SYLLABLE AND SOUND CHANGE IN SOUTHERN BANTU LANGUAGES

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SUMMARY

The purpose of the paper is to show the restrictive effect of the temporal quantity [Q] in Southern Bantu Languages which, with reference to its components, may also be described as 'syllable'. All sound changes occur within [Q] although there are harmonizing changes that echo the effects of [Q] intersyllabically.

OPSOMMING

Die doel van hierdie studie is om die beperkende uitwerking van die temporale kwantiteit [Q] in die Suidelike Bantoetale aan te toon. Met verwysing na die komponente, kan [Q] ook beskryf word as „lettergreep". Alle klankveranderinge vind plaas binne [Q] alhoewel daar harmoniserende veranderinge is wat die effekte van [Q] intersillabies weerspieël.

On the occasion of this memorial publication dedicated to Prof. P. de V. Pienaar I wish to pay him a tribute . . . and to settle a 33 year old debt. In my undergraduate days I prepared an essay on sound change for him but I did not present it for scrutiny. Instead I chose an easier alternative he had given me on another subject. What was in doubt at the time was the relationship between synchronic and diachronic linguistics, but since then the matter has arisen on frequent occasions and it is perhaps not inappropriate to present some parts of this essay on historical and contemporary sound change in Southern Bantu languages.

On reading the important work by Wallace L. Chafe[2] introducing his views on the nature of a 'semantic grammar' *(Meaning and the structure of language,* 1970), I was struck by his repeated reference to a recapitulation of historical changes in the post-semantic processes he describes. He considers that certain changes, themselves being processes, should be described as processes also (chapters: 4.5, 4.8, 5.4, 5.6, 20.6). In Chomsky and Halle's[3] 'syntactical grammar' such a description would not be 'explicit' in the required sense and phonological processes not yielding to 'feature phonetics' would be treated either as a phonological sub-component or would be relegated to the 'lexical component' hold-all.

My undergraduate essay was concerned with Bantu consonants and consonant combinations which never occurred in given grammatical circumstances. For example, the phonology of class 9/10 words was a severely restricted phonology in which certain 'prime' sounds never occurred. This phenomenon could be handled easily enough in terms of junctions of the prefix ₦- of classes 9/10 of nouns with the Noun Root, but, on the other hand, there were *derivations from* such class 9/10 words – side by side with the *derivations into* class 9/10 – that preserved the class 9/10 shapes of the Roots and not the 'prime' shape:

Ve.: -rofhe 'mud' as in lurofhe 11 'thin mud'
-tope 'mud' as in matope 6 'mud'
cf. thophe 9 'heavy mud', dope 5 'very heavy clay or mud'

In the secondary root -tope -r-/-fh- are replaced by -t-/-p- i.e. not only the root syllable is affected but also the second syllable not directly in contact with the prefix ₦-.

In Venda the processes by which r/t/th/d are associated can perhaps be derived from extant examples, but this is not always the case in other languages. In such languages the native speakers' insistence that certain words are semantically associated cannot always be verified in such a direct manner . . . especially in the absence of suitable examples of sound-shift:

So.: kgútsaná 'orphan' and mofútsaná 'poor, friendless person'

Though a comparison with other languages will demonstrate that there is a relationship of -fu- with -kgu- and that -fu- may be derived from **hu̧ and **fu̧ (CB*ku̧ and CB*pu̧), there is only one example that will support this derivation viz.:

So.: -fubȩdu 'red' with cl. 9 form kgubȩdu

But see also: -kgutshwane 'short', kgúdú 9 'tortoise'

There is therefore clearly a hiatus in the Sotho relationships between -fu- and -kgu- and there are formations and back-formations that cannot be accounted for as processes, though the spontaneous nasalisation of certain combinations is in fact a process in Sotho. Thus:

So. -kgutshwane 'short' cf. Xh. -fuphi, -futshane CB* -ku̧pi
So. kgudu 9/10 'tortoise' cf. Xh. ufudu 11/10 CB* ₦-ku̧du̧

Clearly the following is a back-formation and not a regular form:

So. mafura 6 'fat' is derived from So. ** ma-pu̧ta and not from CB* ma-ku̧ta

The fact that historical changes and historical derivations play a part in spoken language is a factor that would have to be built into a 'syntactical' and (generative) grammar' in the form of a 'popular etymology component'.

