

# PHONOLOGICAL TRACES IN THE LOSS OF A PLURAL MARKER IN BRAZILIAN PORTUGUESE<sup>1</sup>

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*ABSTRACT: A number of recent works has shown that linguistic representations incorporate redundant information which plays an important role in linguistic systems. Works on experimental phonetics and along the lines of Laboratory Phonology indicate the gradual nature of phonetic representations (Browman & Goldstein (1992), Zsiga (1995), Albano (2001), Bybee (2001, 2002), Pierrehumbert (2001)). This paper follows this line of research by investigating plural loss in Brazilian Portuguese. We will investigate lenition in Brazilian Portuguese plural forms that end in a sibilant, as in *mês* 'month' whose plural form is *meses* 'months'. This paper offers evidence for the gradual implementation of phonetic changes by showing that the loss of a morphological category (plural) leaves traces in the continuum of speech in the form of compensatory lengthening.*

*KEYWORDS: phonology, morphology, phonetics, plural forms*

## Introduction

An interesting issue in current research in linguistics regards the nature of representations. Traditional approaches assume categorical representations which may be altered through the application of rules. Optimality

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Theory suggests that constraint ranking selects the most appropriate representation. In these later two views, linguistic representations are understood as being categorical where redundant or predictable information is not present. A number of recent works; however has shown that linguistic representations incorporate redundant information which plays an important role in language processing. Works on experimental phonetics and along the lines of Laboratory Phonology indicate the gradual nature of phonetic representations (Browman & Goldstein (1992), Zsiga (1995), Albano (2001), Bybee (2001, 2002), Pierrehumbert (2001)). A question which arises from these observations regards the nature of representations: are they categorical or gradient? This paper intends to contribute to the answer to this question. More specifically we intend to evaluate whether the loss of a morphological category (plural) leaves traces in the continuum of speech. In order to investigate this issue we will evaluate plural loss in Brazilian Portuguese focusing in the loss of plural markers in nouns and adjectives ending in a sibilant, as for example in *mês* ‘month’ whose plural form is *meses* ‘months’.

### 1.1. The loss of plural markers in BP

One of the features of standard spoken Brazilian Portuguese (henceforth BP) is the alternative loss of plural markers in nouns and adjectives (Scherre 1998; Scherre & Naro 2003). All cases of plural loss display variation.<sup>2</sup> Thus, we find forms in competition where, in a noun phrase, the plural marker occurs in all constituents, i.e. the article, noun and adjective, as in “**os** meninos bonitos” *some handsome boys* or “**uns** dias alegres” *some happy days* in competition with forms where the plural marker is present only in the article and omitted in the noun and adjective, as in, “**os** menino bonito” *some handsome boys* or “**uns** dia alegre”. Examples in Table 1 illustrate cases of plural loss in BP.

In all examples in Table 1 the third column illustrates that the plural marker(s) may be omitted in the noun or adjective. The definite or indefinite article retains the plural marker whereas the plural markers are not present in the nouns and adjectives. The five possibilities of forming nominal plural in BP are listed in a-f (Cunha & Cintra 1985). Cases in (a) represent the regular plural forms which reflect the most frequent pattern when a single morpheme (-s) is added at the end of the noun or adjective. Nominal plurals in (b) present two different

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<sup>2</sup> For the sake of clarity the plural marker will be presented in bold and it will also be underlined.

Type of Plural Marker	Singular	Plural > Nominal Plural Loss	Glossa
(a) single-s <sup>3</sup>	“o menino”	“os <u>meninos</u> ” > “os menino”	<i>the boys</i>
(b) Metaphony	“um r[o]sto”	“uns r[ɔ]stos” > “uns r[o]sto”	<i>some faces</i>
(c) Final-L words	“o sal”	“os <u>sais</u> ” > “os sal”	<i>the salts</i>
(d) Final-R words	“a flor”	“as <u>flores</u> ” > “as flor”	<i>the flowers</i>
(e) ão-alternations: $\tilde{A}O > \tilde{o}es, \tilde{a}os, \tilde{a}es$	“um leão”	“uns <u>leões</u> ” > “uns leão”	<i>some lions</i>
(f) Final-S words	“o mês”	“os <u>meses</u> ” > “os mês”	<i>the months</i>

