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A PRELIMINARY REPORT ON KGALAGADI VOWELS*

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INTRODUCTION

Kgalagadi[1] is a Sotho language spoken in central and southern Botswana. It comprises a number of dialects, the two most widely spoken being Ngologa[1] and Shaga[1]. All the data shown in this paper come from the Shaga dialect, which is spoken in and around the town of Kang.

We intend here to examine the vowels of Kgalagadi with a view to

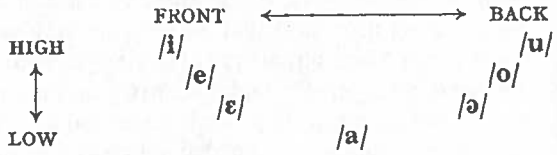
1. classifying them phonologically,
2. describing their morphophonemic alternations, and
3. explaining their historical development from Proto-Kgalagadi to the modern language.

1. CLASSIFICATION

1.1. TRADITIONAL CLASSIFICATION

Unlike most other Sotho languages, Kgalagadi has the classic "Italian" system of seven vowels. These have no phonetically distinct allophones. They are shown classified along the traditional articulatory parameters in Figure 1.

Figure 1



These vowels are exemplified in the words below:

biža "call!" **phuŋa** "stab!"
lema "plough!" **loma** "bite!"
rɛqa "buy!" **bɔna** "see!"
bala "count!"

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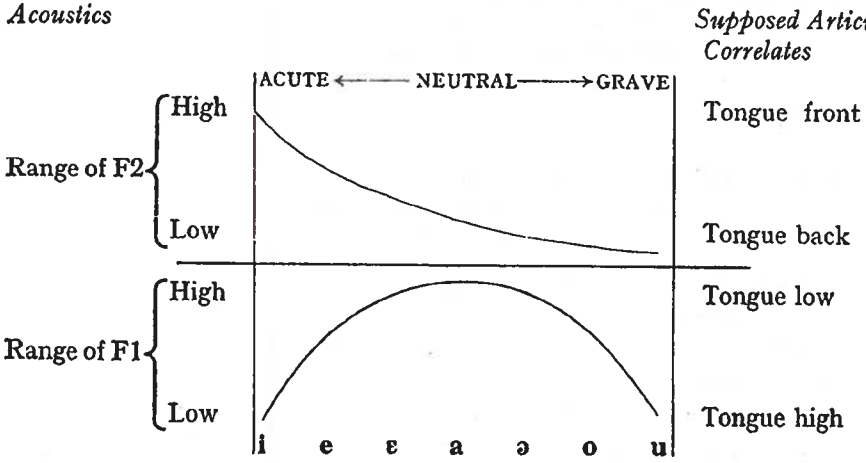
[1]The Kgalagadi people themselves refer to their language as [*šiqɾhalaxarī*], and the two dialects mentioned as [*šiŋoloxa*] and [*šišaxa*].

1.2. Lieberman's classification

Lieberman (1976) has shown conclusively that there is no observable invariance between the height or configuration of the tongue during the production of vowels, and the quality of vowels. In other words it is quite possible, and in fact usual, to produce, for example, all the front vowels with approximately the same tongue height and configuration. This means that the quality of a particular vowel is produced by an over-all configuration of the vocal tract, and that it is impossible to produce the same vowel by more than one such configuration. There can therefore be no vowel classification based on articulatory invariance.

Rather, says Lieberman, the invariance lies in the acoustic properties of vowels, that is in the relationship between the first and second formant frequencies of the vowels (henceforth these will be abbreviated F1 and F2 respectively). The features he proposes to replace the traditional articulatory ones of *high* and *back* are *grave* and *acute*, in keeping with Jakobson's original feature-terminology. Instead of binary features, he suggests that vowels be "characterized in terms of their relative graveness or acuteness" (p. 102), these two features replacing the combinations of *high/low*, *back* and *high/low*, *front* respectively. [i] is then the most acute vowel, [u] the most grave vowel, and since [a] is the starting point for both the grave and the acute continuum, it is neither grave nor acute, therefore the *neutral* vowel. The diagram of Figure 2 illustrates the relative heights of the formant frequencies for Kgalagadi vowels.

Figure 2



In this scheme of gradient vowel-classification, Kgalagadi vowels would be classified as shown in Table 1.

Table 1

Vowel	*Degree of Gravity*
i	−3
e	−2

ɛ	**−1**
a	**0**
ɔ	**+1**
o	**+2**
u	**+3**

As can be seen from the above, we regard a negative grave value to be terminologically equivalent to a positive acute value.