The basis upon which such 'popular etymologies' may be weighed is that of the processes as revealed by regular and attestable shifts. This is directly in line

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Note:

Ve = Venda. So = Southern Sotho. The double asterisk indicates 'proto-Sotho' or 'common Sotho'. The single asterisk or CB followed by a single asterisk indicates 'Common Bantu'. Cedillas and bars under vowels in Sotho are vowel marks. The cedilla is also used to indicate dental sounds in Venda since it is more convenient than the traditional dental sign (viz. the circumflex under [t] or [d]).
The phonological processes are indicated by the use of capitals with double or single lines through them. Thus: ₦ = nasalisation, N̶ = de-nasalisation, V̿ = vocalisation, V̶ = devocalisation. New symbols are ŧ and đ where the sounds [t ɬ] and [d ɮ] are not analysed as affricates but as single lateral plosives.

with Chafe's[2] proposal – even if, as he suggests, sounds that do not occur in the spoken language have to be hypostatized.

The Southern Bantu consonants could thus be arranged in a paradigm capturing their essential associations with a 'prime sound' somewhat as follows:

	Prime sound	+passive	+diminutive	+causative
Prime sound	C+V	Cw+V	C(w)+V	Cy+V
Nasal + C	₦C+V	₦Cw+V	₦C(w)+V	₦Cy+V
₦C - ₦	NC+V	NCw+V	NC(w)+V	NCy+V

There are of course other processes that will be revealed in the paradigmatic statement for each language. In this statement ₦- has the meaning of 'plus nasalisation' or '+nasalisation' while N- has the meaning of 'minus nasalisation (of ₦C)' or '-nasalisation'.

The treatment of the consonants in this manner reveals the basic importance of a unit within which fusion takes place. This will lead us to a statement of the entity Q.

The terms at the head of each column have the following significance: +P = passive (in which -w- is an essential element), +D = diminutive (in which in general palatalisations and velarisations are only effected when -o̱-, -o-, and -u- follow), +C = causative. The columns marked +w do not merit special differentiation of passive and diminutive forms.

SOTHO (IPA ORTHOGRAPHY):

	.	+P	+D	+C	.	+P	+D	+C	.	+w	.	+w
Prime C	f	fʃw	tshw/fʃw		r	rw	tsh/	s.	ɬ	+w	h/ϕ,h	uw
₦C	ph	pʃhw	tshw/		th	thw	/tʃh		ɬ-tɬh	+w	x-kxh	+w
NC												
Prime C	b	djw	di/djw		l/d	lw	ts'/dj	ts'	(ŧ)	+w	ϕ	
₦C	p'	pʃ'w	ts'w/		t'	t'w	tʃ'/tʃ'w		ŧ	+w	k'	
NC												
Prime C	m	ŋw	ŋw		n	nw	nw	ny	(ny)	ŋŋw	(ŋ)	ny
₦C	m				n							
NC												

Residual sounds: Clicks, ʃ, dj-j relationship. Though the fricatives are derivative sounds, they are not entirely and satisfactorily derivative and, so, merit separate statement:

Prime C	s	ʃ
₦C	tsh	tʃh
NC		
Prime C	(ts')	J
₦C	ts'	tʃ'
NC		

In this statement the IPA orthography has been modified for both typographical and phonetic reasons. The lateral fricative series (shown by the symbols [ɬ] and [ɮ]) and the lateral plosives (shown by the symbols [ŧ] and [đ]) are treated as single-movement sounds. The symbol [ʝ] represents the voiced palatal fricative.

XHOSA (IPA ORTHOGRAPHY):

	.	+P	+D	.	+w	.	.	+w	.	+w
Prime C	ph	tʃhw	tʃw	th	+w	ch	ɬ	+w	kh/k'	+w
₦C	mp'	ntʃ'w	ntʃ'	nt'	+w	nc'	nɬ'	+w	nk'	+w
NC	p'	tʃ'w	tʃ'	t'	+w	c'			k'	+w
Prime C	6	c'w	c'	l	+w	ʝ	đ	+w	ϕ,y	+w
₦C	mb	ndʝw	ndʝ	nd,l	+w	nʝ	nđ	+w	ng	+w
NC	bh	dʝ	dʝ	dh,lh	+w	ʝh	đh	+w	gh	+w
Prime C	m	nyw	ny	n	+w		(ny)	+w		
₦C	m			n	+w		ny	+w		
NC	mh			nh	+w		nyh			

