

Verbal Stress Assignment in Brazilian Portuguese and the Prosodic Interpretation of Segmental Sequences

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Abstract

This paper offers a contribution towards the prosodic interpretation of segmental sequences. Focus will be given to consonantal sequences where epenthesis may optionally occur in Brazilian Portuguese, as in *o[bs]truir* or *o[bis]truir* “to obstruct”. We will show that some consonantal sequences have distinct representations from others, being that the difference in representation has an impact on innovative stress pattern attested in verbal forms. Considering the underlined epenthetic vowels in [a'dapitu] and [ada'pitu] *adapto* “(I) adapt” the former example is the traditional form and the later is the innovative form. We will show that sequences of stops – as [pt] for example – represent a sequence of consonantal positions, whereas [ks] sequences represent a single consonantal position associated to two segments. This later case corresponds to a complex consonant and behaves like other complex consonants in the language, such as [kw, gw]. An experiment was run in order to investigate the innovative stress pattern in verbal forms in BP. We found that whereas most verbal forms with a sequence of stops display the innovative stress pattern all analyzed verbal forms with a [ks] sequence do not present the innovative stress pattern. We account for this distinct behavior regarding stress by offering support towards the different representation of segmental sequences. Our results contribute towards a better understanding of stress assignment in Brazilian Portuguese, we provide additional information about complex consonants and we also offer support to the claim that epenthetic vowels are present in lexical representations.

1. Introduction

This paper intends to be a contribution towards a better understanding of the prosodic interpretation of segmental sequences. Focus will be given to some heterosyllabic consonantal sequences in Brazilian Portuguese (henceforth BP) which may or may not undergo epenthesis. Epenthesis occurs in nouns, as in [ps]icologia or [pis]icologia “psychology”, in verbs, as in *o[bs]truir* or *o[bis]truir* “to obstruct” and in adverbs as *a[bs]olutamente* or *a[bis]olutamente* “absolutely”, and it is understood to be optional (Collischonn [1]; Cristófarosilva; Almeida [2]). The epenthetic vowel, which is typically realized as a short and unstressed [i] in BP, will be underlined throughout this paper. It will be shown that stress assignment in verbal forms has started to display innovative patterns as a consequence of

epenthesis. Considering the underlined epenthetic vowels in [a'dapitu] and [ada'pitu] *adapto* “(I) adapt” the former example is the traditional form and the later is the innovative form. The innovative forms appear as a consequence of stress assignment parameters that apply to the verbal paradigm in BP. Thus, potentially any verbal form with an epenthetic vowel in the adequate position between two heterosyllabic consonants could have the innovative stress pattern. We will show that it is not the case by presenting results from an experiment designed to investigate stress assignment in verbal forms with an epenthetic vowel. Whereas most verbal forms with epenthesis will display the innovative stress pattern all analyzed verbal forms with a [ks] sequence do not present the innovative stress pattern. We will argue that (velar stop+alveolar fricative) sequences, i.e [ks], have a distinct representation from the other consonantal sequences. Therefore, the innovative stress pattern is not expected to occur when [ks] is involved whereas the innovative stress pattern occurs when other stop sequences are involved. Our analysis shows that similar segmental sequences may have distinct representations and thus distinct impact on to the prosodic system. This paper is organized as follows. Section 2 reviews the major issues related to primary stress assignment in BP. In section 3 we discuss the main principles of primary stress assignment to verbal forms in BP and we identify the innovative stress pattern observed in cases where an epenthetic vowel occurs. The experiment and its results are discussed in section 4. Section 5 discusses specific issues related to [ks] sequences indicating potential topics for further investigation. The final section presents the major findings and identifies issues for further investigation.

