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26 Portuguese

Abstract: This chapter offers an overview of some of the most significant aspects of Portuguese phonetics and phonology. It contemplates the language's phonological inventory, and several lexical and post-lexical segmental processes, accounting for major (morpho)phonological alternations in the language. It also describes various aspects of suprasegmental phonology, such as word and phrasal prominence, tonal inventory, tones distribution, duration, and rhythm. The phonology of prosodic domains operative in the language is surveyed, exposing areas of interaction of phonology with other components of grammar. While its main focus is the standard variety of European Portuguese, this chapter also includes dedicated sections highlighting distinctive traits of other dialects of this variety, as well as the Brazilian variety of Portuguese.

Keywords: Portuguese, segmental phonology, prosodic phonology, intonational phonology, rhythm

1 Introduction

Portuguese is spoken in Europe (Continental Portugal and the Azores and Madeira archipelagos), South America (Brazil), Africa (Cape Verde, São Tomé and Príncipe, Guinea-Bissau, Angola, Mozambique), Asia (Macao, East Timor, and only to a residual extent, in some areas of India; cf. Segura 2013a). While Portuguese is the native language of more than 210 million, often monolingual, speakers in Portugal and Brazil, in the other regions of the world it tends to coexist with other native languages. Globally, over 230 million people are estimated to speak Portuguese as a native language (Reto 2012; Segura 2013a).

In this chapter we outline the major facts of Portuguese phonetics and phonology, with particular focus on the standard variety of European Portuguese, spoken in the Lisbon area. In our description, we adopt the distinction between *lexical* and *post-lexical phonology*, as well as the basic tenets of feature geometry theory, autosegmental phonology, prosodic phonology, and intonational phonology (cf. Kaisse/Shaw 1985; Goldsmith 1990; Nespór/Vogel 1986/2007; Clements/Hume 1995; Ladd 1996/2008; and

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references therein). Along the lines of most literature on Portuguese phonology in the last decades, we may assume that phonetic realization follows from the application of rules to underlying forms (*à la* Chomsky/Halle 1968) or the interaction of ranked constraints, as modeled in the framework of Optimality Theory (Prince/Smolensky 1993/2004, among others).

We first describe the segmental inventory of the language and lexical segmental processes (Sections 2–3). Post-lexical phonological and phonetic processes are surveyed in the section devoted to prosodic phonology, where various kinds of phonological phenomena are considered (Section 4). A few areas of variation across European Portuguese dialects are also highlighted, as well as major differences between European Portuguese and the variety of Portuguese spoken in Brazil (Sections 5–6). We conclude in Section 7 with some final remarks.

2 Segmental inventory

2.1 Vowels and glides

The underlying vowel system comprises seven oral vowels (cf. Table 26.1). Central close and mid-close vowels (respectively, [i] and [e]) are phonetic variants found in specific phonological contexts (cf. 3.1). Underlying glides (i.e. obligatory, unpredictable glides) tend to appear only in post-vocalic position (*pai* ['paj] ‘father’; *pau* ['paw] ‘stick’). Prevocally, glides are most often optional variants of underlying vowels (*piano* [pi'enu]~[pjenu] ‘piano’).

Table 26.1: Oral vowels (and glides) in European Portuguese. Underlying segments inside slashes; variants only found superficially inside square brackets.

	Front	Central	Back
	Unrounded	Unrounded	Rounded
Close	/i/ [ĩ] (/j/ [j̃])	[i]	/u/ [ũ] (/w/ [w̃])
Close-mid	/e/ [ẽ]	[e] [ẽ]	/o/ [õ]
Open-mid	/ɛ/		/ɔ/ [ɔ̃]
Open		/a/ [ã]	

Obligatory rising diphthongs have long been noticed in words with velar consonants (*água* ['agwe] ‘water’; *quando* ['kwẽdu] ‘when’). Their phonological status is controversial. For example, for Massini-Cagliari/Cagliari/Redenbarger (2016) these sequences correspond to obligatory rising diphthongs, while for other scholars they contain an underlying labialized velar plosive (/k^w g^w/), instead of a velar consonant

and a full glide (e.g. Mateus/d'Andrade 2000). Despite Mateus/d'Andrade (2000, 110, fn. 2) and others, we should notice that there are actually other consonants that precede obligatory, unpredictable rising diphthongs, for instance with the sequence <ion>, as in *racional* [resju'nal] 'reasoned', *avioneta* [evju'nete] 'small aircraft' (but *diurno* [di'urnu] or [d'jurnu] 'diurnal'; *biologia* [biulu'zie] or [bjulu'zie] 'biology') (Vigário 2016). This means that European Portuguese has underlying glides preceding vowels with which they will form a rising diphthong. Whether this analysis is suitable only for the sequence <ion> or should be adopted for the sequences involving velar plosives mentioned above requires further research.

For some authors, glides always correspond to underlying vowels (Mateus/d'Andrade 2000, 30). In this case, it is necessary to explain why some vowels always surface as glides, while others do not (e.g. *vaidade* [vaj'dad] 'vanity' vs. *sairia* [sei'rie] 'leave_{3SG.COND}'; *avioneta* [evju'nete] 'light aircraft' vs. *viola* [vi'ole] or [vjole] 'guitar').

The formation of oral diphthongs coming from the combination of underlying vowels depends on prosodic information, as we will see in 3.1, 4.2, and 4.3.2. Nasal vowels result from the association of a nasal feature to a syllabic nucleus (cf. 3.2). Because open and open-mid nasal vowels undergo a general raising process (e.g. *campo* ['kẽpu] (← /kaNpu/) 'field'), the open-mid and close-mid contrast is neutralized in this context (e.g. *vento* ['vẽtu] 'wind', *[vẽtu]; *ponto* ['põtu] 'dot', *[põtu]), and nasal variants of /ɛ/, /a/, and /ɔ/ are usually supposed not to exist in Standard European Portuguese (Mateus/d'Andrade 2000, 19; Bisol/Veloso 2016). However, this is in fact not accurate, as [ã] and [õ] regularly emerge as a result of central vowel merging across words (cf. 4.3.2) and of Spondaic Lowering (cf. 3.1), respectively.

Nasal diphthongs are a particular feature of Portuguese, considering the Romance languages area (e.g. *mãe* ['mẽj] 'mother'; *cão* ['kẽw] 'dog'; *put* ['põj] 'put'). Because of their phonological origin, nasal diphthongs are mostly found in word-final position (cf. 3.2).

Position in the word and relative to word stress are the major conditioning factors for vowel distribution, together with feature similarity between vowels and adjacent segments (cf. 3.1).

European Portuguese vowels and glides are commonly characterized with the following binary distinctive features: [high], [low], [back], [round] (Mateus 1975/1982; d'Andrade Pardal 1977; Mateus/d'Andrade 2000). Under this approach, close-mid vowels are characterized as [-high, -low], whereas open-mid and open vowels are [+low], since open-mid and open vowels often pattern as a single class. A three-way distinction in height ([±open₁], [±open₂], and [±open₃]) is also found in the literature, especially when the Brazilian variety of Portuguese is considered (Wetzels 1992; Bisol/Veloso 2016). Central and back vowels are classified as [+back], whereas front vowels are [-back]; and front and central vowels are [-round], whereas [u o ɔ] are [+round].

2.2 Consonants

The consonantal system comprises the consonants in Table 26.2.

Table 26.2: European Portuguese consonants. Underlying consonants appear between slashes; variants only found superficially between square brackets.

	Bilabial, Labiodental		Dental, Alveolar		Postalveolar, Palatal	Velar	Uvular
Plosive	/p/	/b/	/t/	/d/		/k/	/g/
Fricative	/f/	/v/	/s/	/z/	/ʃ/	/ʒ/	[ʁ]
Nasal		/m/		/n/		/ɲ/	
Lateral				/l/ [ɫ]		/ʎ/	
Trill				[r]			[ʀ]
Tap				/ɾ/			

Plosives may also surface as (non-strident) fricatives, but this is not a salient phenomenon in Standard European Portuguese (e.g. Mateus/d'Andrade 2000). For this reason, we have not included these realizations in Table 26.2. Most phonologists report spirantization of voiced plosives only ([β ð γ]; e.g. Barbosa 1965/1983, d'Andrade Pardal 1977; Mateus/d'Andrade 2000). Spirantization can occur when the underlying plosive appears between vowels (as in *o gado* [u'ɣaðu] 'the cattle') or when it is preceded or followed by a liquid or a glide. By contrast, the process does not apply if the preceding vowel or glide is nasal (Barbosa 1965/1983; d'Andrade Pardal 1977).

There is individual variation in the use of trills in Standard European Portuguese, i.e. [ʀ] or [r] may be found, depending on the speaker, but the uvular variant is currently the most common, also surfacing as a fricative ([ʁ] or [χ]). Trills are in complementary distribution with the tap (/ɾ/). Distributional evidence indicates that trills result from a process of strengthening of /ɾ/ (cf. 3.2).

Alveolar laterals are usually realized with some degree of velarization (Andrade 1999; Rodrigues et al. 2019), but the secondary velar articulation has been particularly noted in phonological literature when laterals are in syllable final position, in which case they are represented as [ɫ] (cf. 4.1, 4.3.2).

There is some disagreement as to the underlying status of palatal sonorants. These segments are explicitly assumed to be underlying singleton palatals in Pereira (1999) and Mateus/d'Andrade (2000), among others. However, there are several distributional facts pointing to the underlying complex nature of [ɲ] and [ʎ], which, for that reason, have also been proposed to be in fact underlying geminates, associ-

3.1 Segmental processes affecting vowels

A number of lexical processes affect European Portuguese vowels. Here we briefly review some of the most important ones.

3.1.1 Vowel reduction

Vowels undergo dramatic reduction in both pretonic and posttonic position. Vowel reduction (VR) consists of the raising of central and back vowels (/a/ → [e]; /ɔ o/ → [u]), and the raising and centralization of non-back non-close vowels (/ɛ e/ → [i])¹ (cf. e.g. Mateus 1975/1982; Mateus/d'Andrade 2000). The examples in (2) illustrate typical vowel alternations in stressed and unstressed position.

(2)	cedo	[ˈsedu]	‘early’	cedinho	[siˈdɨnu]	‘early _{DIM} ’
	testa	[ˈtɛʃtɐ]	‘test _{3SG} ’	testar	[tiʃˈtar]	‘test _{INF} ’
	fala	[ˈfalɐ]	‘speak _{3SG} ’	falar	[fɛˈlar]	‘speak _{INF} ’
	gordo	[ˈgordu]	‘fat _{M.SG} ’	gordura	[ɡurˈdure]	‘fat _{NOUN} ’
	roda	[ˈɾɔdɐ]	‘turn _{3SG} ’	rodar	[ɾuˈdar]	‘turn _{INF} ’

Extending Wetzel’s (1992) analysis of pretonic vowel neutralization in Brazilian Portuguese, Bisol/Veloso (2016) analyze European Portuguese vowel reduction as the delinking of aperture features and two distinct processes: neutralization, which consists of the raising of non-back and of round vowels, and subsequent centralization of [i] → [ɨ] and [a] → [ɐ].

Stressless /i/ only undergoes VR (i.e. centralization) in verb-final syllables (*partir* [pɐˈtir] ‘leave_{INF}’ / *partes* [ˈpartɨʃ] ‘leave_{2SG}’ or, more frequently, [ˈpartʃ]), after schwa deletion; cf. 4.1, 4.2).

There are systematic exceptions to VR, which depend on various kinds of prosodic, and in some cases also morphological, information (Mateus 1975/1982; Mateus/d’Andrade 2000; Vigário 2003, 67–73 and 92–99; cf. also 4.1, 4.2). For instance, unstressed vowels do not reduce completely in prosodic word-initial position (thus, the initial vowel of *ovelha* ‘sheep’ may be realized as [o] or [ɔ], but not as [u]). Additionally, VR does not apply in syllables containing diphthongs or ending in a lateral (e.g. unstressed /a/ in *vaidade* ‘vanity’ and *salgado* ‘salty’ surfaces as low, instead of close-mid), nor at the right edge of a prosodic word that contains a morphological root within a morphological compound (always in non-final position of the

¹ From a phonological point of view, /e/ and /ɛ/ are classified as non-back and [i] as back; from a phonetic perspective, when we look at the so-called vocal triangle, [i] is a central vowel. This is why reduction of non-back vowels in stressless position is usually characterized as (raising and) centralization.

compound), as in *monogâmico* [ˈmɔnɔˈgɐmiku] ‘monogamous’ (cf. Vigário 2003 for further illustration).²

Unpredictable exceptions are also frequent (e.g. *procura* [pɾɔˈkuru] ‘search’, *retórica* [ɾɛˈtoɾikɐ] ‘rhetoric’). As noted in Vigário (2003; 2016), exceptions must be lexically specified for whole words rather than morphemes, because the same morpheme may be realized with or without VR depending on the word within which it appears – for example, /ɛ/ in the root *velh-* surfaces as low in *velharia* [vɛλɛˈɾiɐ] ‘antique’ but as schwa/∅ in *envelheço* [ẽviˈλɛsu] or [ẽvˈλɛsu] ‘age_{1SG}’, despite the fact that in both cases it is in stressless position;³ furthermore, except for PW initial position, when unstressed non-close vowels do not undergo VR they always surface as open.