Residual sounds: Clicks, fricatives and vibrants (shown below):

Prime C	f		s	ʃ	x	
₦C	mpf'		nts'	ntʃ'	x	
NC		(k'r)	(ts')	(tʃ')	kx'	
		(k'rh)	(ts'h)	(tʃ'h)		
Prime C	(v)	(r)	(z)		(ɣ)	(h)
₦C	mv	r	nz	nʝ		h
NC	vh	rh	zh	dʝh	ɣh	hh

Note: The bracketed pronunciations do not occur; only the tone-depressor pronunciations are found. No 'prime C' is a tone-depressor.

Though these paradigms do not reflect the Ur-Bantu or Common-Bantu sound-shifts they will be seen to reflect the 'prime consonants' and the 'derived consonants' of each language, and, on comparison with other languages, of Ur- or Common-Bantu. Similar paradigms from some 40 or 50 other languages illustrate various degrees of complexity and various kinds of solution to the various problems posed in the sound-change situations, particularly those of the class 9/10 prefixes and of the passive. A full range of processes may be observed ranging from labialisations, alveolarisations, palatalisations, velarisations, devocalisations, vocalisations, and the like. In Venda the processes of vocalisation and devocalisation and of nasalisation and denasalisation are active. In Shona vocalisation is accompanied by implosion.

What is not reflected in such statements is the underlying reason for the change which cannot simply be stated in these phonetic terms. This underlying reason may be hypostatised as a need for homogeneity within a particular kind of entity, the syllable. But such an entity is not provided by standard 'feature phonetics' or by any other phonology since it is assumed that whatever can be said about syllables is effectively stated in terms of their components . . . whatever these may be considered to be. In general the major elements incorporating whatever might be said about a hypothetical syllable are the vowels and consonants. Yet, while two major divisions of speech sounds – the vowels and the consonants – are recognised there is no indication in modern theory why only 2 (perhaps 3) such major stratifications or divisions are made in the speech sounds of any given language . . . and not 4 or 5 or any number.

The description of linearised speech sounds in whatever kind of grammatical segment they may occur (e.g. in morphemes, words, phrases, sentences) lacks a fundamental coherence if it cannot be shown why vowels and consonants alternate in linearised sequences. Phonologists arbitrarily and capriciously introduce a major division of the speech sounds into vowels and consonants and then blandly state that they alternate in sequences such as C+V+C+V+C+V etc. In both classical and modern (chiefly TG) grammar 'vowels' and 'consonants' are regarded as axiomatic and there is no satisfactory explanation why they should be auditorily and functionally distinct nor is it shown how and where sound change occurs in a featureless sequence such as C+V+C+V +C+V.

Early attempts were made to introduce a coherence to phonological and phonetic descriptions by introducing the concept of 'a syllable', but with no marked success. The term has been used from Middle English onwards, but in modern usage no reality could be given to the concept though it was felt to be a necessary concept. J.R. Firth, according to F.R. Palmer[5] introduced the concept though he nullified its value by insisting that its behaviour could be adequately stated in terms of C+V sequences. Chomsky and Halle[3] use the term though with a double meaning of '+vocalic' and '+syllabic consonant'. It is suggested by Gillian Brown[1] that the terms 'syllabic' and 'consonantal' may be diversified as '+syllabic', '-syllabic', '+consonantal', and '-consonantal', though she also finds it necessary in her description to speak of 'syllables', 'syllable nuclei' and 'syllable onsets' while concluding that there is no justification for setting up a separate syllable generator. The result of this assortment is that *nasal compounds* are set up as the entity: +cons/+syll . . +cons/ -syll . . -cons/+syll, where the third element is the vowel. All this in a Bantu language.

The description emanates from Chomsky and Halle's[3] treatment of the feature '+syllabic'. This they describe as one of their major class features:

a 'sonorant' e.g. semivowels, glides, etc.
b 'syllabic' e.g. vowels, syllabic consonants
c 'consonantal' e.g. non-syllabic consonants etc.