2. Stress assignment in BP: a brief overview

In this section we review the major issues related to primary stress assignment in BP. Câmara Jr. [3] identifies the major stress patterns in BP assuming that stress is lexically determined. Leite [4] offers a view of stress and related phenomena in BP within the Generative Phonology framework where rules were the centre of the analysis. It is with the appearance of metrical phonology that a number of works focusing solely on stress assignment in BP appeared in the literature. These analyses offer a range of alternatives from syllable weight sensitivity (Wetzels [5]) to the parameters involved in primary stress assignment in noun and verbal forms, whether following similar or distinct principles (Bisol [6]; Lee [7]; Massini-Cagliari [8]). More recent analyses based

¹ Maria Cantoni would like to acknowledge support from CNPq (postgraduate grant). Thaís Cristófarosilva would like to acknowledge support from CNPq, research grant number 303397/2005-5.

on Optimality Theory also address similar issues although the core problems remain: whether verb and nouns have stress assigned by similar or distinct principles and also whether or not stress in BP is quantitative sensitive or not. Therefore, principles of stress assignment in BP are still controversial.

Although the debate on stress assignment in BP is very lively there are two facts that seem to be consensual. The first one concerns the distribution of primary stress, which may be final, penultimate or antepenultimate except when under two conditions: 1) when epenthesis occurs as in [ˈtɛ.ki.ni.ku] *técnico* “technical” or 2) with clitics, as in ([fa.ˈla.va.mos.tʃi] *falávamos-te* “we were telling you”). The second point under agreement is that the majority of words in Portuguese are stressed in the penultimate syllable, i.e. they present penultimate stress.

Concerning epenthetic vowels they may be understood as being blind to the metrical system (Lee [7]; Wetzels [5]). Thus, a form such as *té*[ki]n*ico* “technical”, where stress falls on the fourth-to-last syllable, indeed has an underlying antepenultimate stress pattern since epenthetic vowels do not count to stress assignment. Therefore, we do not expect any epenthetic vowel to bear primary stress. However, this is not the case. Indeed, innovative verbal forms in BP show epenthetic vowels bearing primary stress. The next section addresses this issue.

3. Stress assignment in verbal forms and an innovative pattern

In this paper we will be concerned with the following verbal tenses: present indicative, present subjunctive and imperative, P1, P2, P3 and P6 (where P stands for the person in verbal conjugations). In the conjugated forms of regular verbs for the above mentioned tenses stress falls on the second-to-last vowel. For example, in a form such as “(I) like” (*eu gosto*) stress falls on the vowel in bold. We will focus our analysis on verbal forms that can potentially have an epenthetic vowel in the last vocalic position in the verbal root. For example, in the verbal form “(I) opt” (*eu opto*) following conventional parameters for stress assignment the primarily stressed vowel should be the second-to-last one: *opto*. However, stress varies in forms where an epenthetic vowel occupies the final nucleus in the verbal root and either [ˈoʔpitu] or [oʔpitu] are currently possible forms in competition.²

Notice that in a form like [oʔpitu] stress falls on the epenthetic vowel – which theoretically would be blind to stress assignment. The same happens to similar examples such as [aˈdapitu]~[adaˈpitu] (*eu adapto* “I adapt” or [heˈzigu]~[heziˈginu] (*eu resigno* “I resign”). In order to have a better understanding of this phenomenon we run an experiment to evaluate the degree of variation of primary stress assignment in verbal forms that present a consonantal sequence in the stem. We examined the following consonantal sequences: [tʃm], [dʒn], [kt], [pt] and [ks]. We also expected

² Open and closed mid vowels, i.e. [o] and [ɔ], alternate in verbal forms when in primarily stressed position. This alternation has been analysed as a case of Spondaic Lowering by Wetzels [5]. The cases we will analyse do not involve primarily stressed mid vowels and therefore Spondaic Lowering will not be discussed in this paper.

to verify if all segmental sequences behaved in a similar fashion or not towards the innovative stress pattern.

