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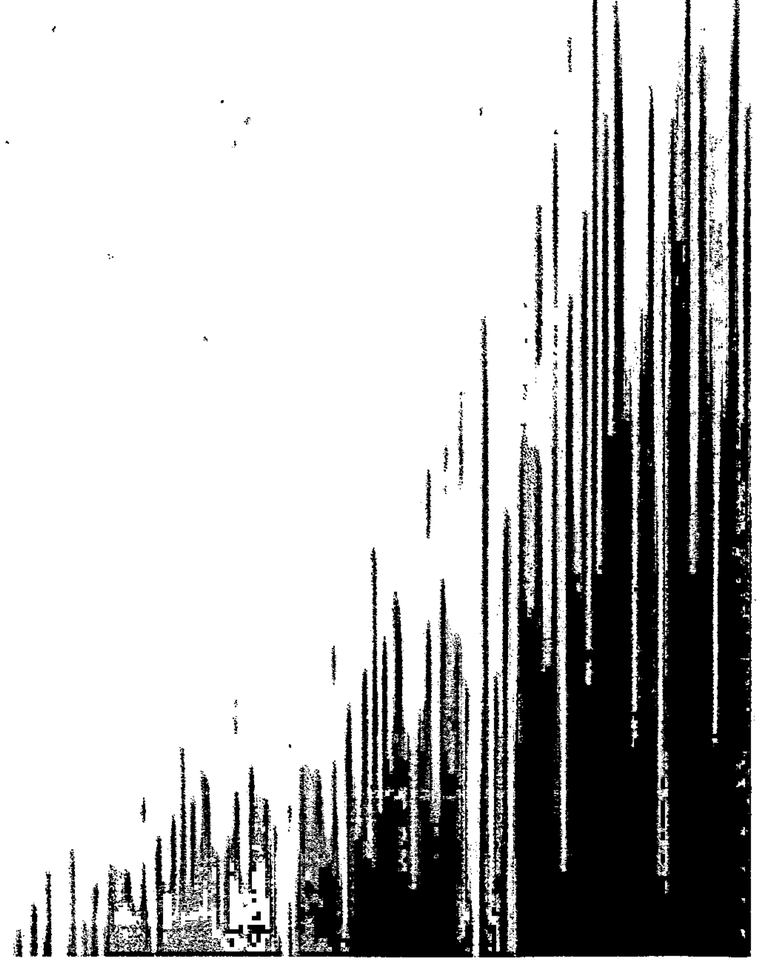

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論文/Articles

Conflict in Patterns of Lexical Diffusion in Diphthong Reduction in Brazilian Portuguese*

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ABSTRACT. This paper investigates reduction of the unstressed [ãw] diphthong in the verbal morphology of Brazilian Portuguese (BP). It evaluates the roles played by phonetic and analogical motivation in the implementation of the phenomenon by considering patterns of lexical diffusion (Bybee 2001, 2012). Phonetically motivated sound changes apply from high-frequency to low-frequency words and, in the case under study, involve a reduction in magnitude of the gestural configurations for an [ãw] diphthong to yield an oral monophthong. On the other hand, analogically motivated sound change applies from low-frequency to high-frequency words and, in the case under study, is related to the loss of alternations in the morphological paradigm so that a reduced number of forms occur. We will show that segmental reduction together with reorganization of the verbal paradigm explains the lexical implementation of [ãw] reduction in the verbal morphology of BP. We argue that a careful examination of patterns of lexical diffusion offers an important contribution to the understanding of the causes and the mechanisms of sound change.

Keywords: diphthong reduction, Usage-based Phonology, frequency effects, lexical diffusion

1. Introduction

Bybee (2012:211) suggests that patterns of lexical diffusion may serve as a diagnostic for the source of sound changes, which may be grouped into two major types: phonetically motivated sound changes and analogical changes. This paper discusses a case in which a conflict occurs between a phonetically motivated sound change and an analogical change, thus contributing to a better understanding of patterns of lexical diffusion as a diagnostic. Situated within a Usage-based Phonology framework (Bybee 2001, 2010, 2012), our analysis will consider unstressed [ãw] diphthong reduction in the verbal morphology of Brazilian Portuguese (henceforth BP). Diphthong reduction reflects a general characteristic of synchronic BP involving segmental reduction in prosodically weak positions (Battisti 2000, Schiwndt et al. 2010, 2012). Diphthong reduction involves reduction of the magnitude of gestural configurations and is thus phonetically motivated. On the other hand, BP is undergoing a change which reorganizes the verbal paradigm and reduces the number of verbal endings (Duarte 1996). This process is an analogical change which involves the loss of alternations in the verbal paradigm. It implicates grammatical analysis and thus differs from phonetically motivated sound changes. We intend to show that in [ãw] reduction there is a conflict between phonetic motivation and analogical leveling. We will use Usage-based Phonology to evaluate patterns of lexical diffusion and to discuss frequency effects in their

