (*O dançaRI* ϕ) (*ama*) ϕ (*a bailaRI* ϕ) (*RUssa*) ϕ **dançarin*[w]*ama*
 ‘The dancer loves the Russian chorus girl.’

Like semivocalization, higher-level prominence may also constrain the application of vowel deletion across words. In her experimental work, involving acoustic analysis of read sentences created to control for various segmental and prosodic conditions, Frota (2000) found that different rhythmic configurations yield distinct results, depending on levels of stress under clash (namely phonological phrase and intonational phrase level prominence) and the location of phrasal heads (heads on the right or on the left of clashing stresses result in different deletion possibilities). Back vowel deletion, for instance, has the same general properties as semivocalization, except that it is blocked under more restrictive conditions of stress clash. This is illustrated in (9), where V1 is preceded by a vowel bearing phonological phrase

⁴ In EPor rising diphthongs usually result from the application of an optional process of semivocalization, and according to the results in Chitoran/Hualde (2007), who experimentally compared French, Spanish, Romanian, EPor and BPor in this respect, EPor speakers show a systematic tendency for producing hiatus rather than rising diphthongs. However, there are some regular instances of obligatory rising diphthongs, as in the sequence /jɔn/, surfacing as [jɔn] and [jun] in stressed and unstressed position, respectively (e.g. *nacIoNAL* ‘national’, *accIoNAR* ‘to activate’, *aCCIoNas* ‘(you) activate’). To our knowledge, this fact was not previously reported in the literature on EPor. Chitoran/Hualde (2007) propose that Portuguese is different from other Romance languages that show a greater tendency to resolving hiatus via V1 gliding, because it lacks the historical sources that created important amounts of rising diphthongs in other Romance languages (especially Spanish), which act as “attractors” to diphthongization.

level prominence: in (9a) deletion is impossible because deletion would result in a stress clash at the level of the phonological phrase; in (9b) deletion optionally applies, since although V2 bears prosodic word (PW) level stress, it is not the head of its phonological phrase (adapted from Frota 2000, 87–88).

- (9) EPor. a. (*o dançaRIIno*) ϕ (*Ama*) ϕ (*a bailaRIIna RUssa*) ϕ **dançarín ama*
 b. (*o bailaRIIno*) ϕ (*ANda SEMpre*) ϕ (*de limuSIIne PREta*) ϕ ^{ok}*bailarín anda*
- | | | | |
|---|---|--|--------------------------|
| s | s | | ϕ -level prominence |
| s | s | | PW-level prominence |
- i. (*o dançaRIIno*) ϕ (*Ama*) ϕ (*a bailaRIIna RUssa*) ϕ
- | | | | |
|---|---|---|--------------------------|
| s | w | s | ϕ -level prominence |
| s | s | s | PW-level prominence |
- ii. (*o bailaRIIno*) ϕ (*ANda SEMpre*) ϕ (*de limuSIIne PREta*) ϕ

V1 deletion sensitivity to stress clash configurations and levels of phrasal prominence is attested, with some relevant differences, in other Romance languages as well, like Galician (Fernández Rei 2002, 130–151, 180–183), BPor (Tenani 2002, 193–195), and Catalan (Cabré/Prieto 2005).

Notice that blocking of segmental rules is one of various possible ways of avoiding stress clash, which may also be achieved via stress retraction (as in Northern varieties of Italian, cf. Nespor/Vogel 1986/2007, section 6.3, and in BPor, as shown below), stress demotion (restricted to lower prosodic domains, according to Nespor/Vogel 1989), and beat insertion, namely via vowel lengthening. The latter strategy operates in EPor when two clashing stresses are within the same phonological phrase, according to the experimental work conducted by Frota (2000). A sentence like (10), taken from Frota (2000, 128), illustrates the context where segmental lengthening is found in EPor as a way to avoid adjacent clashing stresses.⁵

- (10) EPor. (*O café[:]* *LUso*) ϕ *contém cevada de boa qualidade.*
 ‘The Lusitanian coffee contains barley of good quality.’

When across-words hiatus are formed of similar vowels, Romance languages may show a variety of different solutions. Without entering in too much detail, we highlight the following facts: (i) in EPor, hiatus formed by two unstressed central mid vowels [e] usually merge in a single low [a], while word stress on V2 blocks vowel merger (Frota 2000, 82); (ii) in BPor the same vowels become a single one without concomitant vowel quality; here, both an analysis of vowel merger or of V1 deletion yields the same result; (iii) in very specific cases, stress on V1 does not block vowel

⁵ Unlike the large majority of segmental phenomena surveyed in this chapter, this type of lengthening is only observable with acoustic measurements, as it is beyond speakers awareness.

merger (or V1 deletion) in BPor; an explanation for this is that stress shift applies in these cases as a strategy for stress clash resolution, and hence V1 is in fact unstressed, as shown in (11) (cf. Bisol 2003, 190).

(11) BPor. *soFÁ aZUL* > *sòfazúl* 'blue sofa'

Importantly, there is some indication that variation across (Romance) languages in hiatus tolerance may be explained, among other things, by the availability of different strategies to avoid stress clashes (cf. Frota 2000, 92–94 for EPor; Fernández Rei 2002, 141–142 for Galician).

In general, only V1 may delete. However, some languages allow V2 deletion under particular conditions (Casali 1997). An interesting question that may be raised here is why some Romance languages allow V2 deletion (like Galician and Catalan, cf. Fernández Rei 2002, 143–151, and Cabré/Prieto 2005, respectively), while in others V2 deletion is strictly forbidden, regardless of the properties of the vowel sequences (as in EPor, cf. Frota 2000, 88–89). Casali (1997) and Cabré/Prieto (2005) analyze this type of deletion within OT framework: constraint rankings account for different possible outcomes, including variable rankings of position-sensitive faithfulness constraints that ensure that word initial segments are preserved or, by contrast, may be deleted.