3.1.2 Centralization of /e/

In Standard European Portuguese /e/ usually surfaces as [ɐ] when followed by a high palatal segment, as illustrated in (3) (Mateus 1975/1982; d’Andrade 1994a; Mateus/d’Andrade 2000; Vigário 2003).

(3)	fecho	[ˈfɛʃu]	‘zip’
	cereja	[siˈɾɛʒɐ]	‘cherry’
	engenho	[ẽˈʒɛnu]	‘cleverness’
	telha	[ˈtɛλɐ]	‘tile’
	européizar	[ewɾupɛiˈzar]	‘europeanize _{INF} ’
	areia	[ɐˈɾɛjɐ]	‘sand’

Palatal fricatives in coda position, by contrast, do not trigger /e/ centralization (*cesto* [ˈsɛʃtu]/*[ˈsɛʃtu] ‘bin’, *mesmo* [ˈmɛʒmu]/*[ˈmɛʒmu] ‘even’). D’Andrade (1994a) interprets the absence of centralization in this context to follow from the fact that, when /e/ centralization operates, coda fricatives are not yet specified as palatal, being specified as such only at a later stage. This analysis cannot be applied here, however, as there is

² *Monogâmico*, like many other morphological compounds and other types of morphosyntactic words, is formed of two prosodic words (PW), each of which with one PW-level stress (i.e. [ˈmɔnɔ] and [ˈgɐmiku]). The two PW are grouped into one prosodic word group (PWG). At the PWG level, prominence falls on the last PW. Since in our phonetic transcriptions, we mark PW-level stress, the transcriptions of this type of words include more than one main stress. Cf. 4.2 for the distinction between PW- and PWG-level stress.

³ As we will see in 4.1, schwas, and less frequently stressless [u], are often deleted in normal, and more so in fast speech rate. In these cases, the organization of segments within the syllable becomes unclear. In order to avoid any assumption on the post-lexical status of the syllable in European Portuguese, in this chapter stress marks are indicated right before what we take to be the *lexical* syllable. Additionally, the phonetic transcription of the variants with and without schwa and [u] deletion will be given only occasionally.

evidence that coda fricatives must be specified at least as non-back at the lexical level, because the place of articulation of the plural morpheme ([ʃ]) participates in the lexical specification of the back feature of glides derived from nasals and laterals in rhyme position – e.g. in *animais* [eni'majʃ], the plural form of *animal* [eni'maɫ] ‘animal’, the lateral surfaces as a glide that is homorganic to the following fricative, instead of the preceding vowel, that is, it surfaces as [j] instead of [w] (Morales-Front/Holt 1997; Vigário 2003, 74–82; cf. also 3.2, below). For Vigário (2003), therefore, there are two contexts for /e/ centralization: *heterosyllabic /e/ centralization* applies when /e/ is followed by a(ny) high palatal segment that belongs to a different syllable, as shown in the examples in (3); and *tautosyllabic /e/ centralization* applies when a palatal glide is part of the same syllable nucleus as /e/ (as in *leiteiro* [lej'tej.ru] ‘milkman’).

With heterosyllabic fricatives only, there is a very small number of exceptions to /e/ centralization (e.g. *mexo* [mefu] ‘touch_{1SG}'). By contrast, enclitics, which incorporate post-lexically into the host prosodic word, never trigger it, e.g. *dê-lha* [dɛʎɛ]/*[dɛʎɛ] ‘give_{3SG.IMP-3SGDAT-ACC.F.SG}'). The fact that /e/ centralization has exceptions and that palatal segments that do not trigger centralization integrate the same prosodic word as /e/ only post-lexically indicates that this is a lexical process (Vigário 2003).

3.1.3 Monophthongization of /ow/

The diphthong /ow/ systematically undergoes monophthongization, surfacing as [o] (e.g. *roupa* [rope] ‘clothes’) (Mateus 1975/1982; Miguel 1994; Mateus/d'Andrade 2000). Evidence for the underlying diphthong is the fact that monophthongized [o] in stressless position does not undergo vowel reduction, unlike synchronic underlying /o/ (e.g. *roupa* [ro'pejru]/*[ru'pejru] ‘wardrobe’ vs. *sopeira* [su'pejre]/*[so'pejre], ‘household servant_r’, compared with *sopa* [sope] ‘soup’; Miguel 1994).

To our knowledge, except for word-initial position, in native words [o] in stressless position can only be found in (superficially) open syllables that derive from /ow/; by contrast, underlying /o/ in open syllables undergoes systematic vowel reduction in stressless position, except in prosodic word-initial position, where vowels systematically reduce less (*ocupado* [oku'padu] or [ɔku'padu], but *[uku'padu]) (cf. Vigário 2003, 92–99). The diphthong [ow] may nevertheless also surface in European Portuguese because when /o/ is stressed and followed by /u/ in prosodic word-final position, post-lexical V2 semivocalization optionally applies, as in *do*, realized as [dou] or [dow] ‘donate_{1SG}’ (monophthongization cannot apply here, however; Vigário 2003, 100–102).

3.1.4 Underlying V+/N/ sequences: nasalization and raising

In most accounts of Portuguese phonology and in different theoretical frameworks, nasal vowels are assumed to correspond to underlying oral vowels followed by an

underspecified nasal segment in syllable final position – usually represented as /N/, but also analyzed within the autosegmental framework as a floating autosegment (Câmara 1953; Barbosa 1965/1983; d’Andrade/Kihm 1988; cf. also Morales-Front/Holt 1997, 429, endnote 2, for work adopting a phonemic account of nasal vowels, and Guimarães/Nevins 2013, who found evidence for one particular phonemic nasal vowel in Brazilian Portuguese). Thus, words such as *undo* [ˈmũdu] ‘world’ vs. *udo* [ˈmudu] ‘mute’ are not minimal pairs, because in the underlying representation there is an additional segment in *undo* (cf. /muNdu/ vs. /mudu/). Distributional evidence corroborates this analysis. For example, syllables with nasal vowels may not be closed by liquids (*[ˈmũrdu], *[ˈmũɫdu]) (cf. 4.1); and segments that may not follow heterosyllabic consonants, such as the tap or palatal sonorants, cannot follow a nasal vowel either, indicating that the nasal autosegment patterns like a coda consonant (Câmara 1953; Morales-Front/Holt 1997; Mateus/d’Andrade 2000; cf. 2.2, 3.2).

Non-close vowels preceding underlying nasals tend to surface as non-open, and more so when vowels surface as nasal, i.e. when the underlying nasal is syllable final (Mateus 1975/1982). This behavior is found in European and Brazilian Portuguese. Nevertheless, in Standard European Portuguese only, /a/ systematically escapes raising to [ɐ] before a nasal consonant in the past perfect tense, e.g. *falamos* [feˈlamu] ‘speak_{IPL.PRET}’. Exceptions to the raising of vowels when followed by a nasal are more frequent with non-central vowels, however, in particular in words with exceptional stress patterns (cf. below). Furthermore, as pointed out in Mateus (1975/1982), in 1st-conjugation verbs non-close non-central vowels preceding nasal consonants usually surface as open, as in *tomas* [ˈtɔmɐ] ‘take_{2SG}’.

3.1.5 Processes dependent on particular stress patterns

Four major processes are concomitant with exceptional stress patterns.

Dactylic Lowering and Spondaic Lowering, which were first described for Brazilian Portuguese by Wetzels (1992; 2006/2007), also operate in the European variety of Portuguese (Vigário 2016). Dactylic Lowering is a process that opens stressed vowels in proparoxytone non-verbs, e.g. *esquelético* [ʃkˈletiku] (or [ʃkiˈletiku]) ‘skeletal’, compared with *esqueleto* [ʃkˈletu] (or [ʃkiˈletu]) ‘skeleton’. In European Portuguese this rule wins over the rather general process that neutralizes open-mid and close-mid oral vowels before nasal consonants, with vowels usually surfacing as close-mid, as we have seen above – cf. *António* [ɐˈtɔnju] (proper name), *prémio* [ˈpɾɛmjɐ] ‘prize’, *anónimo* [ɐˈnɔnimu] ‘anonymous’.

Spondaic Lowering opens stressed close-mid vowels in non-verbs with penultimate stress ending in a closed syllable, as in *dócil* [ˈdɔsi] ‘gentle’, to be compared with *doce* [ˈdosi], or most often [ˈdos] ‘sweet’ (cf. also 4.1). In European Portuguese this rule is also responsible for the only instances of [ɔ̃] in the language, which can be found in the speech of many speakers of European Portuguese (e.g. *ontem* [ɔ̃ˈtɛj])

‘yesterday’; *anteontem* [ɛ̃ˈtjõ̃tɛ̃] ‘the day before yesterday’; Vigário 2016). Furthermore, despite the fact that non-close vowels often surface as close-mid before a nasal consonant, Spondaic Lowering may explain why open and open-mid vowels appear in that context, as *ténis* [ˈtɛniŋ] ‘tenis’, *Vénus* [ˈvɛnuŋ] ‘Venus’, *abdómen* [ɛbˈdõmɛn] ‘abdomen’.

In European Portuguese there is yet another rule of opening that affects non-close vowels in words with exceptional stress patterns, but instead of targeting stressed vowels, in this case it affects post-tonic vowels in syllables closed by non-inflectional consonants in prosodic word-final position, as in *júnior* [ˈʒunjõr] ‘junior’, *revólver* [Rˈvõlɐɾ] ‘revolver’, *âmbar* [ɛ̃ˈbar] ‘amber’, *sílex* [ˈsileks] ‘silex’, *Lúcifer* [ˈlusifer] ‘Lucifer’, *abdómen* [ɛbˈdõmɛn] ‘abdomen’ (Vigário 2003; 2016).⁴ Importantly, the rule applies equally to words with penultimate and antepenultimate stress.⁵

The last process that operates in a particular way because of a marked stress pattern is post-tonic non-final gliding, as in *família* [fɛˈmiljɐ] (Mateus 1975/1982; Vigário 2003; 2016; Wetzels 2006/2007). Because of its post-lexical status, we will return to this process in 4.2.

3.1.6 Other lexical processes affecting vowels

There are a number of specific and very systematic processes, many of them operating in the verbal system (Mateus 1975/1982; d’Andrade 1994b; 1994c; Mateus/d’Andrade 2000, 81–87; Vigário 2003, 73–78; Matzenauer/Miranda 2005). For space limitations, we merely list some of them here: deletion of the theme vowel when followed by a vowel, as in *falo* [ˈfalu] (/fal+a+u/) ‘speak_{1SG}’; hiatus resolution via glide insertion, where the first vowel is /e/, as in *passeio* [pɛˈsɛju] (← [pɛˈseju] /pase+u/) ‘walk_{1SG}’; assimilation of place features of a following glide by the theme vowel, as in [fɛˈlej] (← [fɛˈlej] /fal+a+j/) ‘speak_{1SG.PRET}’; vowel harmony in verbs and metaphony in non-verbs, accounting for alternations as those in, respectively, *movo* [ˈmovu] ‘move_{1SG}’ vs. *movem* [ˈmõvɛ̃] ‘move_{3PL}’, and *grosso* [ˈgrosu] ‘thick_M’ vs. *grossa* [ˈgrõsɐ] ‘thick_F’.

Several other major processes that affect vowels are purely phonological and interact with prosodic information. These include other hiatus resolution processes, external sandhi phenomena, phonetic reduction and schwa insertion, and will be surveyed in 4.2 and 4.3.

⁴ With the central vowel /a/ only, VR may apply in this context in a few very frequent words. In these cases, [a] alternates with [ɐ] (*açúcar* [ɐˈsukar] or [ɐˈsukɐ] ‘sugar’). Also, unlike non-central vowels, /a/ undergoes vowel raising before word-final nasal consonants, as in *íman* [ˈimɛn] ‘magnet’.

⁵ Like many other facts of Portuguese phonology described in the literature in the last decades and reviewed in this chapter, the realization of stressless vowels as low in word-final syllables ending in *r* and *l* (but, in contrast with present-day European Portuguese, not *n*) is already reported in Gonçalves Viana (1883/1973).

3.2 Segmental processes affecting consonants

Most, though not all, productive lexical processes affecting consonants refer to the realization of syllable-final consonants.

3.2.1 /r/ strengthening

The trill has been considered by many phonologists to derive from the tap, despite the superficial existence of pairs of words where the tap and the trill seem to contrast, as in *caro* ['karu] 'expensive_m' / *carro* ['karu] 'car' (Câmara 1953; Barbosa 1965/1983; Morales-Front/Holt 1997; Mateus/d'Andrade 2000).