Table 1: Example of plural losses in BP

plural markers expressed in the same noun: final morpheme (-s) and change of quality in the stem vowel. Thus, the singular form “r[o]sto” *face* has its corresponding plural form as “r[ɔ]stos” *faces* (a closed mid vowel becomes open in the plural form). This case is known as nominal metaphony in plurals. Cases in (c) involve words whose singular forms end in an /l/ which is vocalized in most varieties of BP: sa/l/ > sa[w] *salt*. In this case there is the suppression of the final segment in the singular form (which may be either a lateral or a backglide depending on the dialect: sa[l] or sa[w] *salt*) and the segmental sequence [is] is added to the noun or adjective: sa[is] *salts*. Cases in (d) involve words that end in an R-sound which vary considerably in their pronunciation in BP (Cristófar-Silva 2002).

In the variety we are considering, Belo Horizonte, final R-sounds are pronounced as a fricative (either velar or glottal). Thus, a word like “flor” *flower* is pronounced as [ˈfloh]. In the plural forms the final R is pronounced as a tap after the suffix [is] is added to the noun: [ˈfloh] > [ˈfloris]. Cases in (e) are known as ão-plurals which may present three alternative plural forms whose choices are idiosyncratic: ãos, ães, ões. Examples are: “leão” (sg) and “leões” (pl) *lion(s)*; “capitão” (sg) and “capitães” (pl) *captain(s)* and “mão” (sg) and “mãos” (pl) *hand(s)*. Finally, (f) illustrates the cases of nouns end-

<sup>3</sup> In Belo Horizonte, the variety we will consider in this paper, sibilants in coda are systematically pronounced as alveolar. This pattern is also witnessed in many other varieties of BP. Another alternative pronunciation for sibilants in coda, which is observed in Rio de Janeiro and some northeastern states, is the realization of an alveopalatal sibilant. Sibilants agree in voicing with other consonants when in word internal position. In word final position sibilants in coda are typically voiceless although some northeastern varieties appear to present alveolar voiced sibilants in this position.

ing in (-s) which have (-is) as the plural marker. This paper will focus on cases like those illustrated in (f).

Although a number of works look at plural loss in different varieties of BP from a morphological and syntactic point of view, little has been said about the phonological consequences related to it (Scherre 1998; Scherre & Naro 2003). This paper aims to fulfill this gap in the literature by evaluating whether the loss of a morphological category (plural) leaves traces in the continuum of speech. We will show that the loss of a plural marker in BP yields to the lengthening of segments (vowel and sibilant).<sup>4</sup> Thus, plural forms whose morphological mark is not present have vowels and sibilants with greater duration than that observed for average vowels and sibilants in BP.<sup>5</sup>

In section 2 we indicate the theoretical background to be assumed in this paper and we describe our research design. Methodological procedures are also presented. Section 3 discusses quantitative and experimental results. Finally, section 4 indicates future lines of research.

### **Case Study: Plural forms of nouns ending in a sibilant**

This section indicates the theoretical approaches assumed in this paper, describes the experiment design and presents the main methodological procedures that were adopted.

#### **2.1. Theoretical Approaches**

Traditional approaches assume that linguistic representations are categorical. However, recent work has challenged this view by positing that linguistic representations incorporate redundant information which plays an important role in language processing. Within this perspective “alternations and judgments display properties of continua and show markedly gradient behaviour” (Bod, Hay & Jannedy 2003:1). Approaches that accommodate these findings have to assume multiple levels of representation (Pierrehumbert 2003; Cristófaró-Silva & Gomes 2004). Experimental work in phonetics shall provide evidence for gradualness in the continuum of speech indicating the gradual nature of phonetic representations. This paper intends to contribute to research along these lines by evaluating whether the loss of a morphological category (plural) leaves traces in the continuum of speech.