We should emphasize that stress effects in hiatus resolution phenomena across words are not restricted to clashing configurations. For example, a less common process of [j] insertion to break a hiatus across words is active in Northern varieties of EPor (cf. Lopo 1895; Segura 2013; Oliveira et al. 2014). Insertion applies between non-high central vowels [a e ã ê], when V2 bears word-level stress, as illustrated in (12a). In a recent study based on speech collected in several Northern areas, Oliveira et al. (2014) found that higher-levels of prominence in V2 may also promote glide insertion. This can be illustrated by the sequence in (12b) where in six occurrences of the same phrase produced by several speakers in a map task, four show glide insertion in *Ana_Alves* (where *Alves* bears phonological phrase prominence), while none shows insertion in *Moda_Alves* (where *Alves* bears word- but not phrase-level prominence).⁶

- (12) EPor. a. *a ÁRvore é amarela* *a[j]ÁRvore*
 'the tree is yellow'
- b. *MOda Ana ALves* (...) *MOda_Ana; Ana[j]ALves*
 'Moda Ana Alves' (name of store)

⁶ In this map task two subjects of the same variety interact. Each of the subjects has a map with landmarks and a road. One of the subjects is asked to provide the directions for the other to reach a designated point in the map. The two maps are not exactly identical, and the mismatches create the motivation for naturalistic-like dialogs. This type of task is especially suitable to trigger spontaneous-like renditions of various sentence types, contrastive focus and the occurrence of specific words or expressions.

Importantly, V1 may be stressless and not preceded by another stressed syllable, as in (12a). Hence, in this case glide insertion seems to be a strategy for preserving the integrity of word initial stressed V2, especially favored when V2 is the head of the prosodic domain containing both vowels.

We may note that [j] insertion to break a hiatus is also found in some dialects of Galician, but the conditions for the process are very different (cf. Fernández Rei 2002, 246–253; Colina 1997a, section 3.2). Here, distinct vowels may be involved, stress on V2 is not required, and insertion seems to be active across words only when clitics are part of the word sequence.

2.4 Interactions between segmental and tonal phenomena

Besides word stress and phrasal prominence, particular intonational contours may also impact on the realization of segments. For example, in EPor both schwa epenthesis at the right-edge of oxyton words ending in sonorant consonant (e.g. *azul* ‘blue’, *mar* ‘sea’ surfacing as [e’zuli] and [‘mari], respectively) and blocking of non-back vowel deletion (*brilhante* ‘brilliant’, surfacing as [bri’lãti], instead of [bri’lãt]), are common in word-final position of non-final intonational phrases, as well as at the right edge of yes-no questions and vocatives with calling contours (cf. Frota 2002; 2014). According to Frota (2014), what these various cases of word-final schwa realization have in common is the presence of complex tonal events (namely a pitch accent and a boundary tone) that require enough segmental space for their realization (in the case of intonational phrases ending in oxyton words, both the nuclear pitch accent and the boundary tone(s) would be realized on a single syllable, the final stressed one). Hence, schwa insertion or schwa deletion blocking ensures the realization of the segmental material required for tonal anchoring.⁷

We may notice that other strategies exist in Romance languages to deal with complex tunes-text accommodation, such as tonal truncation (as in Southern varieties of Italian, like Bari and Palermo Italian; cf. Grice et al. 2005), tonal compression (e.g. anticipation of tonal targets under tonal crowding coexists with tonal truncation in Neapolitan, cf. D’Imperio 2006) and final vowel lengthening, a possibility also available in EPor (Frota 2002; 2014) and in Logudorese Sardinian. In the latter language, post-tonic syllables of vocatives may be truncated and originate a monosyllable, in which case lengthening creates the space that is required for the realization of the vocative L+H* L* L% melody (cf. Vanrell et al. 2015, and references therein).⁸

⁷ Other reasons may, nevertheless, account for vowel insertion in similar contexts, since according to Cruz (2013), IP final epenthesis in a Southern dialect of European Portuguese, spoken in Alentejo, is also found in non-tonal crowding contexts, like in declarative utterance final position.

⁸ Recent investigation by Frota et al. (2016) has revealed variation in the strategies to deal with tonal crowding in varieties of Portuguese, some favoring the preservation of the segmental string and consequently exhibiting tone truncation and some preferring to maintain tones and changing the segmentals instead.

2.5 Summary

To sum up, in this section we have reviewed a number of phonological processes that apply in Romance languages showing some of the many interactions between segments and suprasegmental properties. In the following section we will exemplify how prosodic organization may also impact on the way segmental phenomena operate.

3 Segmental phenomena and prosodic structure

It is well-known that segmental processes may also be constrained by prosodic structure, that is, some rules target specific segments or strings of segments in particular positions within specific prosodic domains. This also means that segmental phenomena may cue prosodic phrasing and are therefore one of the sources of evidence for the existence of a prosodic structure that is distinct in nature from morphological and syntactic structures (e.g. Selkirk 1984; Nespor/Vogel 1986/2007, and the synopsis in Vigário to appear a, b).

In this section we will review work on some of the segmental processes that apply with reference to each of the prosodic domains in Romance languages, starting from the syllable, the lower constituent of the prosodic tree.

Following a common trend in language, Romance languages allow for a restricted set of consonants in syllable final position, which usually includes coronal fricatives, nasal and lateral consonants and rhotics. There are several processes that affect consonants in this position. One such process is fricative voicing assimilation (e.g. *O*[ʒ] *bon*[ʒ] *me*[f] *tre*[f] ‘the good teachers’ (Portuguese), *e*[z] *meu*[z] *mapes* ‘my maps’ (Catalan)), which is found in all major linguistic areas of Romance, and is active word-internally as well as across words (e.g. Frota 2000, 53–74; Tenani 2002, 128–135; Fernández Rei 2002, 57–87; Hualde 2005, 159–161; notice that from a phonetic point of view fricative voicing may show some variation, as noticed in Frota 2000, 54 for EPor, and Garcia 2013 for Colombian Spanish).

The phonology of syllable-final laterals and nasal consonants varies more in the Romance space. For instance, word-internal nasal consonants surface as such in syllable-final position in most languages, but assimilate the point of articulation of the following consonant (e.g. Harris 1969; Hualde 2005 for Spanish; Krämer 2009 for Italian; Bonet/Lloret 1998 for Catalan); furthermore, point of articulation assimilation may also apply across words, e.g. *so*[m] *pletits* ‘(they) are small’, *so*[ŋ] *kjuatre* ‘(they) are four’ in Majorcan Catalan (Prieto 2004, 254; cf. also Nespor/Vogel 1986/2007, 211–213 for Spanish). In Portuguese, by contrast, word-internal coda nasals nasalize the preceding vowel and delete (e.g. *campo* [ˈkẽpu] ‘field’, respectively). d’Andrade/Kihm (1988) propose that in EPor a nasal in this context is an auto-segment, i.e. a nasal feature that is not segmentally anchored, which associates to

the preceding vocalic nucleus, yielding a nasal vowel. As these authors notice, nasalization is not, however, a purely phonological process in the sense that it is also conditioned by morphological and lexical factors (cf. also Vigário 2003, 74–78 and Sampson 1999 for an overview of the evolution of nasal segments in the Romance languages).