development. We will use unstressed [ãw] reduction in the verbal morphology of BP to show that although patterns of lexical diffusion may sometimes appear to be obscure, they in fact identify the course of an ongoing sound change. Thus, the evaluation of frequency effects adds an important element to the understanding of sound change (Bybee 2012, Phillips 2006).

This paper is organized as follows. The next section provides information on Brazilian Portuguese phonology and morphology which will be relevant to the discussion presented later. The third section discusses Bybee's (2001, 2012) proposal concerning patterns of lexical diffusion in sound change and expected frequency effects. The fourth section presents the methodology and discusses how data collection proceeded. The fifth section discusses the results within the theoretical perspective adopted.

2. Brazilian Portuguese phonology and morphology

This section presents information on BP phonology and morphology which is relevant to the discussion presented below. We focus on issues related to unstressed [ãw] reduction in the verbal morphology of BP. As mentioned in the previous section, there are two mechanisms involved in [ãw] reduction: phonetic motivation and analogical leveling. We will first consider phonetic motivation and then turn to analogical leveling.

BP has seven vowels in stressed position: [i, e, ɛ, a, ɔ, o, u]. Stressed vowels can also be nasal, in which case there are only five different vowels: [ĩ, ẽ, ã, õ, ũ]. Oral and nasal diphthongs also occur in stressed position. A diphthong consists of any stressed oral or nasal vowel and a glide which can be either palatal or velar. Thus, all possible vowels and diphthongs in BP may occur in stressed position. However, in unstressed positions, both pretonic and posttonic, the inventory of vowels is reduced, that is, a smaller set of vowels occurs. We will focus on posttonic positions, since in the case to be considered we will analyze [ãw] reduction in this environment. In posttonic final position we find three oral vowels: [i, a, u] (Câmara Júnior 1979). The high vowels have their origin in mid vowels: *classe* > *class*[i] 'class' or *suco* > *suc*[u] 'juice'. The central vowel is reduced to a schwa-like vowel. There have been reports that posttonic final nasal vowels also reduce (Battisti 2000, Schwindt et al. 2010, 2012). Posttonic nasal vowels and diphthongs are reduced to oral vowels in both nouns and verbs, as in *homem* > *hom*[i] 'man'. Thus, posttonic final vowel reduction in BP may be understood as a phonetically motivated change. As for [ãw] reduction in the verbal morphology, we observe two patterns. In the Present and in the Past Imperfect [ãw] is reduced to [a], and in the Past Perfect [ãw] is reduced to [u] (Cristófaro Silva, Fonseca & Cantoni 2012). For this study, the crucial fact is that a posttonic final nasal diphthong may be reduced to an oral vowel and that such a reduction applies widely in BP in nouns and verbs.

Let us now consider analogical leveling. Portuguese is an inflecting language (Monteiro 1986). Verbal forms are composed of a stem, a thematic vowel, and a verbal ending indicating person and number. For example, in *cantaram* 'they sang' the stem is *cant-*, the thematic vowel is *-a-*, and the verbal ending indicating person and number is *-ram*. There are three verbal conjugations, and the thematic vowel of a verb form is determined by the

conjugation to which it belongs. In the first conjugation the infinitive form of the verb ends in *-ar*, as in *cantar* 'to sing'. In the second conjugation the infinitive form ends in *-er*, as in *vender* 'to sell'. In the third conjugation the infinitive form ends in *-ir*, as in *sair* 'to leave'. The first conjugation is the most frequent, the one that accommodates neologisms, and the one with regular inflections (Câmara Júnior 1979). In this paper we will examine unstressed [ãw] reduction in the first conjugation. We will restrict the analysis to the three verbal tenses which are productive in spoken BP: Present, Past Perfect and Past Imperfect. The second and third conjugations also show unstressed nasal diphthongs which are reduced to oral vowels. However, those diphthongs are different from [ãw], and the analysis of their reduction would take us beyond the scope of this paper. Nevertheless, we suggest that the analysis presented in this paper might be expanded to all verbal tenses and to all three conjugations.

