Phonology Squib: Bororo stop voicing

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1 Introduction

Bororo (Macro-Jê family, Brazil) features a rare laryngeal co-ocurrence restriction, namely, it disallows two voiceless obstruents in the same word (rule in 1). This is a strong lexical restriction, and also has the power to trigger voicing alternations, though only the latter aspect has been documented in the sparse literature about it (see Colbacchini and Albisetti, 1942; Crowell, 1977).

(1) $*\,\#(...)\begin{bmatrix} +\text{obstruent} \\ -\text{voiced} \end{bmatrix}(...)\begin{bmatrix} +\text{obstruent} \\ -\text{voiced} \end{bmatrix}(...)\#$

In this squib I will delimit the phenomenon and discuss the challenges it poses to traditional accounts. In section 2 I introduce very quickly the phonological structure of the language. In section 3 I describe the empirical data that lead to the generalization in (1), both as a lexical generalization and as an alternation trigger, and in section 4 I make some considerations about the theoretical import of this phenomenon.

2 Phonology in a Nutshell

Table 1 and 2 below organize the consonants and vowels that enter in Bororo's strictly **(C)V** syllable[1].

	labial		coronal		palatal		velar			
	+voi	-voi	+voi	-voi	+voi	-voi	+voi		-voi	
							-round	+round[a]	-roud	+round[a]
obstruent	b	p	d	t	dʒ	tʃ	g	g^{w}	k	k^{w}
nasal	m		n							
glide	w				j					
flap			ɾ							

[a]This contrast is lost before rounded vowels.

Table 1: Consonantal Inventory

front	back unrounded	back
i	ɯ	u
e	ʌ	o
	a	

Table 2: Vocalic Inventory

[1]A more complete phonological description is offered in Nonato (2007, ch. 3.1)

3 Co-occurrence restrictions

3.1 Lexical restrictions

As stated in the introduction, Bororo restricts voiceless obstruents to occurring at most once per word (cf. rule 1, repeated below as 2). In a collected corpus of 990 entries, from roughly 436 entries featuring any two obstruents in same word, only 46 seemed to be exceptions to this general claim.

(2) $*\,\#(...)\begin{bmatrix} +\text{obstruent} \\ -\text{voiced} \end{bmatrix}(...)\begin{bmatrix} +\text{obstruent} \\ -\text{voiced} \end{bmatrix}(...)\#$

Taking a closer look at these exceptions, we find that most of them —34— are formed either by cliticization or by compounding (some examples in 3a), from what we learn that the restriction in (1) doesn't apply across clitic or compound boundaries. Among the other exceptions, some can be clearly identified as loans (3b)[2] and the rest, as far as my ignorance of the language goes, could as well be loan-words (with obscure origins) or compounds (whose parts I couldn't analyze). In any case, even if they proved to be real exceptions, their small number doesn't pose a threat to the generality of the restriction in (1).

(3) a. /tʃa-kuɾiˈdʒe/[3] 'very early', /ka-ˌkodi-ˈwɯba/[4] 'which one of them', /mʌˈtʌ-tʌ/[5] 'into the earth', /okʷa-kuˈɾi-dʌ/[6] 'to bless', /okʷaˈpaga/[6] 'to try', /ɔtɔˈkɯɾi/[7] 'to be pointy', /buˌbutɯˈkɯɾi/[7] 'to rain heavily', /ˈpepe/[8] 'manure'

b. /taˈpiɾa/[9] 'cattle', /takʷoˈɾewɯ/[9] 'bamboo'

3.2 Morphological Alternations

As exemplified by the words in (3a), the restriction in (1) doesn't hold across clitic boundaries. But it does apply across affix boundaries. The affixes that are going to be relevant are the ones that contain voiceless obstruents. That leaves us with one suffix —/ka/ 'verbal negation'— and also with some agreement prefixes.

3.2.1 What happens when both the root and a suffix have a voiceless obstruent

As we see in (4), the negation marker is directly suffixed onto the verb. In (5) we can see that the obstruent in this suffix becomes voiced in the presence of a voiceless obstruent in the root, in apparent conformance with the restriction in (1). However, if the voiceless obstruent is not in the last syllable of the root, it looks like the obstruent in the suffix doesn't need to become voiced (cf. 6) —but the relevant data are rare.