In the case of alveolar laterals, similarly to English and unlike most other Romance languages (cf. Bullock 1995 for an overview), coronal laterals also show a particular realization in syllable-final position both in BPor and EPor. The two varieties do not treat the lateral in similar ways, however, as in BPor coda laterals surface as a velar glide [w], whereas in EPor the lateral is velarized, that is, it is realized with a velar secondary articulation (l-velarization is also found in Galician, although in more restricted contexts, cf. Álvarez/Xove 2002, 41; cf. also Mateus/d'Andrade 2000, 137–141 for an analysis of the phonology of syllable-final consonants in Portuguese within the framework of autosegmental phonology and feature geometry).

Note that only in EPor velarization behaves like a purely prosodic phenomenon, in the sense that it applies across-the-board, whenever its structural description is met, including in domains larger than the word. In BPor, by contrast, [w] obtains even when across word resyllabification removes /l/ from coda position (cf. 13a). /l/-velarization, but not nasalization in EPor or /l/-gliding in BPor, operates within a larger prosodic domain in EPor (the intonational phrase), as illustrated in (13b), where /l/ is velarized in *Miguel*, because there is an intonational phrase boundary that blocks resyllabification, unlike in *mel* ‘honey’, where due to resyllabification the lateral becomes syllable initial and hence the conditions for velarization are not met.

- (13) a. BPor. *Quanto a Migue[w], ele achou o me[w] agradáve[w].*
 b. EPor. *Quanto a Migue[l̥], achou o me[l̥] agradáve[l̥].*
 ‘As to Miguel, (he) found the honey nice.’

Notice that there are also processes that affect segments in other syllabic positions, as in the case of r-strengthening in Spanish (Harris 1983; Nespor/Vogel 1986/2007, 81; Hualde 2005, 181–184) and in Portuguese (Mateus/d'Andrade 2000, 15–16; Vigário 2003, 89–91). Word-internal r-strengthening applies in these languages when /r/ is preceded by a heterosyllabic consonant, in which case it surfaces as a trill, as in *honra* ‘honor’ in both languages (with a further change in point of articulation, in the case of Portuguese).

Let us now turn to segmental processes that apply with reference to the prosodic word (PW). We shall illustrate PW-bound segmental rules with a PW-limit deletion rule in EPor and a process of vowel harmony bound by the PW domain in a variety of Piedmontese (spoken in the North of Italy).

In EPor, schwas (corresponding to realizations of underlying /e/ and /ɛ/, as well as, more rarely, /i/ in unstressed position) regularly delete in prosodic word final position (except in the contexts where tonal crowding presses segmental material to emerge, as mentioned in section 2.4, above, and in particular metric configurations within a prosodic compound, as we will see further below). This process is very informative of the way clitics and other types of morphosyntactic objects are organized within prosodic words and prosodic word groups (Vigário 2003, 163–165; 2010). The data in (14) illustrate the main facts (‘x’ signals marked, infrequent realizations). Both (14a) and (14b) show the (nearly) obligatory application of [i] deletion in PW-final position, whether or not a following word starts with a vowel. In (14c) [i] deletion does not operate because the prefix *re-* ([ɾi]) is not a PW (the very presence of the reduced vowel [i] shows the unstressed status of this prefix, which therefore cannot be a PW independent of its base). In (14d) encliticization of weak pronominal clitics to the preceding verb yields incorporation of the clitic into the PW that contains the verb; hence the verb-final vowel is no longer PW-final and deletion is impossible. In these cases, the hiatus is post-tonic and therefore gliding is obligatory (like in *faMília* ‘family’ – cf. section 2.3, above), a fact that further supports the incorporation of enclitics into the preceding PW. The pattern in (14e) is similar to that in (14a–b), because clitic incorporation into the preceding PW causes clitic-final vowels to become PW-final, which is the context for [i] deletion. Finally, examples (14f–g) show that clitics other than post-verbal weak pronouns do not cliticize to the preceding PW, and hence in (14f) the last vowel of that word deletes. Clitics in this position attach to the following PW instead, so that the final vowel of the clitic can no longer undergo PW-final vowel deletion (a reduction process that affects very frequent words, to which we return in subsection 4.3, below, accounts for optional deletion in this case).

(14) Por. a.	<i>BEbe.</i> ‘drink _{IMP} ’	0 / ^x [i]	<i>PEle.</i> ‘skin’	0 / ^x [i]
b.	<i>BEbe aGOra!</i> ‘Drink _{IMP} now!’	0 / ^x [j] / ^x [i]	<i>PEle ALva</i> ‘white skin’	0 / ^x [j] / ^x [i]
c.	<i>reavaliAR</i> ‘reevaluate’	*0 / [i] / [j]	<i>reutiliZAR</i> ‘reuse’	*0 / [i] / [j]
d.	<i>BEbe-a!</i> ‘Drink it _F !’	*0 / [j]	<i>PEde-o!</i> ‘Ask it!’	*0 / [j]
e.	<i>VIU-me ONtem.</i> ‘(S/he) saw-me yesterday’	0 / ^x [j] / ^x [i]	<i>PEço-te aGOra.</i> ‘(I) beg-you now.’	0 / ^x [j] / ^x [i]
f.	<i>PEde o Livro.</i> ‘(S/he) asks for the book’	0 / ^x [j] / ^x [i]	<i>SÓ HenRIque o DISse.</i> ‘Only Henrique said it.’	0 / ^x [j] / ^x [i]
g.	<i>JÁ te ofereCI.</i> ‘(I) have already offered (it) to you.’	0 / [j] / ^x [i]	<i>GOSTo de obserVAR.</i> ‘(I) like watching.’	0 / [j] / ^x [i]

The second phenomenon we will consider here is vowel harmony in Piverone (a dialect of Piedmontese). According to Loporcaro (2000), vowel harmony in this dialect is a PW-bound process affecting word-final non-low vowels, which harmonize in height to the stressed vowel. This is illustrated in (15), taken from Loporcaro (2000, 164): non-low vowels surface as [e o] if preceded by a stressed low or mid-low vowel, and as [i u] if preceded by a stressed high or mid-high vowel (15a). The examples in (15b) show that enclitics incorporate into the preceding PW, since they pattern like PW-final elements.

