

The distribution of rhotics in Portuguese and in other Romance languages

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The distribution of rhotics in the Portuguese of Rio Grande do Sul¹ illustrates quite well a situation that, with some variations that do not invalidate the general picture, extends to many other Romance varieties that present a contrast between [r] and [r̄]. Here are the relevant data:

(1) Possible contrast: between vocoids

[r]		[r̄]	
mi[r]a	'myrrh'	mi[r̄]a	's/he looks'
a[r̄]ar	'to lower'	sé[r̄]u	'serious'
ba[r̄]o	'neighborhood'	che[r̄]o	'odour'

(2) Complementary distribution

	[r̄]	[r]
a. Word initially	[r̄]isco	'risk'
b. Syllable initially after true consonant	hon[r̄]ado	'honest'
c. Second element in an onset	p[r̄]ata	'silver'
d. Syllable finally (internal position)	ma[r̄]ca,	'mark'
	ma[r̄. t]ranquilo	'quiet sea'
e. Syllable finally (absolute position)	ma[r̄]	'sea'
f. Between vocoids, word finally	ma[r̄. a]zul	'blue sea'

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¹ See Monareto (1997) for detailed data. For other Brazilian varieties see Angenot and Vandressen (1979), Cristóforo (1998, p. 51).

We can break the analysis of rhotic distribution in two parts:

- (3) Problem 1: How do we account for the contrast?
 Problem 2: How do we account for the distribution in noncontrasting positions?

The standard approach to this questions in Romance is inspired in work by Harris (1983), but it is fair to note that the first proponent of the diphonemic source of intervocoid tense [r] as /rr/ is Mattoso (1953). Under this approach there is contrast because although there is a single underlying rhotic, /r/, it can be geminate.²

- (4) Standard approach:
 Problem 1: Intervocoid [r] is /rr/.
 Problem 2: Distribution is derived by language particular rules.

In Harris' analysis, which can easily be extended to our Portuguese data (provided we drop the last rule), there are four rules that we will dub for ease of reference Postconsonantal tensing, Word-initial tensing, Degemination, and Coda tensing.

- (5) Rules
- | | |
|--|-------------------------|
| a. $r \rightarrow r / [+cons]\sigma[_]$ | Postconsonantal tensing |
| b. $r \rightarrow r / x^0 [_]$ | Word-initial tensing |
| c. $r \rightarrow \emptyset / _ r$ | Degemination |
| d. $r \rightarrow r$ (in emphatic speech) | Coda tensing |
| | |
| R | |

The standard approach explains why there is no contrast in all positions: sequences of two liquids are not possible word initially, as an onset, or as a coda. At the same time, however, it has to resort to geminate liquids which, even if allowed in some Romance varieties, are rare or inexistent in others.

On the other hand the analysis relies on a battery of language particular rules of which only one, Degemination, is independently motivated (it is necessary in order to account for cases like ma/r/evolto \rightarrow ma[r]jevolto 'rough sea').

Descriptively, the situation depicted in (5) is not an impossible one. But, curiously enough, the situation described by (5a-c) is found again and again, with minor changes, in other varieties of Portuguese and in other varieties of other Romance languages as well, while other possible solutions do not arise.

² A recent analysis of (European) Portuguese can be found in Mateus and Andrade (2000).

On the other hand, (5c) varies across varieties. I summarize the problems of the rule-based account in (6):

- (6)
- | | |
|---|------------------------------|
| a. Problem of lost generality | |
| Why two rules of tensing in onset initial position? | [r]isco / hon[r]ado |
| b. Problem of directionality | |
| Why the flap in [σC_] | p[r]ata |
| and tense variety in C [σ_]? | hon[r]ado |
| c. Problem of variation | |
| Why linguistics, dialectal, style variation in coda | ma[r], ma[r],
ma[x], etc. |

One of the problems is to account for (6a), i.e. to explain why Postconsonantal tensing and Word-initial tensing are independent processes. If so, why don't we find varieties where only the first or only the second apply, like Unattested A and Unattested B?

- (7) Unattested A Unattested B
- | | | | |
|-----------|---------|-----------|---------|
| mi[r]ja | mi[r]ja | mi[r]ja | mi[r]ja |
| [r]isco | | [r]isco | |
| hon[r]ado | | hon[r]ado | |

An apparently easy answer consists of merging (5a, b) into (8):

- (8) $r \rightarrow r / \sigma[_]$

But now (8) overapplies to intervocoid cases giving rise to *mi[r]ja from underlying /mira/: the contrast in this position would be incorrectly neutralized.

On the other hand, it is practically impossible, in a rule based approach, to account for (5b) – while (5c) is easily accounted for: a language with coda [r] has a rule of Coda tensing, a language with coda [r] lacks it.

In trying to give an appropriate answer to the questions in (6) I will rely on the approach developed in Bonet and Mascaró (1997) which develops ideas of Murray and Vennemann (1983), Vennemann (1988), and Clements (1990).

