The Tibetan Vowel Feature 'Constricted'

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The purpose of this paper is to argue in favor of the employment of the vowel feature Constricted in the description of spoken Tibetan (phöö̤qɛɛ).[1] This feature has been discussed previously in the literature in terms of the position of the root of the tongue in relation to the size of the pharynx, within the context of vowel harmony processes that occur in many Niger-Congo languages of West Africa and Nilo-Saharan languages of East Africa.

The Tibetan vowels are given below, classified according to the features High, Back, and Round.

	-Back		+Back	
	-Round	+Round	-Round	+Round
+High	i	ü		u
	I		(ə)	U
	e	ö		o
-High	ɛ		a	ɔ

At issue here is the question: which feature best specifies the contrast between the vowels of Set A, and the vowels of Set B, which are generally lower and more central than the Set A vowels:

TIBETAN:	Set A:	i	e	u	o
	Set B:	I	ɛ	U	ɔ

Also to be answered is the question of how the four remaining Tibetan vowels, ü, ö, a, and ə, are defined in relation to this feature.

Two types of explanations or features have traditionally been offered to account for the contrast between the Set A and Set B vowels. One explanation is the tense/lax distinction. The other explanation is a multi-valued height specification, where the vowels, i, I, e, and ɛ, for example, would differ only in terms of height and not in terms of any additional feature, such as tenseness. It will be demonstrated that neither of these two explanations gives a satisfactory account of the patterning of Tibetan vowels, but rather that a third explanation or feature is the only viable solution.

The basis of this third explanation was first outlined by Stewart (1967), who proposed that the advancement of the root of the tongue was the articulatory gesture that accounted for the vowel harmony alternation in Akan, a West African language. He noted that in Akan, the vowels of Set 1 patterned as what he called the 'raised' alternates of Set 2:

AKAN:	Set 1:	i	e	ạ	o	u^2
	Set 2:	I	ɛ	a	ɔ	U

Ladefoged (1964) had used the term 'tenseness' to describe the vowels of Set 1. However, Stewart hesitated to apply the tense/lax distinction to Akan, because the Set 2 vowels, he stated: '. . . particularly the high ones I and U, have often struck me as choked or even strangled' (1967:196). Stewart referred to the literature that he consulted on vowel tenseness as 'singularly unilluminating,' with the exception of Hockett's reference to the 'bunching and tension in the muscles . . . above and in front of the glottis within the frame of the lower jaw' (1958:78-79).

Stewart reproduced Ladefoged's cineradiographic film showing the tongue positions for one set of Igbo vowels, indicating that the position of the back or base of the tongue for one set of vowels was consistently positioned further back than the other set. Stewart discounted the tense/lax explanation for Akan vowels, and maintained that the vowels of Set 1 were associated with 'an advancement of the root of the tongue, as well as a wide pharynx' (1967:199). Stewart therefore introduced the notion that more than just the body of the tongue was relevant in determing the perceived height of a vowel. The importance of tongue body position was a basic implicit assumption behind the tense/lax explanation for vowel contrast, as well as the multi-valued height explanation.

Regarding the advancement of the tongue root in Akan, Clements (1980) subsequently noted:

> This distinction can be confirmed visually by observing an Akan speaker in profile.....the advancing of the tongue root produces a noticeable protrusion at the angle of the throat and upper neck in each case.

Following Stewart, Halle and Stevens (1969) proposed that the position of the base of the tongue be considered the articulatory gesture for the binary feature Advanced Tongue Root (ATR). other terms used have been Covered (Chomsky and Halle 1968:314), or simply, Advanced (Clements 1980).

Lindau (1978) elaborated on Stewart's account of Akan vowels. Lindau's superimposed tracings from cineradiographic recordings of eight Akan vowels are reproduced on the following page.[3] With reference to these tracings, she stated:

> The tongue-root mechanism is usually combined with vertical displacements of the larynx, and sometimes with movements of the back pharyngal wall. It thus seems that what a speaker tries to accomplish is variation of the pharyngal size. (551)

Akan vowels[4]

(ɪ = I)

(ʊ = U)

