Is there reduction via laxing in northern dialects of Brazilian Portuguese?

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Introduction. In general, reduction is interpreted as a mechanism to enhance contrast in a given prosodic domain. In OT (Prince & Smolensky, 1993), this has been accounted for as a compliance to markedness contraints on vowels' sonority (Kenstowicz, 2010), as well as in terms of prominence-based licensing constraints (Walker, 2011) and maximizing contrast constraints (Flemming, 2004). As noted by Crosswhite (2004), reduction via tensing fits in much better with the theoretical approaches to vowel reduction. However, sociolinguistic analysis on vowel harmony in Brazilian Portuguese have indicated that in northern dialects, the neutralization of mid-vowel /ɛ, e; ɔ, o/ in pre-tonic syllables favors lax mid vowels /ɛ, ɔ/ (Silva, 2009; Araújo, 2007). In general, the methodology used by the sociolinguistics studies that addressed this issue did not result in phonological balanced corpora. Therefore, the main aim of this paper is to investigate the existence of reduction via laxing in northern dialects of Brazilian Portuguese through a controlled experiment designed to eliminate possible discrepancies in the corpus.

Background. Brazilian Portuguese (BP) has a vowel system of seven vowels in stressed syllables /a, ɛ, e, i, ɔ, o, u/. In pre-tonic syllables, the contrast between low-mid /ɛ, ɔ/ and high-mid vowels /e, o/ is lost. In southern dialects, the high-mid vowels are favored and low-mid vowels are, in most cases, blocked from being produced (see (1), where bold indicates stress). However, in northern dialects, low-mid and high-mid vowels are variably produced in pre-tonics (see (2)).

Methodology. In order to analyze this alternation, a controlled experiment was carried out. 20 speakers of BP's northern dialect produced 80 words in carrier sentences with mid-vowels in pre-tonic position. Each word was randomly repeated three times throughout the experiment, which resulted in 240 productions per speaker and a total corpus of 4800 tokens. The dependent variables controlled were the height and the place of articulation of the stressed vowel, the preceding context (consonant in onset position of the pre-tonic syllable) and the syllable weight. An ANOVA was ran based on the value of F1 of the pre-tonic vowel. Also, pre-tonic vowels were categorized by the experimenter as either lax [ɛ, ɔ], tense [e, o] or high vowels [i, u] and a chi-square test was ran. The results obtained were consistent between tests.

Results. As expected, alternation in pre-tonic syllable occurred between low-mid, high-mid and high vowels, the latter ones, with a very low rate frequency, were mostly produced before nasal consonants (see (3)). Considering all contexts, tense vowels were the most frequent cases (see Table 1). However, regressive nasal assimilation is categorical in northern dialects, and since BP does not license nasalized *[ɛ̃, ɔ̃], this general distribution is biased against the production of lax vowels. If we do not consider this context, the general distribution (now with 3600 tokens) shows that, in fact, lax vowels are the most frequent vowels in pre-tonic syllables (See Table 2). More interestingly is the fact that tense vowels are predictable. Both [e] and [o] were significantly produced more when (i) they were followed by stressed tense [e, o] or high vowels [i, u] (see (4) and Table (3)) (ii) when they were followed by a nasal consonant (in this case, they become nasalized [ẽ, õ]) (See (5)); and specifically for the front vowel, [ɛ] tended to be blocked when followed by a palato-alveolar fricative [ʃ], that is, [e] tended to be preferred in the context (see (6)).

Analysis. For southern dialects of BP, mid-vowel harmony has been described as a variable assimilation process of the pretonic mid-vowel to a following high vowel (Bisol, 1989). We argue here that for northern dialects, the assimilation is triggerd by both tense and high vowels, resulting in pretonic tense vowels. The high vowels [i, u], therefore, does not seem to be resulted from vowel harmony, rather, are either specified as such or are the result of articulatory maneuver. For the

cases of pretonic [e] followed by stressed [ɛ, ɔ, a], results showed correlation with the patatal fricative [ʃ] in coda position. Following the Task Dynamics module of speech production (Saltzman & Munhall, 1989), we propose that this has to do with the position of the tongue body, the same for the production of both [e] and [ʃ]. However, some exceptions were noticed. Specifically, [e] and [o] were produced 32 and 55 times, respectively, in unexpected contexts. Besides the fact that the frequency of exceptions were extremely low given the total corpus, a possible explanation has to do with the fact that these are the canonical forms used in southern dialect, the standard dialect of BP. As speakers of northern dialect are under constant exposition to this variety of the language, a strong influence would also be expected. Further sociolinguistic studies are necessary regarding this aspect.