Here I will only give a basic sketch of a solution couched in OT that solves, I think, the main problems of other analyses. I will not go into detailed discussion of the arguments put forward in the literature in favor of particular solutions. Some of the most recent literature, which brings important insights, will not be covered.³

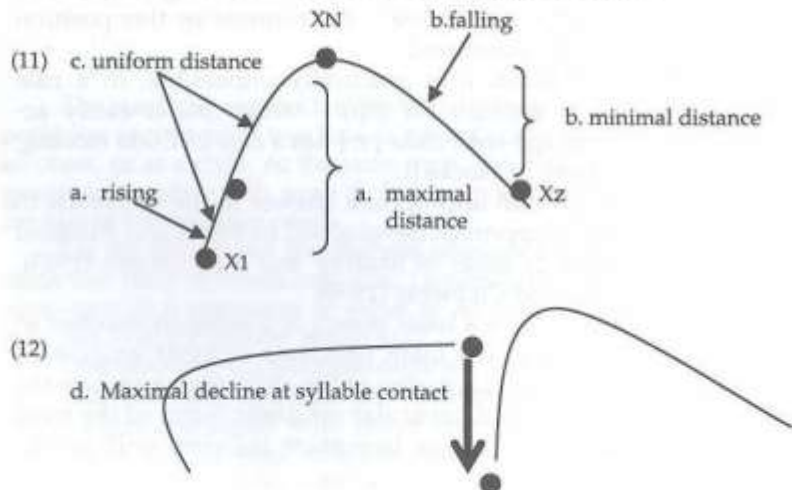
³ In particular Bradley (2001), Harris (2002), and Padgett (2003).

The basic idea is the following: [r] and [r̥] differ in sonority, and their distribution is heavily influenced by universal sonority preferences in different syllabic positions. The sonority differences can in part be derived by their production and acoustic properties: the trill [r̥] is typically tense and long, can appear devoiced like obstruents, and in many varieties that keep the /r/ - /r̥/ distinction and the distribution of rhotics analyzed here it has changed into a fricative, mainly [x] or [χ], or into an assibilated [ʁ]. The flap, on the contrary, is short and displays small amounts of energy in the spectrogram. The basic idea is summarized in (9-11).

- (9) Choose tense variety or approximant, whichever makes a best (less marked) syllable.

What are the basic conditions for best syllables? They are shown in (10-12);

- (10) Murray and Vennemann (1983), Vennemann (1988), Clements (1990)
- ONSET. Maximal sonority rise in first demisyllable (σ_1)
 - CODA. Minimal sonority decline in second demisyllable (σ_2)
 - UNIFORMITY. Maximal uniformity of dispersion (uniform sonority distances between pairs of adjacent segments)
 - CONTACT. Maximal sonority decline at syllable contact



More formally, we can restate (9-12) as follows:

- (13) Where $\sigma = X_1 \dots X_n \dots X_z$, X_i a segment, let demisyllable $\sigma_1 = X_1 \dots X_n$ and demisyllable $\sigma_2 = X_n \dots X_z$; then:
- In σ_1 , $\text{Son}(X_n) - \text{Son}(X_i)$ tends to be maximal ONSET
 - In σ_1 , $\text{Son}(X_n) - \text{Son}(X_i)$ tends to be minimal CODA
 - $|X_i - X_{i+1}|$ tends to be constant⁴ UNIFORMITY
 - Given adjacent segments of different syllables, $X_n X'$, $\text{Son}(X) - \text{Son}(X')$ tends to be maximal CONTACT

Consider now the following sonority scale, where fricatives are equalled to fricatives, the flap to laterals, and these are kept at equal distance from the end of the scale by increasing sonority distances at its right side:

(14) Sonority scale

0	1	2	5	8	10
stops	fricatives	nasals	laterals	glides	vowels
trill			flap		

Let us now see how the questions in (6) can be answered. We begin with the first question in (6b), namely why do we get the flap in [σC ___], as in p[r̥]ata, and not the trill? Given the sonority scale, and uniformity (10c) we predict demisyllables with complex onsets like pra, pla, but not *pta, *psa, *pna, because the sonority distances from the central element of the demisyllable to the first and to the third element are equal (uniform) in the first case, but not in the second. In the following tableau (15) uniformity is shown through subtracting sonority distances. For pra and pra, the relevant sonority values are $\text{Son}(p)=0$, $\text{Son}(r)=5$, $\text{Son}(r)=1$, $\text{Son}(a)=10$. The differences (in absolute values) are as follows: from p to r = 5, from a to r = 5. We now subtract 5-5=0 and obtain the lowest (i.e. best) value for uniformity. In the case of candidate (15b), we get p to r = 1, a to r = 9, hence 9-1=8 and we obtain a high (i.e. adverse) value for uniformity. Here are the relevant constraints:

UNIFORM DISTANCE: Distances between members of an onset/coda are equal.⁵

IDENT R: Corresponding segments have the same value for rhotic features (the features distinguishing r̥ from r).