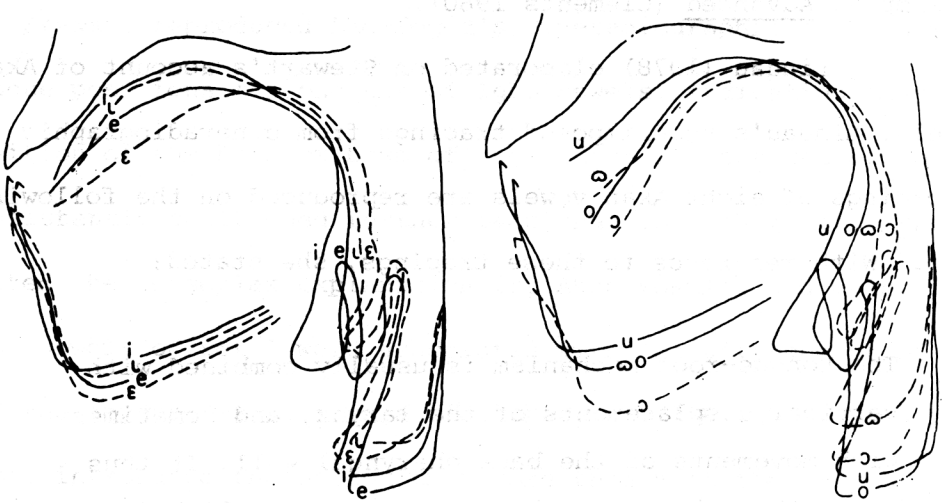


FIGURE 6. Superimposed tracings of front and back vowels from a speaker of Akan.

On this basis, Lindau proposed that this feature be termed Expanded, rather than ATR, to account for the enlarged pharynx as the crucial articulatory gesture. Thus Set 1 of the Akan vowels, considered previously as +ATR, would now be termed +Expanded. Set 2 of the Akan vowels would be assigned the value of -Expanded.

Referring to the same tracings, Lindau also noted:

> . . .the highest point of the tongue is very similar for /i/ and [/I/], and for /u/ and [/U/]. This demonstrates that the tongue root in this type of language is independent of the mechanism for controlling tongue height. (551)

That is, it is often the case that advancing the root of the tongue also serves to push up the tongue body. The interdependence of the mechanism that advances the root and raises the height of the body of the tongue is observable in languages such as English and German, which have the tense/lax vowel contrast. (Lindau 1978:557-58) However, Lindau notes that the tongue height differences are negligible for the pairs of Akan high vowels, and thus the height of the tongue body cannot be regarded as the crucial articulatory gesture to account for the Akan case.

Given that Lindau demonstrated that the feature Expanded (ATR), rather than Tense, is the appropriate one for Akan, let us examine whether the tense/lax distinction (i.e., the feature Tense)

is adequate to account for the contrast between the Tibetan vowels of Set A and B. The definition of tense will be: maximal narrowing of the vocal tract at the relevant point of articulation, i.e., the palate for front vowels, the velum for high back vowels, the uvula and upper pharynx for mid vowels, and the lower pharynx for low vowels (Clements 1980).

Tibetan phonological processes provide evidence against the adoption of the feature Tense to account for the contrast between the Tibetan Set A and Set B vowels. In such an analysis, the vowels of Set A, as phonetically higher and less central than the vowels of Set B, would be assigned the value of +Tense. Set B would be assigned the value of -Tense. The lowest back vowel, a, having maximal narrowing of the vocal tract, would be defined as +Tense, and therefore included within the vowels of Set A. In the same way, the more central of the back (unrounded) vowels, ə, would be considered -Tense, and should pattern with Set B. However, no Tibetan vowel process offers evidence that this is the case.

The process of Fronting in Tibetan, stated informally here, serves to front a to ɛ (as well as u to ü, and o to ö), when followed by i.[5]

(1) Fronting: V → [-Bk] / ___ i

This highly productive process accounts for alternations such as the following:

wo̲ma	'milk'	wo̲mɛɛ	'of the milk'
pɛ̄ɛ̄ma	'lotus'	pɛ̄ɛ̄mɛɛ	'of the lotus'
ta̲wa	'moon'	ta̲wɛɛ	'of the moon'

The analysis of a as +Tense would incorrectly predict that it should front to a vowel that is also +Tense. This would be the vowel e. Since, however, a fronts to ɛ, this provides evidence that a should be classified with the Set B vowels, of which ɛ is one.

In addition to Fronting, the process of what I will call Constriction, stated informally here, provides additional strong evidence that a patterns with Set B vowels.

(2) Constriction: V → [+Constr] / ____ a

The vowel changes that Constriction must account for are illustrated in the following:

yi̲qi	'letter'	yi̲qII	'to the letter'
qha̲re	'what'	qha̲rɛɛ	'to what'
pū̲qu	'child'	pū̲qUU	'to the child'
qhõ̲tso	'they'	qhõ̲tsɔɔ	'to them'

The vowel changes illustrated in the second column above are conditioned by a. If a is assigned the value of +Tense, we would have the highly undesirable consequence of an unnatural dissimilatory rule, whereby a +Tense vowel conditions other vowels to become -Tense. Avoiding this consequence is the primary basis for rejecting the assignment of the feature +Tense to the Tibetan vowels of Set A.

