There is only one rhotic phoneme in Portuguese, Spanish and Catalan: a coda mirror consonant analysis in CVCV phonology

Abstract

The purpose of this article is to present evidence corroborating the proposal, couched within CVCV theory, that the coda mirror is a phonological object. The analysis of the distribution of rhotics in three Brazilian Portuguese varieties testifies to the existence of the coda mirror in the phonological component of the grammar. It also demonstrates that languages are not limited to only two categories of consonants, namely, simple consonants and geminates. By means of the coda mirror, languages may evidence a third category, which I call *mirror consonants*. Mirror consonants are those attached to one syllabic consonantal position but, unlike simple consonants, they require the presence of an empty syllabic CV unit to their left. Evidence for this proposal is based on the stress facts of Portuguese. My analysis avoids the postulation of degemination rules necessary in current accounts of the distribution of rhotic consonants in Portuguese.

1 Introduction

In standard syllabic theory, there is general agreement concerning the fact that a consonant followed by a heterosyllabic consonant (CV<u>C</u>.CV) and a word-final consonant (CV.CV<u>C</u>) are not in two different syllabic contexts (_C and _#), but only one: the coda (e.g. Goldsmith 1990, 2011, Blevins 1995). There is also general agreement that consonants can undergo the same phonological operations when they are in an internal coda or in a final coda, as these positions have the same structural definition as in [Onset [[Nucleus Coda] Rhyme]]. As examples of these operations, one can mention the vocalization of *r* in English and German, the velarization of *l* in English and European Portuguese, the vocalization of *l* in Serbo-Croatian and Brazilian Portuguese, among others (e.g. Harris 1994, Wiese 1996, Spencer 1996, Mateus & D'Andrade 2003, Kenstowicz 1994, Cristófaro Silva 2010). However, the fact that identical phonological operations are attested to cross-linguistically target post-coda consonants (CVC.<u>C</u>V) and word-initial consonants (<u>C</u>V.CV) – and not the intervocalic ones (CV.<u>C</u>V) – does not evoke the same degree of agreement regarding the unitary nature of these apparent disjunctive contexts, i.e. C_ and #_ (Scheer 2016, Ségéral & Scheer 2008b). According to many studies, in particular those within the framework of CVCV theory, diachronic and synchronic data in numerous languages demonstrate that post-coda and word-initial consonants undergo identical phonological processes such as fortition or resistance to lenition (e.g. Ségéral & Scheer 1999a, 1999b, 2001, 2005, 2008a, 2008b, Szigetvári 1999, Dalbera & Dalbera-Stefanaggi 2004, Scheer & Brun-Trigaud 2012, Brun-Trigaud & Scheer 2010, Scheer & Ségéral 2001, Scheer 2004, 2015, 2016). To illustrate this briefly, consider that in the evolution from Latin to French, word-initial and post-coda consonants mostly resisted lenition (e.g. **p**orta>**p**orte, tal**p**a>tau**p**e), while intervocalic consonants and coda consonants tended to undergo typical processes of lenition (e.g. ri**p**a>ri**v**e, ru**p**ta>route in Scheer & Brun-Trigaud 2012, Scheer 2016). Taking this example into account (and a substantial amount of data presented in the aforementioned studies), the fact that one can observe a phonological phenomenon (in this case, the resistance to lenition) in word-initial and post-coda onsets but not in intervocalic onsets (nor in codas) must be formalized within a theory of phonology. Yet, the traditional arboreal conception of syllabic structure does not allow for a unified analysis of patterns attested exclusively in word-initial and post-coda onsets. Independently of the onset's position in the word (#_, C_, and V_V), its syllabic context is always the same: it is the constituent that branches directly to the syllable

node and is located to the left of the rhyme. In contrast, a linear conception of syllabic structure such as is proposed within CVCV theory (Lowenstamm 1996, Scheer 2004, 2015) is able to formalize a unique identity of word-initial and post-coda onsets. According to CVCV, word-initial onsets (of many languages) and post-coda onsets (of all languages) are phonologically preceded by a governed empty nucleus (the nature of a such nucleus will be introduced in section 3). Thus, word-initial and post-coda onsets are found in the same syllabic context: a context dubbed the coda mirror in Ségéral & Scheer (1999a, 1999b, 2001, 2008a), Scheer & Ziková (2010), and Scheer (2004, 2015, 2016). The coda mirror – or the context of a consonant preceded by a governed empty nucleus: Ø__ – explains why phenomena such as fortition and resistance to lenition are attested in word-initial and post-coda onsets, but not in intervocalic onsets (e.g. Ségéral & Scheer 1999a, 1999b, 2001, 2005, 2008a, 2008b, Szigetvári 1999, Scheer & Brun-Trigaud 2012, Brun-Trigaud & Scheer 2010, Scheer & Ségéral 2001, Scheer 2004, 2015, 2016).

In the case of the current study, the first and main objective is to present a new piece of evidence in support of the CVCV proposition that the coda mirror exists in the phonological component of the grammar. The complex distribution of Portuguese rhotic consonants (currently designated "strong-r" as in *carro* "car" and "weak-r" as in *caro* "expensive") testifies to the importance of the coda mirror in the phonological analysis of the language (as will be demonstrated in section 4). Furthermore, it will be shown that the distribution of rhotics in three varieties of Brazilian Portuguese (BP) gives evidence that the role of the coda mirror is not restricted to the word-initial and post-coda positions. This is, by the way, the second objective of this study: to demonstrate that the grammar can make use of the coda mirror in an intervocalic context to define the realization of certain melodic segments. In the case of Portuguese, the emergence of the coda mirror in intervocalic contexts determines the allophonic realizations of one single underlying rhotic consonant. Hence, contrary to the claims that syllable structure does not condition segment realization (Steriade 1999a), this study will demonstrate that the presence (or the absence) of the coda mirror in a precise syllabic context does indeed determine the realization of rhotics, and explains the distribution of strong-r and weak-r in BP. The final objective is to propose that languages are not limited solely to two categories of consonants, namely, geminates and simple consonants. Languages may evidence a third category, which I call *mirror consonants* (subsection 4.3). Mirror consonants are those attached to only one syllabic consonantal position, but unlike simple consonants they require the presence of a governed empty nucleus to their left. As a result, mirror consonants only occur in the coda mirror context as will be argued in sections 4 and 5.

The distribution of Portuguese rhotic consonants and its implications for their phonological status is a subject that is widely debated in the literature. On the one hand, some researchers argue that strong-r and weak-r each have their own underlying phonological representations (e.g. Câmara Jr. 1972, 1977, 1998, 2015, D'Angelis 2002, Cristófaro Silva 2010, Seara & al. 2015 Madruga & Abaurre 2015, Bonet & Mascaró 1997). One of the major challenges for this theoretical position is explaining why weak-r does not occur in word-initial or post-coda onsets (only strong-r is found in these positions). On the other hand, some researchers argue that only weak-r has an underlying representation in the Portuguese consonantal inventory, and that strong-r is its geminate variant (Lopez 1979, Monaretto 1992, 1994, 1997, Mateus & D'Andrade 2003). Others argue that only strong-r has an underlying representation (a geminate) and that weak-r is its weakened variant, i.e. a simple consonant (Câmara Jr. 1953, Wetzels 1997, Abaurre & Sandado 2003). The great challenge of these analyses is explaining the presence of the geminate strong-r in word-initial and post-coda positions since cross-linguistically geminates do not tend to appear in these positions.

Finally, other studies propose the existence of three underlying categories in Portuguese that would include representations of all the phonetic forms of the strong-r, weak-r and other rhotics that may appear in the coda position (Rennicke 2015: 258, 2016). Again, these studies do not explain why the allophonic realizations of weak-r do not occur in word-initial or post-coda onsets. As is well stated by Massini-Cagliari, Cagliari & Redenbarger (2016: 60) concerning Portuguese, "At this moment, an agreement about the phonological definition of the rhotics has not been reached." So, the aim of this study is also to contribute to a better understanding of the underlying phonological representation of these consonants in the Portuguese language.

In the following section, I will present data concerning the distribution of rhotics in three varieties of BP. Then, the CVCV theoretical devices necessary to allow the development of an analysis of the distribution of Portuguese rhotics will be presented. In section 4, I will propose that weak-r and strong-r are different realizations of one single underlying rhotic consonant. Contrary to the aforementioned studies, I will argue that strong-r is not a geminate, but in fact a mirror consonant. It will be demonstrated that the distribution of strong-r and weak-r is managed by the grammar by means of the coda mirror. More precisely, weak-r is forbidden in the coda mirror, while strong-r is allowed in this syllabic context. Thus, it is the presence or absence of the coda mirror that determines the realization of rhotic consonants. Also, I will suggest that this analysis could explain the behavior of rhotics in languages such as Catalan and Spanish where the distribution of strong-r and weak-r is the same as in Portuguese (Bonet & Mascaró 1997, Harris 1983, Wheeler 2005). Section 5 will conclude by corroborating CVCV's proposal regarding the relevance of the coda mirror as a phonological object. Moreover, I will propose that the distribution of the coda mirror is not restricted to contexts where this object is obligatorily present (such as the post-coda position) or parametrically determined (such as the word-initial position). Indeed, my analysis demonstrates that the phonological component of the grammar can also appeal to the coda mirror in intervocalic contexts in order to determine the phonetic realization of certain melodic segments. Finally, I will argue how CVCV is uniquely situated to offer an account of the distribution of Portuguese rhotics in comparison to concurrent theories.

2 On the distribution of BP rhotic consonants

Rhotic consonants "have no articulatory or auditory property in common" (Rennicke 2014: 178). In fact, these consonants "[...] seem to be more of a language-specific class unified by allophony and phonological behavior, as opposed to something that can be defined in terms of features" (idem: 181). This being the case, along with the fact that Portuguese rhotic consonants have many possible phonetic realizations depending on the dialect, I will adopt the traditional terminology in the literature and refer to them as "weak-r" and "strong-r". In contrast to the claim according to which "there seems to be no [...] phonological basis for the strength and weakness of the two phonemes" (idem: 189), I will show in section 4 that only strong-r emerges in strong syllabic positions, whereas only weak-r is allowed in weak syllabic positions. From this perspective, it is therefore appropriate to refer to the BP rhotic consonants as strong-r and weak-r.

Let us now observe the realizations of weak-r and strong-r and their respective syllabic contexts from data on three varieties of BP spoken in Belo Horizonte, Rio de Janeiro[1] and Lavras (Cristófaro Silva 2010: 141, 143, 161, Rennicke 2015: 256, 2016: 90):

(1) *The distribution of weak-r and strong-r*

		Belo Horizonte	Rio de Janeiro	Lavras	gloss
weak-r	a.	[ˈpɾatʊ]	[ˈpɾatʊ]	[ˈpɾatʊ]~[ˈpɾatʊ]~[ˈpɾatʊ]	plate
	b.	[ˈsatʃiɾɐ]	[ˈsatʃiɾɐ]	[ˈsatʃiɾɐ]~[ˈsatʃiɾɐ]~[ˈsatʃiɾɐ]	satire
	c.	[ˈaʊ̯ɾɐ]	[ˈaʊ̯ɾɐ]	[ˈaʊ̯ɾɐ]~[ˈaʊ̯ɾɐ]~[ˈaʊ̯ɾɐ]	aura
	d.	[ˈkaɾʊ]	[ˈkaɾʊ]	[ˈkaɾʊ]~[ˈkaɾʊ]~[ˈkaɾʊ]	expensive
strong-r	e.	[ˈhatʊ]~[ˈɦatʊ]	[ˈxatʊ]~[ˈɣatʊ]	[ˈhatʊ]~[ˈɦatʊ]~[ˈχatʊ]~[ˈʁatʊ]	mouse
	f.	[ishaˈɛw]~[isɦaˈɛw]	[isxaˈɛw]~[isɣaˈɛw]	[ishaˈɛw]~[isɦaˈɛw]~[isχaˈɛw]~[isʁaˈɛw]	Israel
	g.	[ˈgɛwhɐ]~[ˈgɛwɦɐ]	[ˈgɛwxɐ]~[ˈgɛwɣɐ]	[ˈgɛwhɐ]~[ˈgɛwɦɐ]~[ˈgɛwχɐ]~[ˈgɛwʁɐ]	gills
	h.	[ˈʒẽhʊ]~[ˈʒẽɦʊ]	[ˈʒẽxʊ]~[ˈʒẽɣʊ]	[ˈʒẽhʊ]~[ˈʒẽɦʊ]~[ˈʒẽχʊ]~[ˈʒẽʁʊ]	son-in-law
	i.	[ˈkahʊ]~[ˈkaɦʊ]	[ˈkaxʊ]~[ˈkaɣʊ]	[ˈkahʊ]~[ˈkaɦʊ]~[ˈkaχʊ]~[ˈkaʁʊ]	car
weak-r, strong-r, or other	j.	[ˈkuhsʊ]	[ˈkuxsʊ]	[ˈkuhsʊ]~[ˈkuɦsʊ]~[ˈkuχsʊ]~[ˈkuʁsʊ]~ [ˈkuɾsʊ]~ [ˈkuɾ̥sʊ]~ [ˈkuɽsʊ]~[ˈkuɹsʊ]	course
	l.	[ˈmah]~[ˈmaɦ]	[ˈmax]~[ˈmaɣ]	[ˈmah]~[ˈmaɦ]~[ˈmaχ]~[ˈmaʁ]~ [ˈmaɾ]~[ˈmaɾ̥]~[ˈmaɽ]~ [ˈmaɹ]	sea