Conclusion. As shown, the predictability of tense vowels in pre-tonic syllables and the fact that the same patterns of production could not be specified for the production of lax vowels are strong evidence that reduction in northern dialects of BP is, in fact, via laxing. A possible alternative, as proposed by Lehiste (1961) for Slovene, would be to assume that the lax vowels in pretonic position are not fully [ɛ, ɔ], but an intermediate quality between tense and lax vowels, better understood as archiphonemes [E, O] underspecified for laxness or tenseness. However, our results also show that [e, ɛ] and [o, ɔ] are significantly distinct from one another (see fig. (1)) and previous analysis by Kenstowics & Sândalo (2013) have shown that the vowel quality in pretonic syllables is the same of those in stresses position, another evidence for the type of reduction we have argued exists in the language.

Examples

(1)	ca**f[ɛ]**	*coffe*	**(2)**	ca**f[ɛ]**	**(4)**	z[e]**l[o]**so	*careful*	**(3)**	c[ũ]n**c[u]r**so	*contest*
	caf[e]**t[e]**ra	*coffe maker*		caf[e]**t[e]**ra		r[ɛ]s**p[ɔ]s**ta	*answer*		[ĩ]n**tr[ɛ]**ga	*delivery*
	caf[e]**z[a]l**	*skin*		caf[ɛ]**z[a]l**		[ɛ]r**r[a]**do	*wrong*	**(5)**	[ẽ]n**tr[a]**ve	*hindrance*
	b[ɔ]la	*ball*		**b[ɔ]**la		s[o]r**v[e]**te	*Ice cream*		b[õ]n**d[ɔ]**sa	*guest*
	b[o]**l[e]**ro	*ball maker*		b[o]**l[e]**ro		n[ɔ]r**d[ɛ]s**te	*northeast*	**(6)**	[eʃ]**ta**do	*state*
	b[o]**l[a]**da	*jackpot*		b[ɔ]**l[a]**da		[ɔ]r**lan**do	*orlando*		[eʃ]**ta**ca	*stake*

Table 1- General distribution

Front vowels			Back vowels		
[ɛ]	[e]	[i]	[ɔ]	[o]	[u]
38,6%	54,7%	6,7%	41,8%	53,4%	4,8%
Total: 2400 tokens			Total: 2400 tokens		

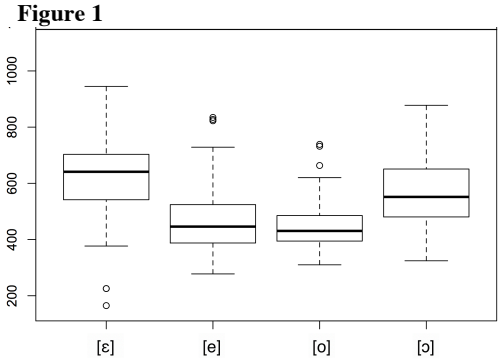
Table 2 – General distribution (without nasals)

Front vowels			Back vowels		
[ɛ]	[e]	[i]	[ɔ]	[o]	[u]
55%	41,7%	3,3%	59,8%	39,1%	1,1%
Total: 1680 tokens			Total: 1680 tokens		

Table 3 – Pretonic X Height of the stressed vowel

Stressed	Pretonic			Pretonic		
	[ɛ]	[e]	[i]	[ɔ]	[o]	[u]
high	36%	63,8%	0,2%	45,8%	53,3%	0,9%
tense	28,6%	71,4%	0%	13%	86,2%	0,8%
lax	95,4%	4,6%	0%	95%	5%	0%
low	58,3%	23,7%	18%	81,4%	15,7%	2,4%
	Total: 1680 tokens			Total: 1680 tokens		
	p-value < 0.001			*p-value* < 0.001		

Figure 1



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