Word internally, /r/ strengthening, as it has been called, operates when the tap is preceded by an underlying heterosyllabic consonant, as in *Israel* [iʒrɐ'ɛʃ] (state name), *melro* ['mɛʁu] 'blackbird', *honra* [õrɐ] 'honor'. The fact that the trill does not occur superficially preceded by a tap is assumed not to be an accidental gap, but rather a consequence of the merging of two underlying taps, realized as a single trill; thus, a word like *carro* corresponds to the underlying form /karru/, and therefore does not form a minimal pair with *caro* (/karu/).

In addition to these observations, the fact that in prosodic word initial position only the trill but not the tap can surface (e.g. *ratu* ['ratu]/*['ratu]), also suggests that [ʀ] and [r] are allophones of the same underlying segment. Importantly, besides /r/ strengthening, there are other phonological facts related to the strength of the left edge of the PW in European Portuguese, namely optional initial stress and emphatic stress assignment and absence of full vowel reduction (Vigário 2003; cf. also 4.2.1).

In the case of Standard European Portuguese, the place of articulation is frequently uvular, meaning that /r/ strengthening also involves a change in place of articulation; furthermore, the uvular segment often surfaces as a fricative rather than a trill (cf. also Jesus/Shadle 2005 for some interesting acoustic details on the realization of the trill and the tap in several syllabic positions).

3.2.2 Realization of /N/

Underlying nasals that are fully specified surface as consonants with contrastive place of articulation in syllable onset position. By contrast, in syllable-final position nasals are usually underspecified and undergo nuclearization (Mateus 1975/1982; d'Andrade/Kihm 1988; Morales-Front/Holt 1997; Mateus/d'Andrade 2000, 54–58). Word-internally, nuclearization seems to be complete, that is, the nasal segment, analyzed in d'Andrade/Kihm (1988) as a floating nasal feature, associates to the preceding syllable nucleus, and the vowel in the nucleus surfaces as nasal, as in *campo* ['kẽpu] (/kaNpu/) 'field'. Importantly, however, the fact that /r/ strengthening applies

when the tap is preceded by a nasal vowel, as we have seen in sections 3.1.4 and 3.2.1, supports the view that the nasal segment is anchored to the coda, instead of being a floating feature. Thus, like laterals, it is possible that rhyme nasals are not fully nuclearized (cf. 4.1).

When the nasal is part of a word-final rhyme, a nasal glide surfaces, also indicating that in this context the nasal is not just a floating feature, but rather part of an anchored non-vocalic segment, although still underspecified for place of articulation. In the latter case, if no segment follows, the place of articulation of the glide corresponds to that of the vowel in the preceding nucleus. Thus, the word-final nasal glide is [w̃] when the preceding nucleus contains a back vowel, as in *pão* [ˈpɛw̃] (/paN/) ‘bread’ or *falam* [ˈfalɛw̃] (/fala+N/) ‘speak_{3PL}’, and [j] when the vowel in the preceding nucleus is non-back, as in *comem* [ˈkɔmɛj] (/kɔme+N/) ‘eat_{3PL}’. By contrast, when the nasal glide is followed by a coda fricative, the nasal glide acquires the place of articulation of the fricative.⁶ In these cases, therefore, the nasal surfaces as a non-back glide, like the coda fricative, irrespective of the value of the back feature of the vowel in the preceding nucleus, as in *pães* [ˈpɛjʃ] (/paN+S/) ‘bread_{PL}’ (Morales-Front/Holt 1997; Vigário 2003, 74–78).

In derived environments, /N/ normally surfaces as a coronal consonant, as in [keˈniɫ] (/kaN+il/) ‘kennel’, compared with *cão* [ˈkɛw̃] (/kaN/) ‘dog’. The exact behavior of the underspecified nasal segment in derivational and inflectional environments is complex and not entirely systematic (cf. Mateus 1975/1982, 44–71; d’Andrade/Kihm 1988; Mateus/d’Andrade 2000, 72–73; Vigário 2003, 74–78).

3.2.3 Realization of laterals followed by a fricative in word-final position

Due to syllable constraints, laterals lose the consonantal feature when followed by a tautosyllabic fricative (cf. 4.1). The combination of lateral+fricative usually results as a consequence of plural inflection in the nominal system.⁷ In this case, there is full nuclearization of the lateral, which surfaces as a non-back, coronal glide, as in *animais* [ɛniˈmajʃ] (/animal+S/) ‘animal_{PL}’ (Morales-Front/Holt 1997 and references therein). As with the glide that originates as /N/, the place of articulation of the glide corresponding to an underlying lateral has been hypothesized to match the place of articulation of the following fricative; this analysis implies that coda fricatives must be at least partially lexically specified for place features (Morales-Front/Holt 1997; Vigário 2003, 74–82).

⁶ A post-vocalic N is followed by a tautosyllabic fricative in word-final position only (Veloso 2007), typically as a consequence of nominal or verbal inflection.

⁷ Word-internal combinations of lateral+fricative are very rare, as in *solstício* [soɫˈtʃisju] ‘solstice’, and in these cases, the lateral does not semivocalize. It is possible that in European Portuguese this sequence in word internal position involves an intervening V-slot (cf. 4.1).

3.2.4 Other lexical processes affecting consonants

As in other Romance languages, in Portuguese many morphophonological alternations, in derived and also in inflected environments, involve consonants, e.g. [k]/[s], as in *elétrico* [e'letriku] 'electric' / *eletricidade* [eletrisi'dad] 'electricity'; [t]/[s], as in *democrático* [dmu'kratiku] 'democratic' / *democracia* [dmukre'sie] 'democracy'; [g]/[ʒ], as in *psicólogo* [psi'kolugu] 'psychologist' / *psicologia* [psiklu'ʒie] 'psychology' (Mateus 1975/1982; d'Andrade Pardal 1977; Mateus/d'Andrade 2000, 88–108). These alternations cannot be accounted for by general phonological rules of Portuguese, being analyzed as involving allomorphy, instead.

Unlike nasals and rhotics, the realization of laterals and of fricatives that are syllable-final at the lexical level depend on post-lexical processes, including resyllabification (cf. 4.1, 4.3).

3.3 Word stress assignment

There is some contention in the literature as to whether Portuguese word stress is weight-sensitive – a position advocated for in particular by Wetzels (2003; 2006/2007) for the nominal system – or assigned with reference to a morphological domain (Mateus 1983; Lee 1995; Pereira 1999; Mateus/d'Andrade 2000, 113–119; Vigário 2003, 64–67; cf. also the review in Magalhães 2016, and Garcia (2017), who defends a probabilistic approach to stress in the nominal system).

In non-verbs and in verbs in present tense forms only, it is particularly defensible that stress location is weight-sensitive. In non-verbs, stress is penultimate if the word ends in a light syllable, and final if the last syllable of the word is heavy. Heavy syllables are syllables closed by glides or non-inflectional consonants, for instance consonants different from the fricative that marks the plural in the noun system, or the 2nd person singular in the verbal system, which are generally assumed to be extrametrical, that is, not computed for the purpose of stress rules (e.g. Bisol 1994; Magalhães 2016). Thus, in words ending in a vowel, or in a vowel plus inflectional fricative, stress falls on the penultimate syllable, as in *janela/s* [ʒe'nɛ.lɐ]/[ʒe'nɛ.lɐʃ] 'window_{SG/PL}'; by contrast, in words ending in a syllable closed by an underlying non-inflectional consonant or a diphthong, stress falls on the final syllable, as in *favor* [fe'vor] 'favor', *anel* [e'nɛl] 'ring', *jardim* [ʒe'r'dĩ] 'garden', *chapéu* [ʃe'pɛw] 'hat', *rapaz* [rɛ'paʃ] 'boy'. Items not following this pattern, namely with antepenult stress (as *pêssego* ['pe.si.gu] 'peach'), with penult stress but ending in a non-inflectional consonant (as *fácil* ['fa.siʃ] 'easy'), or with final stress but ending in vowel (*café* [ke'fɛ] 'coffee'), must be lexically specified as exceptional (Mateus 1975/1982; Bisol 1994; Wetzels 2006/2007).

Some generalizations concerning possible syllable structures and stress patterns seem to corroborate the weight-sensitive approach. For example, no heavy syllables are found in post-tonic non-final position, as in **pifalto*, **súcaula*, or **rámurga*.

Although rare, words with antepenultimate stress ending in a heavy syllable do exist, however, such as *Lúcifer* ‘Lucifer’, *Júpiter* ‘Jupiter’, *sífilis* ‘syphilis’ (Magalhães 2016). This pattern may be accounted for assuming that the domain-final syllable is extrametrical or disregarded for the purpose of stress assignment, like in other words, such as *abóbora* ‘pumpkin’ (e.g. Wetzels 2006/2007).

Under an alternative approach, in the nominal system stress is assigned to the last syllable of the derivational stem (DS) (cf. Mateus 1983; Lee 1995; Pereira 1999). This accounts for stress assignment in words ending in a vowel (possibly followed by an inflectional consonant), because the last vowel is not part of the derivational stem, as in *acento/s* (*acento*_{DS}) [e'sêtu]/[e'sêtu] ‘stress_{SG/PL}’. It also accounts for words ending in a sonorant consonant, like *animal* (*animal*_{DS}) [eni'ma] ‘animal’, and for oxytone words ending in a vowel, like *café* [kə'fê] (*café*_{DS}), because words of these types lack material to the right of the derivational stem. Under this view, oxytone words ending in a vowel are not exceptional with respect to stress location; but it is unclear how stress is assigned in words like *Lúcifer* (*lucifer*_{DS}), since in these words, more than one syllable or vowel has to be lexically marked for not bearing word stress.

To the possible exclusion of the forms in the present tense, which show penult stress, but where most often stress also falls on the syllable containing the last vowel of the verb root, the position of stress in verbs is fixed, falling (i) on the syllable containing the theme vowel in the past tense forms, and (ii) on the first syllable of the tense-mood-aspect (TMA) morpheme in the future and conditional forms (Vigário 2003, 64–67; cf. also Pereira 1999; Mateus et al. 2003, 1050–1059; Wetzels 2006/2007 for similar though not identical generalizations). Thus, for example in past imperfect inflected verbs the syllable that contains the theme vowel bears stress independently of syllable count/weight considerations – e.g. *falava* [fe'lave] (/fal+a+va/) ‘speak_{1SG.IMPF}’, *falávamos* [fe'lavemu] (/fal+a+va+muS/) ‘speak_{1PL.IMPF}’; and in all future and conditional inflected forms word stress falls on the TMA morpheme, e.g. *falaria* [fele'rie] (/fal+a+ria/) ‘speak_{1SG.COND}’, *falaríamos* [fele'riemu] (/fal+a+ria+muS/) ‘speak_{1PL.COND}’.

We may add one piece of evidence showing that in European Portuguese fixed position is extending to present tense verb forms as well. In Portuguese, there is only one inflected form in the present tense where stress does not fall on the last syllable of the root, which is the 1st person plural, as in *percebamos* [prs'bemu] (/perseb+e+a+muS/) ‘understand_{1PL.SBJV}’. In this case, in present subjunctive forms it is not at all uncommon to hear speakers displacing stress from the penultimate syllable to the final syllable of the verb root, as in [pr'sebemu].⁸ For the speakers with this inno-

⁸ Educated speakers of Portuguese are well aware of the prevalence of this type of non-standard stress displacement among the Portuguese population. Like other kinds of innovations and non-standard variants this *wrong placement of stress* is very much stigmatized and is a feature that may contribute to social exclusion, as admitted in official documents from the national Ministry of Education, which contain recommendations on how to work in Portuguese classes to train students to be aware of the fact that this is a non-standard variant and how to avoid it (e.g. Costa et al. 2011, 18).

vative grammatical feature, stress has also become positionally fixed in the present tense, since for these speakers stress always falls on the last syllable of the verb root in present (subjunctive) inflected forms. The fact that currently this only happens in the present subjunctive, but not in the present indicative, may be due to the high frequency of use of the present indicative, since high frequency is a factor known to oppose regularization (Bybee/Hopper 2001). Notice, furthermore, that proparoxyton stress is very marked and infrequent and tends to be avoided in European Portuguese.⁹ Such a tendency for using this marked pattern must therefore have been created by a powerful force. In our perspective, this force is a new grammar of stress assignment in verbs in European Portuguese, whereby stress is assigned with reference to morphological information and stress location contributes to tense marking: stress on the final syllable of the verb root marks present tense (though not yet in indicative forms, due to their high frequency); stress on the syllable containing the theme vowel marks the past tense; and stress on the first syllable of the TMA morpheme marks the future.

Possibly in part related to the current nature of stress in European Portuguese is the fact that, in the absence of vowel quality cues (i.e. vowel reduction cueing stressless position), European Portuguese speakers show stress-deafness effects, like for instance French speakers, while when vowel quality cues stress location, they perceive word stress like, e.g., Spanish speakers (Correia et al. 2015).

