

BAKAIRI AND THE FEATURE 'VOICE'

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INTRODUCTION

It is by now generally agreed that the feature [-voice] plays no role in the early (or lexical) phonology of any language. Recent statements of this nature can be found in Cho (1990a, b), Lombardi (1991, 1996), Iverson & Salmons (1996), among many others. The feature [-voice] is said to be 'unmarked', or, almost equivalently, is regarded as a 'default' feature. As such, the role of [-voice] should be confined to the phonetic component, or, at the very most, it should be active only in the postlexical component (cf. Lombardi 1996). Consequently, one does not expect to find a language where the feature [-voice] must be specified at the level of lexical representation, or participates in lexical rules of any kind, including rules of assimilation and dissimilation.

In this paper I will discuss the patterning of the laryngeal features of Bakairi and argue that in this language the feature [-voice] is lexically relevant. The data are taken from two studies by Souza (1991, 1995). In Souza (1995) a non-linear analysis of the Bakairi facts is given, which is different from the one proposed below in several respects. I will not enter into a detailed comparison between Souza's analysis and my own, simply because the primary aim of my paper is to use the Bakairi facts as an element in the discussion about the lexical relevance of the feature [-voice]. Suffice it to say that, as compared to Souza (1995), the analysis elaborated below presents, in my view, a higher degree of analytical simplicity. Obviously, this paper would not have been possible without Souza's studies, which are in part based on fieldwork done by the author herself.

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1. THE DISTRIBUTION OF LARYNGEAL FEATURES IN BAKAIRI

Bakairi¹ has the following system of consonants²

p	t	k	b	d	g
	t ^w	k ^w		d ^w	g ^w
	s	ʃ	β	z	ʒ
		tʃ			ɣ
				dʒ	
m	n				
	l				
	r				

The syllable structure of Bakairi is of the (C)V type, which means that consonants do not cluster and are only allowed in syllable onset position.

The language shows an interesting distribution of the 'voice' feature, both within lexical roots and inside phonological words. For both categories, the behaviour of 'voice' is more or less identical. I will therefore construct my analysis on the basis of the distribution of the voice feature in lexical roots. Where convenient, mainly to justify some analytical decisions, I will imply the word domain in the discussion. Subsequently I will show how the distribution of 'voice' in phonological words can be predicted.

1.1 Roots without Sonorant Consonants

1.1.1 The data

Bakairi roots may contain sonorant and nonsonorant consonants. Both consonant types may occur together in a root. In this section I will concentrate on roots which exclusively contain nonsonorant consonants. In section 1.2 I will show that the patterning of voiced and voiceless consonants is not crucially different when they co-occur with sonorants.

¹ Bakairi is an indigenous language of Brazil, and is classified as a member of the southern Carib family (see Rodrigues 1986:58-64). The language is spoken by approximately 350 persons who live in the state of Mato Grosso, southwest of the Upper Xingu river.

² From Souza (1995:50, fn 2) I conclude that /s/ and /ʃ/ are in partial complementary distribution, and that /z/ and /ɣ/ are in complete complementary distribution. It is not clear from Souza's study whether the labialised sounds must indeed be considered independent phonemes.

Bakairi has monosyllabic and polysyllabic roots. In polysyllabic roots, voiced and voiceless oral obstruents alternate in a way shown by the following monomorphemic words (for reasons which will be made clear below, I will momentarily exclude from the discussion the root-initial consonants as in *təzekadɔ* 'bench'):

(1)

+ - +	
təzekadɔ	'bench'
- +	
pekɔdɔ	'woman'
- +	
itubi	'skin'
+ - +	
ɔdɔpiga	'heat'
+ -	
paʒika	'ant eater'

Few roots show sequences of non-alternating voiced consonants (again disregarding root-initial consonants):

(2)

+ +		+ +	
ɔdɔdɔ	'jaguar'	kaβida	'arara'
+ +		+ +	
ɔgɔndɔ	'man'	azage	'two'
+ +		+ +	
ãngidɔ	'animal'	ezeɖɪ	'name'

The roots of the type in (2), in which two or more consecutive nonsonorant consonants are voiced, are rare, and may be considered exceptions. The usual distribution of voiced and voiceless consonants consists of an alternating sequence [+,- voice], or [-,+ voice], as in (1). Moreover, no polysyllabic roots are found which show more than a single occurrence of the feature [-voice]. In (3) I have summarised

the voice patterns that one encounters in polysyllabic roots which contain only nonsonorant consonants.