2. Morphophonemic Alternations

2.1. Further classificatory modifications arising from considerations of vowel harmony

Consider the following derivations which illustrate how vowel harmony works in Kgalagadi:

Underlying form	*Surface form*	
le +biža	**libiža**	"call him" (Cl. 5)
ba+rɛq+i	**bareqi**	"buyers"
bɛ+lem+a	**belema**	"they ploughing"
bɔ+otšhwe	**bootšhwe**	"ostriches"
bɔ+hule	**bohule**	"bats"

Clearly what happens here is that when a grave or acute vowel is followed in the next syllable by a vowel more grave or acute respectively than itself, then it becomes one degree more grave or acute. This alternation may be written in rule form as:

$$[X \propto \text{GRAVE}] \longrightarrow [X+1 \propto \text{GRAVE}] / \_\_\_\_ (C) [>X \propto \text{GRAVE}], \text{ where } X \neq 0.$$

A problem arises with Lieberman's classification when we investigate more examples of vowel harmony, for we find that the affected vowel becomes more acute or more grave than it was, *irrespective* of whether the following vowel is grave or acute. In other words, and according to the terminology of the classification given in the previous section, a −2GRAVE vowel will, for example, become a −3GRAVE vowel when followed by a −3GRAVE vowel *or* a +3GRAVE vowel, and so on. The examples below illustrate this:

Underlying form	*Surface form*	
xo+biž+a	**xubiža**	"to call"
bɔ+isɛ	**boisɛ**	"your fathers"
le +phuɲ+a	**liphuɲa**	"stab him!" (Cl. 5)
bɛ+phuɲ+a	**bephuɲa**	"they stabbing"
bɛ+lom+a	**beloma**	"they biting"

Obviously what is happening here is that the assimilation is taking place on only one of the two constituent parts of the feature GRAVE, namely on the frequency level of F1, or, in the traditional articulatory terms, tongue height.

A revision of Lieberman's classification is indicated. F1 (tongue height) and F2 (tongue backness) behave independently of each other, but this fact cannot be

shown if the behaviour of both formants is assumed under one feature, namely GRAVE. So although it is more accurate *phonetically* than the traditional theory, it obscures *phonological* generalizations that were statable in that theory.

We suggest therefore the following modifications to the Lieberman classification we have hitherto tacitly adopted:

1. F1 and F2 are treated as separate, independent features.
2. Two conventions:
   (a) The value of the vowel [a] is 0F1 and 0F2.
   (b) Any vowel having a higher formant frequency than [a] will be designated by a positive integer for that formant, and any vowel with a lower formant frequency will be designated by a negative integer for that formant.

Table 2 below illustrates this modified approach to classifying Kgalagadi vowels.

Table 2

Vowel	*Formant 1*	*Formant 2*
i	−3	+3
e	−2	+2
ɛ	−1	+1
a	0	0
ə	−1	−1
o	−2	−2
u	−3	−3

The rule given at the beginning of this section can now be extended to account for our second set of data.

$$[X\ F1] \longrightarrow [X-1\ F1] \,/\, \underline{\qquad}(C)\ [<X\ F1], \text{ where } X \neq 0$$

Stated in words, the rule would read: A vowel having an F1 value less than 0, when preceding a vowel with an even lower value for F1, will itself become one degree lower.

It should be noted that in this modified approach, the phonological accuracy of the traditional approach has been restored, without losing any phonetic accuracy.

2.2. FURTHER DETAILS OF VOWEL HARMONY

2.2.1. *Iterative application of the rule*

The rule of vowel harmony (henceforth VH) given in the previous section can be shown to apply iteratively from right to left in a word or phrase containing more than one vowel which is subject to it. This means that the output of the rule may also be its input. The examples below illustrate the iterative application of the rule.

Underlying form: **he+le+phuŋ+a+xə** "We stab him" (Cl. 5)

VH rule applies to **le**

he+li+phuŋ+a+xə

VH rule applies to **he**

Surface form: **hiliphuŋaxə**

Underlying form: **xa+ki+bɔn+ɛ** **chuzwa** "I don't see the giraffe"

VH rule applies to **ɛ**

xa+ki+bɔn+e **chuzwa**

VH rule applies to **bɔn**

Surface form: **xakibóne** **chuzwa**

The second example shows that the rule may also apply across word boundaries.

2.2.2. *Application of the VH rule across oF1, oF2 syllables*

The rule applies even though there may be syllables intervening between the vowel which the rule will change and the vowel which causes the change, as long as the intervening syllable contains the vowel [a], that is the neutral vowel. Consider the derivation below.