As can be seen from the data in Table 1, weak-r is realized as a tap in the three BP varieties. In fact, the realizations of weak-r are tap-like articulations in all varieties of contemporary BP (Cristófaro Silva 2010: 48, Oliveira & Cristófaro Silva 2002: 30). Thus, in order to facilitate our exposition, I will adopt the phonetic symbol [ɾ] to indicate all weak-rs in this paper. In regards to

---

[1] Nevins (2008) states that strong-r in the BP variety spoken in Rio de Janeiro is realized phonetically as a voiced glottal fricative in word-initial and post-coda positions. He also states that strong-r is realized as a voiced velar fricative in intervocalic position. I do not adopt this description of the BP variety spoken in Rio because there are no other works – to the best of my knowledge – claiming that strong-r is realized phonetically in a specific manner in word-initial and post-coda positions and in another specific manner in the intervocalic position (see among others: Câmara Jr. 1953, 1972, 1977, 2015, Lopez 1979, Callou & Moraes 1995, Cristófaro Silva 2010, Abaurre & Sandalo 2003, D'Angelis 2002, Rennicke 2014, 2015, 2016, Ferreira Neto 2011, Seara & al. 2015, Madruga & Abaurre 2015).

its distribution, weak-r occurs in the second position of a branching onset (1a) and in intervocalic position (1b-d). It can also occur in the coda, as observed in the Lavras variety (1j-l).

With regards to the distribution of weak-r, it is also important to discuss the contexts in which it does not occur. In the three BP varieties in Table 1, weak-r does not occur word-initially (e.g. Câmara Jr. 1953, 1972, 1977, 1998, 2015, Lopez 1979, Bonet & Mascaró 1997, Abarurre & Sandalo 2003, Cristófaro Silva 2010: 143, Meireles 2014a: 15, Seara & al. 2015: 119, Madruga & Abaurre 2015, Rennicke 2015: 257, 2016: 90). Weak-r can be the onset of an internal syllable, but not the onset of a word-initial syllable. Only strong-r is found in this position (1e). Also, weak-r does not occur in the onset of an internal syllable if it is preceded by a heterosyllabic consonant (as also noted by the aforementioned studies). In the post-coda position, it is strong-r that appears (1f-g). Interestingly, a study conducted in Belo Horizonte found that some speakers of this variety (the second column in Table 1) can produce a weak-r in the onset of a post-coda syllable when (and only when) it is preceded by the alveolar lateral /l/ (Oliveira & Cristófaro Silva 2002). The study's authors explain this phenomenon as a consequence of the well-known BP phenomena of /l/ vocalization in coda. Accordingly, /l/ in the coda-position is in a transition period in BP where it is interpreted either as a glide (e.g. in the word [pawha] "babbling", the /l/ is attached to a consonantal syllabic position and it is the strong-r, [h], that occurs in the post-coda position), or as the vowel [ʊ̯] (e.g. in the word [pa̯ʊ̯ra], the /l/ is attached to a vocalic syllabic position and weak-r can thus occur in the following onset, as this onset is intervocalic)[2]. So the grammar of some BP speakers treats the word *palra* [pa̯ʊ̯ra] "babbling" in the same way as the word *aura* [a̯ʊ̯rɐ] "aura" (1c). The emergence of weak-r is therefore consistent with the generalization that it does not occur in a post-coda position.

One final context in which weak-r never occurs is after a nasal vowel (e.g. Câmara Jr. 1953, 1972, 1977, 1998, 2015, Abarurre & Sandalo 2003, Cristófaro 2010, Ferreira Neto 2011, Meireles 2014). In contrast, strong-r does emerge after such a vowel (1h). Abaurre & Sandalo (2003: 145) draw attention to the fact that in the pronunciation of foreign names like Marilyn Monroe, native speakers of BP produce it as Ma[ɾ]ilyn (and never as *Ma[h]ilyn), whereas Monroe is produced as Mon[h]oe (and never as *Mon[ɾ]oe). This shows that there is still an active phonological rule in the grammar of BP speakers that prevents the occurrence of weak-r after a nasal vowel.

Now consider the distribution of strong-r. It occurs in word-initial and in post-coda positions (1e-g). In regards to its phonetic realization, strong-r may be produced as a glottal fricative, a velar fricative or a uvular fricative in the three varieties of BP in Table 1 (Cristófaro Silva 2010, Rennicke 2015, 2016). According to some researchers, the glottal fricative is the most widespread phonetic realization of strong-r in BP (Abaurre & Sandalo 2003: 167, Callou, Leite & Moraes 2002: 544). Thus, in order to facilitate the current exposition, strong-r will be transcribed uniformly as the glottal fricative [h]. See (2) for additional data, which attest to the presence of strong-r in word-initial and in post-coda positions:

---

[2] On the phonological status of glides and diphthongs in BP, see: Meireles (2014).

(2) *Strong-r in word-initial and post-coda positions*

	#	gloss		coda	gloss
a.	[ˈheɹ]	king	c.	[mɛwˈhʊ]	blackbird
b.	[hiˈzadɐ]	laughing	d.	[deshesˈpeɹtʊ]	disrespect

Referring specifically to the post-coda position, strong-r can be preceded by an alveolar lateral (as in 2c, remember that the /l/ in coda is realized as [w] in BP) and also by an alveolar fricative (2d). There is no other consonant that can precede strong-r when it is in the post-coda position. In fact, the only other consonant that BP admits in coda is a rhotic as in [ˈtohtʊ], [ˈtoɾtʊ] or [ˈtoɹtʊ] "crooked" (the differing pronunciations are due to the particularities of the regional varieties). However, a strong-r in the post-coda position is never preceded by another rhotic. Thus, words such as *[ˈtohhʊ], *[ˈtoɾhʊ] or [ˈtoɹhʊ] are inadmissible in the language (even though the consonants [h], [ɾ] and [ɹ] can occur in coda as it will be discussed in next paragraphs).

Another context where strong-r occurs is intervocalically. This context is the only one where strong-r contrasts with weak-r. Observe the following minimal pairs:

(3) *Contrast between strong-r and weak-r*

	strong-r	weak-r	gloss
a.	[ˈmihɐ]	[ˈmiɾɐ]	myrrh, (he) looks at
b.	[kaˈhetɐ]	[kaˈɾetɐ]	cart, grimace
c.	[ˈmuhʊ]	[ˈmuɾʊ]	punch, wall

In coda position, speakers from the varieties spoken in Belo Horizonte and Rio de Janeiro produce a strong-r. In the case of the variety spoken in Lavras, in addition to the various phonetic realizations of the strong-r, speakers can also produce a weak-r, as well as rhotic variants that never appear in other syllabic positions (e.g. the retroflex approximant [ɻ]). Therefore, a word like *mar* "sea" can be produced as [ˈmah], [ˈmax], [ˈmaɾ], [ˈmaɻ] or even with another rhotic as shown in 1j-l. Moreover, it may be the case that Brazilian speakers will not produce the rhotic consonant, particularly in verbs, when in a word-final coda (Cardoso 1999). Thus, an infinitive verb such as *falar* "speak" can be pronounced as [faˈlah], [faˈlax], [faˈlaɾ], [faˈlaɻ] or [faˈla].
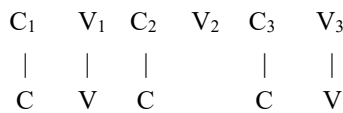
To conclude this section, the distribution of rhotic consonants can be summarized as follows: weak-r occurs in the second position of a branching onset and intervocalically, while strong-r appears in word-initial, post-coda and intervocalic positions. The only context where strong-r contrasts with weak-r is between two oral vowels. In the coda position we find phonetic realizations of strong-r, of weak-r, of rhotics that do not occur in other syllabic positions, or the rhotic may be deleted. Now let us turn to the presentation of CVCV theory (Lowenstamm 1996, Scheer 2004, 2015), which will allow us to formulate an analysis of the distribution of BP rhotic consonants.
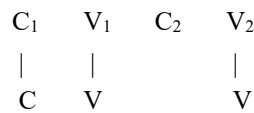
3 Theoretical devices

According to CVCV theory, syllabic structure is not arboreal but strictly linear (Lowenstamm 1996, Scheer 2004, 2015, 2016, Scheer & Szigetvári, 2005). In this flat structure the presence of a consonant implies the existence of a vowel to its right (C$\underline{V}$) and the presence of a vowel implies the existence of a consonant to its left ($\underline{C}$V). As a result, there is always an empty nuclear position (i.e. without melodic content) between two linearly adjacent consonants and an empty onset between two linearly adjacent vowels (Scheer 2015: 118). By way of illustration, consider the representation of the underlying structure of a closed syllable followed by an open syllable in (4a), an open syllable followed by a hiatus in (4b), a geminate in (4c), and a long vowel in (4d):
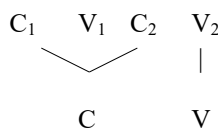
(4) *Some syllabic structures in the CVCV framework*
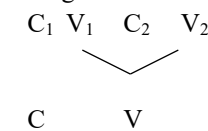
a. Closed syllable followed by an open syllable

$$C_1 \quad V_1 \quad C_2 \quad V_2 \quad C_3 \quad V_3$$
$$| \quad\quad | \quad\quad | \quad\quad\quad\quad | \quad\quad |$$
$$C \quad\quad V \quad\quad C \quad\quad\quad\quad C \quad\quad V$$

b. Open syllable followed by a hiatus

$$C_1 \quad V_1 \quad C_2 \quad V_2$$
$$| \quad\quad | \quad\quad\quad\quad |$$
$$C \quad\quad V \quad\quad\quad\quad V$$

c. Geminate

$$C_1 \quad V_1 \quad C_2 \quad V_2$$
$$\quad\quad\quad\searrow\quad\swarrow\quad\quad\quad |$$
$$C \quad\quad\quad\quad V$$

c. Long vowel

$$C_1 \quad V_1 \quad C_2 \quad V_2$$
$$\quad\quad\quad\searrow\quad\swarrow$$
$$C \quad\quad\quad\quad V$$

The only syllabic constituents in CVCV are onsets and nuclei. This being said, CVCV continues to use the term "coda" to refer to a consonant at the end of a closed syllable (for example, the consonant attached to C_2 in the representation (4a)). However, the identity of a coda is not determined by its association with the nucleus to its left (as proposed by standard syllabic theory) but rather with the nucleus to its right. A coda in CVCV is a consonant followed by a governed nucleus, and all governed nuclei have no phonetic content (Scheer 2015: 150).
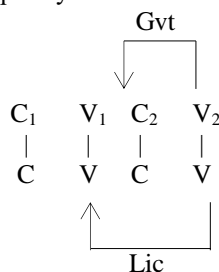
In order to fully understand the nature of a governed nucleus, one must first know how CVCV translates the hierarchical relations between constituents. Recall that in CVCV, syllabic structure corresponds to a linear sequence of consonants and vowels. As a result of this linearization, hierarchical relations between syllabic constituents are lateral (and not vertical). Therefore, in a chain formed by the sequence of consonants and vowels, each contentful nucleus (that is, any vocalic segment realized phonetically) is capable of dispensing the lateral forces of *licensing* and *government*. Licensing has the effect of supporting the melodic expression of its target, while government has the effect of restricting it. Because of their opposite effect, no constituent can be governed and licensed at the same time (Scheer 2015: 186). Thus, when an object is prone to be either governed or licensed, it will be governed[3]. To illustrate this, let us observe how CVCV represents the implementation of the two lateral forces in a word consisting of two open syllables (5a) and in a word consisting of a closed syllable followed by an open syllable (5b):
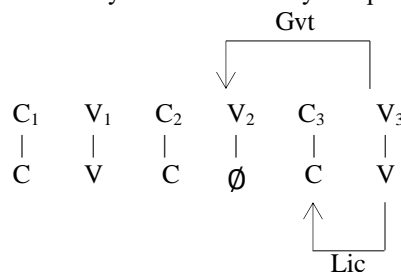
---

[3] For arguments in favor of government's priority over licensing, see: Scheer & Ziková (2010).