- (3)
- a. - +
 - b. + -
 - c. + - +
 - d. + +
 - e. (+ + +)
 - f. (- + +)

Although the patterns (3e-f) are not attested in the polysyllabic roots which I have at my disposal, I suspect that the absence of these sequences does not represent a significant fact of Bakairi phonology. Roots of the type (C)VCVCVCV, which have three or more root-internal CV-syllables of which moreover all C's are nonsonorants, are very rare. More significantly, in derived words, for example in words consisting of a trisyllabic (C)VCVCV root followed by one or more suffixes, the patterns of (3e-f) are normal³. More important for the proper analysis of the voice distribution in Bakairi are the patterns that are unattested for structural reasons, and which are lacking both in roots and in words. I have summarised these patterns in (4a) and compared them in (4b) with the corresponding minimally different grammatical sequences.

(4)	a (unattested)	b (grammatical)
i	+ -	- + +
ii	+ + -	+ + +
iii	+ - -	+ - +
iiii		- +, or + -

Clearly, the occurrence of [-voice] in Bakairi is subject to two restrictions. The first restriction prohibits the presence of more than one [-voice] feature per root. This is why the patterns (4ai, iii, iiii) are ungrammatical. The second restriction binds an alternating [+,-] or [-,+] pattern to the first two intervocalic nonsonorant consonants of the root (or to the only nonsonorant consonant of a (C)VCV root and to the initial consonant of an immediately following suffix). In different terms, the feature [-voice] can only occur on the first or second intervocalic consonant of the root (or word). This restriction explains the nonoccurrence of the pattern in (4aii).

³ Of course, the root is of the exceptional type (2) in words which allow the pattern (3e)

Except for the occurrence of a single intervocalic [-voice] feature, voiced and voiceless consonants are in complementary distribution in a way which follows from universal markedness conventions: word-initially only voiceless stops occur, whereas intervocalically one only encounters voiced segments (except for one position). To clarify this point, I will turn to the root-initial consonants, which have been left out of the discussion so far.

Root-initial consonants do not take part in the game of contrastive voice features. To see this, compare the words in (5a) with those in (5b):

(5)	a.		b.	
	- -		+ -	
	təkə	'bow'	tə-dəkə-ge	'have a bow'
			agent-bow-verbaliser	
	- -		+ -	
	pepi	'canoe'	i-βepi-re	'his canoe'
			3p-canoe-poss.	
	- -		+ -	
	petə	'fire'	i-βetə	'his fire'
			3p-fire	

As was stated before, the Bakairi syllable is either V or CV. Therefore, a root may either start with a vowel or with a consonant. For consonant-initial roots, the voice value of the consonant is always predictable: when the root is not prefixed, i.e. when the root-initial consonant surfaces in word-initial position, it will be voiceless, whereas in intervocalic position it will always be voiced. I will therefore leave this consonant lexically underspecified and predict the phonetic values for the feature voice with the rules in (6):

- (6) a. \emptyset laryngeal \rightarrow [+voice]/V----V
b. \emptyset laryngeal \rightarrow [-voice]/elsewhere

The morpheme structure condition in (7) formalises the fact that in root-initial position no laryngeal specifications are allowed in Bakairi.