It is not difficult to see why the term 'syllable' is redundant in TG-grammar: it is built into the system of 'TG feature-phonology' as a synonym for what was earlier described as 'vocalic' and now carries the meaning of 'vocalic', 'syllabic consonant' and 'syllabic nucleus' or 'main syllable marker'. In the last sense it skirts the issue of syllable boundaries. This example, perhaps better than most, illustrates the opportunistic bases of TG 'feature phonology' . . . though those who have studied the 'evaluation measures' for determining 'complexity' by the 'markedness' or 'unmarkedness' of a sound, warn us not to come to a hasty conclusion on this point.

For those of us who would seek to establish auditory reality – besides articulatory reality and acoustic reality – it is important to know whether 'syllables' have such an auditory reality. From an auditory point of view it seems that Chomsky and Halle[3] have created a cover term for 'vowel' and 'syllabic consonant' as follows:

+syllabic → vowel
syllabic consonant

But where it can be shown, as it can be in the languages of the Sotho Group, that syllabic consonants have syllabic quality while consisting of a '+consonant' and a '+latent vowel' element, the terms 'syllabic' and 'vowel' are reversible in the formula and are therefore synonyms. One of them is clearly redundant. If this is so then the authors could equally well acknowledge the syllable as a 'generator' and describe their major class features as follows:

a '- syllabic' = sonorant (+ further features provided)
b '+syllabic' = vocalic
c '- syllabic' = consonant

The single feature '(+-)syllabic' together with a restatement of the cavity, stricture type, and stricture degree features would then provide an absolute as against a contrived measure of complexity. Whatever the result of such an application, the concept of the 'syllable' has by no means been dispensed with and the contrived 'unmarkednesses' devised to secure the smallest number of marked features will not obscure the need for it. Indeed it has been built into the TG phonology as indicated, though as a synonym for vocalic. The framework provided by Chafe's vastly more promising 'symbolization rules' in his semantic grammar is more capable of absorbing the syllable as a symbol and as a generator in directional speech leading (a) from a semantic structure to a phonetic structure as the *articulatory output* and (b) from a phonetic structure to a semantic structure as the *auditory input.* As Chomsky and Halle's[3] terminology will show on examination, the auditory input is not their main concern, and other writers (e.g. Fudge 1973[4]) have commented on it.

In Southern Bantu languages there is a temporal measure which, because of its relative and non-absolute nature, is not clearly revealed in experimental analysis. It is against this measure that we may judge one speaker to speak more rapidly than another, that we may say that some segments are longer than others in a sentence, that we may say that statements have a longer termination than questions, that some vowels are double-pulse vowels while others are merely long or short.

I shall term the temporal quantity [Q]. [Q] contains several pre-phonetic features . . . by which I mean that it is not a symbolic abstract in the sense of Firth's C+V successions. The essential markers of [Q] are shown as its nucleus [/Q/] and as its boundaries [#Q . . . . Q#]:

(1) Q → #Q, /Q/, Q# + (Q)

However, [Q] has certain functions that are localisable to one or other component just as the essential nature of [Q] may be stated in terms of the Q-nucleus and may be observed in the periodic recurrence of this nucleus. The localisable functions (which include tone, stress, duration) cannot be stated in terms of [Q] itself but rather in terms of the Q-nuclei and Q-boundaries.

Nevertheless they are functions of [Q] and not of the components. The components in the nucleus and in the boundaries may roughly be characterised as [V] = vowels and [C] = consonants and statement (1) may then be expanded as follows:

(2) $Q \rightarrow ((C(V)C), (Q)$

where [C] is a consonant to be further specified and is a boundary, and where [V] is a vowel to be further specified and is a nucleus, while the right-hand [Q] marks the recurrences. The corresponding tree diagram incorporating statements (1) and (2) cannot be stated until the localisable functions of [Q] are placed. We thus invest the components [C] and [V] with these functions as follows:

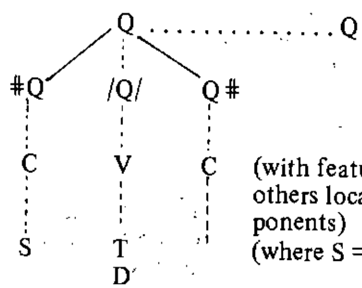
(3) C → (C +stress prominence)
(C -stress prominence)

V → (V +tonal prominence)
(V -tonal prominence)

V → (V +length prominence)
(V -length prominence)

The tree diagram then has the form:

(4)



(with features of stress, tonality, duration and others localised on one or other of these components)
(where S = stress, T = tonality, D = duration)

Where the locking C # is absent the temporal quantity may be said to be open, and where it is present it may be said to be closed. A closed Q does not of necessity bring about a change in vowel quality though it will almost certainly bring about a reduction in the duration of V.