4. Investigating primarily stressed epenthetic vowels in verbal forms

This section describes the experiment which investigated primarily stressed epenthetic vowels in verbal forms in BP. The main point to be investigated in the experiment was the innovative stress pattern where an epenthetic vowel bears primary stress. We also investigated the behaviour of the segmental sequences involved. A set of seven verbs was considered. These verbs are listed below:

	Infinitive	Gloss	Flexioned form (present indicative, P1)	Conventional stress	Innovative stress
1	ritmar	to rhythm	<i>ritmo</i>	[ˈhiʃmɔ]	[hiˈtʃimɔ]
2	indignar-se	to turn indignant	(<i>me</i>) <i>indigno</i>	[ˈiːdʒignɔ]	[iːdʒiˈginɔ]
3	compactar	to compact	<i>compacto</i>	[kɔˈpaktɔ]	[kɔpaˈkitɔ]
4	adaptar	to adapt	<i>adapto</i>	[aˈdaptɔ]	[adaˈpitu]
5	optar	to opt	<i>opto</i>	[ˈɔptɔ]	[oˈpitu]
6	anexar	to annex	<i>anexo</i>	[aˈnɛksɔ]	[aneˈkisu]
7	fixar	to fix	<i>fixo</i>	[ˈfiksɔ]	[fiˈkisu]

Table 1: Verbal forms considered in the experiment

Table 1 shows the gloss, the infinitive form and then the conventional and alternative stress observed to the forms we tested. The boxes in grey indicate that these forms were not attested. Segments in bold indicate the context where epenthesis could potentially occur. Two issues were to be addressed. The first one concerned the rate at which the innovative stress pattern occurs in BP. The second point was to verify if all cases of epenthetic vowels would, in principle, accept primary stress.

The seven verbal forms were tested with a group of 10 (ten) speakers who leave and work in Belo Horizonte city. Half of the speakers were male and the other half female, aged between 20 to 50 years old. All participants were educated under university level. The participant was presented with an interrogative sentence where the verb appeared in P2 in the perfect tense: *Você já comeu doces?* “Have you ever eaten sweets?” S/he was then asked to reply to the question by using the verb in the present form, and in P1: *Eu sempre como doces* “I always eat sweets”. To assure the desired verbal form was given the speaker was requested to use the following template: *I always (verb in the present indicative)*. A set of 70 (seventy) tokens was considered for the ten speakers eliciting seven verbal forms.

General results showed that 40% (28/70) of tokens presented the innovative stress pattern. However, an interesting point has to be made: two verbs did not present any case with the innovative stress pattern. These verbs were *anexar* and *fixar*. Since two verbs did not present the innovative pattern the general rate for innovation was much higher: 56% (28/50).

It is important to mention that all participants presented the innovative stress pattern in some of the verbal forms listed

in 1-5 in Table 1 whereas no participant had the innovative stress pattern for the verbs listed in 6-7 in Table 1. This shows that the innovative stress pattern seems to be favored for a set of verbs, but not others and that speakers group these verbs into different categories.

We were then faced with the fact that a high rate of innovative stress pattern was presented for a group of verbs (56%) whereas two verbs did not present a single case of the innovative stress pattern. In order to understand this issue we investigated the characteristics of the consonants involved with epenthesis.

Five out of the seven verbs presented an (affricate+stop) or a (stop+stop) sequence (cf. data 1-5 in Table 1). The verbs listed in 5-6 in Table 1, i.e., *anexar* and *fixar*, both involve a velar stop followed by a sibilant: *ane[ks]ar* “to annex” and *fi[ks]ar* “to fix”. We posit the hypothesis that [ks] sequences had a different phonological representation from the other segmental sequences. More specifically, we suggest that [ks] sequences behave as a complex consonant whereas (affricate+stop) and (stop+stop) sequences behave as a sequence of consonants (where an epenthetic vowel may appear). If this hypothesis is correct then we have to demonstrate that [ks] sequences behave differently from the other segmental sequences given in Table 1.

In order to understand fully the behavior of [ks] sequences we have to examine how complex consonants behave in BP. A number of works have looked into (velar stop+back glide) sequences in BP as in [ˈkwatru] *quatro* “four” (Cristóforo Silva [9]; Couto [10]). These works show that (velar stop+back glide) sequences in BP behave differently from branching onsets and also from sequences of consonants. The main argument for assuming that (velar stop+back glide) sequences behave as complex consonants is that primary stress is not antepenultimate when the final onset is filled with a complex consonant. For example, a noun like [iˈnikwa] *iniqua* “iniquitous (fem.)” does not present antepenultimate stress – as in **iniqua* – because when a complex consonant occupies the final onset position of the word stress must fall on the syllable that precedes the complex consonant (Cristóforo Silva [9]; Harris [10]).

