

# LOWER YOUR VOICE: VOWEL DEVOICING AND DELETION IN BRAZILIAN PORTUGUESE

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## ABSTRACT

The devoicing and deletion of unstressed vowels are common processes that may be viewed as stages in a gradual process of elision. This paper examines the sociolinguistic conditioning of variable final vowel devoicing and deletion in the Portuguese spoken in the city of São Paulo (SP), Brazil. From sociolinguistic interviews with 46 speakers, we extracted and coded 5,413 tokens for their acoustic realisation and for a series of factors: speaker sex, age, level of education and neighbourhood, the vowel and its surrounding phonetic context. Logistic regression analysis shows that both devoicing and deletion are socially stratified and preferred with high vowels and preceding voiceless segments. While the linguistic effects reflect articulatory and perceptual considerations, social stratification reveals some of the social affect that these features provide in SP. Comparison of regression analyses suggests that the two processes are unrelated.

**Keywords:** phonetic variation, sociophonetics, vowels, devoicing, Brazilian Portuguese.

## 1. INTRODUCTION

As a result of their lack of prominence, unstressed vowels may undergo a number of processes of reduction. Apart from shortened duration and a change in vowel quality or position, vowels may be devoiced or even deleted [10]. Such processes have been observed in a number of unrelated languages, such as Canadian French [4,5], Korean [12], Modern Greek [1,6], Japanese [3] and the Spanish spoken in Peru, Ecuador and Mexico [7,8,9,13]. While vowel deletion is a characteristic feature of European Portuguese [15], vowel devoicing and deletion have received little attention in the Portuguese spoken in Brazil (BP) (but see [14]).

In this paper, we investigate the variable devoicing and deletion of unstressed vowels in the Portuguese spoken in São Paulo (SP), Brazil's largest city. Apart from documenting the existence and frequency of these processes in BP, the purpose of this paper is to determine which linguistic contexts are most propitious to their occurrence and whether they serve to distinguish residents of the

city along social lines. Furthermore, since devoicing and deletion may be seen as points along a cline of weakening or reduction, we examine whether they are related or operate independently of each other.

## 2. VOWEL DEVOICING IN SÃO PAULO PORTUGUESE

### 2.1. Stress and vowel reduction in BP

Word stress in BP generally falls on the penultimate syllable [2] (e.g. *saco* ['sa.ku] 'sack', *tempo* ['tẽm.pu] 'time'), with the final syllable unstressed. Final unstressed /a/, /e/ and /o/ are commonly raised to [e], [i] and [u], respectively [2]. Although some words contain stressed final syllables (e.g. *caçar* [ka.'sa] 'to hunt', *até* [a.'tẽ] 'until'), the vowels in these syllables are never raised and have not been observed to undergo devoicing or deletion.

### 2.2. Data

The data for this study were taken from Project SP2010 (projetoSP2010.fflch.usp.br), a corpus of spoken BP collected in 2010, consisting of sociolinguistic interviews with 60 speakers stratified according to sex, age and level of education, transcribed in ELAN [16].

For this analysis, we draw on a subsample of 46 speakers from whose interviews we extracted a sample of unstressed vowels at three points in each interview (five minutes each at the beginning and end of the interview and five minutes in the middle when speakers were discussing the same topic), yielding a dataset of 5,413 tokens.

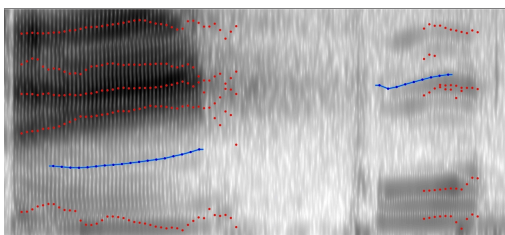
### 2.3. Factors coded

Each of the tokens was coded for a series of social and linguistic factors.