The S, T and D features are not always confined to the components on which they are based e.g. as in the depressor-consonants of Xhosa which anticipate the function of the tonal nucleus, or as the locking function of the nasal in nasal compounds of Xhosa where the nasal element has a distribution in the preceding [Q].

I should perhaps say explicitly that I am here concerned with the orthographic representation of auditory (not articulatory) features. The premature exclusion of these auditory features will severely restrict discovery procedures that will show some languages to be 'syllable number sensitive' and that will show that certain types of [Q] permit a very restricted phonology only e.g. the Bantu noun prefixes which are limited to 3 vowel sounds and 7 consonant sounds.

The temporal quantity has a rhythmic nature though it clearly is not an exact measure of time as in music. At least one experiment can be set up with an airflow meter to demonstrate the articulatory basis of [Q].

It has a componential statement in terms of its nucleus and its boundaries, the difference between these duties being the true distinction between vowels and consonants. All sounds with core duties are vowels or vowel-like while all sounds with boundary duties are consonants or consonant-like. Each will therefore have its special functions according to its position in [Q].

[Q] has tonal functions (usually but not only stated in terms of its [V]-component), stress functions (which may be expressed by the V-component though very often with the introduction of boundary phenomena), duration (always stated in terms of the V-component or of the syllabic consonant component), loudness (stated in terms of [Q]).

But [Q] also has features that have in the past been stated as functions of the consonants – perhaps rightly in the case of some languages – but which could also be stated in terms of the V-components, or, in terms of the whole unit. Such features are e.g.

aspiration in a series such as ph/th/kh or pfh/tsh/kxh

ejection in a series such as p'/t'/k' or pf'/ts'/kx'

voicing in a series such as b/d/g or bv/dz/gx

or combinations of these as e.g.

voiced aspiration in a series such as bh/dh/gh . . .

These features can probably be multiplied endlessly as special features of consonants, but they can and do also function as features of the vowels or of the whole temporal quantity. In this latter interpretation they will also be seen to interfere with tonality and can therefore also be stated as C to V transition phenomena as in the Bushman languages.

The following paradigmatic statement suggests the complete range of features that may be linked, according to the languages, either with [C] or with [V] or with [Q]. In the statement it should be noted that voicing is an additive feature affecting [C] while aspiration [+h], ejection [+'], and, strangely, implosion [+ˆ], (a laryngeal closure feature), are seen as vowel onset features. The frictionless continuants (such as the laterals, the nasals, etc.) and the vibrants are sounds that do not usually offer a choice in voicing: they are always voiced though they may be de-vocalised in certain combinations.

(P) plosive				(F) fricative				(K) click				
clear	+hV	+'V	+^V	clear	+hV	+'V	+^V	clear	+hV	+'V	+^V	
p	ph	p'		ɸ				ʘ	ʘh	ʘ'		(1)
				f	pfh	pf'						(2)
t	th	t'		θ								(3)
t̂	t̂h	t̂'		s	tsh	ts'		/	/h	/'		(4)
t				ṣ	tṣh	tṣ'		!	!h	!'		(5)
				ʃ	tʃh	tʃ'						(6)
c	ch	c'		ç	(cçh	cç')		≠	≠h	≠'		(7)
ŧ	ŧh	ŧ'		ɬ	(tɬh	tɬ')		//	//h	//'		(8)
k	kh	k'		x	kxh	kx'						(9)
q				X								(10)
				h								(11)
+voicing				. . . .				. . . .				
b	bh	b'	ɓ̂*	β				bʘ	bʘh	bʘ'		(1)
				v	bvh	bv'						(2)
d	dh	d'		J								(3)
d̂	d̂h*	d̂'	d̂	z	dzh	dz'		g/	g/h	g/'		(4)
d				ẓ	dẓh	dz'		g!	g!h	g!'		(5)
				j	djh*	dj'						(6)
J	Jh	J'	J	y	(Jyh	Jy')		g≠	g≠h	g≠'		(7)
đ	đh	đ'		đ	(dđh	dđ')		g//	g//h	g//'		(8)
g	gh	g'	ĝ*	x	gxh	gx'						(9)
G				ɣ								(10)
				ɦ								(11)