(5) *The implementation of lateral forces*

a. Open syllable followed by an open syllable

```
                  Gvt
            ┌──────────┐
            ↓          │
   C₁    V₁    C₂    V₂
   |     |     |     |
   C     V     C     V
            ↑          │
            └──────────┘
                  Lic
```

b. Closed syllable followed by an open syllable

```
                        Gvt
                  ┌──────────┐
                  ↓          │
   C₁    V₁    C₂    V₂    C₃    V₃
   |     |     |     |     |     |
   C     V     C     Ø     C     V
                        ↑          │
                        └──────────┘
                              Lic
```

The representations in (5) show that government and licensing apply from right to left[4]. They also show that lateral relations respect the principle of locality. The governing/licensing nucleus targets the constituent closest to its right (Scheer & Brun-Trigaud 2012: 88-89). Thus, in (5a), the constituent under C_2 is governed by V_2 because government has priority in the order of application with regard to licensing (Scheer 2015: 186). In this configuration, V_1 is the target of V_2 licensing. Note that C_2 is in a weak position since it is target by government (which can restrict its melodic expression[5]). With respect to the representation in (5b), there is no melodic content associated with the vocalic position V_2 (where Ø represents an empty nucleus). In this case, CVCV proposes that V_3 has an obligation to govern its neighboring empty nucleus. In other words, since the nucleus under V_2 is not linked to any melody, it requires the government of V_3 (Scheer 2015: 129). The effect of government on a vowel renders it mute; a governed nucleus never has a phonetic realization (Scheer 2015: 152). A governed nucleus, however, assigns consonant to its left to the coda position. As shown in (5b), the consonant in coda C_2 escapes the government and licensing of V_3. Since the nucleus under V_2 is governed, it exerts no lateral force. Thus, a coda consonant (that is to say, a consonant to the left of a governed nucleus: __Ø) is neither governed nor licensed. Turning to the consonant under C_3 in (5b), once the nucleus in V_3 has exhausted its potential for government towards V_2, it now has only the potential to license. The nucleus under V_3 targets the closest segment not already targeted by government, which in this case is C_3. Thus, given that the consonant in C_3 is to the right of a governed nucleus (Ø__), it is in a strong position since it receives the licensing of V_3. A consonant preceded by a governed nucleus (Ø__) is identified in CVCV as emerging in the position dubbed the coda mirror (Ségéral & Scheer 2001, 2008a, Scheer & Zicová 2010, Scheer 2004, 2015, 2016). A consonant in the coda mirror escapes the weakening effect of government. It is, on the other hand, strengthened by licensing[6].

---

[4] For arguments in favor of the regressive directionality of lateral relations, see: Scheer 2015: 123-127.

[5] This is largely observable in a diachronic analysis of languages. Intervocalic consonants tend to undergo lenition (e.g. ri**p**a>ri**v**e in Scheer & Brun-Trigaud 2012, Scheer 2016). See first paragraph in section 1. For more data: Ségéral & Scheer 1999a, 1999b, 2001, 2005, 2008a, 2008b, Szigetvári 1999, Dalbera & Dalbera-Stefanaggi 2004, Brun-Trigaud & Scheer 2010, Scheer & Ségéral 2001, Scheer 2004, 2015.

[6] This is also largely observable in a diachronic analysis of languages. Post-coda consonants tend to resist lenition (e.g. tal**p**a>tau**p**e in Scheer & Brun-Trigaud 2012, Scheer 2016). See first paragraph in section 1. For more data: Ségéral & Scheer 1999a, 1999b, 2001, 2005, 2008a, 2008b, Szigetvári 1999, Dalbera & Dalbera-Stefanaggi 2004, Brun-Trigaud & Scheer 2010, Scheer & Ségéral 2001, Scheer 2004, 2015.

Let us recapitulate: 1) a consonant in the coda mirror is always licensed, and therefore it is in a strong position, 2) an intervocalic consonant is always governed, and therefore it is in a weak position, and 3) a consonant in a coda is neither governed nor licensed. In the following section we will see that CVCV offers a unique insight into the analysis of the distribution of Portuguese rhotic consonants.
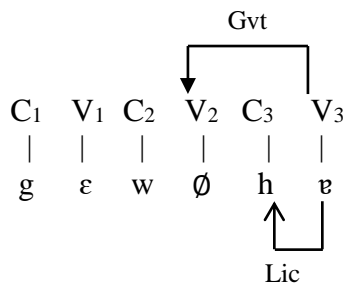
4 Analysis of the distribution of BP rhotic consonants

In this section, I will elaborate a unified description of the contexts – or better, the sole syllabic context – where weak-r is disallowed in BP. Furthermore, I will propose that only weak-r can occur in the syllabic positions where a rhotic consonant is governed, while only strong-r can occur in the positions where such a consonant is licensed. In the case where a consonant is not subjected to any force, any (language-particular) subset of the rhotic allophones available to a dialect may surface. We will begin this analysis by examining the context of the coda mirror.

4.1 The coda mirror

As we have already seen (in section 2), strong-r can occur after a heterosyllabic consonant, while weak-r never occurs in this position. We have also seen that in CVCV, the post-coda position is the coda mirror: $\emptyset$__. Observe the representation in (6) of the word *guelra* [gɛwha] "gills" where strong-r emerges in the coda mirror:

(6) *The strong-r in coda mirror – I*

$$
\begin{array}{cccccc}
 & & & \text{Gvt} & & \\
C_1 & V_1 & C_2 & V_2 & C_3 & V_3 \\
| & | & | & | & | & | \\
g & \varepsilon & w & \emptyset & h & ɐ \\
 & & & & \text{Lic} & \\
\end{array}
$$

In (6), the vowel under V_3 honors its obligation towards V_2, which is to govern the neighboring empty nucleus. The strong-r in C_3, preceded by the governed empty nucleus in V_2, becomes thus the target of V_3's licensing. Therefore, this consonant is in a strong position; it is licensed.
We begin to see here how CVCV is uniquely situated to offer an account of the distribution of BP rhotics: strong-r can be freely preceded by a governed nucleus. In other words, strong-r appears in the coda mirror ($\emptyset$__). In contrast, the non-occurrence of weak-r after a heterosyllabic consonant can be explained: weak-r cannot be preceded by a governed nucleus. It is forbidden in the context of the coda mirror.

This reasoning can also be applied to the distribution of BP rhotic consonants after a nasal vowel. As mentioned in section 2, weak-r never follows a nasal vowel. In contrast, strong-r can very well be preceded by such a vowel. Importantly, Portuguese nasal vowels are not monophonemic, but

are rather the output of an underlying oral vowel followed by a nasal consonant[7ab] (e. g. Câmara Jr. 1953, 1972, 1977, 1998, 2015, Mateus 1975, Wetzels 1997, 2000, D'Angelis 2002, Cagliari 2009, Cristófaro Silva 2010). The only monophonemic vowels in Portuguese are oral. The above proposal implies the following structure for Portuguese nasal vowels:

(7) *Syllabic structure of a nasal vowel in Portuguese*

$$C_1 \quad V_1 \quad C_2 \quad V_2$$
$$\mid \quad \mid \quad \mid$$
$$V \quad N \quad \emptyset$$

Let us remember that in CVCV any consonant implies the existence of a vowel to its right. We therefore predict the existence of V_2 to the right of the nasal consonant under C_2 in (7). The nucleus in V_2 must be empty because if it were contentful, C_2 would be in an onset position, which would not trigger the distinctive kind of nasalization of the vowel under V_1. Therefore, Portuguese minimal pairs such as *mundo* [ˈmũdʊ] "world" and *mudo* [ˈmudʊ] "mute" have distinct syllabic structures. Based on CVCV theoretical devices, I propose the following representation for their syllabic structures:

(8) *Syllabic structure of Portuguese nasal and oral vowels*

(a) [ˈmũdʊ]

(b) [ˈmudʊ]
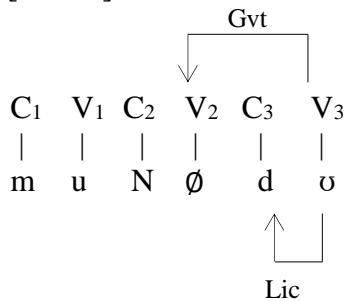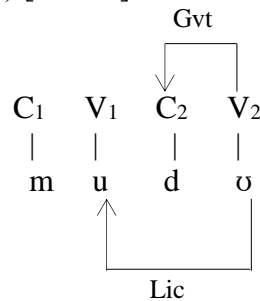
First let us observe the representation in 8 (b). Given that government has priority over licensing, the closest object to V_2 (in this case, C_2) is governed, while the second closest object (V_1) is licensed. In 8 (a), the situation is different since the empty nucleus in V_2 requires the government of V_3. Once the government potential of V_3 is exhausted, this nucleus licenses C_3. This is exactly

---

[7a] I am talking specifically about vowels followed by an underlying nasal consonant in the coda position. These vowels have a distinctive function in the language (e.g. *minto* [ˈmĩtʊ] "(I) lie" versus *mito* [ˈmitʊ] "myth"; *pinto* [ˈpĩtʊ] "(I) paint" versus *pito* [ˈpitʊ] "pipe or cigarette"; *mundo* [ˈmũdʊ] "world" versus *mudo* [ˈmudʊ] "mute"). I do not address the nasalization of vowels in open syllable followed by an onset occupied by a nasal consonant. This case of nasalization is not systematic and has no distinctive value (e.g. the word *camada* "layer" can be pronounced as [kaˈmadɐ] or [kãˈmadɐ] (e.g. Câmara Jr. 1977: 109-110, Wetzels 1997, 2000: 9, Cristófaro Silva, 2010: 133)).
[7b] There are different propositions regarding the underlying representation of this nasal consonant (apart, of course, from the nasal feature). However, such a debate is not relevant for the purposes of this study. What is important is the common conclusion of the aforementioned studies. Portuguese nasal vowels are, at a phonological level, a sequence of an oral vowel and a nasal consonant. For the arguments in favor of the biphonemic nature of Portuguese nasal vowels, see among others: Câmara Jr. 1953, 1972, 1977, 1998, 2015, Mateus 1975, Mateus & D'Andrade 2003: 16, Wetzels 1997, 2000, D'Angelis 2002, Cagliari 2009, Cristófaro Silva 2010.

the same configuration in a word like *genro* [ˈʒẽʊ] "son-in-law" whose representation is presented in (9):

(9) *The strong-r in coda mirror – II*
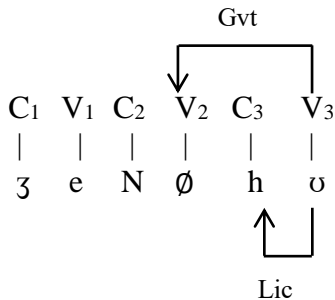
As we can observe, the syllabic representation of the word [ˈʒẽʊ] in (9) is identical to one of the word [ˈgɛwha] in (6). The final nucleus in V_3 governs the empty nucleus in V_2 and licenses the strong-r in C_3. Thus, in Portuguese, the apparent dichotomy of the positions *after a nasal vowel* and *after a heterosyllabic consonant* refers to a single phonological context, which is: after a governed nucleus or better, in the coda mirror.
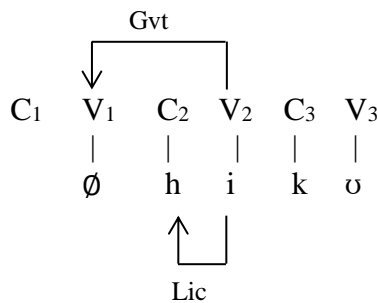
The representation in (9) corroborates the proposition that strong-r emerges when it is preceded by a governed nucleus. The absolute exclusion of weak-r in the onset position of a syllable preceded by a nasal vowel can be similarly explained by the underlying presence of a nasal consonant followed by a governed nucleus in the underlying representation of these words. Weak-r cannot be preceded by a heterosyllabic consonant – phonetically realized or not – because it is forbidden from the context of the coda mirror.