(15) Piedmontese (Piverone)

- | | | | | |
|----|-----------|-------------------|-----------|-------------------------|
| a. | [ˈpɛrɛ] | ‘stones’ | [ˈbryti] | ‘ugly _{F.PL} ’ |
| | [ˈkanto] | ‘(they) sing’ | [ˈtʃitu] | ‘silent’ |
| b. | [ˈda-me] | ‘(s/he) gives me’ | [ˈmus-mi] | ‘(s/he) shows me’ |
| | [ˈmat-lo] | ‘(s/he) puts it’ | [ˈpij-lu] | ‘(s/he) takes it’ |

Notice that processes like these may be crucial to determine how particular words (like clitics) and morphemes (like affixes) are prosodized (e.g. Peperkamp 1997; Vigário 2003). Another example of a process that has been used to this end is *raddoppiamento sintattico* (RS), mentioned in subsection 1.2 and section 3. Peperkamp (1997, 71–72) offers it as a diagnostic to the prosodic status of monosyllabic prefixes: Because monosyllabic prefixes do not trigger RS (as illustrated in 16a), they are argued not to bear word-level stress or form autonomous prosodic words (as *tré* in 16b).

- (16) It. a. *pre*[g]réci ‘pre-Greek_{M.PL}’
 b. *tré* [g:]réci ‘three Greeks’

(Other) segmental phenomena that apply with reference to the PW have been reported, for instance, in Nespor/Vogel (1986/2007) and Peperkamp (1997) for several dialects of Italian (but cf. Loporcaro 2000 for a critical view), Loporcaro (2000) for Algherese, Romanesco and Friulian, three Romance varieties spoken in Italy, Bisol (2000; 2004) and Schwindt (2008) for BPor, and Vigário (2003) for EPor.

The next level of prosodic hierarchy that constrains segmental processes is the Prosodic Word Group (Vigário 2010), or, in other approaches, the Clitic Group or the Composite Group (Nespor/Vogel 1986/2007 and Vogel 2009, respectively). The behavior of word-final schwas in EPor illustrates the relevance of the PWG for the realization of segments. As we have seen above, schwas are usually deleted in prosodic word-final position. However, deletion is blocked within PWGs, when the target vowel is followed by a vowel bearing PWG prominence (Vigário 2010). This is illustrated in (17), where both the compound in (17a) and the abbreviation in (17b) are formed of more than one PW. The vowel that starts the rightmost PW bears PWG

prominence, blocking final *e*-deletion in the previous PW, and deletion applies between the first and the second PW of the abbreviation because the second PW is not the head of PWG. Word-final *e*-deletion in EPor may thus be understood as a domain-limit process (it applies at the right-edge of PW) that operates within a larger domain (the PWG).

- (17) EPor. *grande-área* [ˈgrẽ ˈdjarjɐ] ‘penalty area’
RFM (erre-efe-eme) [ɛˈrɛˈfjɐm] (name of radio station)

Let us now consider segmental processes at the level of the phonological phrase. According to Féry (2004, 170–173), in French the gradient processes of obstruent voicing assimilation (e.g. *bec de gaz* ‘gas tap’ /kd/ → [gd]) and nasal-obstruent simplification (e.g. *dinde de Noël* ‘Christmas turkey’ /ɛdd/ → [ɛnd]) apply within the phonological phrase and are blocked across phonological phrase boundaries (at least when narrow focus is involved). In Romance languages, however, most commonly only the processes that are sensitive to word stress and phrasal prominence are conditioned by the phonological phrase. For example, *raddoppiamento sintattico* has been argued to apply within, but not across the phonological phrase (Nespor/Vogel 1986/2007; notice nevertheless that according to Marotta 2011, the process may apply in higher levels as well). Similarly, in EPor vowel lengthening is a strategy for stress clash resolution available within, but not across phonological phrases, as we have seen before. Furthermore, sandhi processes that originate syllable loss, like those referred to in subsection 2.3, are also usually constrained by stress clash configurations involving phonological phrase prominence (Frota 2000; 2014).

The Intonational Phrase, by contrast, is the domain for many other types of segmental processes that apply across words. Very often, they involve resyllabification, a phenomenon that is shared by all Romance languages, implicating syllable restructuring across words. Unlike in Germanic languages, where the domain of resyllabification is the prosodic word (e.g. Booij 1995, for Dutch), in the Romance languages it is the intonational phrase (e.g. Nespor/Vogel 1986/2007 for several languages, Frota 2000, 60–62 for EPor; Féry 2004 for French), or even a higher domain, such as the utterance. In fact, in her experimental work on Galician, Fernández Rei (2002) finds that sandhi processes such as fricative voicing and vowel deletion may apply across IP boundaries with no intervening pause, within the Utterance (with some interspeaker variation). This is illustrated in (18), taken from Fernández Rei (2002, 81–82): Fricative voicing optionally applies in (18a), where each sentence may be phrased within a single Utterance, but not in (18b), where both sentences form two distinct Utterances.

- (18) Gal. a. *Xá son maiorciños. Deixaos ir.*
 ‘(They) are older now. Let them go’
 b. *Comprou dous iates. Dáme un cigarro.*
 ‘(He) bought two yachts. Give me a cigarette.’

Furthermore, using a methodology similar to that of Frota (2000) and Fernández Rei (2002), Tenani (2002) finds that in BPor the processes involved in resyllabification (fricative voicing, tapping, vowel degemination, deletion and diphthongization, and syllable degemination) may in fact be unbound, as speakers resyllabify not only within and across IPs, but also across Utterances that do not qualify for restructuring into a single Utterance (with no intervening pause), as in (19) (from Tenani 2002, 178).

- (19) Por. *O Pedro comprou pêssego. Alegaram falta de provas.*
 ‘Pedro bought peaches. They have claimed lack of evidence.’
pêsse[gw a]legaram
pêsse[g a]legaram

What ultimately accounts for the variation across (Romance) languages in the prosodic domain for resyllabification is certainly an interesting, though not very much investigated topic (but cf. Kleinhenz 1997 for some suggestions).