Multirepresentational models that support our work are Usage-based Phonology (Bybee 2001) and Probabilistic Phonology (Pierrehumbert 2001, 2003). These approaches assume that words (and frequently used phrases) are the units of representations. Such units are organized in a network of connections that operate at various levels, such as semantic, morphological,

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<sup>4</sup> In this paper we will refer to the loss of a plural marker when investigating the fine phonetic properties of segments which are associated to a plural marker and lenition involved with the loss of a plural marker.

<sup>5</sup> Alternative analyses for plural forms of words ending in a lateral in Portuguese (cf. Table 1, c) could also be suggested following Morales-Front & Holt (1997) and Vigário (2003).

etc. (Goldlinger 1997; Bybee 2001). In cases of plural forms, both the singular and the plural are lexically listed. The morpheme for plural, which has the function of expressing number, is connected to various other morphemes for plural forms. Singular and plural forms are also related at the semantic level.

Besides the multirepresentational models mentioned above we assume the theoretical foundations of Articulatory Phonology (Browman & Goldstein 1992). Articulatory Phonology suggests that gestures unfold during speech production because in the continuum of speech multiple gestures overlap and interact with each other. Experimental work should be able to express findings along these lines. This paper shows that the loss of a plural marker causes the lengthening of an adjacent vowel and sibilant. Our findings contribute to the development of multirepresentational models, to the evaluation of gradualness in linguistic representations and also to works on experimental phonetics. The next section describes our experiment which investigates the loss of plural markers in words ending in a sibilant in BP.

## 2.2. Research Design

This research was carried out at the city of Belo Horizonte in Minas Gerais, Brazil ([www.pbh.gov.br](http://www.pbh.gov.br)) at the Federal University of Minas Gerais ([www.ufmg.br](http://www.ufmg.br)). Belo Horizonte is the third largest city in Brazil counting over two million inhabitants. The research we designed aimed at gathering data from members of different sexes (4 female and 4 male) which were divided into two age groups (over 40 and under 25). Educational levels were also considered by grouping speakers as either University educated or as educated through 8<sup>th</sup> grade. Whether the word was frequently or rarely used was also considered. Token frequency was obtained from the BP LAEL corpus (<http://lael.pucsp.br/corpora/index.htm>), which comprises 233 million words. The token frequency of these words will be presented later under the discussion of our results.

In order to collect specific data concerning plural (and plural loss), we designed an experiment which was carried out in three stages: elicitation, reading a word list and reading in context (see [www.projetoaspa.org/351srl](http://www.projetoaspa.org/351srl) for tests). In the first stage the participant was asked to look at some pictures and describe them and required to come up with a plural form. At a second stage the participant had to read a text aloud. The text contained all the words tested in the picture naming experiment carried out in the first stage. In the second stage the words were in context. The story was written in an interesting style, and participants were eager to know how it developed. This contributed to distracting their attention from the experiment itself. Finally, at a third stage, participants were asked to read aloud a word list which contained all the words to be investigated in the experiment as well as some distractors.

A set of 14 words was analyzed. All these words had their singular form ending in (-s) whose plural form is marked by the suffix (-is). In word final position sibilants in BP are pronounced as either as alveolar or as alveopala-

tal, depending on the geographical variety. In Rio de Janeiro, for example, we have an alveopalatal sibilant so that the word for “mês” *month* is pronounced as [ˈmɛʃ]. In the variety we are considering, i.e., spoken in Belo Horizonte, an alveolar sibilant occurs in the end of the word: [ˈmɛs]. In the plural form in any variety of BP, the middle sibilant which was formerly in word final position must be a voiced alveolar sibilant i.e. [ˈmeziʃ] or [ˈmezis] *months*.<sup>6</sup> The postonic high vowel that occurs between the sibilants is very short (Marusso 2003). Vowel reduction in postonic position is a major feature of BP phonology one effect of which is a smaller duration than those observed for stressed or pretonic vowels.