A final note on the word-stress window: stress falls on one of the three final syllables of the word, but enclitics may originate prosodic words (PWs) with the stress on the fourth or fifth syllable counting from the right edge of the word, as in *dávamo-vo-la* ['davemuvule] 'give_{1PL.IMPF=2PL.DAT=3SG.F.ACC}'. There is evidence that pronominal enclitics incorporate into the verb's PW and are attached to the verb post-lexically, while word stress has the properties of a lexical process; thus, enclitics do not induce violations of the maximal stress window, if this constraint operates at the lexical level only (Vigário 2003; cf. also 4.2).¹⁰

⁹ In the FrePOP database (Frota et al. 2010), based on a corpus from various sources containing more than two million words, in the adult materials (speech and written), totaling 763,168 words, only 1.0% of the total number of tokens, and 1.4% of the total number of PW are stressed on the antepenult syllable. Similarly, very low rates of antepenult stress are also reported for smaller (speech) corpora in Viana et al. (1996) and Vigário/Frota/Martins (2010).

¹⁰ Veloso (2012) argues in favor of a different prosodization of clitics, crucially grounded on the lack of interaction between enclitics and word stress. As in other proposals for different Romance languages, Veloso claims that clitics do not attach to the prosodic word, but rather to a higher prosodic domain (in this case, the clitic group), thus falling outside the word stress window. This analysis does not, however, account for the existing evidence for enclitic incorporation into the preceding PW and seems to disregard the evidence in favor of word stress assignment being a lexical process and pronominal cliticization a post-lexical operation.

4 Prosodic phonology

An important part of Portuguese phonology refers to prosodic domains. Investigation on Portuguese prosodic phonology has mostly been conducted within the model of prosodic phonology developed by Nespor/Vogel (1986/2007) and others (cf. the reviews in Frota 2014 and Santos/Vigário 2016, and references therein). In this section, we survey the phonology and construction of each domain that is operative in the language, i.e. the syllable (σ), the foot (Σ), the prosodic word (PW), the prosodic word group (PWG), the phonological phrase (PhP) and the intonational phrase (IP).

4.1 The phonology of the syllable and the foot

In European Portuguese the syllable nucleus includes an obligatory vocalic position, which in unstressed syllables is not necessarily phonetically filled, as in *dedal* [d'daʎ] 'thimble' (alternating with [di'daʎ]). Post-vocalic glides are usually assumed to be under the syllable nucleus, together with the vowel (d'Andrade/Kihm 1988; Mateus/d'Andrade 2000). A major argument for this is the fact that in falling diphthongs nasality spreads to both the vowel and the glide, e.g. *pão* ['pẽw̃] 'bread'. We may add three further arguments in favor of glides being in the nucleus instead of the syllable coda: (i) glides in falling diphthongs do not trigger /r/ strengthening, unlike coda consonants and nasal segments, e.g. *Cairo* ['kajru]/*['kajru] (place name) (cf. 3.2); (ii) they block vowel reduction, like nuclearized nasals and velarized (partially nuclearized) laterals, and unlike full coda consonants (taps and fricatives) and glides in rising diphthongs (cf. 3.1);¹¹ (iii) glides can be followed by [R], suggesting that they do not occupy the same position as [r] (e.g. ['bajru] ← /bajrru/).

There is nevertheless room for some controversy (e.g. Barbosa 1965/1983; Collischonn/Wetzels 2016). For example, Collischonn/Wetzels (2016) argue in favor of glides being syllabified as codas because (i) palatal sonorants cannot be preceded by glides, which therefore behave like other coda segments, also not found before palatal sonorants; and (ii) glides seem to contribute to syllable weight for the purpose of stress location (i.e. syllables with falling diphthongs pattern like heavy syllables). However, these are not clear-cut arguments, at least in European Portuguese, because in this variety of Portuguese there is evidence against the complex nature of palatal sonorants: (i) as we have just seen, stressless vowels that precede glides and tautosyllabic (partially nuclearized) laterals escape vowel reduction; nevertheless, vowel reduction usually applies before oral palatals (e.g. *falhar* [fe'ʎar]/*[fa'ʎar] 'fail_{INF}');

¹¹ Some scholars have argued in favor of rhyme laterals being part of the nucleus instead of the coda (cf. Freitas 2016 for a review). However, the fact that /r/ strengthening is triggered by preceding laterals indicates that the lateral is not fully nuclearized (cf. 3.2.1).

oral palatal sonorants therefore pattern like singleton segments in this respect; (ii) the fact that there is no nasalization of the vowels that precede the palatal nasal (e.g. *apanha* [e'pɛɲɛ]/*[e'pẽɲɛ] 'catch') also shows that these segments do not trigger the typical phonology of coda nasals or of diphthongs in nasal context. Thus, the first argument above does not seem valid at least for European Portuguese.¹² The same can be said of the second argument, as stress assignment in Portuguese is not necessarily weight-sensitive, and hence stress distribution may be assumed not to be sensitive to syllable coda composition (cf. 3.3).

Consonants and glides may appear before and after the nucleus, within the syllable onset and rhyme, respectively. Syllable onsets may be empty (*ai* [e'i] 'there'), or filled with one or two consonants (*pato* ['pa.tu] 'duck', *prova* ['prɔ.vɐ] 'test'). Semivocalization may lead to prevocalic glides (*hiato* [i'a.tu]/['ja.tu] 'hiatus', *criança* [kri'ẽ.sɐ]/['krjẽ.sɐ] 'child'). The fact that prevocalic glides do not contribute to weight for the purpose of stress distribution and that nasality does not affect prevocalic glides, as the preceding example shows, indicates that they are not part of the nucleus (an assumption that is, however, challenged by some scholars, such as Freitas/Santos 2001, 40–46). This entails that onsets may have up to three segments. Rhymes usually contain one or two segments, but three-segment rhymes are also possible, as in *mais* 'more', *claustro* 'cloister'.

A small number of principles account for the distribution of segments within the syllable (Vigário/Falé 1994; Collischonn 1999; Mateus/d'Andrade 2000; Collischonn/Wetzels 2016). A major principle is the Sonority Sequencing Principle (SSP), according to which the sonority of segments in the syllable decreases from the nucleus to the syllabic edges. The SSP accounts for possible sequences such as [priʒ], [grẽw̃] or [dɛrʃ], as in *prisma* ['prizmɛ] 'prism', *líderes* ['lidɛrʃ] 'leader_{PL}' and *grãos* ['grẽw̃] 'grain_{PL}', as well as for the impossibility of sequences such as *[lpiʃr]. Relative sonority is defined in Collischonn/Wetzels (2016) as in (4).

(4) *Sonority scale*

obstruents < nasal consonants < liquids < glides < vowels

¹² Co-occurrence restrictions among segments within the syllable rhyme may also suggest that postvocalic glides occupy the same position as postvocalic liquids (i.e. the coda), since glides cannot be followed by [r] and [ʃ]. However, they can be followed by the palatal fricative, not only at the end of the word, but also word internally, as in *fausto* ['fawʃ.tu] 'luxury', *austero* [awʃ'tɛru] 'austere', *auscultar* [awʃ.kuʃ'tar] 'auscultate', *sexto* ['sejʃ.tu] 'sixth', *extra* ['ɛjʃ.tɾɐ] 'extra', while only very exceptionally are liquids followed by the fricative in word-internal codas (*solstício* 'solstice'), and in fact those exceptions should probably be analyzed not with a lateral in coda position followed by a tautosyllabic fricative, but with a lateral in the onset followed by an empty V slot and a coda fricative (i.e. *so.IVs.ti.cio*). This would suggest that glides and liquids occupy different syllabic positions: (i) postvocalic glides share the nucleus with vowels, (ii) liquids and fricatives occupy the word-internal coda position, and (iii) the prosodic word-final position may admit additional complexity (cf. below).

Combinations of consonants within a syllable cannot have the same degree of sonority or be adjacent in the sonority scale, as a minimal difference is required in the sonority scale (cf. Dissimilarity Condition in Vigário/Falé 1994; Mateus/d'Andrade 2000; or Minimum Sonority Distance in Collischonn/Wetzels 2016). Hence, sequences of obstruent plus liquid, as in *gra* are well-formed, while sequences of obstruent plus obstruent, obstruent plus nasal consonant and nasal consonant plus lateral or vibrant are ill-formed (e.g. *[fsa], *[tdi], *[fne], *[mla], *[nra]).

In some cases, however, orthography seems to indicate that such combinations might occur, as in *advogado* [ədvu'gadu] 'lawyer' (many examples can be found for instance in Mateus/d'Andrade 2000, 42). Nevertheless, in these cases, syllabification judgments become difficult and inconsistent, and syllable breaks are usually reported to be possible between the two relevant consonants. In order to account for the facts described, it has been proposed that in such words there is in fact a vocalic position intervening between the two consonants apparently violating the Dissimilarity Condition (Vigário/Falé 1994; Mateus/d'Andrade 2000). In the variety of European Portuguese, this vocalic position, or V-slot, may also be optionally filled by a schwa ([i]), in the same way as it may be filled by an epenthetic [i] in Brazilian Portuguese; in European Portuguese, however, the realization of the vowel is rather uncommon, while in Brazilian Portuguese vowel epenthesis in these contexts is systematic (cf. Section 6).¹³

Intrasyllabic constituents license particular features only. Collischonn/Wetzels (2016) adopt the following general constraints interacting in a language-specific way in order to account for syllable forms in Portuguese: *DEL(ETION) (MAX-IO) and *EP(ENTHESIS) (DEP-IO), respectively requiring that "input segments must have output correspondents" and "output segments must have input correspondents". These two constraints dominate ONSET and *CODA, respectively requiring that syllables "start with an onset" and "end in a vowel". Thus, for example, onsetless syllables (e.g. [.a]) are allowed to surface in the language because, although violating ONSET, other possible candidates are eliminated due to violation of a more highly ranked constraint, namely *EP or *DEL – the former excludes outputs with segments not in the input (e.g. [.ta]), and the latter penalizes outputs with less material than in the input (e.g. eliminating the syllable in the input altogether).

As we have seen in 3.2, some processes are motivated by syllable constraints. The fact that the coda position licenses only continuant segments may explain, for

¹³ Vigário/Falé (1994) point out that words like *segmento* 'segment' may be realized as either [seg.'mētu] or [segi'mētu], and the V-slot can even be reflected in non-conventional spellings, for instance by graduate students (at least in the North of Portugal), as in <seguemento>. In adult speakers, this sort of phonetic alternations and spelling errors do not tend to occur when legal consonant clusters are involved (e.g. [p'ɾovɐ] vs. *[pi'rɔvɐ] and <prova> vs. *<perova> 'test'). Evidence from language acquisition also supports a distinction between legal consonant clusters and other consonant combinations with intervening V-slots, and the same is true of oral and written productions by children in the first years of schooling (Freitas 2016 and references therein).

instance, the nuclearization phenomena described in 3.2 involving syllable-final nasals and laterals.

Fricatives in syllable-final position, often represented as /S/ or /s/, are considered in the literature to be lexically underspecified for voice and place of articulation (Mateus/d'Andrade 2000, 142). These features are specified post-lexically, since both the realization of word-final laterals and fricatives may be affected by the post-lexical context, as we will see below. We may notice, nevertheless, that nothing prevents final fricatives at the lexical level from being *partially* specified for place of articulation. Since all existing realizations of the fricative, namely [ʃ ʒ z] (and also possibly [s]), are [+coronal, -back], it may be assumed that these features are part of the underlying specification of /S/; this would explain why (partially underspecified) word-final fricatives may play a role in the definition of the place of articulation of the glides that derive from laterals and nasal segments (cf. 3.2).

Another process that may be motivated by constraints on the maximum number of segments in coda is /l/ semivocalization when the lateral is followed by a tautosyllabic fricative. Tautosyllabic /l/+S/ combinations can be formed in word-final position with the addition of inflectional /+S/ to morphological bases ending in lateral, as in *animais* (← /animal+S/) ‘animal_{PL}’ (cf. 3.2). /l/ semivocalization allows avoidance of an important source of branching codas in Portuguese.

Prosodic word margins seem to have a special status, with implications for syllable forms apparently allowed. For example, more consonant types are allowed in word-final position (Velooso 2007), namely [n], [ks], [ps], as in *hifen* ‘dash’, *silex* [‘sileks] ‘silex’, *biceps* [‘biseps] ‘biceps’. /rS/ is also typically found in word-final position, as in *repórteres* [r‘pörtɛrɐʃ] (or [rɪ‘pörtɛrɐʃ]) ‘correspondent_{PL}’ (word internally, the position of the tap in the syllable is variable, and in more informal speech, the tap is often deleted, cf. Collischonn/Wetzels 2016). Besides that, only in word-final position can a nasal diphthong be followed by a fricative, as in *Guimarães* [gime‘rẽʃ] (place name; cf. Velooso 2007).

Words phonologically starting with a partially underspecified fricative followed by a consonant admit two distinct resyllabification patterns when preceded by words ending in a fricative (5).