(N) nasal			(L) lateral			(R) rolled			(W/Y) semivowel			
clear	+h	+'	clear	+h	+'	clear	+h	+'	clear	+h	+'	
m	mh								w	wh		(1)
												(2)
n			l									(3)
n̂	nh		l̂	lh		r	rh					(4)
ɳ			ɭ									(5)
			λ						y	yh		(6)
ɲ	ɲh											(7)
l̃												(8)
n						R						(10)
												(11)

Footnote * Ɉ = [ʄ]: ɓ̂ = [ɓ]: d̂ = [ɗ]: J = [ʒ]: ĝ = [ɠ]

Notes

a) All speech may be whispered in which case voicing is not an essential part of phonation. Other characters of the sound may then come to the fore and may be relied upon for distinctiveness.

b) The transition from C to V may be 'clear', 'aspirated' (+h), 'ejective' (+'), and 'pressed with implosion of C' (+ˆ). These transitions may be affected by voicing.

c) The auditory characters are the following:

(P) plosion i.e. stop consonants
(F) friction i.e. obstruent continuant sounds
(K) click i.e. injective suction sounds
(N) nasal
(L) molar-lateral non-obstruent sounds
(R) rolled or tapped sounds
(W) semi-vowels

Though (N), (L), (R), and (W)-sounds may be whispered their character is 'voiced'. In a number of languages they may appear as '- voice' in combinations with V-C transitions e.g. [nh] in oluNhkumbi, an Angolan language.

d) The place of articulation is indicated as follows:

(1)	labial (lab)	lip-front
(2)	denti-labial (del)	lip-back
(3)	dental (den)	tongue-tip
(4)	alveolar (alv)	tongue-front
(5)	retroflex (ret)	tongue-tip
(6)	prepalatal (prp)	tongue-front
(7)	palatal (pal)	tongue-back
(8)	palatal-lateral (lat)	tongue-side
(9)	velar (vel)	tongue-root
(10)	faucal-pharyngal (fau)	
(11)	glottal (glo)	
(12)	epiglottal (epi), not shown in charts.	

From the second column indicating the position of the moving parts (lips, tongue, uvulus, pharyngeal wall, epiglottis and larynx) it will be seen that the fixed-position classification is incidental to control and that the moving-parts classification is much more to the point and possibly more economical to state.

e) The palatal and palatal-lateral fricative sounds are bracketed in the chart since they are indistinguishable in practice from the relevant plosive sounds, cf.:

[ch] and [cçh], [c'] and [cç'], etc. for 'voiced'
[th] and [tɬh], [t] and [tɬ'], etc. for 'voiced'

f) All compound sounds may be stated in terms of a double/treble involvement of the moving parts features thus e.g. [px], [tx], [tsx], [pk], [mŋ], and many more:

lab.	.	.	.	.	pk	+voiced
	ps	pʂ	pʃ	pç	px	+aspirated
	ɸs	ɸʂ	ɸʃ	ɸç	ɸx	+ejective
del.	fs	fʂ	fʃ	.	.	
alv.					.	
	ts				tx/tsx	
					sx	
ppl.					.	
	tʃ				cx/tʃx	
					ʃx	
vel.					kx	

g) Since [Q] is a compensatory unit (a unit limiting the extent of compensatory movements), it will follow that certain effects such as de-vocalisation, aspiration, etc. will be limited by it in the grammatical (morpho-phonemic) processes. Thus e.g. the de-vocalisation in Sotho languages in class 9 may be compared with the vocalisation of voiceless plosives in Herero.

A specification in terms of this analysis will permit us to reduce the 'Feature Phonetics' of Chomsky and Halle[3] to a mere 19 items, though, in order to do this, we must specify some selections as *necessary* selections and some as *optional.* Thus e.g. 'voicing' is a necessary selection with vowels and the continuants while there is a 'voice choice' item with such distinctions as p/b, f/v, etc.

With the above analysis the primary operators may be confined to (1) Primary Q-features (i.e. syllabic features) and (2) Voice-production (glottal) features. All other features are 'modification features' and not 'production features'.