It remains still to explain why weak-r does not occur at the beginning of a word. One might simply say that weak-r is forbidden from *word-initial* and *post-coda* positions. This is, by the way, the typical description of analyses made in standard syllabic theories. If one tries to describe the contexts in which weak-r is forbidden within the arboreal conception of syllabic structure, these contexts can only be described in this dichotomous manner. One could obviously try to unify these positions by saying that a consonant in word-initial and in post-coda positions are both in the onset. This kind of reasoning would lead us to say that weak-r is forbidden in onset positions, which would account for its absence in word-initial and post-coda contexts. Nonetheless, this is easily falsified by the fact that weak-r occurs intervocalically, also an onset position.

An alternative analysis concerning this disjunction is, however, available in the CVCV framework. According to CVCV, several languages of the world give a particular visibility to the word-initial position by means of a parametric choice: a word may or may not begin with an empty CV (Lowenstamm 1999, Scheer 2004, 2015, 2016). Thus, the diacritic "#__" commonly used to indicate the beginning of a word is completely absent in CVCV. Strictly speaking, the diacritic "#__" is indeed the empty CV unit in the word-initial position. According to CVCV, phonology uses strictly phonological items to interpret morphosyntactic information. In these terms, phonology translates the morphosyntactic information "beginning of a word" into an initial empty CV unit (a # is not a native phonological object). It is precisely by means of this proposition that

CVCV is capable, in a unified fashion, of accounting for cross-linguistic phonological phenomena such as: 1) the restriction (or lack of restriction) of initial consonantal clusters to an obstruent-sonorant sequence (rather than sonorant-obstruent, sonorant-sonorant, or obstruent-obstruent), 2) vowel-zero alternations in the first vocalic position of words, and 3) the fact that "languages vary as to whether initial consonants are strong or weak"[8] (Scheer 2004: 667). Due to limitations of space, and mainly because it is not the purpose of this study, I will not reproduce the arguments demonstrating how the presence (or the absence) of an empty CV unit in the word-initial position accounts for the three aforementioned phenomena[9]. What is essential to my analyses is the fact that in a language in which the word-initial position is marked by this empty syllabic unit, the first vocalic position contains a governed nucleus. In line with CVCV predictions, several Indo-European languages, including Portuguese (as well Catalan and Spanish) display behavior that is consistent with word-initial empty CVs. Taking this into account, let us thus observe the representation of the Portuguese word *rico* [ˈhikʊ] «rich»:

(10) *Strong-r in coda mirror – III*

$$
\begin{array}{cccccc}
& \text{Gvt} & & & & \\
C_1 & V_1 & C_2 & V_2 & C_3 & V_3 \\
| & | & | & | & | \\
\emptyset & h & i & k & \upsilon \\
& & \text{Lic} & & &
\end{array}
$$

As can be seen, the empty nucleus in V_1 requires the government of the contentful nucleus in V_2. Consequently, V_2 licenses the consonant in word-initial position (on the melodic tier). This means that even when strong-r is at the beginning of a word, it is phonologically preceded by a governed nucleus. So, we have in (10) the same context seen in representations (6) and (9): strong-r is in the coda mirror. In contrast, weak-r is attested in neither word-initial nor post-coda positions. The fact that weak-r is forbidden in these "two" positions is more simply explained if the BP grammar is really referring to a single phonological environment in these cases, corroborating the CVCV proposition that the coda mirror is a unitary and unique object (Scheer 2015: 181). So here we have a unitary description of the context in which weak-r is forbidden in the syllabic structure of BP: it never occurs to the right of a governed nucleus; in the coda mirror (as suggested in *author*).

4.2 Weak-r in branching onsets

The attentive reader may be wondering about the context in which weak-r occurs as the second member of a branching onset (e.g. *trato* [ˈtɾatʊ] "treaty"). Since in CVCV any consonant implies

---

[8] Word-initial consonants in languages with an initial empty CV tend to resist lenition (e.g. **p**orta>**p**orte in Scheer & Brun-Trigaud 2012, Scheer 2016). See first paragraph in section 1. For more data: Ségéral & Scheer 1999a, 1999b, 2001, 2005, 2008a, 2008b, Szigetvári 1999, Dalbera & Dalbera-Stefanaggi 2004, Brun-Trigaud & Scheer 2010, Scheer & Ségéral 2001, Scheer 2004, 2015.
[9] The interested reader may refer to Scheer (2015: 118-121, 204) for a concise presentation of the subject or to Lowenstamm (1999) and Scheer (2004) for detailed information.

the presence of a vowel to its right, there must be an empty nucleus between the two consonants of a branching onset. Yet, we have just seen that weak-r is forbidden after a governed empty nucleus.

Before continuing this discussion, let us recall that one of the characteristics of several Indo-European languages – including Portuguese – is the presence of an empty CV unit in word-initial position (Lowenstamm 1999, Scheer 2004, 2015). Let us also recall that one of the impacts of the presence of this empty CV unit is that word-initial consonant clusters (i.e. a branching onset) are strictly restricted to an obstruent-sonorant sequence (and not sonorant-obstruent, sonorant-sonorant, or obstruent-obstruent)[10]. A further particularity of languages having an empty CV unit at the beginning of words is that the sonorant in a TR cluster (i.e. a branching onset) enters into a lateral relation with the preceding obstruent on the melodic level, that is to say, below the CVCV tier. This direct relation between the sonorant (henceforth R) and the obstruent (henceforth T) in the specific case of branching onsets is called Infrasegmental Government (IG) (Scheer 2004: 40-64, 2015: 146-152, 199-206, Scheer & Brun-Trigaud 2012, Brun-Trigaud & Scheer 2010). It is by means of IG that CVCV accounts for phonological phenomena demonstrating that these languages with empty word-initial CVs do not treat TR clusters in the same manner as RT, RR and TT clusters. Infrasegmental Government ensures that the empty vocalic nucleus in a TR cluster (i.e. a branching onset) is indeed active (ungoverned). This is not the case for the empty nucleus internal to RT, RR and TT clusters. More specifically, the nucleus circumscribed by the infrasegmental relation in a TR cluster does not require the government of the vowel to its right. This vowel is thus free to govern the nearest syllabic constituent (i.e. the consonant to its left). To illustrate this, let us observe the representation of the word *retrato* [heˈtɾatʊ] "picture" where the symbol "<=" between the sonorant and the obstruent represents Infrasegmental Government:

(11) *Weak-r in branching onsets – I*
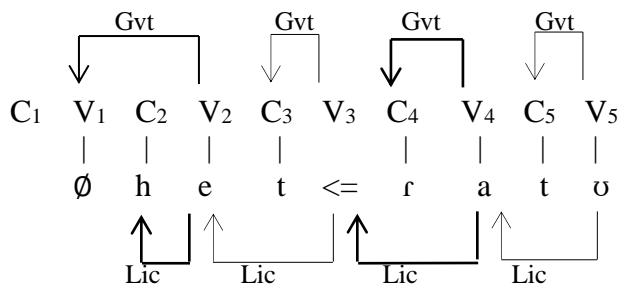
In (11), the nucleus under V_3 is circumscribed by the infrasegmental relation between C_4 and C_3. For this reason, it does not call for the government of V_4. As already seen in section 3, no constituent can be simultaneously targeted by government and licensing (Scheer & Ziková 2010, Scheer 2015). Thus, the consonant under C_4 is targeted solely by the government of V_4 (since government has priority over licensing). Also as seen in section 3, lateral relations must be local (Scheer & Brun-Trigaud 2012: 188-189). This is why the empty nucleus in V_3 becomes the target of the licensing of the vowel in V_4. So even if the nucleus in V_3 does not have phonetic content, it is capable of establishing lateral relations due to its ungoverned status. Indeed, any ungoverned nucleus may govern and license (Scheer & Brun-Trigaud 2012: 189, Scheer 2015: 153). Importantly, since the nucleus under V_3 is ungoverned, the rhotic in C_4 is not in the coda mirror,

---

[10] For the arguments in favor of this prediction, see: Scheer (2004, 2015: 199-206).

and therefore emerges as weak-r. The weak-r in a TR cluster is certainly preceded by an empty nucleus, but this nucleus is phonologically active. Consequently, even if this weak-r is phonetically preceded by a consonant, the syllabic position to which it attaches is found between two active vocalic nuclei. A weak-r in a branching onset is therefore phonologically intervocalic. For this reason it is targeted by the government of the vowel to its right (as in (5a)).

Consistently with what has been stated in the preceding paragraphs, these same principles are applied to words beginning with a branching onset. Let us thus observe the representation of the word *trato* [ˈtratʊ] "treaty":

(12) *Weak-r in branching onsets - II*
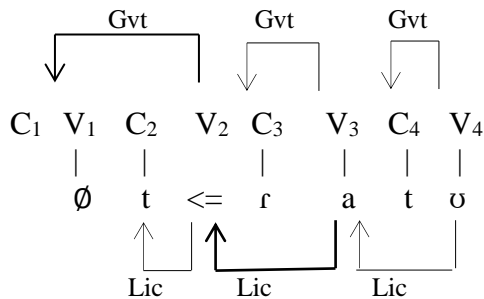
In (12), the empty nucleus under V_1 (of the initial CV) must be governed because only empty nuclei circumscribed by IG do not require government[11]. Thus, in order to respect the principle of locality (Scheer & Brun-Trigaud 2012: 88), the nucleus that must govern V_1 is the one under V_2. The rest of the structure is the same as in (10). Once V_2 has exhausted its government potential, only its licensing potential remains. The closest constituent (not targeted by government) is C_2, which becomes the target of licensing. Thus, weak-r in (12) is between two active nuclei, even though it is phonetically preceded by a tautosyllabic consonant. In sum, as can be seen in the representations (11) and (12), the empty nucleus that precedes weak-r when it occupies the second position of a branching onset is empty but never governed. We are therefore dealing with the same situation presented in (6), (9) and (10): weak-r never occurs after a governed nucleus, that is, in coda mirror. Now let us pass to the analysis of the distribution of intervocalic rhotics.

4.3 The intervocalic context

The data in Table (1) show that weak-r also occurs in intervocalic position. The syllabic representation of the word *caro* [ˈkarʊ] "expensive" where this consonant is between two vowels is presented below:

---

[11] There are languages where the empty nucleus at the end of the word is capable of dispensing lateral forces and for this reason it is not governed. According to Kaye (1990), the existence of final empty nuclei in each language is decided by a parameter: they may or may not be governed. This apart, every empty nucleus must be governed to exist with the only exception of the nucleus circumscribed in the Infrasegmental Government (T<=R).