(4) iwogukaɾe *'I haven't fished'*

i- wogu -ka ɾe
1s- 'to fish' -'not' assertive

(5) a. utɯɾe *'he went'*

u- tɯ -ɾe
3s- 'to go' assertive

b. utɯgaɾe *'he didn't go*

u- tɯ -ga ɾe
3s- 'to go' -'not' assertive

(6) iɾe kuɾukadʌ *'i didn't make him swim'*

i- ɾe kuɾu -ka -dʌ
1s- assertive 'to swim' -'not' -causative

Another logical way to avoid disobeying the restriction would be to voice the obstruent in the root. As that never happens, two possibilities arise. Either the language is more faithful to the root, or to the first voiceless consonant. As we will see in the next section, when we look at the interaction between prefixes and roots, the latter is the right account.

[2] Note that most recent loan-words seem to go by the rule (e.g. /baˈpeɾa/ 'paper', from Portuguese /paˈpɛw/)
[3] /tʃa/ is an interjection
[4] /ˈkodi/ 'why'
[5] /tʌ/ 'into'
[6] /okʷa/ 'mouth'
[7] /kɯɾi/ 'very'
[8] /pe/ 'shit'
[9] from a Tupi language

3.2.2 What happens when both the prefix and the root contain a voiceless obstruent

An agreement morpheme conforms to either one of the following templates **V(C)** or **CV(G)** (where C stands for a voiceless and G for a voiced consonant). The final consonant is dropped when the root it applies to begins with a consonant. The same set of agreement morphemes is used onto either verbs, possessed nouns or postpositions, and the complete paradigm is shown in table (3) below.

		singular	plural	
1st Person		i(t / n / k)-[a]	exclusive	ce(d / n / g)-[a]
			inclusive	pa(g)-
2nd Person		a(k)-	ta(g)-	
3rd Person	pronominal	u- / ∅-	e(t / n / k)-[a]	
	anaphoric	t- / tu(d)-		

[a]Pick the coronal before a back vowel, nasal or oral as lexically specified by the root.

Table 3: Agreement Prefixes

Most of the time, when an agreement prefix of the form **V** is added to a root, nothing of interest could possibly happen (e.g 7). Alternations are triggered when a prefix of the form **CV** or **VC**[10] is added to a root containing a voiceless obstruent, in which case it will become voiced (cf. 8 and 9).

(7) ukuɾuɾe *'I swam'*

u- kuɾu -ɾe
3s- 'swim' assertive

(8) tʃeguɾuɾe *'we swam'*

tʃe- kuɾu -ɾe
1pe- 'swim' assertive

(9) a. ikɯɾɯdu *'he pissed'*

∅- ikɯɾɯdu
3s- 'piss'

b. akigɯɾɯdu *'you pissed'*

ak- ikɯɾɯdu
2s- 'piss'

So far the examples featured two underlyingly voiceless obstruents in adjacent syllables, but the restriction in (1) can also skip syllables, for instance, when a prefix of the form **CVG** is added to a root that contains a voiceless obstruent, as in (10).

(10) tagigɯɾɯdu *'you (pl.) pissed'*

tag- ikɯɾɯdu
2p- 'piss'

3.2.3 Alternations triggered without apparent violation to the restriction in (1)

Sometimes, voicing is triggered without a clear violation to (1). For instance, when an agreement prefix ending in a nasal coronal is taken by a root containing a voiceless obstruent (cf. 11)[11], the obstruent will be voiced. It has been proposed (Rodrigues, 1993) that in a previous stage of the language the nasals ending these prefixes were stops that got nasalised by a following nasal vowel. In Bororo (but not in other closely related languages), the nasalization might have been lost in the vowels, but kept on the nasalized obstruents.

[10]Remember that prefixes of the form **CV** are added to consonant-initial roots and **VC** to vowel-initial roots.

[11]For every root beginning with a back vowel, it is lexically determined whether it takes a prefix ending in a nasal coronal or in an oral coronal.