(5) as escolas [ɛʃʃ‘kɔlɐʃ]¹⁴/[ɛʃ‘kɔlɐʃ] ‘the_{F,PL} school_{F,PL}’

14 In Standard European Portuguese the V slot is typically not filled (neither by a schwa nor by [i]) in prosodic word-initial position, unlike in other dialects (d'Andrade/Rodrigues 1999; Freitas/Rodrigues 2003). Interestingly enough, in these cases it is unclear whether the fricative before #/S/+C may be (partially) voiced, as occurs when the same fricative is followed by a word that starts in a full vowel, e.g. as *alunas* [ɛzɛ‘lunɐʃ] ‘the_{F,PL} student_{F,PL}’ (Frota 2000). To our ears, only in the latter case does the fricative sound like a voiced segment. Further acoustic studies are needed in order to determine if the two fricatives indeed behave differently with respect to voicing.

These facts suggest two alternative syllabifications: one involving an empty V-slot at the left edge of the word (along the lines of d'Andrade/Rodrigues 1999), with a full syllable node projected, in which case the word-initial fricative is in coda and the preceding word-final fricative surfaces as [+anterior]; the other not involving a V-slot or an independent syllable, where the two identical adjacent fricatives (one word-final and the other word-initial) degeminate obligatorily.¹⁵

Additional segmental complexity at the left edge of the PW is also found in loan words (716 Loanword phonology in Romance) starting with a fricative (in this case specified for place of articulation as [+anterior]), as in *stress* ['stres] 'stress', *sprint* ['sprĩt] 'sprint'. In these cases, no vowel (including schwa) can be inserted between the fricative and the following C, indicating that in these cases there is no intervening V slot (d'Andrade/Rodrigues 1999).

In Mateus/d'Andrade (2000, 63) post-vocalic consonants are left unattached to a syllable node at the lexical level and are associated with a syllabic position only post-lexically. While this proposal elegantly accounts for resyllabification facts (cf. below), it may be problematic for the analysis of some lexical processes, such as vowel reduction, since vowels in syllables closed by laterals do not undergo vowel reduction, and in word-final position they undergo an opening process, as in *álcool* ['ałkwɔł] (or ['ałkɔł]) 'alcohol' vs. *alcoholizado* [ałkwuli'zadu] (or [ałkuli'zadu]) 'inebriated' (cf. 3.1). It may also be problematic for weight-based accounts of word-stress distribution, which rely on the presence/absence of final consonants for the computation of syllable weight relevant for stress location (cf. 3.3).

It is well-known that European Portuguese schwas, and to a lesser extent [u] in unstressed position, often delete in running speech, and more so in fast speech, resulting in multiconsonantal sequences (e.g. Mateus/d'Andrade 2000). Thus, sequences of six or even more consonants can be found, as in *desprevenidos* [dʃprv'nidʃ] 'unaware_{M.PL}', *restremecerás* [ʀʃtrms'raʃ] 'tremble again_{2SG.FUT}'. This sort of data seems to indicate that in European Portuguese constraints on core syllabification might be loosened post-lexically (cf. also Collischonn/Wetzels 2016, 96–97).

As in other Romance languages, in European Portuguese resyllabification applies in a phrasal domain (cf. 4.3.2), when the following word starts with an onsetless syllable, a glide, or an empty V-slot (superficially, a palatal fricative+C, cf. above). All coda consonants usually undergo resyllabification in the appropriate context (6a), with fricatives, which are partially underspecified for place of articulation, being specified by default as [+anterior] in the standard variety of European Portuguese. Resyllabified laterals surface with no noticeable secondary velarization. Resyllabification may also involve consonants that are already part of the onset in core syllabification, when

¹⁵ We refer to d'Andrade/Rodrigues (1999) for a more comprehensive description, based on a corpus of speech collected in Lisbon and Braga, and an analysis, within an OT model, of different types of words that may start with a palatal fricative+C cluster.

the first word ends in an underlying vowel that undergoes deletion, semivocalization, or vowel merger, and the following word starts with an underlying vowel or glide (6b), but, according to our intuition, not if it starts with a(ny) consonant (cf. also 4.3).

(6) a.	mar ameno	[ˈma.rɐˈmɛ.nu]	‘peaceful sea’
	mél agradável	[ˈmɛ.lɐ.grɐˈda.vɐʃ]	‘fine honey’
	giras imagens	[ˈzi.rɛ.ziˈma.ʒɛ̃ʃ]	‘nice images’
	pós iodizados	[ˈpɔ.zju.diˈza.duʃ]	‘iodized powders’
b.	ponte usada	[ˈpõ.tuˈza.dɐ]	‘used bridge’
	amigo imaginário	[ɐˈmi.gi.mɛ.ziˈna.rju]/ [ɐˈmi.gwi.mɛ.ziˈna.rju]	‘imaginary friend’
	garota educada	[gɐˈro.te.duˈka.dɐ]/ [gɐˈro.ti.duˈka.dɐ]	‘polite girl’
	vela amarela	[ˈvɛ.la.mɐˈrɛ.lɐ]	‘yellow candle’

Let us now turn to the foot domain. Contrasting with the other prosodic domains reviewed in this section, the status of the foot in European Portuguese is not very clear, since there is no evidence for rhythmic alternating stresses in pretonic position, or other known phenomena referring to a foot that is not the head of the PW (although there is some disagreement on this in the literature; cf. Magalhães 2016; 4.3.3). In addition, as word stress has been claimed to be assigned with reference to morphological structure, rather than phonological information (cf. Section 3), it is unclear how PW prominence is connected to the foot domain (Vigário 2003). Nevertheless, the phenomena we have reviewed in 3.1.5, referring to marked foot formats, constitute evidence that PWs in European Portuguese are indeed headed by a foot.

4.2 The phonology of prosodic words, clitics, and prosodic word groups

It is well established for many languages that the notion of “word” varies according to the components of grammar. While arguably most frequently syntactic words, morphological words, prosodic words, and PWGs are isomorphic (e.g. *chuva* ‘rain’, *agradável* ‘pleasant’), in European Portuguese there are many instances of mismatches between the different sorts of words. Thus, for instance, (i) a single syntactic word may include more than one (minimal) morphological word and more than one prosodic word, forming a single PWG (e.g. *lava-louças* [ˈlavɐˈloʃɐʃ] ‘sink’), (ii) one morphosyntactic word may not correspond to an autonomous prosodic word, i.e. it is a clitic form (e.g. *a* [ɐ] ‘the_F’, *que* [ki] ‘that’), and (iii) one syntactic word containing a single morphological word may form more than one prosodic word and a single PWG

(e.g. *monogâmico* [ˈmɔnɔˈgɐmiku] ‘monogamous’; *agradavelmente* [ɐgrɐˈdaveɫˈmɛt] ‘pleasantly’; *pré-acentual* [ˈprɛsɛtuˈaɫ] ‘pretonic’).¹⁶

In European Portuguese there is rich phonology associated with the prosodic word domain, as well as clear evidence for the identification of clitics and the way they are prosodically organized with their hosts (Vigário 2003; 2010). We survey below the phonology related to the word-level units.

4.2.1 Prosodic words and clitics

As in other languages with word-level stress, there is a one-to-one correspondence between word stress and the prosodic word (PW). Thus, presence or absence of main stress and the application of rules related to the presence or absence of stress are indicative of the phonological status of words. For example, vowel reduction, semivocalization and vowel deletion may only target stressless positions. Thus, a PW must have at least one vowel that does not undergo these rules, as in, for example, the first word of the sequences *pó azul* [ˈpɔɛˈzuɫ] (*[puɛˈzuɫ], *[pweˈzuɫ]) ‘blue dust’ and *nu artístico* [ˈnuɛrˈtʃtiku] (*[nwerˈtʃtiku]) ‘artistic nude’. By contrast, words composed only of vowels to which one of the aforementioned processes may apply do not form independent PWs, i.e. they are clitics (CLs). This is the case for very frequent monosyllabic and disyllabic function words, such as *de* [dɨ] ‘of’, *que* [ki] ‘that’, *se* [si] ‘if’, *a* [ɐ] ‘the_F’, *mas* [mɐʃ] ‘but’, *para* [pɐrɐ] ‘to’, *o* [u] ‘the_M’, *do* [du] ‘of-the_M’, *no* [nu] ‘in-the_M’, and all weak personal pronouns. Besides the presence of vowels that only appear in unstressed position, like schwa and [ɐ] (not followed by a nasal or a palatal segment), deletion and semivocalization also indicate absence of word-level stress, and hence CL status, as in *de aves* [ˈdjavʃ]/[ˈdavʃ] ‘from birds’, *no artista* [ˈnuɛrˈtʃtɨ]/[ˈnwerˈtʃtɨ] ‘in.the artist’ (cf. Vigário 2003, 157–203, for the full list of clearly identifiable CL in European Portuguese and further evidence for their prosodic status).

A number of phonological processes apply with reference to the prosodic word domain, in particular, its edges. We review these in the following paragraphs.

Unstressed non-back non-close vowels (/e ɛ/) and in verbs also /i/ are regularly deleted in PW-final position. The rule is blocked when the target vowel is followed by a word starting with a vowel that bears PWG prominence (cf. 4.2.2); and it is also optionally blocked in certain tonal configurations in Intonational Phrase-final position (cf. 4.3.2). In other contexts, deletion applies categorically, operating whether the vowel is in absolute final position or followed by another word; if followed by a word starting with a vowel, resyllabification subsequently operates, as illustrated in (7a). The application of non-back vowel deletion in PW-final position is revealing of how clitics are prosodized. With pronominal enclitics (i.e. post-verbal weak pronouns), the rule does not apply when the non-back vowel is verb-final, as in (7b), but it applies categorically

¹⁶ Token counts indicate that around 30% of the words used in European Portuguese are phonological clitics (Vigário/Frota/Martins 2010), and 0.3% correspond to compounds (Vigário/Garcia 2012).

when the vowel belongs to the enclitic, as in (7c). This indicates that enclitics incorporate into the verb's PW and become PW-final. By contrast, with proclitics the structural description of the rule is not met, and thus the rule does not apply. Instead, the underlying non-back vowel in proclitic-final position may surface with various degrees of reduction, as in (7d); according to Vigário (2003, 273–324), this and several other types of reduction are characteristic of clitics and other highly frequent words.

- (7) a. colhe azeitonas [ˈkɔʎezɐjˈtonɐʃ] ‘collect_{3SG} olive_{PL}’
 come ovos [ˈkɔˈmɔvuʃ] ‘eat_{3SG} egg_{PL}’
 b. come-os [ˈkɔmjɔʃ] ‘eat_{3SG=M.PL.ACC}’
 c. dou-te anéis [ˈdoteˈneʃ] ‘give_{1SG=2SG-DAT} ring_{PL}’
 d. se te achamos [stʃeˈʃɐmuʃ]/
 [stʃeˈʃɐmuʃ]/
 [stɛˈʃɐmuʃ] if_{2SG.ACC}=find_{1PL}
 ‘if we find you’

The obligatory realization of verb final /e/ as a glide, exemplified in (7b), indicates in addition that enclitics are incorporated into the preceding PW, a point previously unnoticed, to the best of our knowledge. Indeed, while in other contexts the formation of rising diphthongs tends to be optional, non-back vowels and round vowels obligatorily semivocalize when followed by a vowel in post-tonic position, as in *águia* [ˈagjɐ] ‘eagle’, *estátua* [ʃˈtatwɐ] ‘statue’ (d’Andrade/Viana 1994; Mateus/d’Andrade 2000); and thus the fact that semivocalization of the first vowel of the VV sequence (V1 gliding) is also obligatory when the post-tonic vowel belongs to an enclitic further supports the prosodic incorporation of the enclitic into the preceding PW.¹⁷

Stressless /u/ or /a/ in PW-final position may delete as well when followed by a word starting with a vowel, as in (8).¹⁸ In this case, the rules are optional. Note also that the presence of word stress in the second vowel of the VV sequence (V2), or particular stress clash patterns, often block these processes of hiatus resolution (Frota 2000; Mateus/d’Andrade 2000; Vigário 2010; cf. 4.2.2, 4.3).

- (8) a. colho azeitonas [ˈkoʎezɐjˈtonɐʃ] ‘collect_{1SG} olive_{PL}’
 b. compra hotéis [ˈkɔproˈtejʃ]/[ˈkɔproˈtejʃ] ‘buy_{3SG} hotel_{PL}’

Example (8b) illustrates, in addition, the particular way vowel reduction applies to stressless vowels in PW-initial position. As briefly mentioned when discussing /ow/ monophthongization in 3.1, full VR does not occur PW-initially. Instead, non-close

¹⁷ Wetzels (2006/2007) also suggests that obligatory V1 gliding in post-tonic position is a post-lexical process, since these surfacing glides pattern like full vowels (i.e., contributing to the proparoxyton pattern) for the purpose of Dactylic Lowering, a lexical process (cf. 3.1).

¹⁸ If the two vowels in hiatus are central, only vowel merger may apply (cf. 4.3.2).

round vowels may surface as close-mid or open-mid ([o'tejj]/[ɔ'tejj]), but not as close (*[u'tejj]), and non-back vowels do not reduce to schwa, as they do in PW-internal position (e.g. [e'vitu]/[i'vitu]/*[i'vitu] 'avoid_{1SG}'; cf. Vigário 2003, 92–99, for further details).