Having rejected the feature Tense to explain the contrast between the Set A and B vowels, let us examine the second traditional explanation offered to account for this contrast. This second alternative assigns a multi-valued, rather than binary, specification to the feature High. Height is viewed as a continuum with necessarily more than three levels. For the Tibetan case, the proposed height continuum explanation would entail four levels of height, as follows:

TIBETAN:	Most high:	i	u
		I	U
		e	o
	Least high:	ɛ	ɔ

An alternate account similar to this was suggested by Smalley (1964: 363), who proposed the classificatory feature +Lower for vowels such as those in the Tibetan Set B, while -Lower would apply to vowels such as those in Set A.

We have seen that Lindau rejected the notion of vowel height underlying the harmonic alternations in Akan. As previously noted, Lindau's tracings demonstrate that vowel height as a function of tongue body height is independent of tongue root movement, and that the high Akan vowel pairs show little difference in the height of the tongue. Thus, accounting for Akan vowels with a height continuum is unsatisfactory.

For the Tibetan case, the phonology provides strong evidence that a height continuum is unsatisfactory. This is evident in Vowel Harmony (Raising), as governed by the feature High. The following are examples of the vowel alternations that are at issue:

e ⟶ i: teepə ree / tiiqi ree 's/he gave/will give'

ɛ ⟶ I: ñɛɛpə ree / ñIIqi ree 's/he slept/will sleep'

o ⟶ u: qhopə ree / qhuqi ree 's/he heard/will hear'

ɔ ⟶ U: lɔɔpə ree / iUUqi ree 's/he read/will read'

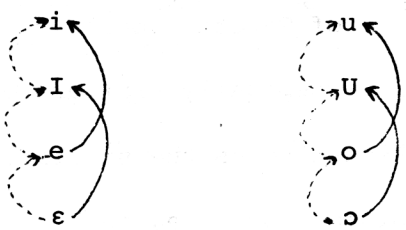
Additional data, presented elsewhere,[6] provides evidence that Raising applies to all -High vowels; and that its application, while stronger regressively, is bidirectional. Raising may be stated as follows:

(3) Vowel Harmony (Raising): $V \longrightarrow [+Hi] \ \% \ \_\_\_\ C_1^2 \begin{bmatrix} V \\ +Hi \end{bmatrix}$

(The symbol % = a mirror image rule that applies bidirectionally.)

A multi-valued height specification for the vowels would predict that Raising applies according to the pattern illustrated below by the left-most broken-line arrows. That is, each vowel would raise to the vowel defined as the next higher on the continuum. This next higher vowel would be defined as the phonetically closest variant.

TIBETAN:



The process illustrated above by the brokenline arrows is not what takes place in Tibetan. Rather, the actual process of Raising is illustrated by the solid-line arrows to the right of the vowels.[7] If the vowels were correctly described by a height continuum, Raising in Tibetan would have no natural explanation, in that it would mean jumping over, as it were, the supposedly next higher vowel to a level defined as two degrees further up on the continuum. At the very least, a height continuum in Tibetan for these vowels would make necessary a complicated, unlikely rule for Raising. On this basis, the height continuum explanation--or a height feature to contrast Set A and Set B vowels--is rejected.

Having rejected both of the traditional explanations--the tense/lax and the multi-valued height continuum--let us return to the feature Expanded, which has been shown to be adequate to account for the Akan vowel alternations. It will be argued that this is the only plausible feature available to account for the vowel processes of Tibetan.

First, there are conspicuous parallels between Akan and Tibetan vowels. Despite the fact that they vary significantly in tongue body height, the pairs of Tibetan vowels, I and e, and U and o, are phonetically and perceptually similar to each other. This is also the case in Akan. Lindau notes the similarity of the tracings of the Akan tongue body position for I, e, and U, o, respectively, and explains how variation in pharyngal size in Akan affects the *acoustic measurements:*

> Varying the size of the pharynx, as in the difference between /i/ and [/I/], affects the frequency of the first formant. Varying the highest point of the tongue, as in the difference between /i/ and /e/, also affects the frequency of the first formant. In fact, the two gestures have resulted in acoustic merging for the front [/I/] and /e/. These two vowels also have the same third formant. (Lindau:552)

The acoustic and perceptual distinction between Tibetan I and e has been demonstrated.[8] As in the Akan case, the first formants, and to a somewhat lesser extent the third formants of these two Tibetan vowels appear to resemble each other more closely than do the second formants of these two vowels.