Vowel	Monosyllabic			Disyllabic		
	Word	Glossa	Token Frequency	Word	Glossa	Token Frequency
/i/	<i>X(xis)</i>	<i>letter X</i>	0	<i>Nariz</i>	<i>Nose</i>	144
/e/	<i>vez</i>	<i>Turn</i>	78211	<i>Chinês</i>	<i>Chinese</i>	3831
/ɛ/	<i>dez</i>	<i>number ten</i>	0	<i>Viés</i>	<i>Habit</i>	25
/a/	<i>gás</i>	<i>Gas</i>	1989	<i>Rapaz</i>	<i>Lad</i>	3100
/o/	<i>Kôs</i>	<i>inv. name</i>	0	<i>Arroz</i>	<i>Rice</i>	2
/ɔ/	<i>voz</i>	<i>Voice</i>	4622	<i>Queiróz</i>	<i>family name</i>	0
/u/	<i>luz</i>	<i>light</i>	3072	<i>Capuz</i>	<i>Hood</i>	103

Table 2: Words used in the experiment and their token frequency rates

Seven monosyllabic words and seven disyllabic words were selected for the experiment. Samples of these words were collected in the singular and the corresponding plural form for all speakers.<sup>7</sup> These 14 words are listed in Table 2 where only the singular form is presented, although data were also collected for singular and plural forms.

Table 2 shows that all possible primarily stressed vowels in BP were considered for monosyllables and disyllables: [i, e, ɛ, a, o, ɔ, u].<sup>8</sup> Thus, the

<sup>6</sup> In some varieties a glide may occur between the stressed vowel and the final sibilant: [ˈmɛjʃ] or [ˈmɛjsʃ] “mês” *month*. The glide does not occur in any varieties in the corresponding plural forms. In plural forms a single stressed vowel occurs: [ˈmeziʃ] or [ˈmezis] *months*.

<sup>7</sup> Final-s nouns tend to end in a stressed syllable. Thus all the words we analyzed have their singular forms ending in a stressed vowel followed by a sibilant. Forms where a singular form ends in a sibilant preceded by an unstressed vowel do not have any morphological mark in their plural forms: “pires” (singular or plural) *saucer* [ˈpiris] or “lápiz” (singular or plural) [ˈlapis] *pencil*.

<sup>8</sup> Some of the words given in Table 2 cannot be pluralized according to the traditional grammar (as *dez*, *X*, *Queiróz*). The word *Kôs* is a made up one. These words were used in the experiment in order to fulfill distributional gaps.

experiment consisted of a total of 336 tokens for plural forms (singular forms and distractors counted as extra data).

Recordings were collected digitally and separated as an individual file to be analyzed experimentally. Each token was edited and analyzed with PRAAT ([www.praat.org](http://www.praat.org)). Using the instrumental editing from PRAAT, tokens were grouped as those where the plural marker (-is) was present or not. Evidence for categorizing a token as having the plural marker was the presence of a vowel in the signal. Thus, in a plural form such as “meses” *months*, we looked for the presence of a vowel in the last syllable that corresponds to the plural. Cases where no vowel was experimentally observed were categorized as having no plural marker.

This categorical result was used in the quantitative analysis which aimed to evaluate cases where a plural marker was present (or not) in the plural forms. Data was grouped as those presenting a plural marker identified as final unstressed high vowel followed by a sibilant: [ˈmeziʃ] *months* or those where the plural marker was not present and the final sibilant was followed by the primarily stressed vowel.

In those tokens which presented a plural marker, – as in [ˈmeziʃ], we measured the length of the following segments: primarily stressed vowel, the sibilant which follows it, the unstressed high vowel and the final sibilant.