(14) *The weak-r in the intervocalic context*
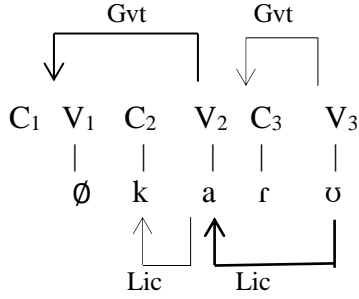
In (14), weak-r in C_3 is preceded by a contentful nucleus in V_2. Also, it is followed by a contentful nucleus in V_3 and targeted by the government of this nucleus. As mentioned in section 2, the contexts where weak-r occurs in the three BP varieties are: 1) intervocalically and 2) in the second position in a branching onset. We have also seen in subsections 4.1 and 4.2 that weak-r never occurs in the coda mirror. Now, by adding the representation (14) to our observations, we are able to establish that weak-r occurs between two phonologically active nuclei, where it is always subject to the government of the following vowel.
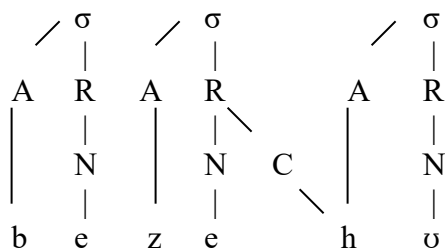
Now let us examine the distribution of strong-r. In subsection 4.1, we saw that strong-r is preceded by a governed nucleus when it occurs in post-coda and word-initial positions (see (6), (9) and (10)). Consequently, strong-r is always licensed in these two positions because they are actually one and the same context: the coda mirror ($\emptyset$__). Now, regarding the intervocalic environment, one might expect that a strong-r in this position, for the first time in our analysis, is in the same phonological context as weak-r: preceded by a contentful nucleus and followed by another one, which would govern it. This would be fatal to the analysis presented herein, as it would appear to be the case that the distribution of strong and weak r is not predictable. However, there is one fact about the position of Portuguese primary stress that leads us to a different analysis. In order to further develop this reasoning, I must first introduce some information concerning the stress pattern of this language.

In Portuguese, the majority of words are stressed on the penultimate syllable (e.g. *cidade* [siˈdadʒɪ] "city", *galera* [gaˈlɛɾɐ] "gang", *damasco* [daˈmaskʊ] "apricot"). Words ending in a consonant are generally stressed on the final syllable (e.g. *computador* [kõputaˈdoh] "computer", *catedral* [kateˈdɾaw] "cathedral") and for this reason several studies consider that Portuguese is a language sensitive to syllabic weight (Bisol 1992, 2002, Wetzels 2000, 2007, among others). Portuguese also contains words, in which the antepenultimate syllable is stressed, such as *ácaro* [ˈacaɾʊ] "acarus", and *ótimo* [ˈɔtʃimʊ] "great". These proparoxytones are considered exceptional, and they represent approximately 13% of Portuguese non-verbs (Garcia 2017). Proparoxytones, in Portuguese, importantly, do not tolerate the presence of a heavy penultimate syllable (e.g. *damasco* [daˈmaskʊ] "apricot" and not *[ˈdamaskʊ]). In addition to this restriction, there is another very intriguing gap in the language, widely known by those who study Portuguese stress. There is an absolute absence of proparoxytones in which the onset of the final syllable contains a strong-r. As it can be seen in the data in Table 1, proparoxytones easily tolerate the presence of a weak-r in the onset of their final syllable (e.g. *ácaro* [ˈacaɾʊ] "acarus", *sátira* [ˈsatʃiɾɐ] "satire"). In contrast, there is no proparoxytone in which the onset of its last syllable is occupied by a strong-r (e.g. *bezerro*

[beˈzehʊ] "calf" and not *[ˈbezehʊ]). Interestingly, Catalan and Spanish also tolerate no proparoxytones in which the last syllable onset is a strong-r, and their rhotic distributions and stress systems are very similar to those of Portuguese (Wheeler 2005, Harris 1983, Bonet & Mascaró 1997).

In order to account for this gap, several studies consider strong-r to be a geminate (e.g. Câmara Jr. 1953, Lopez 1979, Monaretto 1992, 1997, Wetzels 1997, Mateus & D'Andrade 2003, Wheeler 2005, Harris 1983, Abaurre & Sandado 2003). According to these analyses, strong-r occupies two consonantal syllabic positions, one of which would be the onset of the final syllable and the other one, the coda of the penultimate syllable. To illustrate this, let us observe the representation of a word like *bezerro* [beˈzehʊ] «calf» (based in Monaretto, Quednau & Da Hora 2014: 219):

(15) *The 'strong-r as geminate' proposition*

```
      σ           σ                σ
      |           |                |
 A    R      A    R          A     R
 |    |      |    | \        |      |
 |    N      |    N   C      |      N
 |    |      |    |    \     |      |
 b    e      z    e     h    ʊ
```
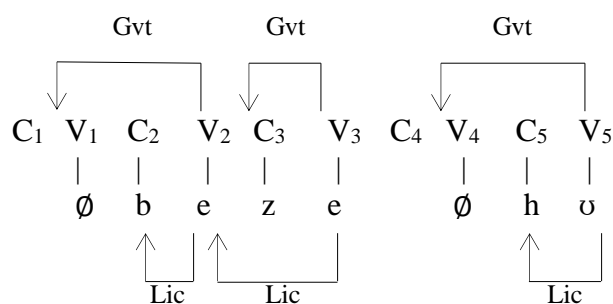
In the 'strong-r as geminate' analysis represented in (15), the penultimate syllable would have an available coda position – even if it is phonetically an open syllable – which would be colonized by geminate strong-r. The penultimate syllable would then be heavy and consequently, stressed. This analysis is thus able to account for the non-existence of Portuguese proparoxytones that contain a strong-r in their final syllable. Nevertheless, it faces major theoretical challenges in justifying the presence of strong-r in post-coda, word-initial, and coda positions (Tables 1 and 2) since cross-linguistically geminates do not appear in these contexts. For instance, it is impossible for a geminate to link itself to a preceding coda position in words like *guelra* [gɛwha] "gills", *desrespeito* [deshesˈpeɪ̯tʊ] "disrespect", and *genro* [ˈʒẽhʊ] "son-in-law" (remember that Portuguese nasal vowels are underlyingly biphonemic) since the coda position in these words is already colonized by a consonant. Thus, to explain the presence of a geminate in post-coda, word-initial, and coda positions, the aforementioned studies must propose rules of degemination (which would have no impact on the melodic quality of the consonant) in each one of these contexts. Furthermore, these studies cannot explain why weak-r – which would be the weakened variant of geminate strong-r, i.e. a simple consonant – is not the consonant that appears in word-initial, and post-coda positions. Hence, it seems that a geminate analysis of strong-r is not the most economical nor easily explainable option from a theoretical point of view.

But, if we reject the geminate analysis, the fact that strong-r never occurs in the onset of the final syllable of a proparoxytone remains to be explained. To do just that I propose that the strong-r implies the presence of a preceding governed nucleus even in intervocalic contexts. The presence of a strong-r between two vowels therefore implies a syllabic structure like the one below for the word *bezerro* [beˈzehʊ] «calf»:

(16) *Strong-r in intervocalic context - I*

```
        Gvt              Gvt                  Gvt
      ┌───┐            ┌───┐                ┌───┐
      ↓   │            ↓   │                ↓   │
 C₁  V₁  C₂  V₂   C₃  V₃   C₄  V₄  C₅  V₅
  │   │   │   │    │   │    │   │   │   │
  Ø   b   e   z    e        Ø   h   ʊ
          └─┐ └─┐  │              └─┐ │
            ↑   ↑                   ↑ │
           Lic  Lic                Lic
```

The representation in (16) illustrates that a strong-r is in the coda mirror even in a phonetically intervocalic environment. It is not a geminate, branching to two consonantal positions (as illustrated in 4(c)). Strong-r is therefore what I call a *mirror consonant*. A mirror consonant is a segment that branches to only one consonantal syllabic position but requires the presence of an empty CV unit to its left. This means that a mirror consonant is the one that occurs solely in the coda mirror.

Note that the representation in (16) implies the existence of an empty CV unit to the left of strong-r, whereas the representation in (15) implies the existence of a coda constituent in a phonetically open syllable. Therefore, the 'mirror consonant' analysis does not require more abstract structure than the 'strong-r as geminate' analysis. This being said, the mirror consonant analysis accounts for the absence of proparoxytones in which the onset of the final syllable contains a strong-r, without any need of degemination rules in word-initial, post-coda, and coda positions (i.e. other contexts where strong-r is also found). Additionally, the mirror consonant analysis explains why weak-r never appears in word-initial, and post-coda positions: it is forbidden to the right of a governed nucleus. This analysis is thus able to predict the distribution of Portuguese rhotic consonants in a unified way: only weak-r occurs between two active nuclei, while only strong-r occurs in the coda mirror.

To further explain the mirror consonant proposal, let us refer to the work of Meireles (2014a, 2014b), who analyzes Portuguese stress within the CVCV framework. According to Meireles, Portuguese regular stress falls on the penultimate vocalic position of a vowel-final word (as in *modelo* [moˈdelʊ] "model" in (17), where an encircled vowel is stressed) and also falls on the penultimate vocalic position in a consonant-final word ending (as in *nariz* [naˈris] "nose" in (18)).

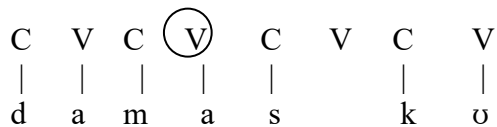(17) Stress *on a word ending in a vowel (Meireles 2014a: 245)*

```
 C   V   C  (V)   C   V
 │   │   │   │    │   │
 m   o   d   e    l   ʊ
```
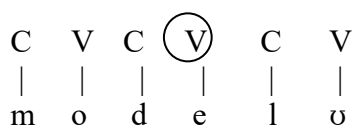
(18) Stress *on a word ending in a consonant (Meireles 2014a: 247)*

```
C   V   C   Ⓥ   C   V
|   |   |   |   |
n   a   ɾ   i   s
```
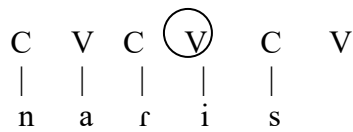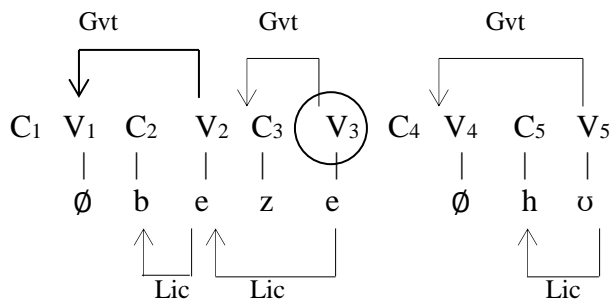
Now, let us consider Meireles' representation of a word like *damasco* [daˈmaskʊ] "apricot" where the penultimate syllable is closed:

(19) Stress *on a word with a closed penultimate syllable (Meireles 2014a: 248)*

```
C   V   C   Ⓥ   C   V   C   V
|   |   |   |   |       |   |
d   a   m   a   s       k   ʊ
```

In the case of the representation in (19), stress should also fall on the penultimate nucleus. However, since the penultimate V position is empty, and stress needs a phonetically overt host on which to be realized, stress falls by default on the antepenultimate nuclear position (Meireles 2014a: 245). If stress in a word like [daˈmaskʊ] falls on the antepenultimate nucleus due to the lack of melodic content attached to the penultimate nucleus, I propose that this is also the case for proparoxytones in which the onset of their last syllable is a strong-r. Below we have the representation of the word *bezerro* [beˈzehʊ] "calf":

(20) *The strong-r in the intervocalic context – II*

```
        Gvt              Gvt              Gvt
      ┌──┐            ┌──┐            ┌──┐
      ↓   │            ↓   │            ↓   │
C₁  V₁  C₂  V₂  C₃  Ⓥ₃  C₄  V₄  C₅  V₅
    |   |   |   |              |   |   |
    ∅   b   e   z   e          ∅   h   ʊ
          ↑   ↑                  ↑
        Lic   Lic              Lic
```

Following Meireles' reasoning, stress should fall on the penultimate vocalic position, which is, in the case of the above representation, V₄. Given the absence of melodic content attached to this nucleus, stress falls by default on the antepenultimate nuclear position, V₃.

In the case of proparoxytones, Meireles (2014a: 248) proposes that Portuguese admits exceptional words in which the stress falls on the antepenultimate nucleus, as in *número* [ˈnumeɾʊ] "number", but that Portuguese does not allows stress to fall on a preantepenultimate nucleus. This is why a word like *[ˈdamaskʊ] is ungrammatical in Portuguese:

(21) *The ungrammaticality of *[ˈdamaskʊ] (Meireles 2014a: 249)*

$$* \quad C \quad \widehat{V} \quad C \quad V \quad C \quad V \quad C \quad V$$

$$\qquad | \quad | \quad | \quad | \quad | \quad \qquad | \quad |$$

$$\qquad d \quad a \quad m \quad a \quad s \quad \qquad k \quad ʊ$$
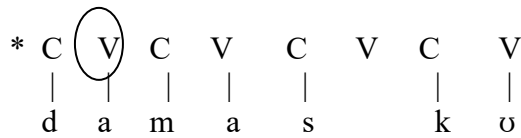
So, Portuguese does not allow the presence of a closed penultimate syllable in proparoxytones because such words would be stressed on the fourth vocalic nucleus (from right to left) as in (21). This also explains why there is no proparoxyton in which the onset of the final syllable is occupied by a strong-r. Consider again the representation in (20). If stress fell on V_2, this word would be ungrammatical for the same reason that *[ˈdamaskʊ] is in (21). Interestingly, this proposal equally accounts for the non-occurrence of proparoxytones containing a strong-r in the onset of their final syllable in Catalan and Spanish.