(11) a. ok^{w}a *'her mouth'*

Ø- ok^{w}a
3s- 'mouth'

b. inog^{w}a *'my mouth'*

in- ok^{w}a
1s- 'mouth'

It can also happen that a prefix of the form **V** change the form of the root without any apparent violation of (1). That will only happen when the root doesn't begin with a voiceless obstruent[12](cf. 5a and 7 for examples of roots beginning with a voiceless obstruent —when no voicing ensues). In (12) there is an example of this behavior in a root that begins with a nasal and in (13) in a root that begins with a flap.

(12) a. makʌɾe *'she spoke'*

Ø- makʌ ɾe
3s- 'speak' assertive

b. emagʌɾe *'they spoke'*

e- makʌ ɾe
3p- 'speak' assertive

(13) a. ɾutuɾe *'she went up'*

Ø- ɾutu ɾe
3s- 'to go up' 'assertive

b. iɾuduɾe *'I went up'*

i- ɾudu ɾe
1s- 'to go up' 'assertive

When an agreement morpheme of the shape **V** is prefixed to a root that begins in a voiced bilabial obstruent or voiced palatal obstruent, the obstruent is furthermore weakened into a glide (cf. 14a and 14b) and, as in the previous cases, if the root contains a voiceless obstruent, it will become voiced (cf. 15a).

(14) a. i. bai̯ *'her house'*

Ø- bai̯
3s- 'house'

ii. iwai̯ *'my house'*

i- bai̯
1s- 'house'

b. i. bai̯poɾo jadʌ *'open the door'*

bai̯poɾo Ø- jadʌ
'door' 3s- 'open'

ii. bai̯poɾodoge eiadʌ *'open the doors'*

bai̯poɾo doge e- iadʌ
'door' -plural 3p- 'open'

(15) a. i. adɯgoɾe bitʌ *'a jaguar killed him'*

adɯgo -ɾe Ø- bitʌ
'jaguar' assertive 3s- 'kill'

ii. adɯgoɾe ewidʌ *'a jaguar killed them'*

adɯgo -ɾe e- bitʌ
'jaguar' assertive 3p- 'kill'

b. i. dʒoki *'his body'*

Ø- dʒoki
3s- 'body'

ii. ii̯ogi *'my body*

i- dʒoki
1s- 'body'

It looks as though the voiceless feature is present at some level relevant to the computation of the restriction in (1) in both cases. I'll try to fancy what the process could look like: when voicing is triggered by a prefix apparently ending in a coronal nasal, some process of the form in (16) might be at work. When voicing ensues after a prefix of of form **V** is added to a root that begins in a consonant other than a voiceless obstruent, it looks like the [-voiceless] feature is conserved (the overt result of which is that voiced obstruents become glides), as in (17).

(16) it + ˜ok^{w}a → ĩtog^{w}a → inog^{w}a

(17) i$_{[-voi]}$ + dʒoki → idʒ$_{[-voi]}$oki → ii̯ogi

3.2.4 Interaction between suffix, prefix and root

As we saw in section 3.2.1, when an a syllable intervenes between the negation marker and the voiceless obstruent in the root, voicing of the obstruent in the suffix isn't triggered. That is also true when a verb intervenes between the agreement prefix containing a voiceless obstruent and the negation prefix (cf. 18). When no syllable intervenes, though, something that can only happen in transitive constructions like (19), voicing happens.

[12]Actually, the only attested cases are of roots that begin with /b/, /dʒ/, /m/ and /ɾ/. Possibly as a gap in the documentation, the corpus doesn't include flexionable words that both contain a voiceless obstruent and begin with /g/, /n/, /w/ or /j/.

(18) itaidɯkaɾe *'I don't want'*

it- aidɯ -ka ɾe
1s- 'to want' -'not' assertive

(19) tʃegaɾe bitʌ

tʃe- ka ɾe ∅- bitʌ
1pe- 'not' assertive 3s- 'to kill'

4 A possible account

In the sections above I tried to describe as completely as my data allow the workings of the laryngeal coocurrence restriction in Bororo. Despite the complications we found, it became clear that the language strongly disfavors sequences of two voiceless consonants, sometimes going to extremes of triggering voicing even though the voiceless feature can only be said to be present at an abstract level (cf. 3.2.3).