Personal pronouns have undergone a change in modern BP, and this change has affected verbal inflections so that currently BP presents a smaller number of endings in carefully pronounced inflectional forms (Table 1: Duarte 1996, Teyssier 1980, Azevedo 2005).

Pronoun		Present	Past Perfect	Past Imperfect
I	*eu*	*cant*[u]	*cant*[ei]	*cantav*[a]
you (sg)	*você*	*cant*[a]	*cant*[o]	*cantav*[a]
s/he	*ele/a*	*cant*[a]	*cant*[o]	*cantav*[a]
we	*a gente*	*cant*[a]	*cant*[o]	*cantav*[a]
you (pl)	*vocês*	*cant*[ãw]	*cantar*[ãw]	*cantav*[ãw]
they	*ele/as*	*cant*[ãw]	*cantar*[ãw]	*cantav*[ãw]
		3 endings	3 endings	2 endings

Table 1: Current personal pronouns and forms of *cantar* 'to sing' for three tenses

The second person singular pronoun changed from *tu* to *você*, the first person plural pronoun changed from *nós* to *a gente*, and the second person plural pronoun changed from *vós* to *vocês* (Azevedo 2005:239, Teyssier 1980). For each inflected form in Table 1 we show the final vowel in phonetic transcription so that the endings can be identified. We will focus in this paper on the reduction of unstressed [ãw] in the forms that go with second person plural (*vocês*) 'you' and third person plural *(ele/as*) 'they'.

Pronoun		Present	Past Perfect	Past Imperfect
I	*eu*	*cant*[u]	*cant*[ei]	*cantav*[a]
you (sg)	*você*	*cant*[a]	*cant*[o]	*cantav*[a]
s/he	*ele/a*	*cant*[a]	*cant*[o]	*cantav*[a]
we	*a gente*	*cant*[a]	*cant*[o]	*cantav*[a]
you (pl)	*vocês*	*cant*[a]	*cantar*[u]	*cantav*[a]
they	*ele/as*	*cant*[a]	*cantar*[u]	*cantav*[a]
		2 endings	3 endings	1 ending

Table 2: Current personal pronouns and reduced forms *cantar* 'to sing' for three tenses

Table 2 lists the personal pronouns and the reduced verbal forms. Duarte (1996) discusses the changes in the personal pronouns and their effect on morphophonological and syntactic patterns. She argues that pronominal changes have triggered the simplification of verbal inflections. We suggest that such changes can be understood as analogical leveling, where the loss of an alternation in the paradigm occurs. The data in (1) show the alternations we will be considering, all of which involve unstressed [ãw] in the Present, Past Perfect, and Past Imperfect.

(1) Reduction of unstressed [ãw] for second and third persons plural

Present	*cant*[ãw]	~	*cant*[a]
Past Perfect	*cantar*[ãw]	~	*cantar*[u]
Past Imperfect	*cantav*[ãw]	~	*cantav*[a]

As (1) shows, unstressed [ãw] reduction in the verbal morphology presents two patterns: in the Present and in the Past Imperfect [ãw] is reduced to [a], and in the Past Perfect [ãw] is reduced to [u]. Diphthong reduction occurs in casual speech and is optional, so it may or may not occur (Battisti 2000, Schwindt et al. 2010, 2012). In this paper we will examine the roles played by phonetic reduction and by analogical leveling in unstressed [ãw] reduction. The next section outlines the theoretical perspective we adopt.

3. Theoretical perspective

Patterns of lexical diffusion can serve as a diagnostic for the source of sound change (Bybee 2012:211). The most common pattern of lexical diffusion is for the changes to affect more frequently used words first and involve phonetic motivation. This is the most common type of sound change, and such changes involve fine phonetic detail in their development. Examples of this kind of sound change are vowel reduction and deletion, consonant reduction, vowel shifts, assimilation, and retiming or overlap (Bybee 2012:215).