There are a number of much debated issues related to resyllabification other than its domain of application. For instance, a well-established fact seems to be the necessity of distinguishing between what one may consider basic syllabification, resyllabification in the lexicon and postlexical resyllabification. Notice that in OT accounts these distinctions may be accomplished without reference to the separation between lexical and post-lexical phonology, but they converge in the need of distinguishing between different types of processes related to the syllabification of segmental material (cf. e.g. Peperkamp 1997; Colina 1997b; Face 2002 for Spanish; Schwindt 2008 for BPor; Peperkamp 1997 and Cardinaletti/Repetti 2009 for Italian dialects).

Among the most challenging questions posed by resyllabification is the status of lexical and post-lexical syllables and word boundaries. For example, it is well known that languages are usually affected by constraints that ban certain segments from word-initial position. Thus, like in other Romance languages, in EPor a number of segments cannot appear prosodic word initially, namely [i r ɲ Δ] (from Vigário 2003, 159). However, resyllabification apparently results in words starting with forbidden segments. One approach to the issue suggested in Vigário (2003, 160) is to admit that phonotactic restrictions of this sort apply only at the lexical level, before word combination and resyllabification (cf. also Peperkamp 1997, 27–30 and references therein). Alternatively, Cardinaletti/Repetti (2009) propose that there are two syllable representations, which are not subject to the exact same requirements: word-level syllables, embedded under the prosodic word, and phrase-level syllables. For example, in a sequence like /l/ + /ɛ/ > [lɛ] ‘he is’ (from the Northern Italian dialect of Donceto), only [ɛ] is syllabified at the prosodic word-level, but at the phonological phrase level [lɛ] forms a (phrase-level) syllable. Duplicating syllable representations in this way is argued, for instance, to account for asymmetries found

in several Romance languages between syllables that are possible at the word-level and marked or impossible resyllabifications involving prosodic words or clitic-host combinations. This is illustrated by the Spanish examples in (20), where resyllabification may apply only if it does not yield a complex onset or coda (although these are legal in the language as in, e.g., *pueblo* [pwe.βlo] ‘village’).

- (20) Sp. a. *club elegante* [klu.βe.le.ɣan.te] ‘elegant club’
 b. *club lindo* [kluβ.lin.do], *[klu.βlin.do] ‘pretty club’

Under this approach, phrasal syllable boundaries and prosodic word boundaries do not have to match, and hence *resyllabification* (i.e. the formation of phrase-level syllables) does not imply prosodic word boundaries restructuring.

Within the Romance space, French liaison presents a number of specific problems that have long attracted the attention of phonologists, in particular the origin of resyllabified consonants (cf. the literature review in Tranel 1995; Bybee 2001; Nguyen et al. 2009). In general it is assumed that when consonants are lexically anchored, word-final consonants always surface and no alternations emerge (as in *seize* ‘sixteen’). However, in the case of prenominal adjectives and when closed lexical classes are involved, either allomorphy (*petit chat* [pətɪʃa] ‘little cat’, but *petit ami* [pətɪtami] ‘little friend’; *les chats* [leʃa] ‘the cats’, *les amis* [lezami] ‘the friends’) or floating consonants (requiring association to segmental and syllabic tiers in order to be realized, as when the following word starts in a vowel) account for the observed alternations. Evidence from speech perception studies in French suggest that word-final fixed and liaison consonants (e.g. *seize élèves* ‘sixteen pupils’ vs. *des élèves* ‘pupils’) have a different phonological status (cf. Nguyen et al. 2009, and the references therein for other work on the perception of liaison consonants in French).⁹

4 Non-general segmental phenomena: subphonological grammars or cophonologies and the lexicon

Many of the processes mentioned in the previous sections are considered purely phonological, in the sense that they depend on phonological constraints alone. However, like in other languages, in Romance languages innumerable segmental

⁹ It is well-known furthermore that in French the so-called *h aspiré* words block liaison and *enchaînement*, despite the fact that they start phonetically with a vowel. We refer to Gabriel/Meisenburg (2009) for a review of the immense literature on this matter and for a recent analysis of the phenomenon within Optimality Theory.

phenomena only apply in smaller areas of the lexicon or in particular morpho-syntactic contexts. Additionally, in many cases specific lexical items or morphemes must be somehow lexically specified in order to be exempted from the application of a rather general process or, on the contrary, so as to exhibit a specific phonological behavior. In different frameworks, distinct theoretical apparatus have been devised to handle this type of phonological facts (cf. e.g. Inkelas/Orgun/Zoll 1997). Here, we will focus on various types of processes rather than on specific theoretical approaches to exceptions in phonology. We will briefly consider three distinct types of processes, which differ at least in their origin.

4.1 Processes that refer to morphological and lexical information

Ever since the early days of generative phonology, processes referring to morphological information and/or with lexical exceptions have been widely documented in the Romance languages space (e.g. Harris 1969; Saltarelli 1970; Mateus 1975/1982; d'Andrade 1977). These rules are not purely phonological in the sense that for their application it is not sufficient that the phonological description of the rule is met, as they are restricted to certain morphological environments, they may have exceptions, and/or they are not sensitive to post-lexical information. Inflectional and derivational environments, as well as verb-clitic and clitic-clitic combinations, display an array of such segmental phenomena.

Well-known illustrative examples from Portuguese of this type of phenomena are the realization of plurals ending in laterals and the realization of nasal feature (Morales-Front/Holt 1997; Vigário 2003, 74–76), and several processes of regular verbal inflection (Mateus 1975/1982; Mateus/d'Andrade 2000), the so-called processes of metaphony (in nouns and adjectives) and vowel harmony (in verbs) (Matzenauer/Miranda 2005 and references therein). Among the processes with similar properties mentioned in the previous sections from other Romance languages are vowel/diphthong alternations in Spanish (cf. Hualde 2005, 193–198; Eddington 2012, among others) and diphthongization in Romanian, which also involves the interaction of morphological and phonological constraints (Chitoran 2002), to mention but a couple of these processes in Romance.

In some approaches, the properties of phonological rules are seen to point to a particular organization of grammar. Furthermore, identifying the locus in grammar that is relevant for a given phonological process or constraint may in fact have further implications for the phonological analysis. For example, as we have seen above, sound patterns may signal prosodic structure. However, this is true only if phonological units are prosodized in the same point in grammar where the particular phonological processes or relevant generalizations apply. We shall illustrate this with a couple of processes in different Romance languages involving verb-clitic combinations.