Several other processes apply with reference to prosodic word edges, including the assignment of PW-initial secondary stress¹⁹ and PW-initial emphatic stress, as well as the opening of non-close vowels in PW-final syllables closed by non-inflectional consonants (cf. 3.1). Thus, for instance, the latter rule applies to the second vowel of *inter* in *inter-continental* [ʔitɛrkõtĩnẽ'taʔ] 'intercontinental' because, although *inter* is not a morphological word, it is a PW and therefore the structural description of the rule is met, whereas the rule does not apply in similar contexts in PW-internal position (e.g. *interpretar* [itĩr'pɛtɔr]/[itĩr'pɛtɔr]/*[itĩr'pɛtɔr] 'interpret_{1SG}'; cf. Vigário 2003).

Phonotactic restrictions also single out prosodic word edges. The left edge is the domain of *r*-strengthening and incomplete vowel reduction, and thus, [r] and [i] do not occur in this position; [ɲ] and [ʎ] are also not found in this position in the native lexicon (cf. 2.2). In contrast, PW edges allow for more consonantal material than the edges of word-internal syllables (cf. 4.1).

Unlike in many languages, it has been claimed that PWs in Portuguese are not subject to a minimal size constraint, since PWs formed of a single open syllable are not uncommon (e.g. *é* 'be_{3SG}', *li* 'read_{1SG}', *cá* 'here'), and their production is adult-like since the first stages of language acquisition (Bisol 2000; Vigário 2003; Vigário/Freitas/Frota 2006). The issue is controversial, however. For instance, based on evidence coming from speakers' preferences in the pronunciation of abbreviations, Veloso (2017) sustains that the *minimal condition* is a functional constraint in European Portuguese which restricts the formation of PW minimally to three segments.

Finally, two particular processes of constituent deletion target the prosodic word. Clipping or truncation consists of the deletion of a PW when a morpho-syntactic word contains more than one PW, as in *hipermercado* [ʔipɛrmĩr'kadu] → *híper* [ʔipɛr] 'hypermarket', and *BMW* [be'ɛm'dɛblju] → *BM* [be'ɛm] 'BMW'; but *diapositivo* [diɛpuzi'tivu] → **diapo* [di'apu], **dia* [diɛ] 'slide', since here the word is formed of a single PW and hence it is not possible to truncate part of the word. Deletion under identity also depends on the presence of more than two PW, in this case in each of the members of a coordinate structure, as in *pré-verbal ou pós-verbal* [pɛvĩr'balo'pɔʒvĩr'baʔ] → *pré ou pós-verbal* [pɛɔ'pɔʒvĩr'baʔ] 'pre- or post-verbal'; but *desfazer e refazer* [dĩfɛ'zɛrĩfɛ'zɛr] → **des e refazer* [dizĩfɛ'zɛr] 'undo and redo_{INF}'. Both processes consist of the deletion of a PW, and the preservation of at least one PW, under specific conditions (Vigário/Frota 2002; Vigário 2003, 250–255).

Phonological evidence indicates that a prosodic word is formed of (i) an affix bearing word-level stress; and (ii) a root plus any following affixes that do not form

19 Cf. 4.3.3 for further details on secondary stress in European Portuguese.

independent stress domains (cf. 9a). Unstressed prefixes are Chomsky-adjoined to the prosodic word that contains the morphological base they attach to, yielding a recursive PW, since the phonology of the left-edge of PW applies both to the left edge of the morphological base and to the prefix itself – for example, in (9b) both the prefix and the initial syllable of the morphological base may bear emphatic stress, emphatic stress being assigned to the left edge of the PW; and the vowel that starts the morphological base (*organizado*) does not undergo full vowel reduction and shows variable heights (it is realized as [o] or [ɔ], but not [u]), a typical behavior of PW initial stressless vowels, as we have seen above. With the exception of weak post-verbal pronouns, which, as we have seen, incorporate into the host prosodic word (cf. the example 9c), all other clitics are proclitic and Chomsky-adjoin to the host prosodic word, as illustrated in (9d). Thus, similar to prefix+base formations, in proclitic+host combinations post-lexical phonology that characterizes PW-initial position applies both to the proclitic and the host PW to which the proclitic adjoins. For example, in (9d) emphatic stress and incomplete vowel reduction and variable realization of PW initial stressless vowels may be found in both *ou* or *ofereço*. (On the prosodic organization of words, clitics and affixes in European Portuguese cf. Vigário 2003).

- (9) a. (pós)_{PW}-(modernismo)_{PW} ‘postmodernism’
 b. (des (organizado)_{PW})_{PW} ‘disorganize_{PTCP}’
 c. (deve-o)_{PW} ‘owe_{3.SG=3SG.ACC}’
 d. (ou (ofereço)_{PW})_{PW} ‘or offer_{1SG}’

4.2.2 Prosodic word groups

Groups of prosodic words that show particular lexical or syntactic cohesion display specific phonology, indicating an independent level of prosodic organization. This domain has been called the “prosodic word group” (PWG; Vigário 2010; Vigário/Fernandes-Svartman 2010; Frota 2014; cf. also Santos/Vigário 2016 for a review).²⁰ PWGs essentially correspond to lexical syntactic heads. Since compounds and other syntactic words containing more than one prosodic word are not so frequent in European Portuguese (cf. fn. 16), most often a PWG is formed of a single prosodic word.

Like the other prosodic domains above PW, PWG prominence is final. Thus, in a branching PWG the last PW is the head, and a subtle difference can be noticed between the prominence pattern of two PWs that are internal to a branching PWG (as in *foi um sucesso* ((*hiper-*)_{PW}(*monstruoso*)_{PW})_{PWG} ‘(it) was a super-great success’) and

²⁰ The PWG is claimed to differ from the clitic group or the composite group (Nespor/Vogel 1986/2007; Vogel 2009) because it is relevant for the prosodization of compound-like constructs in many languages, but not (necessarily) the prosodization of clitics; e.g. in European Portuguese phonological evidence indicates that clitics attach at the level of PW.

that of two PWs each forming an independent PWG (as in *viu um ((híper)_{PW})_{PWG} ((monstruoso)_{PW})_{PWG}* ‘(he) saw a huge hypermarket’).

As mentioned in 4.2.1, within a PWG, PW-final unstressed vowels (V1) systematically fail to delete when the following word starts in a vowel (V2) that bears PWG prominence. This is illustrated in (10a), where abbreviations form a single PWG and V2 is assigned PWG, but not phonological phrase prominence (adapted from Vigário 2010 and Santos/Vigário 2016). The example in (10b) shows that deletion of the underlying non-back vowel in PW-final position spans the PWG, i.e. the rule regularly deletes the unstressed vowel in PW-final position within the PWG, being blocked only when V2 bears PWG prominence (*eme*). The examples in (10c–d), in turn, show that with underlying back vowels, when V2 bears PWG prominence, the deletion of the vowel is blocked, just like underlying non-back vowels in similar context, while when V2 does not bear PWG stress, V1 deletion is optional.²¹

- (10) a. SN (*esse-ene*) objeto [ɛ'sjɛn]/*[ɛ'sɛn]
 ‘object NP (noun phrase)’
 b. RFM (*erre-efe-eme*) [ɛ're'fjɛm]/*[ɛ'rjɛ'fjɛm]
 (name of radio station)
 c. JS (*jota-esse*) forte [ʒɔtɛ'es]/*[ʒɔt'es]
 ‘strong JS’ (a youth party)
 d. JSD (*jota-esse-dê*) [ʒɔtɛ'es'dɛ]/[ʒɔ'tɛs'dɛ]
 ‘JSD’ (a youth party)

The same type of evidence indicates that the PWG is constrained by a maximality condition, imposing PWGs to include at most three PWs (Vigário 2010).

4.3 The phonology of phrasal domains

The phonological phrase and the intonational phrase are the domains of phonological and phonetic phenomena of various kinds. In this section we review some of the major aspects of phrasal phonology and phonetics in European Portuguese.

²¹ One of the editors of this book questions the existence of the internal adjacent word-level stresses. Nevertheless, a wide range of phonological evidence does show that several adjacent PW-level stresses may exist inside the PWG. For example, vowel reduction always fails to apply to the vowels in the syllables that bear stress inside abbreviations. Similarly, semivocalization of a high vowel followed by another vowel never applies to the vowels bearing PW stress, even if they immediately precede a syllable that bears PW and PWG prominence, as in *UL* [u'ɛɫ]/*[wɛɫ] ‘UL (University of Lisbon)’. Notice that semivocalization that creates rising diphthongs is a purely prosodic process that applies optionally, without exception, within and across words inside the intonational phrase, as in *Manuel* [mɛ'nwɛɫ] (or [mɛnu'ɛɫ]) (proper name) (cf. also 4.2.1 and 4.3.2).

4.3.1 Phonological phrases

Compared with the intonational phrase (IP), the phonological phrase (PhP) is weakly cued by phonological phenomena in European Portuguese, but it still plays an important role in the language (Frota 2000; 2014).

PhP-level prominence is often, but not always, perceptible. In neutral sentences, it falls on the rightmost PWG. Experimental work has shown that PhP-level prominence plays a critical role in processes related to stress clash avoidance (Frota 2000; 2014). For instance, a stress clash within, but not across PhP, yields the lengthening of the first stressed syllable in the clashing sequence, as illustrated in (11); in (11–12), capitalization indicates the syllable bearing PW stress.

- (11) a. (O caFÊ: LUso)_{PhP} contém cevada de boa qualidade. ‘The Lusitanian coffee contains barley of good-quality.’
 b. (O caFÊ)_{PhP} (LUta)_{PhP} pelo prêmio do produto mais qualificado.
 ‘The coffee disputes the award for the best product.’

In addition, hiatus resolution processes involving V1 deletion are blocked if deletion would originate a stress clash at the level of PhP (as in 12a, but not in 12b, where *sempre* ‘always’ is the head of the second PhP).

- (12) a. (O dançaRIno)_{PhP} (Ama)_{PhP} a bailarina russa. *dançarín[e]ma
 ‘The dancer loves the Russian chorus girl.’
 b. (O bailaRIno)_{PhP} (ANda sempre)_{PhP} de limusine preta. ^{ok}bailarin[ẽ]da
 ‘The dancer always drives a black limousine.’

PhP also plays a crucial role in pitch accent distribution. Although internal PhP most often lack pitch accent, when there is one or more pitch accents in a PhP, the head of PhP must bear one (Frota 2000; 2014; Frota/Vigário 2000).

Another area where the phonological phrase plays a part is in word order preferences. It has been found, for instance, that speakers’ preference for the relative ordering of Direct and Indirect Objects is sensitive to PhP weight (cf. the details in Frota/Vigário 2002, and Santos/Vigário 2016 for a brief review).

Phonological evidence shows that PhP in European Portuguese is formed by a lexical head (Lex) plus all preceding material, within the domain of the maximal projection of Lex (Frota 2000; 2014).²² Modifiers and complements of Lex consisting

²² Lexical heads belong to the open classes, i.e. nouns, verbs, adjectives, and adverbs (Nespor/Vogel 1986/2007; Frota 2000). Like in other languages, prepositions do not pattern with lexical heads for the purpose of PhP construction in Portuguese. Although occasional phenomena of lexicalization may cause the introduction of a new preposition into the language vocabulary, this is by no means a typical property of this class.

of a single lexical head and appearing on the recursive side of Lex (i.e. to its right), are grouped in the same PhP as Lex; adverbs and adjectives on the non-recursive side of Lex, within its maximal projection, are included in the same PhP as Lex. (13) illustrates PhP formation in European Portuguese.

- (13) ((Os jovens ativistas)_{PhP} (plantaram árvores)_{PhP} (por todo o país)_{PhP})_{IP}
 the young activists plant_{PRET.3PL} trees over all the country
 ‘The young activists planted trees all over the country.’

4.3.2 Intonational phrases and compound prosodic domains

The intonational phrase (IP) is richly cued in European Portuguese (Frota 2000; 2014; Frota/Moraes 2016). For instance, the IP is the domain of the tune, minimally composed of a pitch accent and a boundary tone. In broad focus sentences, IP prominence falls on its rightmost PhP; the head of the IP always bears a pitch accent, and a boundary tone is associated with the syllable placed at the right IP boundary. Final lengthening and (acoustic or simply perceived) pause also usually mark the right edge of the IP.

The IP is the domain of sandhi and resyllabification processes as well (on resyllabification cf. 4.1). The examples in (14), taken from Frota (2000), illustrate sandhi and resyllabification involving word-final fricatives. In (14a), the whole sentence is a single IP, and whenever the fricative is followed by a word starting with a vowel, the fricative surfaces as [z] in syllable onset. In (14b), the same sentence is broken in two IPs, and the internal IP break blocks resyllabification of its final fricative, which then surfaces as [ʃ].

- (14) a. (As antigas alunas ofereceram livros aos amigos)_{IP}
 [z] [z] [z] [z] [z] [ʃ]
 b. (As antigas alunas)_{IP} (ofereceram livros aos amigos)_{IP}
 [z] [z] [ʃ] [z] [z] [ʃ]
 the_{F.PL} old student_{F.PL} offer_{3PL.PRET} book_{PL} to-the_{M.PL} friend_{PL}
 ‘The old students offered books to their friends.’