Our hypothesis, which followed from auditory and experimental examination, was that the so-called loss of a plural marker indeed leaves traces in the continuum of speech. More specifically we posit that in words ending in (-s), which have their plural marker as (-is), we would observe the lengthening of the primarily stressed vowel or the fricatives (or both) when ‘apparently’ we have the loss of the plural marker. Notice that all singular words in (2) have a primarily stressed vowel followed by the final sibilant. In their plural forms they have a primarily stressed vowel followed by a sibilant which is then followed by a high vowel and another sibilant (since the plural marker is (-is)). Therefore, we have a segmental sequence such as (stressed vowel + sibilant from the stem + -is = plural marker). In this context the postonic high vowel which occurs between the fricatives is lenited. As a consequence of vowel lenition, we observe that the gestures from the adjacent sibilants overlap and seem to obscure it. This leads to the lengthening of the adjacent segments which are the primarily stressed vowel and the fricatives. The result is that lenited forms, i.e. those forms which are considered as presenting the loss of plural marker, in fact only present a sibilant after the primarily stressed vowel.

In order to investigate this hypothesis, the length of the primarily stressed vowel and the length of the final fricative were measured for each token and categorized as showing the loss of its plural marker in a noun ending in a sibilant. Our findings are presented in the following section. We first present our quantitative analysis which was carried out with the statistics package Matlab. Then we proceed to the experimental analysis. Measurements followed from records in PRAAT, which were also statistically analyzed.

## Results

### 3.1 Quantitative Results

Our general result showed that lenited forms occurred in 30.1% of the cases (101/336). Lenited forms are those which do not present a morphological marker for plural, i.e. those plural forms which only have a sibilant after the primarily stressed vowel. Data in tables 3 and 4 illustrate results for lenited forms. Observe that lenition may occur with any of the BP vowels and that it was observed in all different stages of the experiment.

An interesting and somehow unexpected result, was that lenition was greater in ‘reading in context’. This was unexpected because reading entails a more formal style in which speakers are more careful about the way they speak. However, the story the participants had to read was very interesting and many of them reported that they were eager to know what would happen next. Their interest in the story may have contributed to them relaxing when reading. Another potential motivation to account for a high rate in “reading in context” is that plural loss has a syntactic explanation (Scherre 1998; Scherre & Naro 2003). Thus, it is expected that plural markers disappear more often when the relevant syntactic configuration occurs, which would be found in reading in context. In any case, the interesting result this paper offers is that lenited forms were found in all speech styles.

Vowel	Monosyllabic	Disyllabic	Total	
/ i /	5 of 24	9 of 24	14	29.1%
/ e /	8 of 24	9 of 24	17	35.4%
/ ε /	6 of 24	9 of 24	15	31.2%
/ a /	7 of 24	8 of 24	15	31.2%
/ o /	7 of 24	5 of 24	12	25.0%
/ ɔ /	9 of 24	6 of 24	15	31.2%
/ u /	6 of 24	7 of 24	13	27.1%
<b>Total</b>	48 of 101	53 of 101	101	30.1%

Table 3: Distribution of lenition occurrence according to number of syllables and vowels

Pierrehumbert (2001, 2003) and Bybee (2001, 2003) provide evidence that token frequency plays an important role in lenition. This means that more frequent forms should undergo lenition at a greater rate than rarely used forms. This follows from the fact that in multirepresentational models, such as Exemplar Models (Johnson 1997; Pierrehumbert 2001), very frequently used words and their respective alternating forms have more robust representations than words that are very rarely used. Results for word frequency and lenition are shown in Table 5.<sup>9</sup>

<sup>9</sup> Notice that some forms have zero token frequency in their plural forms. It either follows from the fact that the word cannot typically be pluralized (as the numeral “dez”, the letter “X” or the surname “Queiróz”) or that it was an invented word “kôs”. As some of the

An overall view of the data in Table 5 shows that frequently used plural forms tend to undergo lenition at a greater rate than less frequently used ones. The graph below, in Figure 1 indicates the lenition rate for every word individually. Less frequent words are presented towards the left and more frequent ones occur towards the right.