In her proposal on the prosodization of clitics in various dialects of Italian, Peperkamp (1997) relies on the word stress patterns displayed by host-clitic combinations. For example, the fact that enclitics do not affect stress placement in Standard Italian, as in *PORTamelo* ‘Bring it to me!’ (bring_{IMP}-me-it), is seen to show that post-verbal clitics do not incorporate into the host prosodic word in this language variety. However, Loporcaro (2000) and Vigário (2003, 333) point out that if stress placement in Standard Italian is a lexical process and pronominal clitics are syntactic words (and not affixes) which combine with their hosts post-lexically, the mere fact that verb-clitic combinations are not present at the lexical component of phonology accounts for the non-application of lexical phonological processes. Loporcaro (2000) further shows that, like in Standard Italian, in Algherese (a Catalan dialect spoken in Sardinia), pronominal clitics do not affect stress placement either. However, post-lexical processes, such as vowel epenthesis, reveal that in this dialect enclitics are indeed integrated within the host prosodic word.

EPor data also show the same need for separating lexical from post-lexical phenomena when considering the prosodization of clitics (Vigário 2003, 162–164). For example, /e/ obligatorily centralizes in stressed position followed by a palatal high segment (coda fricatives are assumed to be lexically underspecified for place features and thus do not trigger the process, e.g. *mesmo* ‘even’ or *vespa* ‘wasp’). Although it has a few exceptions when /e/ is followed by fricatives (*mexo* ‘(I) touch’, *rejo* ‘(I) govern’), the rule is exceptionless when sonorants are involved (*telha* ‘tile’, *tenho* ‘(I) have’, *areia* ‘sand’, *lei* ‘law’). The fact that it has exceptions is a symptom that this is a lexical process. Crucially, when a stressed /e/ is followed by a sonorant palatal segment that belongs to an enclitic, it never centralizes. Notice that evidence from regular, postlexical phonological processes clearly shows that pronominal enclitics incorporate into the prosodic word of their host, as we have seen previously.¹⁰

Not only segmental and suprasegmental processes, but also other important phonological generalizations, such as the Three Syllables Stress Window, as well as phonotactic constraints, show the importance of distinguishing between lexical and

10 Enclitics in the varieties of Romance may interact with stress location in various ways (cf. e.g. Peperkamp 1997, 176–178; Ordóñez/Repetti 2006, among many others, and references therein). In most standard varieties, clitics do not affect word stress location. In some varieties, however, enclitics may bear stress, while the stress in the host is also maintained, as in Neapolitan (e.g. *CÓNtaTÍle* ‘tell_{IMP}-you_{REFL}-it_F’). In addition, enclitics may also be totally integrated in the host prosodic word, contribute to the computation of stress location, and eventually bear the main stress of host-clitic combination, as in Lucanian, Gascon, Majorcan Catalan or Cheso Aragonese (cf. *VÍnne* ‘sell_{IMP}’, *vinnemMÍle* ‘sell_{IMP}me-it’, in Lucanian). In some cases, variation is also found in the same variety, as in Argentinean Spanish, where forms like *¡Preguntásele!* ‘Ask it to him!’ may alternate with *¡Preguntaseló!*, in colloquial, mainly emphatic speech (cf. Gabriel/Rinke 2010; Colantoni/Cuervo 2013). The variation found in the way enclitics interact with prosodic word stress points to different types of prosodic integration of the clitic into the host PW and/or to differences in the point in grammar where the host-clitic combination obtains (at the lexical component or postlexically), and both facts may correlate with varying degrees of grammaticalization of the host-clitic combination.

post-lexical phonology. It is well-known that there is a universal tendency for stress to fall within the three initial or final syllables of a phonological domain (e.g. van der Hulst 1996). On the basis of EPor data, Vigário (2003, 67) argues that this generalization can only be maintained if it is assumed that it operates at the lexical component. In fact, the incorporation of pronominal enclitics into the preceding verbal host may result in (extended) prosodic words with stress on the fourth or even the fifth to the last syllable of the word (21).

- (21) EPor. a. *abandonáramo-la* [e.bẽ.du.'na.rẽ.mu.lɐ]
 '(we) had abandon her'
- b. *oferecíamo-no-lo* [o.fri.'si.ẽ.mu.nu.lu]
 'we used to offer it to ourselves'

In the same line, Loporcaro (2011b) observes that only post-lexical rules, such as schwa epenthesis, may originate prosodic words with stress before the antepenultimate syllable in Romance languages.¹¹

Phonotactic restrictions in EPor banning prosodic word initial [ɲ ʎ r] are also to be observed only in lexical phonology, since proclitic adjunction to prosodic words (*já lhe ofereci* > *já lhofereci* '(I) have already offered-him') and resyllabification (*venho aqui* > *venhaqui* '(I) come here') may originate prosodic words starting with these forbidden segments (but cf. Cardinaletti/Repetti 2009 for an alternative account, as mentioned above).

To conclude this section, we would like to point out that in some cases, it is difficult to determine whether a given pattern of segmental distribution is best analyzed as resulting from the application of phonological rules that operate in very restricted environments or via constraints ordering reflecting preference for a given allomorph over allomorphic competitors (cf. for example the discussion in Mascaró 2007 and Nevins 2011). Alternations may involve affixes, clitics and clitic-host combinations, and other types of words as well. Examples of such alternations in Romance, analyzed from many different perspectives are copious, e.g. Italian pronominal clitics (Nespor/Vogel 1986/2007; Peperkamp 1997, and references therein) and inflected prepositions (Napoli/Nevins 1987), Catalan clitics (Bonet/Lloret 2005) and definite masculine article (Mascaró 2007), EPor pronominal clitics (Vigário 2003) and the plural morpheme in the nominal system (Mateus 1975/1982; Morales-Front/Holt 1997), French liaison allomorphy (Zwicky 1985; Tranel 1996; Perlmutter 1998), and the feminine definite article in Spanish (Zwicky 1985; Harris 1987).

¹¹ It is well known that the third person plural morpheme in the present tenses may also cause stress to fall before the antepenultimate syllable of the word in Standard Italian (e.g. *telefonano* '(they) phone', cf. Peperkamp 1997, 194, and the references therein).