Most of the languages that restrict the occurrence of two consonants having the same laryngeal features can be accounted for as complying with some sort of OCP. In order for that to work, it is necessary to assume that the features voiced, aspirated or ejective are privative, while voicelessness is underspecified (cf. MacEachern, 1999).

In the case at hand, though, the restriction is in terms of voicelessness. Even if we were willing to suppose that the feature voiceless is also privative, the existence of this phenomenon forces us to rethink the old solution. To reassure the reader, I provide below two spectrograms that show clearly that the contrast is indeed in terms of voicing (cf. figures 1 and 2).

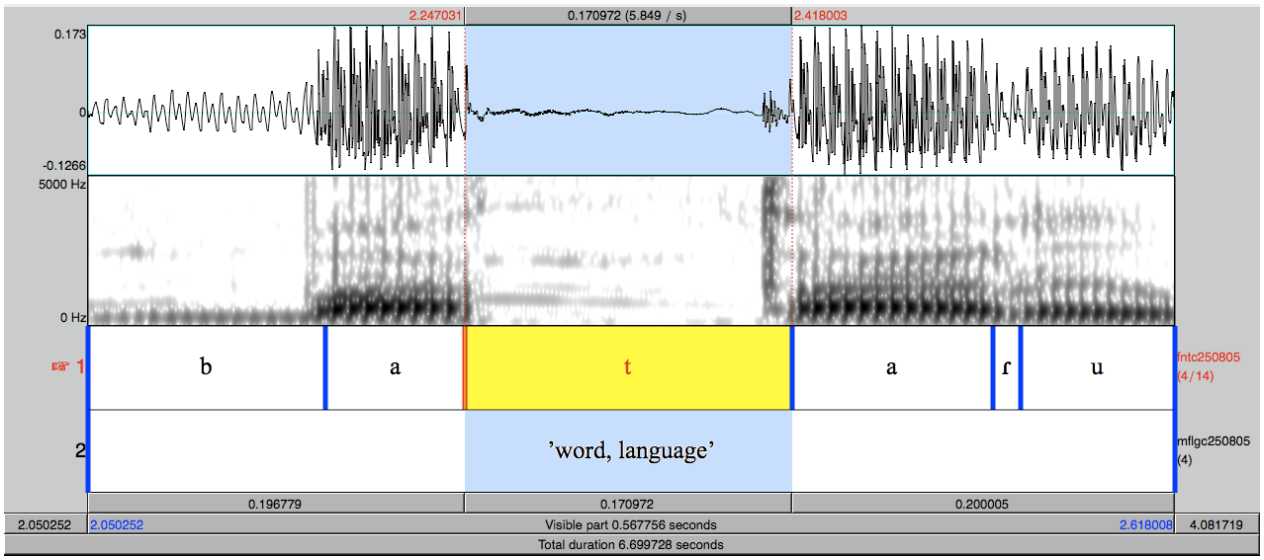

Figure 1: 'his word'