The other pattern of lexical diffusion is from low-frequency to high-frequency words and involves sound changes that are not phonetically motivated, such as analogical changes. Analogical changes are associated with morphophonological changes or changes in a morphological paradigm. The most common of these changes is analogical leveling, which involves the loss of an alternation in a paradigm. An example of analogical leveling is the regularization of past tense forms in English. For example, the form *leapt* is regularized to the *-ed* past tense formation, resulting in *leaped*. High-frequency verbs, such as *keep*, tend not to undergo analogical leveling, so *kept* is not regularized to *keeped*. Analogical leveling does not affect high frequency forms because they are strongly represented in memory and easy to access, so there is no reason to level them or reorganize them to conform to a more productive pattern.

Unstressed [ãw] reduction in BP poses a challenge to a clear identification of patterns of lexical diffusion and their frequency effects. On the one hand, unstressed [ãw] reduction could be a phonetically motivated phenomenon, in which case it should affect high-frequency words first and low-frequency words later. On the other hand, if it is a case of analogical

leveling, we expect it to begin with lower-frequency words and spread to higher-frequency words. It thus appears that there is a conflict between the two patterns of lexical diffusion. We claim that although patterns of lexical diffusion may appear to be in conflict, they in fact indicate the course of an ongoing sound change. In order to investigate patterns of lexical diffusion we designed an experiment to test frequency effects in unstressed [ãw] reduction.

4. Methodology and data collection

We examined unstressed [ãw] reduction in verbal forms in an experiment with 12 subjects, half male and half female. The participants were divided into two age groups: under 25 and 35 or over. All participants were educated to university level. Data collection was done individually with high quality recording so that acoustic analysis would be possible. Participants were asked to read aloud sentences that were displayed on a laptop screen. Each slide had the sentence to be read and also a picture related to the sentence. The picture was intended to distract the participant's attention from the written sentence. First, five practice slides were shown as preparation for the task. Then the test slides were presented, with distractor slides interspersed. Each test slide showed one of the target sentences to be analyzed. Frequency information was obtained from ASPA (Avaliação Sonora do Português Atual, http://www.projetoaspa.org/), which is a BP phonological database.

A different set of ten verbs was selected for each of the three tenses to be considered: Present, Past Perfect and Past Imperfect. In each set, five of the ten verbs were high frequency, and the other five were low frequency. The lowest token frequency count in the ASPA database is 6. Therefore, verbs with token frequency 6 in the database were chosen as low-frequency verbs for the analysis. The counts for the selected high-frequency verbs varied, as shown in Table 3.

	Present ending in *-am*			Past Perfect ending in *-ram*			Past Imperfect ending in *-vam*		
	Verb	Gloss	Freq.	Verb	Gloss	Freq.	Verb	Gloss	Freq.
high frequency	*precisam*	need	12,728	*ficaram*	stay	22,944	*passavam*	pass	1,749
	acabam	end	7,092	*passaram*	pass	15,343	*tentavam*	try	1,654
	encontram	meet	6,309	*entraram*	enter	7,924	*ficavam*	stay	1,439
	disputam	dispute	6,081	*levaram*	take	7,770	*usavam*	use	1,398
	indicam	indicate	6,032	*tentaram*	try	4,381	*achavam*	think	1,078
low frequency	*ruminam*	ruminate	6	*versaram*	recite	6	*primavam*	excel	6
	salpicam	sprinkle	6	*gelaram*	freeze	6	*prezavam*	appreciate	6
	respingam	spill	6	*domaram*	tame	6	*vedavam*	seal	6
	picotam	cut	6	*lavraram*	plant	6	*balizavam*	park	6
	ramificar	branch	6	*bordaram*	embroider	6	*jorravam*	gush	6

Table 3: Token frequency of the verbs analyzed in the experiment

Some of the recorded tokens were discarded because the participant read the sentence with another verb tense or omitted some relevant part of it. Each token was examined using the acoustical analysis software package Praat (Boersma & Weenink 2011). Relevant vowels were classified as either a diphthong or a monophthong. We classified as a monophthong any vowel token that had stable formants. On the other hand, we classified as a diphthong any

vowel token that showed a gliding movement in the vowel formants.

5. Results and discussion

The rates of monophthong pronunciation show that unstressed [ãw] reduction took place.