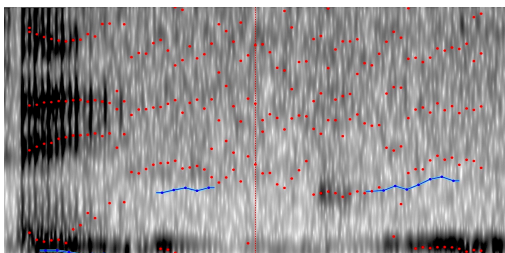
Working with a group of undergraduate students at the University of São Paulo as part of a class project, we first coded the realisation of each token according to the presence of clear (voiced), weakened (devoiced) or absent (deleted) vowel formants, based on visual inspection of the spectrogram, some examples of which are provided in Figure 1.

**Figure 1:** Spectrograms of the word *tempo* ‘time’ with (a) voiced, (b) devoiced and (c) deleted final [u].

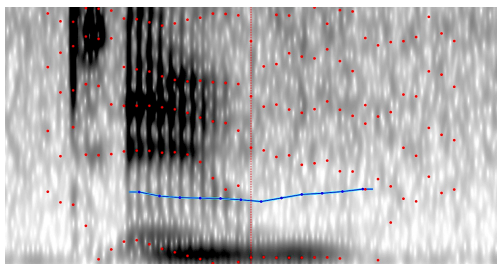
a. Voiced:



b. Devoiced:



c. Deleted:



Each token was then coded for the social characteristics of the speaker: their sex (male or female), their age-group (20-34, 35-59, 60+), their level of education (secondary vs. tertiary) and whether their neighbourhood of residence was located in the core or periphery of SP.

Linguistic factors relate to the vowel and the phonetic context in which it occurred. Each token was coded as one of the three unstressed final vowels: [e] (unstressed /a/), [i] (unstressed /e/) and [u] (unstressed /o/). The preceding segment was coded as voiceless or voiced. Two realisations of preceding orthographic {r}/{rr} were coded separately, because of differences in voicing: word-medial /r/ occurs variably as flapped [r] or retroflex [ɹ], which are voiced, while word-initial /r/ and word-medial /rr/ occur in a number of voiceless realisations (such as [x] or [h]). The segment in the following word was coded similarly, although codes were also included for a following word beginning with a vowel and for no following word (pause).

## 2.4. Results

The overall distribution of variants is shown in Table 1. Although voicing is the majority variant (69.5%), a substantial proportion of tokens (22.4%) are devoiced, and a somewhat smaller portion (8.1%) are deleted.

**Table 1:** Overall distribution of unstressed vowel realizations.

	N	%
Voiced	3760	69.5
Devoiced	1212	22.4
Deleted	441	8.1
Total:	5413	

As a first attempt to determine whether the two processes were related, we examined two different scenarios. In scenario (1), the processes of devoicing and deletion are unrelated to each other. In scenario (2), devoicing feeds a rule of deletion.

- (1) a. Voiced  $\rightarrow$  Devoiced  
b. Voiced  $\rightarrow$  Deleted
- (2) a. Voiced  $\rightarrow$  (Devoiced + Deleted)  
b. Devoiced  $\rightarrow$  Deleted

Each of these scenarios involves different ways of calculating rates of occurrence, which ultimately influence the factors selected as significant in statistical modelling. Using the stepwise logistic regression procedure incorporated in Rbrul [11], we ran each of the two scenarios with the same configuration of factors and compared the log likelihoods (a measure of how well the models fit the observed distribution of data). As this comparison showed scenario (1) to provide statistical models with a significantly better fit to the data than scenario (2), we conclude that devoicing and deletion are not in a feeding relationship but are operating independently of each other. Therefore, in the analyses that follows, we calculate the occurrence of each variant of interest (devoiced and deleted) in opposition to the other two variants.

The results of the logistic regression analyses of the contribution of linguistic factors to the occurrence of devoicing and deletion are shown in Table 2. Effects are indicated in the form of logodds, with effect values centred on zero: values above zero are favourable to the occurrence of the variant, while values below zero disfavour the variant. The numerical coefficient indicates the strength of effect.