Underlying form: **le+da+xo+ba+lem+is+a** "He will make them plough"

VH rule applies to **lem**

le+da+xo+ba+lim+is+a

VH rule applies to **xo**

le+da+xu+ba+lim+is+a

VH rule applies to **le**

Surface form: **lidaxubalimisa**

This aspect of vowel harmony can be incorporated into the rule as follows:

$$[X\ F1] \longrightarrow [X{-}1\ F1]\ /\_\_\left(C\begin{bmatrix}0 & F1\\ 0 & F2\end{bmatrix}\right)\ (C)\ [<X\ F1], \text{ where } X \neq 0.$$

2.2.3. *Variability*

Before the variability of the VH rule can be quantified, further research will have to be done. We can, however, at this stage give reasonably accurate pointers as to when and how the rule varies.

Second and subsequent applications of the rule are subject to variation along three linguistic parameters and at least two sociological ones.[2] The rule is less likely to apply under the following linguistic conditions:

1. the further away the susceptible vowel is from the vowel which actuated the change;
2. across word boundaries (as opposed to morpheme boundaries);
3. if there is an intervening 0F1, 0F2 syllable between the susceptible and the actuating vowels.

[2]The first application of the rule is obligatory when there is no intervening 0 F1, 0 F2 syllable.

Similarly, the rule is less likely to apply when the following sociological conditions are present:

1. when the speakers are elderly people;
2. in a formal situation.[3]

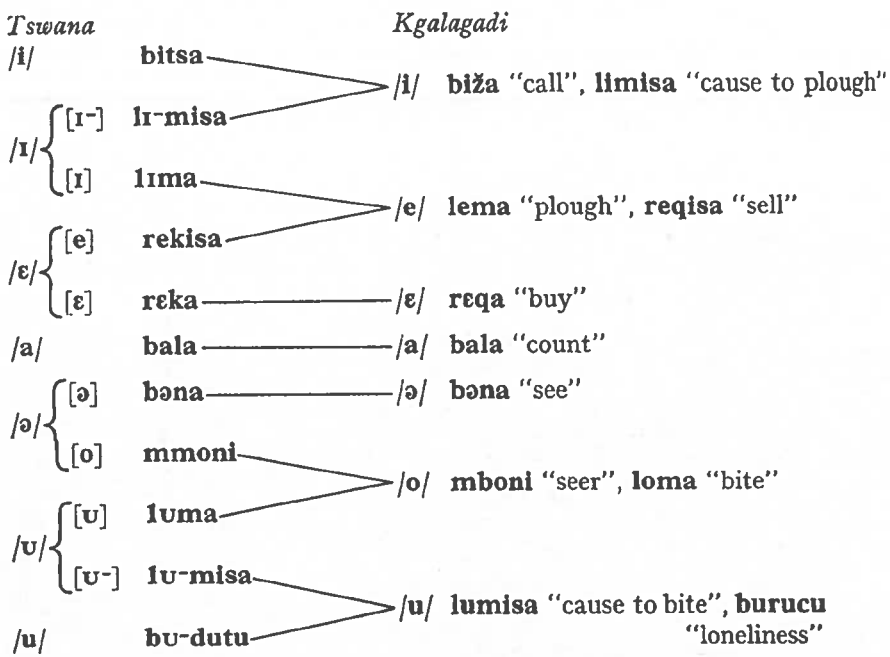
3. Historical Development

We believe that the Proto-Kgalagadi vowel system still exists today in the form of the vowel system of the other seven-vowel Sotho languages. This system (exemplified here by Tswana vowels, from Cole 1955) is, apart from allophonic and morphophonemic detail, identical to that reconstructed by both Meinhof (1937) and Guthrie (1967) for Proto-Bantu.

3.1. Vowel changes viewed as a simplification of the system

Table 3 below illustrates the change from Proto-Kgalagadi (=Tswana) vowels to modern Kgalagadi vowels.

Table 3[4]

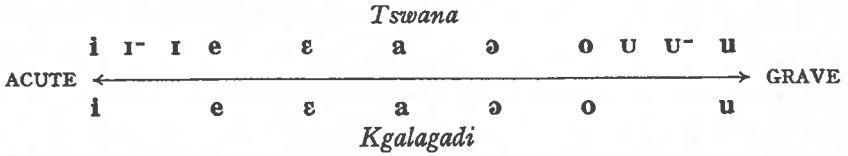


If we compare the two vowel systems along an acoustic continuum of gravity and acuteness it becomes clear that the scale is more economically used by the Kgalagadi vowels than by the Tswana vowels. Consider Figure 3.