In the absence of additional acoustic date for Tibetan, the parallels mentioned here between Akan and Tibetan are only suggestive. However, the remarks made by Lindau regarding the relationship of the Akan vowels, I and e, apply equally well to the Tibetan counterparts of the Akan vowels:

> Presumably speakers can maintain the large consistent articulatory distinction [between I and e] by observing the phonetic correlates of the phonological patterns. The fact that variation in the size of the pharynx and variation of the highest point of the tongue have very similar acoustic effects explains why this [Akan]

> type of vowel harmony [--c.f. Set A and Set B of the Tibetan vowels--] was described in terms of vowel-height defferences by earlier linguistics. (Lindau:552)

Second, Lindau's notion of a change in pharyngal size appeals to the intuitions of some Tibetans, who feel that the vowels I and U are distinguished from their Set A counterparts, i and u respectively, by narrowing in the pharynx. If this observation holds, it would suggest that a feature that takes into account the change of pharyngal size over tongue root movement would capture the crucial articulatory gesture in Tibetan as well as Akan. If the assumption holds that a narrowing of the pharynx is what the Tibetan speaker seeks to achieve, I propose that the vowel feature to account for this contrast be termed Constricted, (which is the term Lindau (553) used to designate the opposite value of Expanded).

A vowel feature such as Constricted is as necessary to handle the vowel processes of Tibetan as it is for Akan. If we follow Kiparsky's (1974:162) suggestion from his discussion of the feature ATR, we would assign the value of -Constricted to the front rounded vowels ü and ö, which have no constricted counterparts--as well as to the Set A vowels. And the value of +Constricted would be assigned to the back unrounded vowels a and ə which have no unconstricted counterparts, and the Set B vowels, as follows. (See Appendix II)

TIBETAN:	-Constricted:	i	e	u	o	ü	ö
	+Constricted:	I	ɛ	U	ɔ	a	ə

These values would enable us to capture all three major vowel processes, Vowel Harmony (Raising), Fronting, and Constriction, as unitary processes that involve the change of a single feature--High, Back, and Constricted, respectively--as conditioned by a vowel that contains that same feature. Thus, these phonological processes offer the principal evidence that a feature which patterns as Constricted does is the only available solution. Before this proposed feature is confirmed for Tibetan, however, additional articulatory and acoustic information must be examined. Until that time, the feature Constricted is proposed as a working hypothesis that awaits validation.

Appendix I

Tibetan Vowel Processes: Statement of Rules[9]

(1) Fronting: $V \rightarrow [-Bk] \; / \; \_\_\_\_ \begin{bmatrix} V \\ +Hi \\ -Bk \\ -Rd \\ -Constr \end{bmatrix}$ (A vowel is fronted preceding i.)

(2) Constriction: $V \rightarrow [+Constr] \; / \; \_\_\_\_ \begin{bmatrix} V \\ -Hi \\ +Bk \\ -Rd \\ +Constr \end{bmatrix}$ (A vowel is constricted preceding a.)