4.2 Frequency effects on the realization of segments

Word frequency may also affect segmental realization in several ways (e.g. Bybee/Hopper 2001). This topic has attracted less attention in the realm of studies on the segmental phonology of Romance languages, although frequency is very often reported to affect the application of particular rules.

Very frequent words seem to favor the application of idiosyncratic (reduction) processes. Vigário (2003, 303–309) notes that many reductions affecting highly frequent words in EPor result in the avoidance of marked phonological patterns, e.g. marked syllable structures, such as those with complex onsets (22a), complex nuclei (22b), complex rhymes (22c), and empty onsets (22c) as well as marked clitic formats, such as disyllabic clitics (cf. 22d).

(22) a.	CGV > CV	<i>de arte</i>	[ˈdʒart] > [ˈdɑrt]	‘of art’
		<i>com a</i>	[kwe] > [ke]	‘with the _F ’
	CCV > CV	<i>grande</i>	[ˈgrẽd] > [ˈgẽdɛ]	‘big’
	VG > V	<i>em</i>	[ẽj] > [ẽ]	‘in’
		<i>ao</i>	[aw] > [ɔ]	‘to-the _M ’
b.	CVC > CV	<i>mesmo</i>	[ˈmezmu] > [ˈmemu]	‘really’
	CVGC > CVG	<i>pois</i>	[ˈpoij] > [ˈpoj]	‘as’
c.	VCV > CV	<i>avô</i>	[eˈvo] > [ˈvo]	‘grandpa’
		<i>avó</i>	[eˈvɔ] > [ˈvɔ]	‘grandma’
		<i>até</i>	[eˈtɛ] > [ˈtɛ]	‘even’
d.	disyllabic > monosyllabic clitics	<i>para</i>	[pɛrɛ] > [pre] > [pɛ]	‘for’
		<i>pelo</i>	[pelu] > [plu]	‘by-the _M ’

In some cases, it seems that reductions of highly frequent words lexicalize, and both reduced and unreduced allomorphs coexist. However, it is not the case that these phenomena spread into other areas of the lexicon and eventually generalize as a pure phonological rule. Additionally, very frequent combinations of words also seem especially prone to lexicalize (e.g. Napoli/Nevins 1987 for Italian; Bybee 2001 for French; Vigário 2003, 317 for EPor). Finally, high frequency may also result in the preservation of irregularity (Bybee/Hopper 2001). For example, Bybee (2001) argues that in French, grammatical words like *les* ‘the_{PL}’ occurred frequently in positions where their final consonants were prevocalic (as in *les enfants* ‘the_{PL} children’) and this is why they have allomorphs that exhibit the maintenance of the word final consonant in liaison contexts, whereas other words (like *bois* ‘forest’) completely lost it.

4.3 Loanword phonology

Loanwords may pose a number of challenges to native phonological grammar. Only rather recently this area of phonology has been given some attention in Romance, in

particular in languages where language-contact creates large-scale borrowings. This is the case of Eastern Catalan, a language very much exposed to Spanish borrowings.

According to Cabré (2009), loanwords in Eastern Catalan have triggered a new phonology, especially patent in stressless vowel system. For Mascaró (2002, 110–113) loanwords exhibit lexically specified exceptions to vowel reduction, while according to Cabré (2009), in addition to vowel reduction blockage, vowel harmony is also involved, consisting of the long distance assimilation of stressed mid vowels to a following [+ATR] mid vowel. As shown in examples in (23), taken from Cabré (2009, 268), instead of reducing to schwa, stressless vowels surface as [+ATR] (cf. 23a), and mid vowels are pronounced as close mid when followed by close mid vowels (cf. 23b).

- (23) Cat. a. *N[e]pal* *Versall[e]s* *C[o]l[ga]t[e]*
 b. *p[e]st[o]* *B[o]st[o]n* *[o]sl[o]*

Cabré (2009) proposes that these specific phonological patterns are used to identify loans within the lexicon.

Like Eastern Catalan, EPor loanwords also tend to show non-native phonological behavior with respect to vowel reduction (VR). In this language, not only stressless vowels of borrowed words often escape VR but in addition, in these cases, stressless vowels usually surface as low. As we have seen in section 2, in EPor non-high stressless vowels not affected by VR are exceptional, and exceptions to VR that surface as low are by no means exclusive to loanwords, like lexical exceptions to VR that surface as low (cf. 24a), in several prosodic positions non-high stressless vowels are also realized as low [*ɛ a ɔ*], instead of [*i ɛ u*], respectively), namely in prosodic word final positions in syllables closed by consonants different from -s (cf. 24b), at the right edge of prosodic words that are non-final within prosodic word groups, namely in morphological compounds (cf. 24c), or in truncated words (cf. 24d) (cf. Vigário 2003, 67–73). Interestingly enough, like in EPor, the absence of VR and [+ATR] realization in compounds and truncated forms are also found in Eastern Catalan (Cabré 2009, 273).

- (24) EPor. a. *r[ɛ]t[ó]rica* *el[ɛ]ctricidade* *pr[ɔ]curar*
 ‘rhetoric’ ‘electricity’ ‘(to) search’
- b. *tór[a]x* *abdóm[ɛ]n* *Vít[ɔ]r*
 ‘chest’ ‘abdomen’ ‘Victor’
- c. *mon[ɔ]-acental* *cin[ɛ]-radiografia* *sóci[ɔ]-demográfico*
 ‘monoaccentual’ ‘cine-radiography’ ‘socio-demographic’
- d. *exp[ɔ]* *eur[ɔ]* *fot[ɔ]*
 ‘expo’ ‘euro’ ‘photo’

A constraint avoiding mid vowels in word-internal stressless positions could be seen to be responsible for this outcome in EPor, which would also be active in other areas of the lexicon where vowel reduction exceptionally does not apply. However, a piece of evidence suggests that lowering is not specific of stressless vowels. As we have seen in section 2, above, lowering also affects stressed vowels in Portuguese in words with marked stress patterns. Hence in this case, a constraint requiring non-high vowels to surface as low seems to actually signal exceptional, non-regular (in some cases, non-native) phonology (very much along the lines of Wetzels' 1992 suggestions on Spondaic Lowering and Dactylic Lowering cited above). Importantly, EPor also offers evidence suggesting a division of labor between lowering and blocking of vowel reductions. In fact, in the cases illustrated in (24b–d), unreduced vowels in stressless positions also signal prosodic word right-edges. That what is relevant for cuing prosodic edges is the blocking of VR is shown by the realization of the vowels at the left-edge of prosodic words, which regularly escape full VR. Crucially, here lowering does not apply and hence in this position unstressed mid vowels may regularly surface in EPor (e.g. *elegante* 'elegant', where the initial vowel may be realized as [e] or [i], but not [ɨ] or [ɛ]).