If we consider [ks] sequences we observe that a noun like *anexo* “appendix”, which has [ks] in the final onset, presents stress on the second-to-last vowel – as in [aˈneksu]. Thus, a form such as *[ˈaneksu] does not occur because stress would fall on the third-to-last vowel whereas the complex consonant occupies the final onset position in the word. Therefore, [ks] sequences seem to behave as complex consonants such as [kw] and [gw].

It is known that complex consonants such as [kw] and [gw] do not undergo epenthesis. That is, a word like [ˈkwatru] *quatro* “four” is not pronounced as *[kiˈwatru]. If [kw] and [gw] sequences and [ks] sequences share analogous representations we should not expect to find an epenthetic vowel in [ks] sequences: that is, [kiˈs] will not occur. This is exactly the case in the data we gathered in the experiment.

Another experiment carried out by Cantoni [12] showed that epenthesis did not occur for any item with [ks] sequences that were analyzed (13 real words and 9 non-sense words). Thus, it appears that like in (velar stop+glide) sequences no epenthesis may occur when [ks] sequences are involved. Furthermore, Cantoni’s preliminary findings show that in [ks] sequences the velar stop may not be present in some words.

Thus, a form as [siˈtaksi] alternates with [siˈtasi] *sintaxe* “syntax” and a form as [kõˈpleksu] alternates with [kõˈplegu] *complexo* “complex”. A similar behavior is observed in (velar stop+back glide) sequence where [kw] alternates with [k] in forms as *li[kwi]dificador* or *li[ki]dificador* “liquefier”. In spite of which consonant is subject to deletion in either case consonantal reduction is attested. Further investigation is necessary on this topic. What is relevant at this point is the fact that [ks] sequences display analogous phonological behavior to complex consonants as [kw] and [gw]. We argue that the fact that [ks] sequences are not subject to the innovative stress patterns observed in verbal forms follows from the fact that [ks] sequences are understood as complex consonants whereas the other analyzed consonantal sequences (cf. Table 1) are understood as a sequence of consonants.

So far we have shown that when two stop consonants are in a sequence and epenthesis applies an epenthetic vowel may bear primary stress in verbal forms. We called these cases of innovative stress patterns. We have also shown that [ks] sequences are not subject to the innovative stress pattern. We suggested that this follows from the fact that [ks] sequences are analyzed as complex consonants in BP and behave in analogous ways to other complex consonants. In the next section we will indicate some further particularities of [ks] sequences.

5. [ks] sequences

We have seen that [ks] sequences behave alike other complex consonants as [kw, gw] rather than as a sequence of consonants where an epenthetic vowel may appear to separate the two consonants. In this section we intend to indicate some particular aspects of [ks] sequences that may deserve further investigation.

As already mentioned, [ks] sequences seem to be unlikely to undergo epenthesis. It would be interesting to verify if this is valid to any [ks] sequence in terms of its etymological and structural patterns. If we look at the distribution of adjacent consonants in BP we observe that [ks] sequence is the one that presents the highest type count amongst them all (652 types).

C2 C1	p	b	t	d	k	g	f	v	s	z	ʒ	m	n
p			404		1		1	1	319				41
b	23	1	89	75	41	3	13	42	225	2	84	70	20
t		3			2		3	94	19	2	1	50	46
d			1		35	2			13	1	6	148	27
k			530	1			3		652	5	1		101
g		1	3	10			1		2			116	424
f			23		5								1

Table 2: Type Frequency of epenthetic vowels
(Source: Cristóforo Silva; Almeida [2])

The highest type count of [ks] sequences may be a factor that contributes to keep the segmental stability of such sequences. This is because frequency effects may play an important role in keeping and changing the shape of lexical items and their segmental content (Bybee; Hopper [13]).

Another interesting fact regarding [ks] sequences is that the voiced stop does not occur (the two examples attested in Table 2 are related to loan words and neologism).