In Chomsky and Halle[3] the 'unmarked' features on which 'complexity' is determined are ambiguous in that they include both 'no entry' and 'minus' features. If full use of this convention is made then the features needed to specify any sound uniquely can be reduced from their 30 to a mere 19. The use of this convention is however contrary to their basic thinking which appears in the main to be that of 'articulatory control features'.

If now we were to turn our attention from 'output' or articulatory phonetics to 'input' or auditory phonetics (leaving acoustic phonetics as a laboratory interest), and, if we were not to use the combined 'no entry/minus' unmarkedness, then the following would probably be a maximum of features required for an 'auditory control phonetics':

1.0 Primary Q-features

1	+- syllabic nucleus	+vowel	-consonant
2	+- syllabic diffusion	+depressor C	-syllabic C
3	+- H (tone) prominence	+H	-L
4	+- Up-step	+up-step	-down-step
5	+- duration	+long	-'normal'

6	+- stress prominence	+stress	-'normal'
7	+- terminal crumble	+terminal	-non-terminal

2.0 Airstream features

8	+- clear	+clear	-aspirated
9	+- hard	+ejected	-injected
10	+- voice obligatory	+vocalized	-devocalized
11	+- voice choice	+voiced sounds	-unvoiced sounds
12	+- pharyngal production	+pressed	-scraped

3.0 Moving parts/place of articulation features

13	+- labial	+bilabial	-dentilabial
14	+- frontal	+interdental	-alveolar
14	+- apical	+retroflex	-prepalatal
16	+- radical	+palatal	-velar
17	+- lateral (molar)	+lateral-molar	
18	+- faucal	+pharyngeal	-laryngeal

4.0 Degree operators (for 3.0 and for 1.1)

19	+- front	-front/-back = central
20	+- back	
21	+- high	-high/-low = mid
22	+- low	

5.0 Release type features

23 +- P (plosive)
24 +- F (fricative and affricate)
25 +- K (clicks)
26 +- N (nasal continuants, voice obligatory)
27 +- L (laterals, voice obligatory)
28 +- R (rolled sounds)
29 +- W/Y (semivowels, voice obligatory)

With the combined 'no entry/minus' convention these 29 features could be drastically reduced. Clearly some of the associated features require further description e.g. the reason why 'clear/aspirated' are associated is in order to distinguish 'clear/turbulent'. Similarly the '+- hard', '+- voice obligatory', and many other features can only really be clarified from demonstrations in specific languages. This is not the right place in which to demonstrate these specifications. We are here concerned with the statement of the limitations imposed upon sound-change by [Q] in the Bantu languages. For this purpose it was necessary to place the 1.0 'Primary Q-features' within an updated framework. This has been done primarily with the thought of eliminating the ambiguity arising out of the use of the term 'syllabic' to denote vowels and consonants and to show that vowelness and consonantness are secondary to syllabicity features. A further thought was to provide the necessary auditory basis for the statement of sound change.

SOUND CHANGE

This description is concerned only with telescoped syllables in Bantu languages of Southern Africa. It is not concerned with the harmonisation processes in which grammatical and syllabic environment and not telescoping play a part. The harmonising processes may be described as inter-syllabic changes and the following is an illustrative (and therefore incomplete) list of such changes:

a) Accumulations of labial/rounded sounds cause change:

SSotho: mmutla/mebutla 3/4 'hare'
CV+[b]V → Cc+[m]V/ . . . mo+bV → mm+mV
Venda: mmphasi/miphasi 3/4 'hubbly-bubbly' cf. -øasi
CV+[ø]V → Cc+NøV → Cc+[ph]V/ . . . mu+øV → mm+phV

b) Pre-harmonic vowel processes:

SSotho: horekisa 'to sell' cf. horeka 'to buy'
-rek- → -rek-/ . . . '+high vowel' i.e. i/e/ę/u/o/Q where a/e/o are '+low vowel'
SSotho: -fętse 'b. finished' cf. -fela 'come to an end'
-fe- → -fe-/ . . . '+latent-vowel consonant' i.e. s/ts/tsh/ny/ng/some n, etc.

c) Post-harmonic processes (vowel and consonant):

Sound changes that are determined by a preceding syllable include the choice of the 'applied' extension according to the root vowel e.g. -ira/-era/-ina/-ena, -irira/-erera/-inina/-enena, -ura/-ora/-una/-ona, -urura/-orora/-ununa/-onona, etc.; the choice of the final vowel in languages like Herero where e.g. okumuna 'to see' appears as -munu in the environment '+present tense action'.