- (7) *[C
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lar

It is claimed in Wetzels (1994; in preparation) that the rules in (6) are *universal* markedness rules that fill in missing voice features. More in particular, it is claimed that whenever the voice opposition is neutralised in intervocalic position, the unmarked voice value is [+voice]. Very strong evidence for this fact comes from Postlexical Intervocalic Voicing, which, according to Wetzels (1994), may only occur in languages that also have word- (or syllable-) Final Devoicing. The universal implication '*if Intervocalic Voicing then Final Devoicing*' can only be understood properly if it can be shown that Final Devoicing creates the circumstances under which Intervocalic Voicing may occur. In Wetzels (1994) Intervocalic Voicing is said to be the consequence of (a) Final Devoicing, which delinks the laryngeal node in word- or syllable-final nonsonorant consonants, (b) a language-specific rule of Postlexical (re)Syllabification, which takes the neutralised word-final consonants into intervocalic position, and (c), the universal markedness rules proposed in (6), which fill in the missing laryngeal specifications. It is predicted that languages that maintain a voice opposition word-finally (like French or English) - because they always have their laryngeal nodes specified in word-final nonsonorant consonants - could never have Intervocalic Voicing. In a similar vein, there can be no language with postlexical Intervocalic Voicing which does not resyllabify word-final consonants with a following vowel-initial word (like Standard Dutch). Of course, a voice opposition may be neutralised by mechanisms other than Final Devoicing, for example by a generalised rule of Intervocalic Voice-Neutralisation, such as the Flapping rule in some dialects of English which also applies inside words, or simply because the language does not have a lexical voice opposition, either in general or in a specific position. The latter situation occurs in Brazilian Portuguese, where there is no opposition between voiced /z/ and voiceless /s/ word-finally. Brazilian Portuguese does have a rule of Postlexical Syllabification. In (8) I have exemplified the [+,- voice] alternation as it occurs in the surface manifestations of the final consonant of the lexical root /rapaS/.

(8)

rapa[s]	'boy'	inflected	rapa[z]es	'boys'
		derived	rapa[z]iada	'group of boys'
			rapa[z]inho	'little boy'
			rapa[z]ote	'little boy'
			rapa[z]ola	'lad'
		postlexical	Valteir é um	'Valteir is a lively fellow'
			rapa[z]energético	

Clearly, the distribution of the voice values of /S/ is as predicted by the markedness rules in (6). It is therefore not necessary, and it would even be arbitrary, to choose one of the voice values as the lexical value. In the absence of a laryngeal node, the markedness rules of (6) will provide the appropriate voice specifications in both intervocalic and word-final positions.

In the following section I will make a proposal about how to account for the distribution of the voice feature in Bakairi.

1.1.2 The Analysis

In order to describe the Bakairi voicing facts, I have chosen an approach which is based on a type of underspecification known from tonal phonology. More in particular, I will assume that the contrastive voice features are not linked to segmental material in lexical representation, but that they are part of the lexical entries as so called 'floating' features. Just like in tonal systems, we can consequently leave the association of the voice features to the universal Association Convention. On the assumption, which I consider to be empirically motivated (cf. Odden 1994), that the voice feature does not spread over long distances (across vowels), the Association Convention will associate a floating voice feature to the first P-bearing segment ([-sonorant] consonant) of the root. The lexical representation of the three root types that were discussed above are as follows:

- roots which surface with a sequence [+,- voice] (cf. examples in (1) above) will be lexically represented with a floating [+voice] feature;
- roots which surface with a sequence [-,+ voice] (cf. examples in (1) above) will be lexically represented with a floating [-voice] feature;
- roots which surface exclusively with intervocalic voiced consonants (cf. examples in (2) above) will be presented lexically without any voice specification.

I have illustrated the three possible root types in (9) (the consonants are capitalised to express the fact that they are segmentally underspecified for 'voice'):

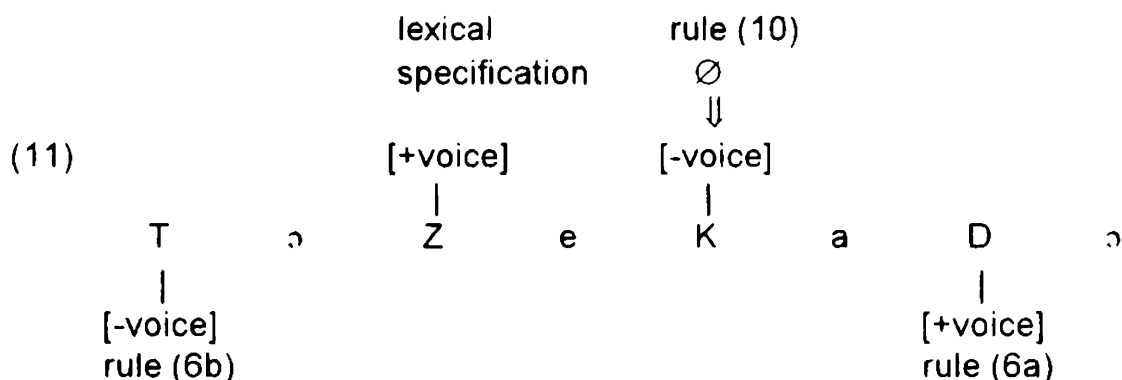
(9)