Verbal tense	diphthong		monophthong		
	N	%	N	%	
Present: ending in *-am*	101	66.45%	51	33.55%	p = 0.1098
Past Perfect: ending in *-ram*	93	66.91%	46	33.09%	p = 0.5107
Past Imperfect: ending in *-vam*	108	77.70%	31	22.30%	p = 0.03825

Table 4: General data distribution

The data in Table 4 show that unstressed [ãw] reduction occurred in 33.55% of Present tokens, in 33.09% of Past Perfect tokens, and in 22.30% of Past Imperfect tokens. The lower rate of diphthong reduction for the Past Imperfect (22.30%) compared to the other two tenses is noteworthy. Since the data were collected in an experimental setting and involved reading, we would expect higher rates in ordinary spoken language. The rightmost column in Table 4 presents the results of binominal tests evaluating whether the reduction rate for each verbal tense is significantly different from chance. Using the standard significance level of .05, these results indicate that the rate of diphthong reduction is statistically significant for the Past Imperfect but not for the Present or the Past Perfect. This disparity can be interpreted as evidence for different patterning of diphthong reduction depending on verbal tense in BP. To understand this difference, we have to consider frequency effects (Table 5).

Tense	Frequency	N	%	Significance
Present	High	35	68.63%	p = 0.01097
	Low	16	31.37%	
Past Perfect	High	39	84.78%	p < 0.001
	Low	7	15.22%	
Past Imperfect	High	19	61.29%	p = 0.2810
	Low	12	38.71%	

Table 5: Frequency effects in [ãw] reduction

Table 5 presents the figures for unstressed [ãw] reduction in high- and low-frequency verbs. All tenses showed a higher rate of [ãw] reduction for high-frequency verbs than for low-frequency verbs. As expected in a phonetically motivated sound change, the high-frequency words are affected first, as shown by the higher rates observed for high-frequency verbs. However, the difference between the rates of [ãw] reduction for high- and low-frequency verbs is significant only for the Present and Past Perfect tenses and not for the Past Imperfect (again, using .05 as the significance level).

In order to understand this outcome, we have to take into consideration the role played by analogical leveling in the verbal morphology of BP (see Table 2). We saw in Table 3 that the Past Imperfect has been regularized by analogical leveling so that all verbal forms have the same *-va* ending. We claim that the lack of a significant difference between the rates of [ãw] reduction for high- and low-frequency verbs for the Past Imperfect is a manifestation of the conflict between a phonetically motivated phenomenon like diphthong reduction, which affects high-frequency words first, and analogical leveling, which affects low-frequency words first.

Let us now consider the Present tense. There is a statistically significant effect of frequency, but low-frequency verbs show a relatively high rate of [ãw] reduction (31.37%). Referring back to Table 2, we observe that analogical leveling has also affected the Present, resulting in only two distinct verbal forms. We suggest that analogical leveling triggers low-frequency verbs to undergo [ãw] reduction at higher rates. Once again, what appears to be a conflict between high- and low-frequency verbs in fact indicates that specific patterns of lexical diffusion are in operation.

Interestingly, in contrast to the Present and Past Imperfect, the Past Perfect does not undergo analogical leveling, and we observe that low-frequency verbs undergo [ãw] reduction at a low rate (15.22%). On the other hand, as expected in cases of phonetically motivated sound changes like diphthong reduction, we observe that high-frequency words show high rates of [ãw] reduction (84.78%).

Thus, at first glance it appears that unstressed [ãw] reduction in the verbal morphology of BP poses a problem for interpreting lexical frequency effects in patterns of lexical diffusion. Nevertheless, a closer examination of the facts indicates that different patterns of lexical diffusion apply concomitantly in the Present and Past Imperfect. Thus, an apparent conflict in patterns of lexical diffusion in fact reveals that different mechanisms are in operation: a phonetically motivated sound change and analogical leveling.

6. Conclusion

This paper investigated unstressed [ãw] reduction in the verbal morphology of Brazilian Portuguese in an attempt to examine different patterns of lexical diffusion. Bybee (2012) considers two patterns of lexical diffusion: high-frequency to low-frequency words, which is characteristic of phonetically motivated sound changes, and low-frequency to high-frequency words, which is characteristic of analogical changes. We showed in this paper that both patterns of lexical diffusion are in operation in unstressed [ãw] reduction. Although patterns of lexical diffusion may appear to be obscure, they can in fact identify the course of an ongoing sound change. Thus, the evaluation of frequency effects adds an important element to our understanding of the causes and mechanisms of sound changes.

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Notes

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