<b>Reading a List</b>	<b>Elicitation</b>	<b>Reading in Context</b>
18 of 112	34 of 112	49 of 112
15.2%	30.4%	43.8%

Table 4: Distribution of lenition occurrence according to the nature of the experiment

The graph in Figure 1 shows a tendency of more frequently occurring words to undergo lenition, although this is not clearly confirmed. However, if tokens are grouped using a logarithmical scale to represent token frequency, results are clearer. This is shown in Figure 2.

Figure 2 shows that words were grouped in four sets according to their token frequency. Notice that in this case we have a clearer picture that less frequently used words undergo a lower rate of lenition (towards the left) and more frequently used words show a higher rate of lenition (towards the right). Our proposal to express results in a logarithmical scale follows (Mendoza-Danton, Hay & Jannedy 2003) analysis, who justify this approach by claiming that “there is good evidence that humans often process frequent information in a logarithmic manner”.

Our analysis supports multirepresentational models and, in particular, Usage-Based Phonology (Bybee 2001) and Exemplar Models (Johnson 1997; Pierrehumbert 2001), that assume that token frequency plays an important role in shaping phonological representations. This is because our results show that more frequently used words undergo lenition at a greater rate than words that are rarely used. As a partial conclusion, we can say that lenited forms occur in different speech styles, in forms with any primarily stressed vowel and that token frequency is relevant in addressing the plural loss in words that end in a sibilant in BP.

As we mentioned before, in the quantitative analysis, words were grouped by those which presented the plural form (-is) by identifying the high vowel in the suffix for plural and those words which underwent lenition, i.e. only a sibilant was observed after the primarily stressed vowel. Our results prove difficult to be expressed in IPA symbols. This is because we had apparently similar segmental sequences which differed with respect to the length of the segments involved and BP is a language that does not pre-

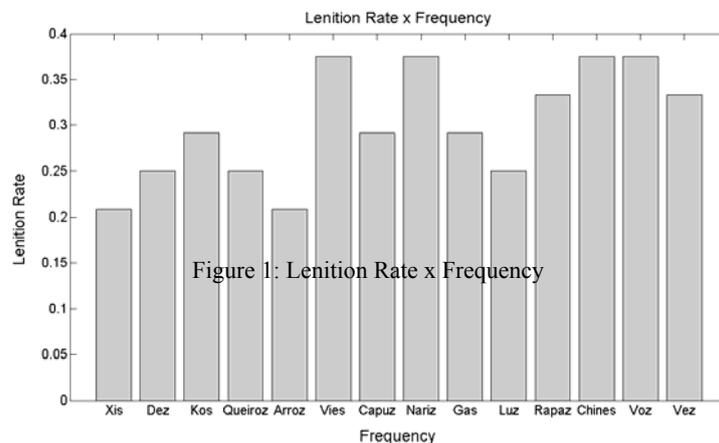
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plural words did not actually exist we present in Table 5 the singular forms although token frequencies are for the plural forms.

sent segmental lengthening as a traditional feature. We have a singular form such as “mês” [ˈmɛs] *month* and alternating plural forms; that is, we have forms where the plural marker is fully expressed as in “meses” [ˈmɛzɨs] *months*, and forms where the unstressed postonic vowel is lenited. This later case could be expressed in IPA symbols as [ˈmɛz̥s], [ˈmɛs:] or [ˈmɛ:s]. This ambiguity in the use of symbols lead us to the experimental analysis with results in the following section.

Vowel	Monosyllabic			Disyllabic		
	Word	Lenition %	Token Frequency	Word	Lenition %	Token Frequency
/i/	X( <i>xis</i> )	20.8	0	<i>Nariz</i>	37.5	143
/e/	<i>vez</i>	33.3	81220	<i>Chinês</i>	37.5	3841
/ɛ/	<i>dez</i>	25.0	0	<i>Viés</i>	37.5	25
/a/	<i>gás</i>	29.2	1979	<i>Rapaz</i>	33.3	3255
/o/	<i>Kôds</i>	29.2	0	<i>Arroz</i>	20.8	2
/ɔ/	<i>voz</i>	37.5	4919	<i>Queiróz</i>	25.0	0
/u/	<i>luz</i>	25.0	3076	<i>Capuz</i>	29.2	103