+S	-S	
TɔZeKaDɔ	TeKɔDɔ	mDɔDɔ

The universal Association Convention associates the voice features from left to right with the potentially laryngeal-node bearing segments, i.e. [-sonorant] consonants. The language-specific constraint in (7) will block the association of the floating feature with a root initial consonant in words like *tɔzekadɔ* and *pekɔdɔ*. Through the joint effect of the constraint in (7) and the Association Convention, the floating voice feature will be realised on the first intervocalic nonsonorant obstruent. For roots which show the [-,+] pattern, the default rule (6a) will apply to fill in the missing [+voice] specifications after [-voice] has been associated. The same default rule will account for the words that have only intervocalic voiced consonants without further proviso. On the other hand, the words that surface with a [+,- voice] pattern ask for a supplementary rule which insert a [-voice] feature after the lexically specified [+voice] feature. I will formulate the rules as in (10):

(10) Voice Dissimilation Insert [-voice] / [+voice] _____⁴

Notice that it is not possible to decide on the basis of the evidence so far whether rule (10) applies before the Association Convention has linked up the floating voice features, or after. We will see below, when we will discuss the behaviour of [+,- voice] in words, that the Association Convention may associate floating features to consonants that belong to suffixes. All other positive voice specifications will be provided by the default rules in (6). In (11) the derivation of *tɔzekadɔ* is exemplified:



Notice that this analysis, which treats the lexically relevant voice specifications as floating features, explains why in roots that only contain nonsonorants, voiceless segments may only show up in one of the first two intervocalic positions. It is also not necessary to

⁴ Notice that this rule could be reformulated as 'insert laryngeal node **after** [+voice]', leaving the insertion of the negative value to the OCP, **usually** considered the default trigger for phonological rules (see Yip 1988).

add a constraint stipulating that Bakairi allows for one [-voice] feature per word only. This fact follows from the more general restriction that the feature voice does not occur in the form of lexical floating melodies, which might in fact be a universal restriction, and OCP, which prohibits the occurrence of sequences of identical floating features. Furthermore, a unified account is given for all intervocalic voiced consonants that are not relevant at the level of core lexical representation. Further evidence for the floating character of contrastive voice specifications in Bakairi will be given below in section (1.3).

1.2 Roots with Sonorant Consonants

In the foregoing section I have not discussed roots which contain sonorant consonants. This was done for expository purposes only. As it turns out, the analysis proposed above accounts straightforwardly for these roots also. Consider the examples given in (12):

(12)	(a)	imasedɔ	'big'	(b)	ɔɔɔɔ	'cashew'
		ipemugɔ	'parent'		telazɔ	'thin'
		iwakurɔ	'pretty'		yamũndo	'boy'
		kɔnɔpiɔ	'little bird'		imɔmbire	'small'

In Bakairi a sonorant consonant may be preceded or followed by a voiced, cf. (12b), or a voiceless cf. (12a), consonant. On the assumption that sonorant consonants are lexically unspecified - to my knowledge the feature [-voice] in sonorants does not play a role in the phonology of Bakairi - the floating feature analysis predicts that a floating [-voice] will dock onto the first available nonsonorant consonant. In *ipemugɔ* 'parent', this will be the consonant that precedes the sonorant, whereas in *imasedɔ* 'big', it is the consonant that follows the sonorant consonant. All other consonants of the root will surface as [+voice], as expected.