In the light of the above discussion, I propose that strong-r is phonologically in the coda mirror even when it is phonetically in an intervocalic environment. In this context, and in word-initial and post-coda positions, strong-r is always licensed by the contentful nucleus to its right. On the other hand, weak-r is always governed by the contentful nucleus to its right, in both the second position of a branching onset and intervocalically. Therefore, the presence of a strong-r or a weak-r implies the following syllabic structures, respectively:

(22) *Strong-r syllable structure in word-initial, post-coda and intervocalic positions*
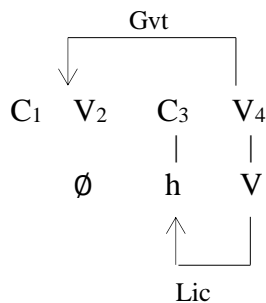
(23) *Weak-r syllable structure in a branching onset and in intervocalic position*
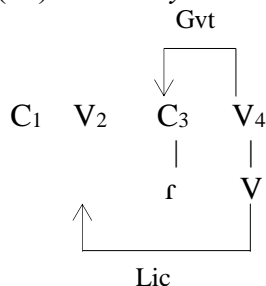
As can be seen in the representation in (22), strong-r is in the coda mirror context and licensed by the contentful nucleus to its right when it occurs in word-initial, post-coda and intervocalic contexts. Importantly, strong-r never emerges between two active nuclei. On the other hand, weak-r never occurs in the coda mirror context. Weak-r always emerges between two active nuclei and

is governed by the following contentful nucleus. Since the presence of a strong-r or a weak-r implies the syllabic structures in (22) and (23), they are in complementary distribution.

Before beginning an analysis of the behavior of weak-r and strong-r in the coda position (ignored up until now), let us examine the behavior and representation of the negative prefix *in-* in the next subsection. This will give us crucial information on the phonological nature of BP rhotic consonants.

4.3.1 The negative prefix *in-*

In Portuguese, the phonetic realization of the negative prefix *in-* is conditioned by the phonological nature of the first segment of the root to which it is attached. The behavior of this prefix before strong-r versus other consonants will give us a better understanding of the phonological identity of rhotics in BP. Consider the following data:

(24) The prefixation of *in-*

	before affixation	after affixation	gloss
a.	[pɾeˈvistʊ]	[ĩpɾeˈvistʊ]	expected, unexpected
b.	[feˈlis]	[ĩfeˈlis]	happy, unhappy
c.	[dʒisˈcɾɛtʊ]	[ĩdʒisˈcɾɛtʊ]	discreet, indiscreet
d.	[ˈgɾatʊ]	[ĩˈgɾatʊ]	grateful, ungrateful
e.	[kaˈpas]	[ĩkaˈpas]	capable, incapable
f.	[leˈgaw]	[ileˈgaw]	legal, illegal
g.	[moˈɾaw]	[imoˈɾaw]	moral, immoral
h.	[neˈgavew]	[ineˈgavew]	deniable, undeniable
i.	[hasi̯oˈnaw] or [xasi̯oˈnaw] or other strong-r phonetic realization depending on dialect	[ihasi̯oˈnaw] or [ixasi̯oˈnaw] or other strong-r phonetic realization depending on dialect	rationnal, irrationnal

As can be seen, the prefix *in-* is realized as a nasal vowel in front of morphemes beginning with an obstruent (24a-e). On the other hand, it is realized as an oral vowel before morphemes beginning with a sonorant (24f-h) or with a strong-r (24i).

According to D'Angelis (2002: 21), the class of Portuguese sonorants is comprised of three nasals (/m/, /n/ and /ŋ/), two laterals (/l/ and /ʎ/) and weak-r (/ɾ/). He proposes that strong-r, along with the rest of the consonants in Portuguese are obstruents. In such an analysis, weak-r and strong-r have two independent underlying representations. This cannot be the case. As can be seen in (24), the grammar does not classify strong-r as an obstruent (compare 24a-e to 24f-i). Actually, the grammar of Portuguese treats strong-r in the same way as the lateral /l/ and the nasals /m/ and /n/, that is, as a sonorant. Based on this evidence, we can state that both strong-r and weak-r are phonologically sonorants. If this were not the case, it would be impossible to explain why the prefix *in-* treats strong-r in the same fashion as other sonorants of the language.

In sum, the behavior of the prefix *in-* demonstrates that strong-r is a sonorant. Let us now turn to the analysis of BP rhotics in the final type of syllabic context: the coda (__Ø).

4.4 The coda

Returning to the data in Table 1, we observe that the coda context is the one that allows the most variation. A word like *curso* "course" can be pronounced as [ˈkuhsʊ] in the variety of Belo Horizonte, as [ˈkuxsʊ] in Rio's variety[12] (Cristófaro Silva 2010: 141, 143, 161) and as [ˈkuhsʊ], [ˈkuɦsʊ], [ˈkuχsʊ], [ˈkuʁsʊ], [ˈkursʊ], [ˈkuɾsʊ], [ˈkuɻsʊ], among other forms of pronunciation in Lavras (Rennicke 2015: 256, 2016: 90). As for the first two varieties, a typical strong-r phonetic realization occurs in the coda. As for the last variety, that of Lavras, all phonetic realizations of strong-r and weak-r (and even some rhotic consonants that never otherwise appear in the language, such as the retroflex approximant) can emerge in the coda (Rennicke 2016: 90).

This huge variability of rhotics in coda (especially in BP spoken in Lavras) does not, however, affect cross-variety comprehensibility. In other words, speakers from Belo Horizonte and Rio de Janeiro who produce a strong-r in coda understand Lavras speakers, who may produce a weak-r, a retroflex approximant or another rhotic in a coda, and vice versa. Now, consider the representation of the syllabic structure of the word *curso* "cours" as it can be pronounced in the variety spoken in Lavras:

(24) *Rhotics in coda*

In accordance with data from Rennicke's studies (2015: 256, 2016: 90) about Lavras' rhotics, all rhotics under C_3 in (25) can be produced in coda. Now, one obvious question to ask is why the coda is the only context that allows the production of all of these rhotics, whereas the other two syllabic environments allow only one realization each; strong-r in the coda mirror and weak-r intervocalically.

---

[12] According to Cristófaro Silva (2010: 141), the voicing of a rhotic in an internal coda is determined by the consonant in the following onset (e.g. [ˈkuhtɐ] or [ˈkuxtɐ] "short" and [ˈkuɦvɐ] or [ˈkuɣvɐ] "curve") in the varieties of Belo Horizonte and Rio de Janeiro.

Before proposing an answer to this question, let us recapitulate some of the notions seen in previous sections. First, we saw at the end of section 4.3 that strong-r is the realization of a rhotic in the coda mirror and therefore subject to the licensing of the nucleus to its right (see (6), (9), (10) and (20)). By contrast, weak-r is found intervocalically, and is thus subject to the government of the nucleus to its right (see (11), (12) and (14)). This implies that strong-r and weak-r are in complementary distribution in these contexts (see (22) and (23)). Second, we have seen in section 4.3.1 that strong-r and weak-r belong to the phonological class of sonorants. Third, we observed in (25) that strong-r and weak-r can both emerge in free variation in the coda. Therefore, taking into account all these facts, I propose that weak-r and strong-r are indeed distinct phonetic realizations of a single rhotic phonological consonant, whose distribution is determined by syllabic context. Based on this proposal, I can answer the question asked in the preceding paragraph in these terms: when the single underlying rhotic in Portuguese is subjected to licensing, it is realized as a strong-r. When it is governed, it is realized as a weak-r. Finally, when this underlying rhotic consonant is not subjected to any force, it can be realized as a strong-r, as a weak-r, or as another variant, according to the particular allophones permitted by each Portuguese variety. A consonant in the coda is thus different from a consonant in the coda mirror and from a consonant in intervocalic position because it is subject to neither the lateral force of licensing nor of government, explaining why certain realizations are attested only in this syllabic context.

A further fact corroborates the proposal that strong-r, weak-r and all other rhotics in Portuguese are indeed realizations of a single underlying consonant. Consider the consonantal alternations in the following singular and plural forms:

(26) *The plural form of words ending in a rhotic consonant*

variety	singular	plural	gloss
BH	[ˈmah]~[ˈmaɦ]	[ˈmaɾis]	sea, seas
RJ	[ˈmax]~[ˈmaɣ]	[ˈmaɾiʃ]	sea, seas
LV	[ˈmah]~[ˈmaɦ]~[ˈmaχ]~[ˈmaʁ]~ [ˈmaɾ]~[ˈmaɽ]~[ˈmaɾ]~ [ˈmaɻ]~[ˈmaɹ]	[ˈmaɾis]~[ˈmaɽis]~[ˈmaɾis]	sea, seas

In (26) we observe that the rhotic consonant is in the coda in the singular form of the word and it is realized as a strong-r in BH and RJ and as a strong-r, a weak-r or another rhotic in LV. However, when such words are produced in the plural form, the rhotic becomes intervocalic. In the plural, this rhotic consonant appears exclusively as a weak-r in all the three varieties – and in all varieties of Portuguese. In other words, even in varieties where a phonetic realization consistent with strong-r is systematically produced in the coda, this same rhotic consonant is realized as a weak-r when intervocalic. In principle, there is nothing in the Portuguese grammar that prevents a strong-r phonetically in the intervocalic position. So, why do speakers who produce a strong-r in the coda not produce *[ˈmahis] or *[ˈmaxis] for the plural form of the word [ˈmah] or [ˈmax]? The proposition presented herein, according to which weak-r, strong-r and the other rhotics seen above are distinct phonetic realizations of one single underlying rhotic consonant, where each variant is determined by syllabic context explains and predicts the kind of alternation observed in (26). Let us put it the following way: in singular words, no force targets the rhotic phonological consonant

in coda. Thus, this consonant is realized as any subset of rhotic allophones available to any particular BP variety (as illustrated in (25)). When the plural suffix is added to a singular word, the rhotic consonant is no longer in the coda but rather, between two vowels. Intervocalically, it becomes the target of the government of the vowel to its right. So, as predicted in (11), it must be realized as weak-r. This is why we observe the pattern in (26). This is a productive rule in Portuguese since this kind of alternation is attested in all singular words ending in a rhotic and their plural forms. Following this analysis, I am finally able to present the conclusion and the theoretical implications of this study.

5 Conclusion

In this article I have studied the distribution of rhotic consonants in Brazilian Portuguese within the framework of CVCV theory. I have proposed that all BP rhotics are distinct realizations of one single underlying phonological consonant for the following reasons: 1) the grammar of Portuguese does not treat weak-r and strong-r as members of two different classes (respectively, sonorant and obstruent), but as members of one same class, i.e. sonorants (as demonstrated by the behavior of prefix *in-*), 2) alternations of surface rhotics in singular versus plural forms, 3) the overlapping between strong-r, weak-r, and other rhotics in the coda, and 4) the complementary distribution of strong-r and weak-r in other syllabic contexts.