As Table 2 shows, both variants are favoured more with the high vowels [i] and [u] than with the low vowel [e]. The preceding segment is significant

for both devoicing and deletion, although the effects are slightly different. Preceding voiceless elements favour devoicing and deletion, while preceding voiced elements disfavour, but the effects of preceding rhotics are reversed: /r/ (weakly) favours deletion but disfavors devoicing, while /rr/ strongly favours devoicing and strongly disfavors deletion. The following segment is selected as significant only for deletion, with following vowels and voiceless consonants favouring and following voiced consonants and pauses disfavouring. A following /r/ weakly favours deletion, while a following /rr/ disfavors.

**Table 2:** Logodds contribution of linguistic factors to the occurrence of vowel devoicing and deletion (N = 5,323)

	Devoicing	Deletion	N
<b>Vowel</b>			
[i]	.505	.208	1134
[u]	.113	.089	2291
[e]	-.638	-.297	1988
<b>Preceding Segment</b>			
/rr/	.561	-.487	67
Voiceless	.266	.486	2209
/r/	-.328	.017	617
Voiced	-.498	-.016	2520
<b>Following Segment</b>			
Vowel		.730	1093
Voiceless		.360	1277
/r/		.144	19
Voiced		-.258	1359
/rr/		-.294	41
Pause		-.682	1624

The results of the analyses of social factors are shown in Table 3, which reveals that the two processes are conditioned differently. Education is significant for devoicing, with speakers with secondary education favouring devoicing and speakers with tertiary education disfavouring. Region is also significant for devoicing, with residents of the core of São Paulo favouring devoicing and those in the periphery disfavouring. For deletion, only sex and age-group are selected as significant, with men and younger speakers favouring deletion and women and speakers of old and middle age disfavouring.

**Table 3:** Logodds contribution of social factors to the occurrence of vowel devoicing and deletion (N = 5,323).

	Devoicing	Deletion	N
<b>Sex</b>			
Female		-.209	3279
Male		.209	2134
<b>Age-Group</b>			
Old		-.172	1591
Middle		-.005	1635
Young		.176	2187
<b>Education</b>			
Secondary	.082		2920
Tertiary	-.082		2493
<b>Region</b>			
Core	.142		3007
Periphery	-.142		2406

### 3. DISCUSSION

The results of this study demonstrate that unstressed vowels in the BP spoken in São Paulo undergo variable devoicing and deletion, although they are not the majority variants. Analysis of the distribution of these variants suggests that they are processes that operate independently of each other.

The linguistic features conditioning the occurrence of both variants are similar, in that both occur more frequently with the high vowels [i] and [u], and that a preceding voiceless segment is more likely to produce devoicing or deletion. These effects can be explained on the basis of two processes: the relatively weak perceptibility of high vowels and the tendency for features such as voicing (or devoicing) to persist across phonological domains. Deletion is additionally conditioned by the nature of the following context. The strong favouring effect of vowels on deletion might indicate a hiatus-resolving strategy, in which two adjacent vowels favour deletion of the first. The disfavouring effect of following pause follows a general pattern of BP in which final consonants are retained with the insertion of a vowel [2].

Devoicing and deletion are also conditioned differently by social factors. Devoicing appears to distinguish residents of São Paulo on the basis of level of education and region of the city. Speakers with tertiary education are less likely to devoice unstressed vowels, as are those who live in the periphery of the city. On the other hand, deletion is characteristic of younger speakers and favoured more by men than by women. The former would

suggest that deletion may be an ongoing change, while devoicing appears to be more stable.

#### 4. CONCLUSION

The results of this study require further instrumental analysis of the tokens and representation of all of the speakers in the corpus to be confirmed. However, these results attest to the existence in BP of processes that have been observed to operate in other varieties of Portuguese and other related and unrelated languages, suggesting that they may be common outcomes to processes of vowel reduction. In contrast to the assumption that devoicing and deletion represent different stages in a process of elision, on the basis of statistical modelling and conditioning by linguistic and social factors, we conclude that they operate independently of each other.

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