Table 5: Percentage of lenition and Token frequency



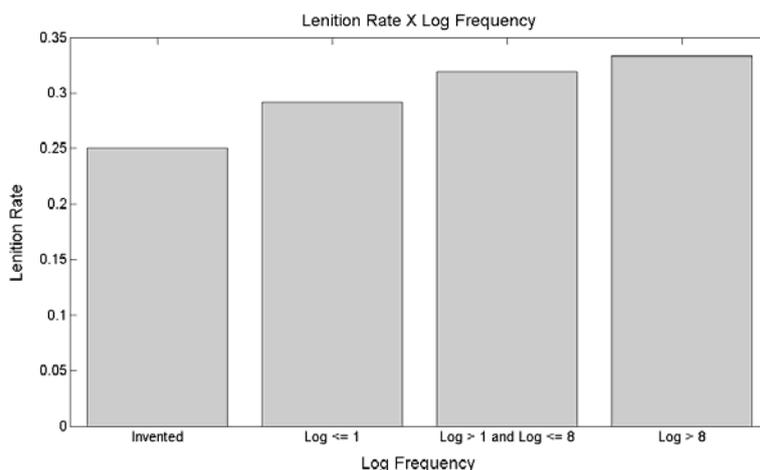


Figure 2: Lenition Rate x Logarithm of Frequency. The fourteen words were divided in four groups according to their log-frequency.

### 3.2 Experimental analysis

This section presents the result of measurements concerning the length of the primarily stressed vowel and the length of the final fricative in lenited plural forms (336 tokens as presented in the previous section). Vowel and sibilant lengthening was measured for each token which was categorized as showing the loss of its plural marker in a noun ending in a sibilant. We also measured the length of the vowel and the fricative in the corresponding singular form in the experiment. Our hypothesis intended to verify if plural vowels and fricatives were longer than singular vowels and fricative. Thus, we performed two hypothesis tests, one for the vowels and another for the fricatives. The null hypothesis being  $H_0: \mu_{\text{plural}} = \mu_{\text{singular}}$ , i.e., the mean duration of singular and plural are the same, and the alternative hypothesis  $H_1: \mu_{\text{plural}} > \mu_{\text{singular}}$ . The low p-values for each test shown in Table 6 lead to rejection of the null hypothesis in both cases. In other words, the mean duration of vowels and fricatives increases when lenition occurs.

Our results suggest that the loss of the plural marker [-is] is indeed phonetically gradual, leaving traces such as a lengthened primarily stressed vowel and a partially voiced lengthened sibilant. In IPA symbols we could express this as: [me:s:]. This can be characterized as a phonological phenomenon typically called compensatory lengthening where a vowel is lengthened when a following segment is lost (Trask 1996:81). The spectrograms presented in Figure 3 illustrate our findings. All spectrograms in Figure 3 are from the word “chineses” *chineses* spoken by three different speakers. In (a) the final vowel is fully present and highlighted. In (b) the final vowel almost disappears, but it can still be seen inside the vertical bars. However, in (c) the final vowel is absent and the word is lenited. Those spectrograms illustrate that, in fact, the loss of the plural marker is phonetically gradual.

A closer examination of figures (3b) and (3c) indicate signs of the palatalization of the final fricative. Such palatalization may follow from the gradual loss of the high front vowel [i] (cf. Albano (2001)). As there are just signs of palatalization of the final fricative it may be understood as additional evidence to gradualness in the process of lenition we have considered.