Concerning the complementary distribution of rhotics, it has been demonstrated that weak-r does not occur in word-initial or post-coda positions because BP prohibits weak-r in the coda mirror; $\emptyset\_\_$. The licensing of consonants in the coda mirror blocks the realization of weak-r in BP. However, this same licensing operation conditions the realization of strong-r, which is the only rhotic that occurs in post-coda and word-initial positions, or in the coda mirror context. Importantly, the coda-mirror establishes a unitary contextual identity to the word initial and the post-coda onsets, and allows us to avoid the disjunct description of these "two" positions found in the traditional arboreal conception of syllabic structure. It has also been demonstrated that when strong-r occurs in phonetic intervocalic contexts, it is phonologically preceded by a governed nucleus. Synchronic evidence for this proposal is based on the non-existence of proparoxytones in which the onset of the last syllable is occupied by a strong-r. This means that strong-r always emerges in the coda mirror, and never between two active nuclei. An important theoretical implication of this analysis can be expressed in the following way: the phonological component of the grammar can refer to the coda mirror not only in contexts where this object is obligatorily present (i.e. the post-coda position) or parametrically determined (i.e. the word-initial position), but also in intervocalic contexts in order to determine the phonetic realization of certain melodic segments. I also propose this analysis can be applied to varieties of Catalan and Spanish since the distributional behavior of strong-r and weak-r in these languages is identical to the one described here for Portuguese (Bonet & Mascaró 1997, Harris 1983, Wheeler 2005).

In order to explain the distribution of rhotics in Portuguese, some studies propose that strong-r is a geminate (e.g. Câmara Jr. 1953, Lopez 1979, Monaretto 1992, 1994, Mateus & D'Andrade 2003, Abaurre & Sandado 2003). So, to account for its occurrence in word-initial, post-coda and coda positions, these analyses must propose the application of degemination rules in each one of these contexts. On the contrary, my proposal explains and predicts the distribution of the strong-r without the need to postulate such rules. In my analysis, the syllabic identity of strong-r does not rest on

the fact that it is linked to two consonant positions (as in the case of a geminate), but on the fact that it is the only possible phonetic realization of the underlying rhotic consonant after a governed nucleus, i.e., in coda mirror. This is why the strong-r is a *mirror consonant* and not a common simple consonant. A mirror consonant is the one that attaches itself to only one consonantal position in the syllabic structure (as a simple consonant), but it requires the presence of an empty CV unit to its left. In the case of Portuguese, this empty CV unit before a strong-r has a diachronic source: in Latin, strong-r is known to have been a geminate in intervocalic environments. Therefore, it is proposed here that in the evolution from Latin to Portuguese, strong-r simple detached itself from one of the two consonantal positions. This is why it can occur in word-initial and post-coda positions in Portuguese. This analysis has a new theoretical implication: languages are not limited to only two categories of consonants (simple ones and geminates), but by the means of the coda mirror they can establish a third category, which I call: mirror consonants. Taking this into account, there are in fact three kinds of consonants: 1) simple consonants, 2) geminates and 3) mirror consonants. Mirror consonants are never in a phonologically intervocalic context, even if they emerges as phonetically intervocalic.

To summarize the distribution of rhotics in Portuguese: when the underlying rhotic consonant is in coda mirror, it is subject to licensing, and then strong-r appears. On the other hand, when the underlying rhotic consonant is between two active nuclei, it is subject to government, and then weak-r occurs. Finally, when the rhotic is in the coda context, and escapes the effect of lateral forces, the grammar allows it to be realized as a strong-r, a weak-r, or as another rhotic according to the variety of the language. Another theoretical implication of this analysis can be expressed in the following terms: the Grammar can use syllable structure to condition segment realization. In the case of Portuguese, it is syllabic structure that determines the variant of the underlying rhotic consonant that may emerge. In the next last section, I will argue how CVCV is uniquely situated to offer an account of the distribution of Portuguese rhotics.

5.1 Why CVCV?

Most of the evidence on which CVCV bases its proposition regarding the reality of the coda mirror as a cognitive object comes from studies on lenition, fortition or resistance of melody to change in specific syllabic positions in numerous languages (e.g. Ségéral & Scheer 1999a, 1999b, 2001, 2005, 2008a, 2008b, Szigetvári 1999, Scheer & Brun-Trigaud 2012, Brun-Trigaud & Scheer 2010, Scheer & Ségéral 2001, Scheer 2004, 2015, 2016). Studies of these phenomena have also been conducted in other frameworks, especially Optimality Theory (e.g. Beckman 1997, 1999, Kirchner 1998, 2004, Steriade 1999a, 1999b, Vijayakrishnan 2003, Zoll 2004, Smith 2002, 2004, Katz 2016). However, as already noted by Scheer (2016), the theoretical challenge posed by the 'word-initial' and 'post-coda' disjunction for a unified analysis for phenomena such as fortition or resistance to lenition is never explicitly addressed in these studies (remember that word-initial and post-coda consonants tend to resist lenition as in **p**orta>**p**orte, tal**p**a>tau**p**e, while intervocalic and coda consonants tended to undergo processes of lenition as in ri**p**a>ri**v**e, ru**p**ta>route in Scheer & Brun-Trigaud 2012, Scheer 2016). For instance, in Kirchner's (1998) analysis of positional influence on lenition in 272 languages, the post-coda position was not even acknowledged. In the case of studies where this disjunction is mentioned, there is no theoretical proposition given to account for the shared characteristics of the word-initial and post-coda onsets, to the exclusion of the intervocalic onset position (e.g. Kenstowicz & Kisseberth 1977, Kenstowicz 1994).

Besides the non-recognition of the unitary nature of word-initial and post-coda positions in several languages (i.e. in all languages where by means of a parametric choice an empty CV unit is present in the beginning of words), it seems that the tools used by certain studies to explain lenition and fortition phenomena cannot be generalized. For instance, let us consider one proposal regarding the analysis of consonantal lenition in intervocalic position. Kirchner (1998: 3) claims that this phenomenon is triggered by "a phonetic imperative to minimize articulatory effort" and accordingly "this effort minimization imperative can and should be incorporated directly into the phonological formalism, as a scalar, violable constraint, which I call LAZY". According to this author, the interaction between the constraint LAZY and other constraints ("faithfulness" and "fortition") could explain "the greater tendency towards lenition in the context of open flanking segments" or, in other words, in an intervocalic context (Kirchner 2004: 342-343). Yet, if the interaction between these constraints explains consonantal lenition in intervocalic position, this same kind of interaction could not explain why the rhotic consonants of Portuguese (as well of Catalan and Spanish) produce lexical contrast only in intervocalic environments (e.g. *carro* "car" and *caro* "expensive"). More precisely, if the phonological effect of LAZY favors consonantal lenition intervocalically, this means that speakers would tend to put less articulatory effort into the realization of consonants preceded and followed by a vowel. However, as shown in sections 2 and 4 of this article, the distribution of Portuguese rhotics does not support this analysis. Lusophones maximize their articulatory effort precisely in intervocalic contexts, the only context in which the two types of consonants (strong-r and weak-r) generate lexical contrast (in word-initial and post-coda positions, just one type of rhotic occurs: strong-r). Thus, to account for the distribution of rhotics within Kirchner's approach, one must at least offer a completely different ordering for the constraints. This means that Kirchner's proposal – as it stands – cannot be generalized to the case of the distribution of Portuguese rhotic consonants (nor to the case of Catalan and Spanish where the distribution of rhotics is the same as in Portuguese (Bonet & Mascaró 1997, Harris 1983, Wheeler 2005)). On the other hand, the proposition of a linear syllabic structure (where the presence or absence of the coda mirror triggers melodic effects) explains intervocalic consonantal lenition and additionally it explains – as it stands – the fact that Portuguese rhotics contrast only in intervocalic environments, without requiring particular phonological information (such as a different constraint ranking) for the specific case of Portuguese rhotics. Moreover, Kirchner's (1998, 2004) proposal must refer to the phonological component of the grammar (to manage, among other things, the ordering of constraints) and to phonetics (« a phonetic imperative to minimize articulatory effort ») in order to account for consonantal lenition. However, the coda mirror accounts for intervocalic consonantal lenition and for the distribution of Portuguese rhotic consonants referring solely to the phonological component of language, which is more economical from a theoretical point of view.

Let us consider briefly another notion that does not seem to be generalizable to the analysis of the distribution of Portuguese rhotics. According to certain studies, the presence of certain perceptual cues can be appealed to explain why some positions – e.g. word-initial – are associated with a stronger potential for segmental contrast (e.g. Beckman 1997, Steriade 1999a, 1999b). According to Beckman, these so-called privileged positions "enjoy some perceptual advantage in the processing system, via either psycholinguistic or phonetic prominence, over the complement of non-privileged positions" (1999: 3). Since non-privileged positions – e.g. non-initial syllables – are proposed to lack this psycholinguistic or phonetic prominence, they are prone to neutralization. But, the distribution of Portuguese rhotics indicates a phonological reality that does not seem to be determined by "physical cues" (idem: 3). In Portuguese (as well as in Catalan and Spanish), the

word-initial position is precisely one of the contexts where there is no contrast between the rhotic consonants. The only context in which these consonants contrast is found in non-initial syllables, more specifically, in intervocalic position. It therefore seems impossible to support that the higher potential for segmental contrast in privileged positions (such as the beginning of a word) is linked to the presence of psycholinguistic or phonetic prominence, because if this were the case, Portuguese, Catalan, and Spanish rhotic consonants should contrast at the beginning of the word and not solely in intervocalic position. Again, the coda mirror explains why the word-initial and post-coda contexts are associated with a higher potential for segmental contrast (e.g. Ségéral & Scheer 1999a, 1999b, 2001, 2005, 2008a, 2008b, Szigetvári 1999, Brun-Trigaud & Scheer 2004, 2015, 2016), and it does so without appealing to extra-linguistic psychological factors. In addition, the coda mirror accounts for the case of Portuguese rhotics, where the only context of contrast is in intervocalic environments.

Note yet that according to Beckman (1999), positions that do have neither psycholinguistic nor phonetic prominence – e.g. non-initial syllables – are prone to neutralization processes. However, we have seen that the contrast between strong-r and weak-r exists only in internal intervocalic onsets. Also, remember there is no contrast in an internal onset if it is preceded by a heterosyllabic consonant (in the post-coda position only strong-r occurs). This means that two behaviours are attested for internal onsets: there is contrast in intervocalic internal onsets and no-contrast in internal post-coda onsets. This being the case, how would it be possible to explain that these internal onsets have different levels of psycholinguistic prominence? Also, given that strong-r and weak-r do not contrast in word-initial position, how can one explain that an onset in this position and one in the post-coda position have an identical level of psycholinguistic prominence? Lastly and crucially, let us recall that there is no contrast between rhotics in the context of the last intervocalic onset of proparoxytones (there are words like [ˈsatʃirɐ] "satire", but *[ˈsatʃihɐ]). It is unclear how the presence of a certain psycholinguistic or phonetic prominence or even how the action of a constraint such as LAZY (Kirchner 1998, 2004) could explain the absence of segmental contrast in the last intervocalic onset of proparoxytones, and at the same time the presence of contrast in all other intervocalic onsets. The coda mirror explains the complex distribution of the BP rhotic consonants without facing these theoretical challenges.

REFERENCES

Author

Abaurre, Maria Bernadete Marques & Maria Filomena Spatti Sandalo (2003). Os róticos revisitados. Teoria linguística : fonologia e outros temas, edited by Dermeval da Hora & Gisela Collischonn. Editora Universitária/UFPB (2003):144-180.

Beckman, Jill (1997). Positional faithfulness, positional neutralisation and Shona vowel harmony. Phonology 14: 1-46.

Beckman, Jill (1999). Positional Faithfulness. Ph.D. dissertation, University of Massachusetts at Amherst. Published by Garland Press, New York.

Bisol, Leda (1992). O acento e o pé métrico binário. Caderno de estudos linguísticos, 22:69-80.

Bisol, Leda (2002). O acento, mais uma vez. Letras & Letras 18(2):103-110.

Blevins, Juliette (1995). The Syllable in Phonological Theory. In: Goldsmith (1995). The Handbook of Phonological Theory. Oxford: Blackwell: 206-244.

Bonet, Eulàlia & Joan Mascaró (1997). On the representation of contrasting rhotics. Issues in the Phonology and Morphology of the Major Iberian Languages, edited by Fernando Martínez-Gil & Alfonso Morales-Front, 103–126. Washington: Georgetown University Press.

Brun-Trigaud, Guylaine & Tobias Scheer (2010). Lenition in branching onsets in French and in ALF dialects. Development of Language through the Lens of Formal Linguistics, edited by Petr Karlík, 15-28. Munich: Lincom. WEB.

Cagliari, Luiz Carlos (2009). Elementos de fonética do português brasileiro. São Paulo: Paulistana.