⁴ I. e. the absolute value of sonority differences of all pairs of consecutive elements within a demisyllable tends to be the same.
⁵ The fact that [r̥v] is also a possible demisyllable should also be accounted for. I will ignore this question here, although many obvious solutions suggest themselves.

(15)

	prata	UNIFORM DISTANCE	IDENT R
a.	☞ prate	(0)	
b.	prate	*!(8)	*

Notice that this precludes the possibility of having an underlying contrast, since it would always be neutralized in this position. Given Richness of the Base and Lexicon Optimization, the underlying structure in (16) below, /prata/ with the trill, is impossible:

(16)

	prata	UNIFORM DISTANCE	IDENT R
a.	☞ prate	(0)	*
b.	prate	*!(8)	

The second question in (6b) is why we get the tense variety in the context C [σ __, as in hon[r]ado, and not the flap, i.e. *hon[r]ado. We can attribute the naturality of the actual solution by appealing to the need to maximal decline in sonority at syllable contact (10b) which is expressed through the constraint ABRUPT DECLINE, which requires a minimum of sonority decline at the syllable boundary.⁶

Notice that satisfying ABRUPT DECLINE is made possible through the existence of two rhotics. Syllabic contacts like those in *asma* 'asthma' [a₃.mɛ] cannot satisfy the requirement of declining sonority because they have to be faithful to manner features, i.e., 3 cannot turn into j, for instance, in order to fulfil syllable contact sonority requirements.⁷

ABRUPT DECLINE: Sonority at the syllable boundary must decline (In C₁.C₂, C₂-C₁ is negative)

IDENT MANNER: Corresponding segments have the same value for manner features.

The decline in sonority is measured by subtracting the sonority value of the final coda segment from the sonority value of the onset initial segment. In on.radu, for instance, n=2 and r=1; since 1-2 = -1, there is decline.

⁶ Of course ABRUPT DECLINE is a constraint family; here the one requiring a decline of at least 1 dominates the rest.

⁷ A case in which this actually happens, namely 3 turning into j because ABRUPT DECLINE dominates faithfulness to manner features, is found in Majorcan Catalan, where the verbal root /kunʃ/ is realized with the final fricative and before vowels but with a glide before 2nd person -s: [kunʃ] 's/he knows', [kunʃ - ʎ] 'to know', [kun.ʃ - s] 'you know'.

(17)

	/onradu/	IDENT MANNER	ABRUPT DECLINE	IDENT R
a.	on.radu		(3)	*
b.	on.radu		(-1)	
<hr/>				
	/a ₃ .ma/			
c.	a ₃ .mɛ		*!(1)	
d.	aj.mɛ	*!	(-6)	

Here again there is no possibility of having an underlying contrast, since it would be neutralized, given Richness of the Base and Lexicon Optimization.

This ranking predicts of course that if we increase sufficiently the sonority of the first element of the contact cluster C₁.C₂, ABRUPT DECLINE will be satisfied. This will happen whenever the sonority of C₁ exceeds the sonority of C₂, namely if C₁ is a vowel. This is shown in (18), where both candidates show a decline in sonority at the syllable contact:

(18)

	fejru	IDENT MANNER	ABRUPT DECLINE	IDENT R
a.	☞ fej.ru		(-3)	
b.	fej.ru		(-7)	*!

Now notice that ABRUPT DECLINE accepts both candidates; this means that an underlying contrast will be possible, since IDENT R after the tie-up of candidates with [r] and with [r], will prefer the faithful one. This is shown in (19) with which has now a lexical r:

(19)

	bajru	IDENT MANNER	ABRUPT CONTACT	IDENT R
a.	baj.ru		(-3)	*!
b.	☞ baj.ru		(-7)	

Finally consider coda position. Here we have variety internal (style) variation, and also variation across languages and varieties. To give just one illustration of this situation, the variety of Portuguese analyzed here has the flap, Central Catalan has the trill, while the variety of Spanish analyzed by Harris has variation between them:

(20)

Portuguese (Rio Grande do Sul)	Catalan (Central)	Spanish (Mexican)
mar	mar	mar, mar

Here the analysis is parallel to the standard one; since there is variation, the most natural tendency to having a coda with low sonority distance to the nucleus will be compensated in some varieties by a requirement to have tense rhotics in coda position.

The final case to be accounted for is word-initial position. So far we would expect contrast in this position, the same we find in intervocoid position. I illustrate these cases with intervocalic and glide-vowel position:

(21)

V__V (internal)	mi[r]a	mi[r]a	
V__V (across #)	este[r]isco	* este [r]isco	'this risk'
glide__V (internal)	ba[jr]o	che [jr]o	
glide__V (across #)	trarei [r]isco	* trarei [r]isco	'I will bring risk'

Here the rhotic in postvocalic position in word initial position must be faithful to the independently existing word [rísku], through an output to output constraint:

(22) Relevant output: [r]isco

	este /r/isco	ABRUPT CONTACT	OO-IDENT R	IDENT R
a.	este [r]isco	(-3)	*!	
b.	☞ este [r]isco	(-7)		*

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