	Singular Duration		Plural Duration		P-value
	Mean(s)	S. Deviation(s)	Mean(s)	S. Deviation(s)	
<b>Vowels</b>	0.177	0.077	0.189	0.060	0.025
<b>Fricatives</b>	0.206	0.101	0.258	0.099	$53 \times 10^{-9}$

Table 6: Duration of vowels and fricatives when lenition occurs and p-value for the hypothesis test:  $H_0: \mu_{\text{plural}} = \mu_{\text{singular}}$  versus  $H_1: \mu_{\text{plural}} > \mu_{\text{singular}}$

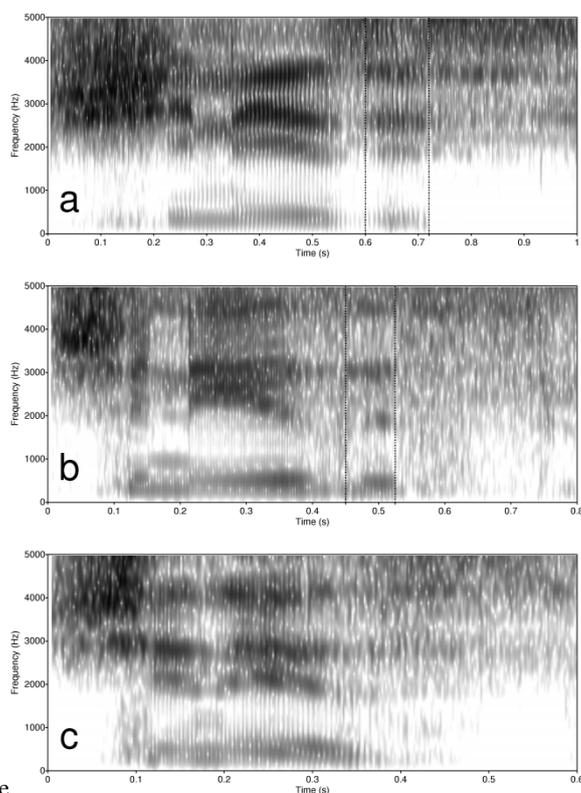


Figure 3: (a) original, (b) partially lenited, (c) lenited

### 3.3 Partial conclusions

In the previous sections we presented a quantitative analysis which showed that lenited forms occur in different speech styles, in forms with any

primarily stressed vowel and that token frequency is relevant in addressing the plural loss in words that end in a sibilant in BP. We have also considered the variability inherent to speech signal showing that segmental loss, in this case the loss of a high vowel, affects the segmental sequence in the final part of the word, where plural is expressed. What we found is that the loss of the high vowel triggers the lengthening of the stressed vowel and the fricative. Our results show that quantitative and experimental analyses contribute to a better understanding of the gradual implementation of phonological variation where fine phonetic detail is relevant. We argue that although singular and lenited plural forms show similar segmental sequences which may be represented respectively as [ˈmes] and [ˈme:s:], the phonetic detail revealed by the experimental analysis expresses that singular and plural are indeed systematically different where segmental lengthening which follows from lenition indicates the form is a plural one. Further research focused on perception could verify whether segmental lengthening is a relevant clue for speakers characterizing pluralized forms in cases where lenition occurs.

## Conclusion

This paper offers evidence for the gradual implementation of phonetic changes in cases of sound variation. Through quantitative and experimental analyses, we have shown that the loss of a morphological category (plural) leaves traces in the continuum of speech in the form of compensatory lengthening.<sup>10</sup>

We have considered cases of plural loss in nouns and adjectives ending in (-s). Work in progress intends to evaluate plural loss in final-l words (cf. 1c), in words with ão-alternations (cf. 1d) and cases which involve metaphony (cf. 1b) (Huback 2005; Cristófaró-Silva et al. 2005; Tomaz 2006). Our work contributes to a general investigation of plural loss in BP. Furthermore by adopting Usage-based Phonology (Bybee 2001) and Probabilistic Phonology (Pierrehumbert 2003), we attempt to offer elements for future work that may address the integration of theories of phonology, morphology and syntax. Finally, our work contributes to a more general investigation of the loss of plural markers in other Romance languages such as French and Spanish.

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<sup>10</sup> Further details regarding this claim may be obtained on <http://www.projetoaspa.org/351srl/>.

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