Pons-Moll (2012) also investigates the contexts for underapplication of vowel reduction in Majorcan Catalan. Besides some striking similarities with Eastern Catalan and EPor, her data show important commonalities between loanwords and learned words as well as other areas of the lexicon (Pons-Moll 2012 for the details).

Loanword phonology has also been investigated in Italian. For example Repetti (2012) examines vowel epenthesis as a repair strategy to avoid marked or impossible structures in consonant-final loanwords in Italian, a language known for the scarcity of word final consonants (e.g. *stop* ['stɔppe], ['stɔppə] or ['stɔppə]). Here, the focus is on the phonology of the epenthetic vowel. Repetti shows that the vowels inserted in this context are phonologically inert (e.g. they do not interact with word stress), are influenced by phonetic and morphological factors, and are distinct in quality from the unmarked epenthetic vowel found in non-final position in the language, which is [i] (e.g. *in* [i] *Svizzera* 'in Switzerland').

A feature common to the different phenomena seen above is that, whereas loanword adaptations occur as means of dealing with marked or illegal patterns in L1, often they still display marked or specific phonology.

5 Conclusion

In this chapter we have examined grammatical factors that may affect the realization of segments in Romance languages. We have seen that the presence and absence of word-level stress and higher levels of prominence constrain the realization of segments in various ways. For example, diphthongization in many Romance languages, vowel lengthening in Italian and vowel harmony in Portuguese affect vowels

in stressed position. Some segmental rules depend on particular stress patterns, like Spondaic Lowering and Dactylic Lowering in EPor and BPor. The interaction between word stress and segments realization may be observed inside words, as in the cases above, but it can also span words, as in the case of *raddoppiamento sintattico* in Italian, of progressive assimilatory diphthongization in the Portuguese dialect of Terceira (Azores) and of [j]-insertion to break a sequence of central vowels in Northern dialects of EPor. Segmental phenomena may also be sensitive to higher-level prominence. This has been reported for several languages, including Catalan, Galician and Portuguese.

Like word stress and higher-level prominence, the lack of stress may condition phonological processes as well. Most Romance languages exhibit neutralization of vowels as a result of varying degrees of reduction in stressless positions (e.g. Italian, BPor, Catalan, EPor). Similarly, semivocalization and vowel deletion as strategies to break hiatus are found across the Romance space (e.g. BPor, Catalan, EPor, Romanian, Spanish). In the latter case, processes are further conditioned, in varying ways, by the presence of word and higher-levels of prominence, since vowel deletion or semivocalization originating stress clash are often avoided. Other sources of language variation may relate to the ranking of faithfulness constraints in particular languages. For example, while in Catalan or BPor hiatus V2 is allowed to delete and semivocalize in some prosodic configurations, in general only V1 is the target of these processes.

Besides word stress and phrasal prominence, also particular intonational contours may impact on segments realization. Schwa insertion or blocking of schwa deletion ensures the realization of the segmental material required for tonal anchoring in EPor, and a similar effect is obtained through lengthening in Logudorese Sardinian.

Segmental processes may further be constrained by prosodic structure. Romance languages exhibit different types of processes that depend on the position of segments in every domain of the prosodic hierarchy. Most often, it seems that segmental phenomena in Romance languages are not bound by the phonological phrase, whereas segmental phenomena constrained by the position in the syllable, in the prosodic word, in the prosodic word group and in the intonational phrase are copious. Nevertheless, hiatus resolution processes (namely, vowel deletion and V1 semivocalization), which apply within the intonational phrase or a higher domain, are sensitive to phonological phrase prominence, i.e. they are blocked under stress-clash configurations (despite some variation in the definition of what creates stress-clash configurations in these languages; evidence for this type of sensitivity is found in languages like BPor, EPor, Galician, and Spanish).

We have seen that segmental phenomena may signal prosodic structure in Romance languages. However, this is usually only the case of purely phonological processes. In fact, the realization of segments may also be constrained by non-phonological information. Segmental processes that depend on morphological or lexical information are abundant throughout Romance and have long been reported

and analyzed under various perspectives. Specific phonology is also found in two other areas of the lexicon: loanwords and highly frequent words. Although these also seem domains for phonological generalizations, they appear to have attracted less attention in Romance. These several types of phenomena raise important research questions: (i) are segmental alternations that are not entirely regular best analyzed as resulting from the application of irregular phonological rules or constraint orderings, or from lexically listed allomorphy, instead, with concomitant ranking of constraints imposing a particular allomorph selection over allomorph competitors? (ii) What are the conditions for lexicalization and generalizations across the lexicon? (iii) Under what conditions loanwords resist full integration into the native language phonology and what effects non-integration may have on the phonological system as whole?

Whatever model is adopted to account for segmental phenomena, it is clear that phonological processes have different properties. What is at stake is not the specific type of phenomena, but rather how general they are. While regular processes only refer to phonological information and are often optional and sensitive to conditions that obtain from word combinations, there are several types of less general phonological phenomena. Some are obligatory and word-bound, in which case they may be sensitive to morphological information and may have exceptions. Others are sensitive to rather superficial, phonetic information, including speech rate, appearance in prosodic positions that exhibit particular phonetics, such as phonetic lengthening or articulatory strengthening, and word frequency. The former type seems to be especially prone to also be sensitive to lexical items' origin, as loanwords more often escape lexical, non-general phonological processes than pure phonological rules. The former also necessarily involves lexicalization, while the latter sometimes result in lexicalized, categorical alternations, but in other cases what we find seems to be phonetic, gradual, non-lexicalized alternations.

Most Romance languages exhibit remarkable similarities in their segmental phonology, certainly partially because of their common Latin origin. For this reason, it is especially interesting to identify areas of divergence and to investigate the conditions for the emergence of phonological variation. Ultimately, we hope to have contributed in this chapter to show the fruitfulness of the comparative approach to Romance phonology.

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