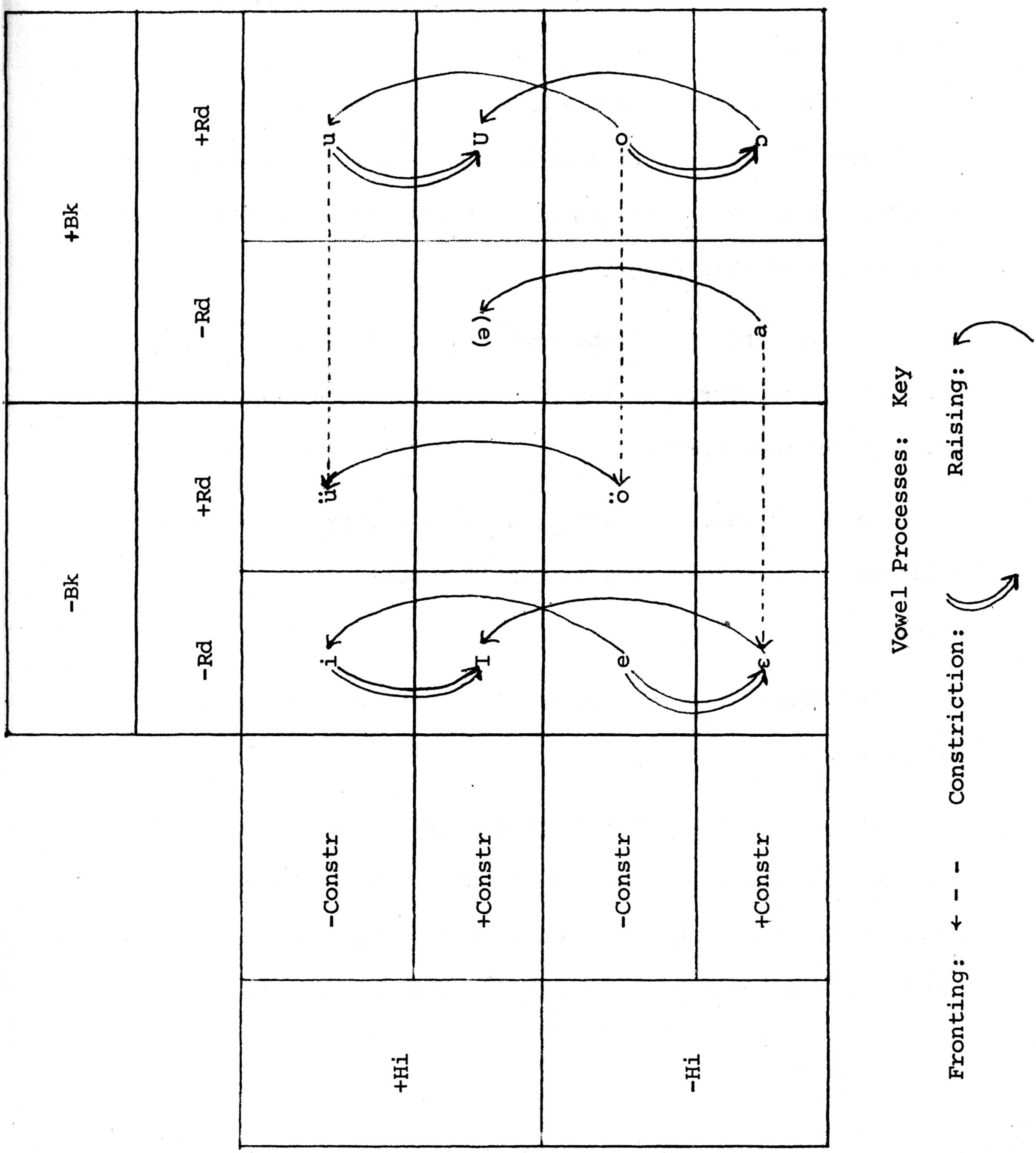
(3) Vowel Harmony: $V \rightarrow [+Hi] \; \% \; \_\_\_\_ \; C_1^2 \begin{bmatrix} V \\ +Hi \end{bmatrix} \#$ (Vowels within a word agree in height.)[10]
(Raising)

(4) Consonant Deletion:[11] $C \rightarrow \emptyset \; / \; CV+ \; \_\_\_\_ V\#$

(5) Complete Forward Assimilation: $\begin{bmatrix} V \\ -Rd \end{bmatrix} \rightarrow V_i \; / \; V_i \; \_\_\_\_$

Appendix II

Tibetan Vowel Processes: Chart



FOOTNOTES

1 An earlier version of this paper was delivered to the Thirteenth International Conference on Sino-Tibetan Languages and Linguistics, Charlottesville, Virginia, U.S.A., in October 1980.

I wish to thank Ellen Kaisse for commenting on this paper and suggesting several revisions. I also wish to thank N.L. Nornang for his kind assistance with the data relevant to the preparation of this paper.

2 I have substituted the symbol a̱ for Stewart's ʒ (and Lindau's ʌ) to represent the phonetically higher variant of a, which often approximates ɛ.

3 Lindau's vowels, ɪ and ʊ, will be referred to in the following discussion using Stewart's symbols, I and U, respectively.

4 Reproduced from M. Lindau (1978) 'Vowel Features,' in Language 54:551.

5 The twelve vowel system given here is taken from Y.-R. Chao (see Yu 1930:8), and Chang and Shefts (1964:1). Chang and Chang gave the first principled account of Vowel Harmony, or Raising (1968:104); and were the first to isolate the two other vowel

processes discussed here. Their 'fronting or i-type internal sandhi' is here termed Fronting. Their 'a-type internal sandhi' (1968:106) is here termed Constriction.

6 See Chapter III of Dawson (1980).

7 See Appendix II.

8 See Chang and Chang 1978: xiii-xvii.

9 For further details, see Dawson (1980).

10 There is a constraint on vowel harmony in Tibetan which blocks the application in a second syllable which contains a long low, back, unrounded vowel (aa).

11 Cf. Chang and Chang (1968:107), for an historical analogue to this synchronic rule.

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