IP-bound sandhi phenomena include several optional domain-limit processes, i.e. they optionally apply at the edge of the PW within the IP domain, as experimentally demonstrated by Frota (2000). These include, (i) central vowel deletion (a process whereby /a/ deletes when followed by another vowel, different from /a/), as in *garota educada* [gɐ'ro.te.du'ka.dɐ] or [gɐ'ro.ti.du'ka.dɐ] ‘polite girl’ (previously given in (6b)), (ii) round vowel deletion (a process whereby a round vowel deletes when followed by another vowel), as in *amigo imaginário* [ɐ'mi.gi.mɛ.ʒi'na.rju] ‘imaginary friend’ (also shown in (6b)), and (iii) syllable degemination (a process whereby the first of

two similar, though not necessarily identical syllables deletes), as in *campo poluído* [kẽpupu'ídu] → [kẽpulu'ídu] ‘polluted field’.

Other processes are domain-span phenomena, that is, they apply both word-internally and across words, within the IP domain (Frota 2000). IP domain-span processes include (i) fricative voicing, which tends to be obligatory (cf. (14) above, and Figure 26.1 in 4.3.3), (ii) semivocalization of unstressed non-open non-central vowels (an optional process whereby the first of two consecutive vowels semivocalizes), and (iii) central vowel merger (the latter two are exemplified in (6b) above).

In the case of central vowel merger, two central vowels are involved, V1 being oral and V2 being oral or nasal, and stressless, and the result is a single open vowel ([a] or [ã]). Notice that if V2 is nasal, the result of vowel merger will be an open nasal vowel, as in *compra anchovas* [kõprẽ'fove] → [kõprã'fove] ‘buy_{3sc} anchovy_{pl}’. This is the only context where a central nasal vowel emerges as open in Standard European Portuguese. Like fricative voicing and resyllabification, vowel merger always tends to apply (cf. Frota 1997; 2000; Mateus/d'Andrade 2000; Vigário 2003; 2010; and 4.2, 4.3.1 for further details on sandhi phenomena).

We have seen that the deletion of word-final underlying non-back vowels /e/ or /ɛ/ (and /i/ in verbs) is a PW-domain limit rule which is bound by the PWG domain and is conditioned by V2 prominence (section 4.2). In addition to PWG prominence, the IP imposes further restrictions on the deletion of these vowels. In fact, in words that are paroxytons in lexical phonology, such as *nove* [nõv] (/ nõve/) ‘nine’, deletion of the final vowel is often blocked so that the vowel, surfacing as a schwa ([i]), participates in the realization of a complex melody, usually involving a final rise or high tonal target. Blocking of deletion optionally happens, for example, when the vowel is at the right edge of a non-final IP bearing H% (signaling continuation), or at the right edge of the utterance in yes-no questions or calls (Frota 2002; 2014).

In the same intonational contexts, when the last word of the IP or utterance is stressed on the last syllable ending in a sonorant consonant, schwa insertion optionally applies. In fact, blocking of non-back vowel deletion and schwa insertion, as well as vowel lengthening and vowel splitting are strategies available in European Portuguese for ensuring the segmental space necessary for the realization of complex tonal material (cf. Frota 2002; 2014; Frota et al. 2016; Frota/Moraes 2016; Vigário/Cruz/Frota 2019).

Although the right edge of the IP is clearly more signaled than the left edge, there are a few known cues to the IP-left boundary as well. For example, clitics clearly tend to appear less reduced in IP-initial position than they do IP-internally (Frota 2000, 251–253; Vigário 2003, 283–298).

Yet another area where the IP plays a role in European Portuguese grammar is with respect to speakers’ word order preferences (cf. Frota/Vigário 2002 for details; and Santos/Vigário 2016 for a short review).

As in other Romance languages (Nespor/Vogel 1986/2007), in European Portuguese syntactic constituents that are not attached to a root sentence form their own

IP; these include parenthetical expressions, topics, vocatives, explicative relative clauses, tags; any remaining sequence of adjacent PhPs in a root sentence also forms an IP (Frota 2000; 2014).

Besides the syntactic conditions on IP formation, phonological information plays a role in the construction of IP as well and may in fact be the sole motivation for IP formation. For example, as in other languages fast and slow speech rates promote larger and shorter IPs, respectively; long IPs tend to be broken into shorter IPs; there is a preference for utterances with balanced IPs or for the final one to be longer (Frota 2000; 2014). Long syntactic subjects (i.e. with more than eight syllables), unlike long objects, also tend to form their own IP (Elordieta/Frota/Vigário 2005).

Phonologically motivated IP phrasing is heavily constrained by syntactic information. For instance, the relation between heads and complements or modifiers tends not to be broken. Besides that, syntactically motivated IP boundaries cannot be undone or demoted. If syntax-phonology mapping rules create for instance two short IPs followed by a long IP, rather than being reorganized to forming a single longer IP, the two short IPs (IP^{\min}) are grouped into a compound IP domain (IP^{\max}). In such cases, both the internal IP and compound IP function like IP domains for the application of phonological rules, including external sandhi rules, which apply across the two IP^{\min} within the IP^{\max} . In addition, the right edge of the internal IP^{\min} is still phonologically signaled with the obligatory nuclear pitch accent, final lengthening and, very often, a H% boundary tone. However, the boundary cues are acoustically less marked, i.e. there is less final lengthening, H% is realized with a lower F0 and no acoustic pause tends to occur (Frota 2000; 2012; 2014; Elordieta/Frota/Vigário 2005).

4.3.3 Intonation and rhythm

It is well established that the domain for tonal contrasts in the languages of the world vary. As in other Romance languages, tonal contrasts in European Portuguese are phrasal, and they may be the only grammatical information distinguishing sentence type and broad and narrow focus (Frota 2000; 2014).

The minimal tune in neutral declarative sentences is formed by a nuclear falling pitch accent and a low boundary tone, i.e. H+L* L% (Frota 2000; 2014). IP-branching neutral declaratives tend to show a tonal event at the left edge of the IP, most typically a phrasal H, which aligns with the right edge of the first PW or its prominent syllable. This tonal event has also been interpreted as a H* pitch accent that may show late alignment (and in that case it is transcribed as <H*; cf. Frota 2003). Also frequent is the association of a L*+H pitch accent to the head of the first PhP of the IP. An example of a typical declarative contour is given in Figure 26.1.

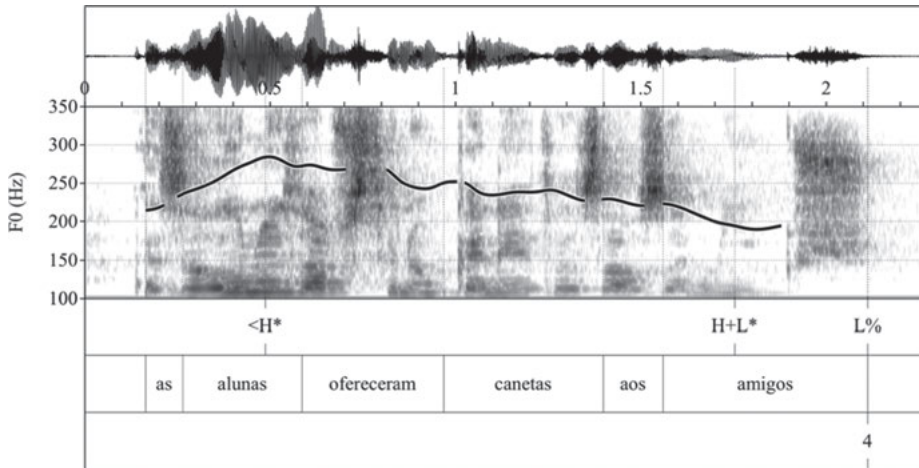


Figure 26.1: F0 contour of the utterance *As alunas ofereceram canetas aos amigos* ‘The students_f offered pens to their friends’, produced as a single IP by a Standard European Portuguese speaker (part of the Interactive Atlas of Portuguese Prosody database, Frota/Cruz 2012–2015).

The sparse distribution of pitch accents in Standard European Portuguese is a salient property of the language, contrasting with other dialects and varieties of Portuguese and other Romance languages (Frota 2000; 2014; Frota/Vigário 2000; Frota/Prieto 2015; Frota/Moraes 2016). It has been proposed that European Portuguese pitch accent paucity follows from the fact that obligatory pitch accent assignment in this variety of Portuguese operates at a higher level of the prosodic hierarchy than in other Romance languages, i.e. at the IP level (Frota 2014).

Specific tunes mark different sentence types; cf. the selection in (15) below, taken from Frota (2014).

- (15) Selected sentence type tunes
- | | |
|---|--------------|
| Neutral declaratives and <i>wh</i> -questions | (H) H+L* L% |
| Neutral yes-no questions | (H) H+L* LH% |
| Requests (multiword) | H* L* L% |
| Requests (one word) | %H L* L% |
| Vocative chants (greeting) | (L+)H* !H% |
| Vocative chants (insisting call) | (L+)H* L% |

Prosodic narrow or contrastive focus marking may vary as a function of focus location in the utterance (late vs. early focus) and sentence type (cf. Frota 2014 for details). In declaratives, the focused constituent is assigned a specific pitch accent, H*+L, be it late or early in the sentence. Early focus is always followed by a very reduced pitch range, and a downstepped reduced H+L* tune may still be detected, associated with the head of the last PhP, followed by the declarative boundary tone (L%).

There is controversy with respect to secondary stress in European Portuguese. Experimental work has shown that secondary stresses are typically found in PW-initial position, most often on the first or second syllable of the word (Frota/Vigário 2000; Vigário 2003; Castelo 2006). According to Castelo (2006), furthermore, (i) the relevant units for secondary stress assignment are segmental sequences containing one full vowel, not abstract syllables with non-surfacing vowels, (ii) vowel quality and eurythmic principles also play a role in perceived secondary prominence, (iii) IP-initial position moderately promotes PW-initial secondary stresses, and (iv) a few particular suffix combinations optionally induce a secondary stress on the second syllable preceding main word stress, irrespective of word size considerations. Nevertheless, some phonologists have also proposed that European Portuguese secondary stress assignment is more similar to that reported for other Romance languages, including a binary rhythmic wave (e.g. Mateus/d'Andrade 2000 and references therein).

The specific phonology of the language is correlated with particular rhythmic properties (78 Comparing and deconstructing speech rhythm across Romance languages). Studies looking at the proportion and variability of consonantal and vocalic intervals, along the lines of Ramus/Nespor/Mehler (1999), have shown that European Portuguese has a mixed rhythm (Frota/Vigário 2001). It patterns with other Romance languages regarding the proportion of vocalic intervals ($V\%$), i.e. as a syllable-timed language, and behaves like languages such as English and Dutch with regard to the variability of consonantal intervals (ΔC), i.e. a stress-timed language.

5 Phonological variation across European Portuguese dialects

Phonological variation in European Portuguese has been traditionally considered from the point of view of segmentals, with some occasional, often impressionistic notes on suprasegmentals (Cintra 1971; Segura 2013b). More recently, prosodic variation in European Portuguese has been subject to systematic investigation (cf. in particular the material in Frota/Cruz 2012–2015 and the survey in Frota et al. 2015). Here, we will report only a few of the most striking differences of other dialects in comparison with the standard variety.

The underlying segmental system is very similar across dialects on the mainland, the most noticeable, widespread exception being the absence of the contrast between /b/ and /v/ in the northern varieties, where [β] is usually found (Cintra 1971; Rodrigues 2003; Segura 2013b). The vowel system in areas of the south (Barlavento) and Beira Baixa and Alto Alentejo (in the center of the country), as well as in some parts of the Azores (in particular, São Miguel) includes round front vowels (Segura 2013b; Krämer 2017 and references therein).

Some of the rules described in 3.1 do not operate in northern dialects, namely, raising by one degree of vowels preceding underlying nasals, /ow/ monophthongization, and /e/ centralization in the context of palatals; and more generalized monophthongization is found in central regions of Portugal and Alentejo. By contrast, stressed vowels tend to diphthongize in the northern region, and also, with some differences, in areas of Madeira (Cintra 1971; Rodrigues 2002; Segura 2013b; Vigário 2016). In Barlavento, in the south, and Beira Baixa and Alto Alentejo, in the center, not only underlying non-back vowels, but also [u] undergo generalized deletion in unstressed word-final position, as in *copo* ['kɔp], instead of ['kɔpu] 'glass' (Segura 2013b).

Consonantal external sandhi is very homogeneous across dialects in the mainland, but the realization of resyllabified fricatives is often palatal ([ʒ]), both in northern and southern dialects (Rodrigues 2003; Cruz 2013). Hiatus resolution processes are also largely similar, although with interesting differences in the frequency of occurrence of deletion and gliding (Paulino/Oliveira/Vigário to appear and references therein). In the northern region (penetrating slightly into the center), and in some areas of the Azores archipelago, [j] is inserted to break a hiatus involving two central vowels when V2 bears word stress, as in *Beira Alta* ['bejrɛj'altɛ], instead of ['bejrɛ'altɛ] (place name; cf. Segura 2013b; Oliveira et al. 2017). In parts of Alentejo, there are dialect-specific contexts for schwa or [i]-insertion and schwa-preservation in IP final position (Cruz 2013).