The situation is less clear in roots that contain a sequence of a voiced nonsonorant consonant and a sonorant consonant, in any order. In the data provided by Souza I have found no examples in which a voiced nonsonorant precedes a sonorant. As for the words in (2b), where a voiced nonsonorant follows a sonorant, there is no example where the voiced nonsonorant is followed by yet another nonsonorant. The non-existence (or rareness?) of such forms might be due to the fact that quadrisyllabic roots are not very frequent in Bakairi in general. In any case, the analysis thus far predicts that

Voice Dissimilation should apply to such forms. Below we will see that this prediction is correct for derived words.

1.3 The Distribution of Voiced and Voiceless Consonants in Words

I will finally turn to the distribution of voiced and voiceless consonants in words. To be sure, the analysis developed above on the basis of lexical roots accounts without further proviso for the alternations of voiced and voiceless segments in words. Let us first notice that words which are derived from roots that consist exclusively of voiced nonsonorant consonants, like the ones given in (2) above, surface without any voiceless segments. This is to be expected, since a voiceless consonant can surface only as the consequence of a lexically present floating [-voice] feature, or as the result of Voice Dissimilation, which in turn requires the presence of a lexical [+voice] specification. We therefore have derived *ezedi-ge* 'with the name'. The same is true for roots which show a [-,+ voice] sequence: *n-ak,ze-ba* 'did not ripen'. Let us next consider the words in (13), in which the last nonsonorant consonant of the root is voiceless:

(13a) Last root consonant is voiceless

s eka-dai	object-ask-past	'asked'
n eɣase-agi	3pers-go-past	'went'
ɔpa ɪzaɣi	newly cleared land-to	'to the newly cleared land'
igatu-dile	sing-aspect	she sings
tɪpɪni-ge-ba	agent-food-verbaliser-negation	'he has no food'
n epi-ge-agi	object-pull-verbaliser-past	'he pulled'

After roots of this type, all following intervocalic nonsonorant consonants surface as voiced, again as expected. Now, the crucial test case of the proposed analysis comes from words derived from bisyllabic roots. Strong evidence for the floating feature analysis, and, at the same time, for the lexical presence of the [-voice] feature comes from words derived from bisyllabic roots of the type (C)VSV, where S represents a sonorant consonant. Some examples are given in (14)

(14) Last root consonant is a sonorant consonant

paru-da	cleared land-in	'in the cleared land'
ila-dibe	wet-participle	'wet'
n-ema-ke-agi	object-hand-verbaliser-past	'won'
m-ema-ke-agi	2pers-hand-verbaliser-past	'you won'
s-ema-ke-Ø	object-hand-verbaliser-past	'I won'
n-ema-ge-aki	object-hand-verbaliser-past	'stole'

We have seen above in (12b) that the voice feature of a sonorant consonant never triggers Voice Dissimilation in roots. It would therefore be *ad hoc* to explain the voiceless consonants in the suffixes of the inflected forms of /ema/ 'to win' as due to the activity of Voice Dissimilation. It is equally not true that the suffix -Ke is lexically voiceless, as can be seen in the last example of (14), as well as in many other words, like *t-ipini-ge-ba* 'he has no food'. Therefore, the root /ema/ 'to win' must be lexicalised with a floating [-voice] feature. Interestingly, the last word of (14) clearly shows that the feature [+voice] must be lexically present in the root /ema/ 'to steal', in order to explain the presence of the voiceless consonant in the suffix -aKi : Voice Dissimilation can only be triggered by a lexically specified [+voice] feature. The necessity of lexical [+voice] is moreover proved by the following words:

(15)	n-ige-aki	3p-die-past	'died'
	n-ike-agi	3p-sleep-past	'slept'
	n-ega-tai	3p-make-past	'made'
	s-eka-dai	object-ask-past	'asked'
	ige-ke	sing-gerund	'singing'
	n-ad-a-ige-aki	3p-intransivator-tear-past	'tore'
	u-di-aki	1p-go-past	'I went'
	n-ige-ipe	object-grate-participle	'grated'
	ad-uge-ipe	intransivator-burn-participle	'burned'

The intervocalic nonsonorant consonant in a bisyllabic root may be voiced or voiceless. As the examples show, the value of the voice feature of the root determines the choice for the voice value of the immediately following suffix-initial nonsonorant. Again, only on the assumption that both [+voice] and [-voice] are lexical values in Bakairi can we explain the alternations which occur in the suffix consonants.