In terms of articulatory phonology (Browman; Goldstein [14]) [k] and [s] may have a tight relationship of gestural

configuration that could contribute to both consonants to be kept together, without and intervening epenthetic vowel.

From an acoustic perspective we would like to posit the hypothesis that the fricative has low intensity as predicted for stops. The sibilant with the drop in intensity would indicate that [k] and [s] share some specific properties that tie them together.

Thus, an interesting line of research to be pursued is that gradience may offer us clues as to why [ks] sequences behave in the way they do. Additionally, a probabilistic perspective may offer some insight as to the number of tokens and consequently the number of words that accommodate specific patterns. We hope that further research will offer us a detailed account of [ks] sequences and stress patterns related to them.

6. Conclusions

This article has shown that analogous segmental sequences may have different representations. That is, whereas [ks] sequences behave as complex consonants such as [kw, gw] a sequence of stop consonants behaves differently. The difference lies on the fact that the former group of consonants, which consist of complex consonants, does not allow for epenthesis, has specific constraints concerning primary stress and also has the distribution of onsets filled with a complex consonant. On the other hand in a sequence of stops epenthesis may occur and no constraint on stress assignment is observed. In this paper we showed that innovative stress pattern applies to verbal forms with sequences of stops but not to [ks] sequences since the later consists of a complex consonant rather than a sequence of consonants. The innovative stress pattern offers support to the fact that epenthetic vowels are present in lexical representations (Cristófaro Silva; Almeida [2]). Further research on the nature of [ks] sequences may offer us a better understanding of the nature of complex consonants.

7. References

- [1] Collischonn, G., 2002. A epêntese vocálica no português do sul do Brasil. *Fonologia e Variação: Recortes do português brasileiro* 1. Porto Alegre: EDIPUCRS, 205-230.
- [2] Cristófaro Silva, T.; Almeida, L.S., 2006. On the Nature of Epenthetic Vowels. In: 10th Laboratory Phonology Conference, 2006, Paris. *Proceedings Labphon 10*. Paris: Université de Paris 3, v. 1, 73-73.
- [3] Câmara Jr., J.M., 1970. *Estrutura da língua portuguesa*. Petrópolis: Vozes.
- [4] Leite, Y., 1974. *Portuguese stress and related rules*. Ph.D. diss., University of Texas at Austin.
- [5] Wetzels, W.L., 2006. Primary Word Stress in Brazilian Portuguese and the Weight Parameter. *Journal of Portuguese Linguistics*. Special Issue on the Prosody of the Iberian Languages 5(2).
- [6] Bisol, L., 1992. O acento e o pé métrico binário. *Cadernos de Estudos Lingüísticos* 22, 69-80.
- [7] Lee, S.H., 1995. *Morfologia e Fonologia Lexical no Português do Brasil*. Ph.D. diss., IEL-UNICAMP.
- [8] Massini-Cagliari, G., 1995. *Cantigas de amigo: do ritmo poético ao lingüístico*. Um estudo do percurso histórico da acentuação em português. Ph.D. diss., IEL-UNICAMP.
- [9] Cristófaro Silva, T., 1992. The Phonological representation of velar stop-glide sequences. *SOAS: Working Papers in Linguistics and Phonetics* 2. London: University of London, 315-338.
- [10] Couto, H.H., 1996. As Sequências Qu- e Gu- Mais Vogal. *Revista de Estudos da Linguagem*, 4(2), 35-43.
- [11] Harris, J., 1983. *Syllable Structure and Stress in Spanish: A Nonlinear Analysis*. Cambridge, Mass: MIT Press.
- [12] Cantoni, M.M., 2007. *O Grafema <x> e suas realizações: propriedades acústicas*. UFMG. Unpublished.
- [13] Bybee, J.L.; Hopper, P., 2001. *Frequency and the Emergence of Linguistic Structure* (ed.). Amsterdam: John Benjamins.
- [14] Browman, C.P.; Goldstein, L., 1992. Articulatory phonology: an overview. *Phonetica*, 49 (3-4), 155-180.