Segmental phonology on the islands shows many particularities (cf. the review in Segura 2013b and references therein). Among other unusual rules, one found in the Azores and Madeira (and residually in areas of the mainland) consists in the diphthongization of vowels bearing word stress when preceded by a syllable headed by a close vowel or glide, irrespective of any intervening consonant (Martins/Vitorino 1989; Segura 2013b). This process creates a rising diphthong containing a glide with the place of articulation of the triggering close vowel or glide, as illustrated in (16), taken from Martins/Vitorino (1989); in the examples, the target standard European Portuguese realization is given inside parentheses.

- (16) em casa [i'kjazɛ] ([kaze]) 'at home'
 estão fartas [i'tɛw̃'fwartɛj] ([fartɛj]) 'be tired_{3PL.F}'

Another very specific process, this time only found in Madeira, consists in the realization of word-final /S/ as [i] or [j] when followed by a word starting in a consonant other than a voiceless plosive, as in [uj'furuj], instead of [u'furu], 'the holes' (cf. Segura 2013b).

There is variation in the suprasegmental phonology of Portuguese dialects as well (Elordieta/Frota/Vigário 2005; Frota/Cruz 2012–2015; Cruz 2013; Barros 2014; Frota et al. 2015; Cruz et al. 2017). Prosodic variation is found, for instance, in (i) the tonal inventory – for example, in some dialects the nuclear pitch accent in declaratives is L*, instead of H+L*, and the boundary tone for yes-no interrogatives may be HL% or L%, instead of LH%; (ii) pitch accent density – several regions show much denser pitch accent distribution than Standard European Portuguese (e.g. Porto, Braga, Algarve, Alentejo); (iii) major

phrasing preferences – for example, SVO (subject verb object) sentences in Northern European Portuguese (Braga) and in areas of Alentejo (Castro Verde) tend to be phrased as (S)(VO), even when subjects are short, while (SVO) phrasing is preferred in the south (Albufeira), unless subjects are long, as in Standard European Portuguese; (iv) rhythm metrics – in some areas, correlates of linguistic rhythm point to stress-timed rhythm (the central interior, Alentejo and south), while in other areas they indicate a mixed rhythm (the north, including Braga and Ermesinde, Lisbon, and Castro Verde, in a southern part of Alentejo). Using an innovative approach, resorting to spatial interpolation methods and spatial interaction models, Cruz et al. (2017) attempt to map prosodic variation in European Portuguese (mainland) on the basis of intonational and rhythmic features. The results indicate that variation in prosodic properties is geographically non-continuous and less dependent on geography than is variation of non-prosodic features.

6 Brazilian Portuguese

European and Brazilian Portuguese are similar varieties, mutually intelligible to a large extent, although it is clearly easier for European Portuguese speakers to understand Brazilian Portuguese than the reverse.

While both varieties seem to share essentially the same underlying system, as well as many lexical and post-lexical processes, several rules are specific to each variety. In Brazilian Portuguese, as spoken in the São Paulo and Rio de Janeiro areas, stressless vowels reduce much less than in European Portuguese and in general do not delete, and [i] does not surface. Nevertheless, close-mid and open mid underlying vowels neutralize in pretonic position, the vocalic system being reduced to [i e a o u] in that position. Thus, for example, /ɔ/ is realized as [ɔ] in stressed position, like in *porta* [ˈpɔɾta] ‘door’, but as [o] in pretonic position, as in *porteira* [pɔɾˈteira] ‘door keeper’. Additionally, further reduction affects post-tonic final vowels, where only [i a u] are found (cf. Bisol/Veloso 2016 for a review).²³

Other very general processes that are specific to Brazilian Portuguese include (i) the lexical rule of coda /l/ semivocalization – for example, in *papel* ‘paper’, /l/ obligatorily surfaces as [w] because it is in coda position (i.e. [paˈpɛw]), while in *papelaria* ‘library’ the lateral surfaces as such because it is in the syllable onset (i.e. [papɛlaˈɾia]); (ii) the palatalization of /t d/ → [tʃ dʒ] when followed by a close palatal vowel or glide ([i ɨ j ʝ]), as in *tio* [ˈtʃiu] ‘uncle’;²⁴ (iii) optional pretonic vowel harmony triggered by close vowels – e.g. in a word like *pepino* ‘cucumber’, the first vowel optionally assimilates the [+high] feature of the stressed vowel, and thus the

²³ In word-final positions the reduced system of vowels /i a u/ may surface more reduced, as [ɪ ɐ ʊ].

²⁴ Although palatalization is found in most Brazilian regions, it does not occur in all areas, even within the state of São Paulo.

word may surface as *p[e]pino* or *p[i]pino*; and (iv) optional nasal spreading in stressed syllable – e.g. *banana* ‘banana’ may surface as *ban[ẽ]na* (and in some dialects also as *b[ẽ]n[ẽ]na*) (cf. Massini-Cagliari/Cagliari/Redenbarger 2016; Bisol/Veloso 2016; Santos/Vigário 2016 and references therein).

Consonants appearing in positions that would otherwise violate basic principles of syllabification are resolved via V-slot insertion, usually filled with [i] – e.g. *advogado* [adzivo'gadu]/*[advo'gadu] ‘lawyer’, *internet* [ĩter'netĩ]/*[ĩter'net] ‘internet’. Experimental research on perceptual epenthesis has shown dramatic differences in the behavior of speakers of each variety of Portuguese, with Brazilian Portuguese speakers patterning similar to Japanese subjects, i.e. showing perceptual epenthesis where no acoustic vowel between consonants exists, unlike European Portuguese speakers (Dupoux et al. 2011).

The formation of prosodic domains is very similar across varieties, with some noticeable differences in the prosodization of clitics, which appears to be somewhat less clear in Brazilian than in European Portuguese, and in the conditions on phonological phrase formation (Frota 2000; Tenani 2002; Sândalo/Truckenbrodt 2002; Bisol 2003; 2005; cf. also Santos/Vigário 2016 for a review). Like in European Portuguese, phonological evidence indicates that clitics are not incorporated into the host-PW – for example, proclitics do not pattern like pretonic vowels within the PW with respect to pretonic vowels’ raising (cf. 17a vs. 17b).

- (17) a. *por tela* [por'tɛla] ~ [pur'tɛla] ‘by screen’
 b. *Portela* [por'tɛla]/*[pur'tɛla] (place name)

This sort of behavior has led to distinct proposals on the prosodization of clitics. According to Bisol (2005), clitics either attach to the clitic group or to the so-called post-lexical PW, while for Brisolará (2008) proclitics are prosodically adjoined to the PW, and for Simioni (2008) they attach directly to PhP.

The formation of phrasal prosodic domains seems to be similar in both varieties of Portuguese, but short verb complements (e.g. containing article+N or possessive+N), have been suggested to form a PhP with the preceding verb, and the phonological phrase has been argued to be affected by the Uniformity Condition in Brazilian Portuguese, i.e. a condition that favors phonological phrases of equal length (Sândalo/Truckenbrodt 2002). Thus, *café quente* is a phonological phrase in (18a) but corresponds to two phonological phrases in (18b).

- (18) a. (*café quente*)_{PhP} (*queima a boca*)_{PhP}
 coffee hot burns the mouth
 ‘Hot coffee burns the mouth.’
 b. (*café*)_{PhP} (*quente*)_{PhP} (*queima*)_{PhP}
 coffee hot burns
 ‘Hot coffee burns.’

Evidence for this prosodic organization comes from stress retraction due to stress clash. This process operates within the phonological phrase only. Thus, in (18a) main stress in the last syllable of *café* moves to the previous syllable, because the following word (*quente*) starts in a stressed syllable and is within the same PhP as *café*, unlike in (18b), where stress retraction cannot operate, indicating that the two words now belong to different PhP.

Sandhi processes in the two varieties are very similar too, with some differences in the way clashes are resolved. For example, stress retraction is a stress-clash resolution strategy in Brazilian but not in European Portuguese, and the exact stress-clash configurations that are resolved differ across the two varieties as well (Sândalo/Truckenbrodt 2002; Tenani 2002; cf. also Barbosa 2002 for an alternative approach).

Rhythmic stress is more clearly binary and its domain excludes (pro)clitics, unlike in European Portuguese (Collischonn 1994; Frota/Vigário 2000; Fernandes-Svartman et al. 2012; Magalhães 2016).

Recent investigation has shown great variation in the intonational system across varieties of Portuguese (Frota/Vigário 2000; Tenani 2002; Fernandes 2007; Vigário/Fernandes-Svartman 2010; Frota et al. 2015; 2016; Frota/Moraes 2016, Vigário/Cruz/Frota 2019). Salient differences are found, for instance, in (i) tonal inventories, (ii) the preferred strategies for dealing with tone crowding – Brazilian Portuguese tending to preserve the text, at the expense of tune changes (e.g. showing tonal truncation), and European Portuguese tending to keep the tune and changing the segmentals (e.g. exhibiting vowel epenthesis); and (iii) tonal distribution (cf. Figure 26.2).²⁵

Dense tonal distribution in Brazilian Portuguese, clearly detectable in Figure 26.2 and contrasting with the sparse tonal assignment in European Portuguese, has been proposed to follow from the domain of assignment of obligatory pitch accent in this variety of Portuguese – specifically, the PW or the PWG, meaning that each word in a sentence tends to be assigned a pitch accent. Furthermore, when words are larger, namely when there are more than two pretonic syllables, more tonal material is usually found towards the beginning of the word, in particular in sentence-initial position (Frota/Vigário 2000; Vigário/Fernandes-Svartman 2010; Frota et al. 2015). The latter is an unusual feature of Brazilian Portuguese considering other Romance languages as well, which places Brazilian Portuguese closer to languages typologically more distant, such as Japanese and Korean (cf. Frota/Vigário 2000 and references therein).

Brazilian also differs from Standard European Portuguese, and in part from the other Romance languages, with respect to its rhythmic properties (Frota/Vigário 2001). Using similar kinds of data and measures as those employed in Ramus/Nespor/Mehler (1999) for investigating languages thought to belong to different rhythmic classes, it was found that the variability of consonantal intervals (ΔC) in Brazilian Por-

²⁵ Following Frota/Moraes (2016), we do not mark ‘**’ in the labeling of L+H prenuclear accents, because in Brazilian Portuguese both L and H often align within the stressed syllable, so it is unclear which of the two tones should be signaled as leading tone.

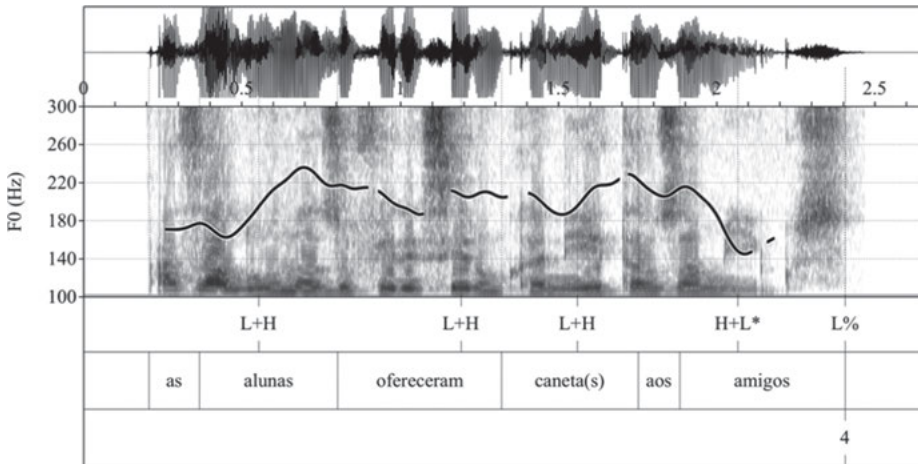


Figure 26.2: F0 contour of the utterance *As alunas ofereceram canetas aos amigos* ‘The students_F offered pens to their friends’, produced as a single IP by a Brazilian Portuguese speaker from São Paulo (part of the of the Interactive Atlas of Portuguese Prosody database, Frota/Cruz 2012–2015).

tuguese is similar to that in languages classified as syllable-timed, such as Italian and Spanish, while the proportion of vocalic intervals (%V) in this variety of Portuguese is analogous to that of languages classified as mora-timed, like Japanese or Basque.

7 Concluding remarks

In this chapter we have surveyed some of the most salient features of Portuguese phonetics and phonology. The Portuguese language has been subject to intense, exciting work especially since the end of the nineteenth century, with a tremendous growth in the last few decades. Some areas are particularly prone to controversy, and many issues also motivate further research. The comparative approach followed in recent years, involving dialects and varieties of Portuguese, as well as other Romance languages, has proved particularly fruitful and will most certainly continue to flourish.

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