2. SUMMARY AND DISCUSSION

In a recent paper by Iverson and Salmons (1995), a distinction is made between languages like English and German, which oppose a 'fortis' feature [spread glottis] (aspiration) to a 'lenis' feature, and languages like Dutch and the Romance languages, which oppose 'voiced' to 'voiceless'. In languages of the former type, [spread glottis] is the marked feature. It is the feature that is lexically present and may be active in lexical phonological processes. The feature [+voice] is unmarked, lexically unspecified and phonological inactive. On the other hand, in languages like Dutch, where it can be shown that [+voice] does spread, it is [+voice] that contrasts with the absence of a laryngeal specification. In the light of the proposed typological distinction, it is interesting to pose the question where Bakairi fits in: is it a [spread glottis] language like English or German, or a [voice] language like Dutch or Portuguese?

There are several reasons to believe that Bakairi is not of the [spread glottis] type. First, to the best of my knowledge, voiceless consonants in Bakairi are not generally aspirated. Unlike in English, where different degrees of aspiration are, among other factors, related to the stress-stressless distinction, in Bakairi the (very limited) distribution of voiceless consonants is in no way related to word stress. Stress in Bakairi words is prefinal almost without exception. Voiceless consonants typically occur as the onset of word-initial syllables, which are usually unstressed, or are conditioned by a preceding voiced consonant, again independently of stress. Finally, voiceless consonants productively alternate with voiced consonants, as in root-initial position, where the consonant shows up as voiceless if the root remains unprefixed, but where it appears as voiced when intervocalic. The alternation between voiced and voiceless in these contexts seems typical for real voice languages, like many dialects of Dutch (see Wetzels 1994), the Slavic languages, and a Romance language like Portuguese (see the examples in (8) above). Also, in Korean, which has a triple laryngeal contrast between [spread glottis], [glottalised] and [voiceless], it is the voiceless consonants which are realised as voiced consonants in intervocalic position.

Probably the most interesting aspect of the Bakairi data is the fact that both [+voice] and [-voice] function as lexical features. According to Iverson and Salmons (1995) this should not be possible, because, if Bakairi is a [voice] language, [-voice] should not be lexically present, and if it is a [spread glottis] language, [+voice] should remain lexically unspecified. The inevitable conclusion is that the hypothesis according to which languages that use a two-way

laryngeal contrast oppose a single laryngeal feature to the absence of such a feature is incorrect.

Let me finally return to the facts of Portuguese, which, according to Iverson and Salmons, is a real 'voice' language. We have seen above that Portuguese lacks a voice opposition for word-final /S/ (the only nonsonorant consonant allowed in the Portuguese syllable coda). In order to bring out the fact that the phonetic realisation of this consonant is predictable by universal markedness rules, it was proposed that this consonant be lexically underspecified. More in particular, /S/ surfaces as [z] in intervocalic position, whether this context is derived by inflectional suffixes, derivational suffixes, or post-lexically. Consider, with this in mind, the alternations in (16):

(16)

tena[s]	tena[z]es (plur)	tena[z]##V	'tenacious'	tena[s]idade	'tenacity'
loqua[s]	loqua[z]es (plur)	loqua[z]##V	'loquacious'	loqua[s]idade	'loquacity'
feli[s]	feli[z]es (plur)	feli[z]##V	'happy'	feli[s]idade	'happiness'

The productivity of the noun-forming suffix *-idade* can be seen in words like *simultaneidade*, *nasalidade*, *mensalidade*, *profanidade*, *irregularidade*, *intensidade*, etc. *-idade* is one of the very few suffixes which cause underlying /S/ to surface as voiceless in intervocalic position. It seems to me that the only reasonable way to account for this fact is to posit a lexical rule which fills in the [-voice] feature in root-final /S/ when followed by this specific suffix. If this view of the fact is correct, Brazilian Portuguese provides another case for the lexical relevance of [-voice].

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