[3] This is as yet an untested hypothesis, but it is usually the case that when a process of assimilation like this one is inhibited to some extent in the speech of an older generation, then it is inhibited by all generations in formal sociological contexts.

[4] A "⁻" beside a vowel indicates a raised variant of that vowel.

Figure 3



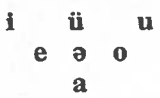
We suggest that the Kgalagadi system represents a simplification of the Tswana one. The Kgalagadi learner, we propose, faced with such great acoustic similarity between the four most grave and most acute vowels, grouped these vowels "incorrectly" into the phonemes /**u**/ and /**o**/ (instead of /**u**/, /**ʊ**/ and /**ɔ**/) and /**i**/ and /**e**/ (instead of /**i**/, /**ɪ**/ and /**ɛ**/) respectively.

3.2. CONTACT WITH SAN LANGUAGES AS A CONTRIBUTING FACTOR

Our hypothesis that the change in the Kgalagadi vowel system is a simplification is supported by the fact that the area in which our field-work was carried out coincides with !xô Bushman territory. In this area it is not an uncommon thing for a child to have a !xô mother and a Kgalagadi father — a perfect language-in-contact situation.

The basic !xô vowel system[6] is shown below in Figure 4.

Figure 4



We suggest that a child, having learnt this system from his !xô-speaking mother first, would, when subsequently faced with the Proto-Kgalagadi system, have had difficulty in assigning the four most grave and acute vowels of that system to their correct phonemes, and that this would have contributed, if not caused, the change to the modern system.

3.3. HISTORY OF THE VH RULE

Kgalagadi is by no means the only Sotho language with vowel harmony. However, the difference between it and the other languages is that its VH rule involves morphophonemic changes (from one vowel phoneme to another), whereas in the others the VH rule is allophonic (from one vowel allophone to another). Consider the following examples from Tswana:

Underlying form	*Surface form*	
lɪm+is+a	**lɪ-misa**	"cause to plough"
bʊ+dutu	**bʊ-dutu**	"loneliness"
rɛk+is+a	**rekisa**	"sell"
m+bən+i	**mmoni**	"seer"

[6]We call this the "basic" vowel system because !xô vowels may also be phonemically breathy and/or pharyngealized and/or nasalized.

We must therefore consider vowel harmony in Kgalagadi to be an inherited, and not a unique, part of the language.

3.4. INSTANCES WHERE VOWELS HAVE RESISTED THE HISTORICAL CHANGE

There is a small number of morphemes originally containing the vowels [ɪ] and [ʊ] which did not become [**e**] and [**o**], but instead [**i**] and [**u**] respectively. These appear in the verb **neri** "bring" (compare the Tswana **lerɪ**), and in certain noun and subject prefixes.

Table 4 gives a comparison between these prefixes in Kgalagadi and in Tswana. The parenthesized prefixes are those containing a vowel which did not undergo the vowel-change in question.

Table 4

Class	*Noun Prefix*		*Subject Prefix*	
	Kgalagadi	*Tswana*	*Kgalagadi*	*Tswana*
1st p.s.	—	—	(**ki**)	**kɪ**
1st p.p.	—	—	he	**rɪ**
2nd p.s.	—	—	(**u**)	**ʊ**
2nd p.p.	—	—	le	**lɪ/lʊ**
1	**mo**	**mʊ**	(**u**)	**ʊ**
2	**ba**	**ba**	ba	**ba**
2b	**bə**	**bə**	—	—
3	**mo**	**mʊ**	(**u**)	**ʊ**
4	**me**	**mɪ**	(**i**)	**ɪ**
5	**le**	**lɪ**	le	**lɪ**
6	**ma**	**ma**	a	**a**
7	(**ši**)	**sɪ**	(**ši**)	**sɪ**
8	**bi**	—	bi	—
9	**Ø/e**	**Ø/N**[6]	(**i**)	**ɪ**
10	**ri**	**di**	ri	**di**
11	**lo**	**lʊ**	lo	**lʊ**
14	**bo**	**bʊ**	bo	**bʊ**
15	**xo**	**xʊ**	xo	**xʊ**

REFERENCES

COLE, D. T. *Tswana Grammar*. London, Longmans, 1955.

GUTHRIE, M. *Comparative Bantu*. Farnborough, Gregg Press, 1967.

LIEBERMAN, P. Phonetic features and physiology. *Journal of Phonetics* 4 : 1976, 91-112.

[6] "N" abbreviates "nasal homorganic with the following consonant".