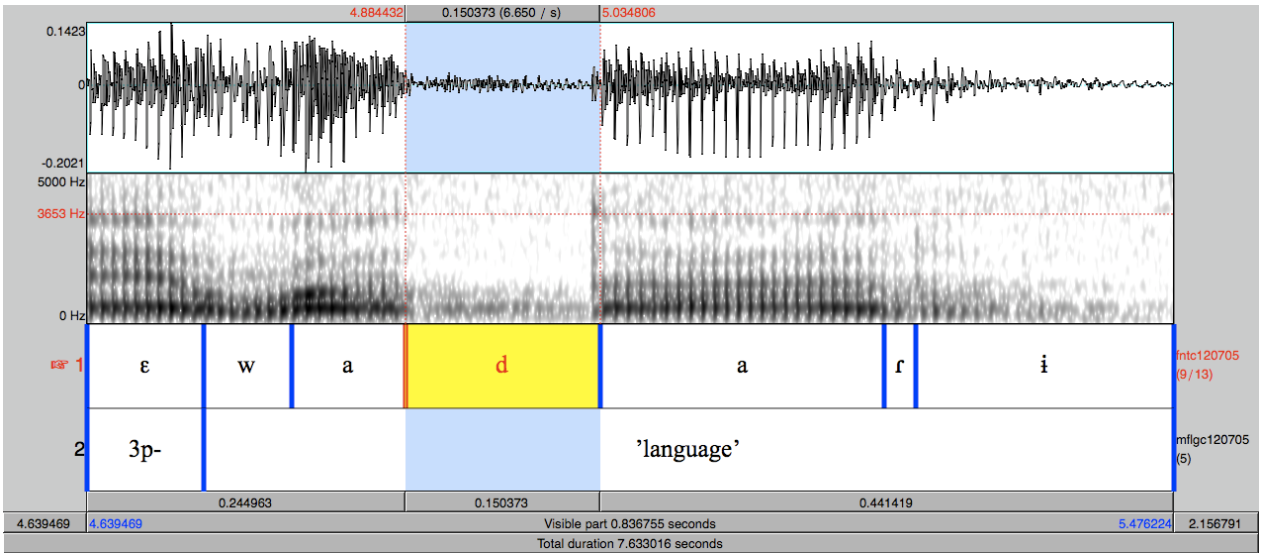

Figure 2: 'their word'

I believe a better characterization of the laryngeal co-ocurrence restrictions, which would easily incorporate the facts from Bororo, is an account in terms of articulatory effort. The core idea is that the markedness of a certain feature is not universally fixed, but dependent on the structural properties of the specific language that instantiates it.

Bororo, as presented in section 2, places all consonants (except the one that might have begun an utterance) in an inter-vocallic context (even word initial consonants follow a vowel, namely, the one the previous word ended in). That is exactly the context where it is less marked to produce voicing, even in obstruents. And this would be the reason why this language would instance a constraint against two voiceless obstruents in a certain domain (apparently, the word).

On the other hand, the fact that it is always the second voiceless obstruent that gets voiced lends credit to the hypothesis that this language prefers to be more faithful to the first occurrence of a voiceless feature. Another option would be to suppose that the first voiceless consonant is less marked. That doesn't seem to be true, except at the beginning of an utterance, but that wouldn't properly characterize this language's behavior either.

An OT analysis along these lines could employ the three following contraints.

- ∗[-VOICE]/V _V: Assign one violation for each voiceless feature between vowels.
- MAX-1ST[-VOICE]: Don't change the value of the first [-voice] feature in the word.
- MAX[-VOICE]: Don't change the value of a [voice] feature.

Tableau 1 shows the derivation of the word /tagera/ *2s+'hand'* using these constraints. As they make reference crucially to a [-voice] feature, they would also be able to derive the cases shown in section 3.2.3, is we accept the autonomous existence of a floating [-voice] feature. That is shown in tableau 2.

/ta+kera/		MAX-1ST[-VOICE]	∗[-VOICE]/V _V	MAX[-VOICE]
a. takera			∗∗!	
b. ☞ tagera			∗	∗
c. dakera		∗!	∗	∗

Tableau 1: Derivation of the word /tagera/

/it+ ok^{w}a/		MAX-1ST[-VOICE]	*[-VOICE]/V _V	MAX[-VOICE]
a.	ĩtok^{w}a		**!	
b. ☞	ĩtog^{w}a		*	*
c.	ĩdok^{w}a	*!	*	*

Tableau 2: Derivation of the word /inog^{w}a/

In the tableaux above, even a voiceless obstruent beginning a word was considered to violate *[-VOICE]/V _V. As previously stated, that would be plausible inasmuch as the syllabic structure of the language puts even these consonants in an intervocalic context. It is easy to see, though, that this assumption is unnecessary. As a voiceless obstruent beginning a word will always count as the first occurrence of a voiceless feature, it won't ever be voiced (cf. tableau 3), and the choice between the two counting methods would have to stem from independent principles.

/ta+kera/		MAX-1ST[-VOICE]	*[-VOICE]/V _V	MAX[-VOICE]
a.	takera		*!	
b. ☞	tagera			*
c.	dakera	*!	*	*

Tableau 3: Derivation of the word /tagera/: alternative counting of violations

References

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