Câmara Jr., Joaquim Mattoso (1953). Para o estudo da fonêmica portuguesa. Rio de Janeiro: Organizações Simões.

Câmara Jr., Joaquim Mattoso (1972). The Portuguese Language. Chicago: The University of Chicago Press.

Câmara Jr., Joaquim Mattoso (1977). Para o estudo da fonêmica portuguesa. 2nd Edition. Rio de Janeiro: Padrão.

Câmara Jr., Joaquim Mattoso (1998). Problemas de linguística descritiva. 17th Edition. Petrópolis: Vozes.

Câmara Jr., Joaquim Mattoso (2015). Estrutura da língua portuguesa. 47th Edition. Petrópolis: Vozes.

Callou, Dinah & João Antônio de Moraes (1995). Condicionamento sócio e geolingüísticos na realização do /R/ no português do Brasil. Estudos Lingüísticos e Literários 17: 69-78.

Callou, Dinah, Yvone Leite & João Antônio de Moraes (2002). Processo(s) de enfraquecimento consonantal no português do Brasil. Gramática do português falado, vol. VIII, edited by Maria Bernadete Marques Abaurre & Angela C. S. Rodrigues, 537-555. Campinas : Unicamp.

Cardoso, Walcir (1999). A quantitative analysis of word-final /r/-deletion in Brazilian Portuguese. *Linguistica Atlantica*, 21: 13-52.

Cristófaro Silva, Thaïs (2010). *Fonética e fonologia do português : roteiro de estudos e guia de exercícios.* 10th Edition. São Paulo: Contexto.

Dalbera, Jean-Philippe & Marie-José Dalbera-Stefanaggi (2004). Grands corpus dialectaux ou la phonologie indiscrète. Corpus 3: 399-433.

D'Angelis, Wilmar da Rocha (2002). Sistema fonológico do português: rediscutindo o consenso. *DELTA.* 18(1), 1–24.

Ferreira Neto, Waldemar (2011). Introdução à fonologia da língua portuguesa. São Paulo: Paulistana.

Garcia, Guilherme D. (2017). Weight gradience and stress in Portuguese. *Phonology* 34: 41-79.

Goldsmith, John (1990). Autosegmental & Metrical Phonology. Cambridge: Blackwell.

Goldsmith, John (2011). The Syllable. In: Goldsmith, Riggle & Yu (2011). The Handbook of Phonological Theory. 2nd edition. Oxford: Blackwell: 164-196.

Harris, James W. (1983). Syllable structure and stress in Spanish. Cambridge: MIT Press.

Harris, John (1994). English Sound Structure. Oxford: Blackwell.

Katz, Jonah (2016). Lenition, perception and neutralisation. *Phonology* 33(01), 43-85.

Kaye, Jonathan (1990). "Coda" licensing. Phonology, 7: 301-330.

Kenstowicz, Michael (1994). Phonology in Generative Grammar. Oxford: Blackwell.

Kenstowicz, Michael & Charles Kisseberth (1977). Topics in Phonological Theory. New York: Academic Press.

Kirchner, Robert (1998). An effort-based approach to consonant lenition. Ph.D dissertation, University of California at Los Angeles.

Kirchner, Robert (2004). Consonant Lenition. Phonetically Based Phonology, edited by Bruce Hayes, Robert Kirchner & Donca Steriade, 313-345. Cambridge: Cambridge University Press.

Lopez, Barbara S. (1979). The sound pattern of Brazilian Portuguese (Cariocan Dialect). Ph.D. Dissertation. Los Angeles: University of Califórnia. In : Bisol, Leda (2014). Introdução a estudos de fonologia do português brasileiro. 5th edition. Porto Alegre: EDIPUC-RS.

Lowenstamm, Jean (1996). CV as the only syllable type. Current Trends in Phonology. Models and Methods, vol. 2, edited by Jacques Durand & Bernard Laks, 419-441. Salford, Manchester: ESRI. WEB.

Lowenstamm, Jean (1999). The beginning of the word. Dans *Phonologica 1996*, sous la dir. de John Rennison et Klaus Kühnhammer, 153–166. La Haye : Holland Academic Graphics.

Madruga, Magnum & Maria Bernadete Marques Abaurre (2015). Restrições fonotáticas de onset e ditongos crescentes em português. *ABRALIN* 14(1), 339-377.

Massini-Cagliari, Cagliari & Redenbarger (2016). A Comparative Study of the Sounds of European and Brazilian Portuguese: Phonemes and Allophones. In: Wetzels, Costa & Menuzzi (2016). The Handbook of Portuguese Linguistics. John Wiley & Sons.

Mateus, Maria Helena (1975). Aspectos da fonologia do português. Lisboa: Instituto Nacional de Investigação Científica.

Mateus, Maria Helena & Ernesto d'Andrade (2003). *The phonology of Portuguese*. Oxford: Oxford University Press.

Meireles, Vanessa (2014a). *Analyse phonologique et métrique des glides et diphtongues en portugais brésilien*. Ph.D dissertation, Université Paris 8.

Meireles, Vanessa (2014b). O acento primário em português: generalidades e proposta de análise. Diadorim 16 :16-32. WEB.

Monaretto, Valéria Neto de Oliveira (1992). A vibrante: representação e análise sociolinguística. Dissertação de mestrado. Porto Alegre : Universidade Federal do Rio Grande do Sul. In: Bisol, Leda (2014). Introdução a estudos de fonologia do português brasileiro. 5th edition. Porto Alegre: EDIPUC-RS.

Monaretto, Valéria Neto de Oliveira (1994). O status fonológico da vibrante. Fonologia. Análises não-lineares. Bisol (org). Letras de Hoje 29(4). Porto Alegre: PUCRS.

Monaretto, Valéria Neto de Oliveira (1997). Um reestudo da vibrante: análise variacionista e fonológica. Tese de doutoramento. Porto Alegre: Pontifícia Universidade Católica do Rio Grande do Sul. In : Bisol, Leda (2014). Introdução a estudos de fonologia do português brasileiro. 5th edition. Porto Alegre: EDIPUC-RS.

Monaretto, Valéria Neto de Oliveira, Laura Rosane Quednau & Dermeval Da Hora (2014). As consoantes do português. In : Bisol, Leda (2014). Introdução a estudos de fonologia do português brasileiro. 5th edition. Porto Alegre: EDIPUC-RS: 202-235.

Nevins, Andrew 2008. Review of Scheer (2004), A lateral theory of phonology. Lingua 118: 425-434.

Oliveira, Marco Antônio & Thaïs Cristófaro-Silva (2002). Variação do "r" pós-consonantal no português brasileiro: um caso de mudança fonotática ativada por cisão primária. Letras de Hoje, 37: 25-47.

Rennicke, Iris. Terminology issues in Spanish and Portuguese phonetics and phonology: vibrantes or rhotics? (2014). *From Language to Discourse: Selected Papers of Linguistic Sharing Forum*, Cambridge Scholars Publishing, 176-198.

Rennicke, Iris (2015). Variation and Change in the Rhotics of Brazilian Portuguese. Ph.D dissertation, University of Helsinki.

Rennicke, Iris. (2016). Representação fonológica dos róticos do português brasileiro: uma abordagem à base de exemplares. *Scripta*, *20*(38), 70-97.

Seara, Izabel Christine, Vanessa Gonzaga Nunes & Cristiane Lazzarotto-Volcão (2015). *Fonética e fonologia do português brasileiro*. São Paulo: Contexto.

Scheer, Tobias (2004). *A lateral theory of phonology*, Vol. 1: *What is CVCV and why should it be?*, Berlin: Mouton de Gruyter.

Scheer, Tobias (2015). *Précis de structure syllabique : accompagné d'un apparat critique*. Lyon: ENS Éditions.

Scheer, Tobias (2016). Why phonology is flat: the role of concatenation and linearity. Paper presented at the workshop 'Hierarchical Structures in Phonology, Morphology and Syntax', Tromsø.

Scheer, Tobias & Guylaine Brun-Trigaud (2012). La lénition des attaques branchantes en français et dans les dialectes de l'ALF. Etudes de linguistique gallo-romane, edited by Mario Barra-Jover, Guylaine Brun-Trigaud, Jean-Philippe Dalbera, Patric Sauzet & Tobias Scheer, 183-198. Saint-Denis: Presses Universitaires de Vincennes.

Scheer, Tobias & Markéta Ziková (2010). The Coda Mirror v2. Acta Linguistica Hungarica 57.4: 411-431.

Scheer, Tobias & Philippe Ségéral (2001). Les séquences consonne + yod en gallo-roman. Recherches Linguistiques de Vincennes 30, 87-120.

Scheer, Tobias & Péter Szigetvári (2005). Unified representations for stress and the syllable. *Phonology* 22: 37-75.

Ségéral, Philippe & Tobias Scheer (1999a). Is the Coda Mirror a phonological object? Paper presented at the First Annual Meeting of the GDR 1954 "Phonologie" on Lenition and Fortition, Nice 24-25. WEB.

Ségéral, Philippe & Tobias Scheer (1999b). The Strong Position - Statement of the Problem. Introduction to the First Annual Meeting of the GDR 1954 "Phonologie" on Lenition and Fortition, Nice 24-25.

Ségéral, Philippe & Tobias Scheer (2001). La Coda-Miroir. *Bulletin de la Société de linguistique de Paris* 96: 107–152.

Ségéral, Philippe & Tobias Scheer (2005). What lenition and fortition tells us about Gallo-Romance Muta cum Liquida. Romance Languages and Linguistic Theory 2003, edited by Twan Geerts, Ivo van Ginneken & Haike Jacobs, 235-267. Amsterdam: Benjamins. WEB.

Ségéral, Philippe & Tobias Scheer (2008a). The Coda Mirror, stress and positional parameters. Lenition and Fortition, edited by Joaquim Brandão de Carvalho, Tobias Scheer & Philippe Ségéral, 483-518. Berlin: Mouton de Gruyter. WEB.

Ségéral, Philippe & Tobias Scheer (2008b). Positional factors in lenition and fortition. Lenition and Fortition, edited by Joaquim Brandão de Carvalho, Tobias Scheer & Philippe Ségéral, 131-172. Berlin: Mouton de Gruyter. WEB.

Smith, Jennifer (2002). Phonological Augmentation in Prominent Positions. Ph.D dissertation, University of Massachusetts.

Smith, Jennifer (2004). Making constraints positional: Toward a compositional model of CON. Lingua 114: 1433-1464.

Spencer, Andrew (1996). Phonology. Oxford: Blackwell.

Steriade, Donca (1999a). Alternatives to syllable-based accounts of consonantal phonotactics. Proceedings of LP'98: Item Order in Language and Speech, Vol. 1, edited by Osamu Fujimura, Brian D. Joseph & Bohumil Palek, 205-245. Prague: Karolinum Press. WEB.

Steriade, Donca (1999b). Phonetics in Phonology: The case of Laryngeal Neutralization. UCLAWorking Papers in Linguistics 2: 25-146. WEB.

Szigetvári, Péter (1999). VC Phonology: a theory of consonant lenition and phonotactics. Ph.D. dissertation, Eötvös Loránd University Budapest.

Vijayakrishnan, K.G. (2003). Weakening processes in the Optimality Framework. The Phonological Spectrum. Vol I: Segmental Structure, edited by Harry van der Hulst, Vincent van Heuven & Jeroen van de Weijer, 241-255. Amsterdam & Philadelphia: Benjamins.

Wheeler, Max W. (2005). *The phonology of Catalan*. Oxford: Oxford University Press.

Wetzels, W. Leo (1997). The lexical representation of nasality in Brazilian Portuguese. Probus, The Netherlands, 9, 203-232.

Wetzels, W. Leo (2000). Consoantes palatais como geminadas fonológicas no português brasileiro. Estudos linguísticos, 9(2): 5-15.

Wetzels, W. Leo (2007). Primary word stress in Brazilian Portuguese and the Weight Parameter. Journal of Portuguese Linguistics, 5(6): 9-58. WEB.

Wiese, Richard (1996). The Phonology of German. Oxford: Oxford University Press.

Zoll, Cheryl (2004). Positional Asymmetries and Licensing. Optimality Theory in Phonology: a Reader, edited by John McCarthy, 365-378. Oxford: Blackwell.