There are also consonantal processes where a root syllable will affect secondary root syllables in reduplications e.g. Venda: phalaphala 9/10 'sable antelope' → +Nøala+Nøala cf. WSotho phalafala → +Nfalafala and Shona mharapara → +Nparapara. This process is also reversed in Venda: kupalapala 20/8 'small sable antelope' → ku-Nøala-Nøala where '-N' represents 'denasalisation'

Several tonal processes and the typical 'concord system' of Bantu languages may also be seen in this light as anticipatory or pre-harmonic processes and as subsequent or post-harmonic processes.
We may now consider any utterance in a Southern Bantu language as a movement across a reticle in which the interstices are temporal quantities formed by C and V alternations. The threads not selected in this movement remain as contrastive elements with a semantic significance of their own. In this model of speech consonants and vowels are selectional items together with a host of 'features' presenting some 2000 specifiable and unique Q-entities for an average language of 40 consonants and 5 vowels.

We have already specified Q as having the following behaviour:

Q → C+V, (Q)

In the reticulated model of utterance we must specify Q-sequences as Q-cohesions in which any Q has ordinal position and in which the total number of Q is always stated. The ordinal position of Q states whether it is a root syllable (with stress) and the count of the number of Q states what prefix rules and what tonal rules shall be applied. In several languages monosyllabic stems require distinct prefixes and in almost all of them the number of syllables by which a word is reduced determines the tonal profile selected i.e. there is an order of deletion which is confined to the specified Q-cohesions.

We may thus also eliminate such rules as the following Xhosa rule as an inter-Q (inter-syllabic) rule:

> 2Q (prefix) → 1Q/ . . . '+polysyllabic stem' where the prefix contains the consonants [l], [b], [m] as in the prefixes ili- cl. 5, ulu- cl. 11, ubu- cl. 14, umm- cl. 3 and umm- cl. 1

We may now specify the components of Q:

(5) Q → C + V

(6) C → (C)
 (∅)
 (c̲) where 'c̲' is a consonantalised vowel

(7) V → (V)
 (v̲) where 'v̲' is a syllabic consonant

With these marking conventions we may now describe sound-changes of a non-harmonising kind as Q-reductions as follows:

(A) *EXAMPLES OF UNCHANGED SYLLABIC STATUS WITH SOUND-CHANGE*

1Q(C'+V) → 1Q(C''+V) e.g. So. /l/ → [[l]]/ . . . '+e/e/e̲/a/o/Q/o̲'
 [[d]]/ . . . '+i/u'
e.g. So. /h/→ [[s]]/ . . . '+i/e/e/e̲'
 [[h]]/ . . . '+other vowels'
 [[∅]]/ . . . 'Q2, Q3. . .'

These are simply the allophonic rules in which the quality of a sound is determined by its immediate syllabic environment. These changes do not include the harmonisation processes. Though there is an alternative rule which may be applied to the case where the vowels -e̲- and -o̲- never occur before -s-, -ts-, -ny-, -ng-, -nng-, -tsh-, these environmental conditions are distributed over 2 syllables. They do not therefore have a place under this heading.

(B) *EXAMPLES OF UNCHANGED SYLLABIC STATUS WITH ADDED C*

1. 2Q(CV+V) remain 2Q but insert a new -C-:
 e.g. Herero oku- + -enda → okuyenda, but also okuenda
 Pattern: oku- + e → ukuye- oku + o → okuwo-
 òku- + a → okuya-

There are many patterns for dealing with juxtaposed vowels, even in Herero where two vowels may be juxtaposed with no change and no insertion.

(C) *EXAMPLES OF REDUCED SYLLABIC STATUS BUT WITH LENGTH COMPENSATION*

1. 2Q(CV+V) → CVV

e.g. Ndonga	oka+iga	→	okiiga okayiga	oka+uli	→	okuuli okayuli
	oka+elo	→	okeelo okayelo	oka+oko	→	okooko okayoko
	oka+anda	→	okaanda okayanda			

Whichever pattern of juxtaposition is employed there is either no loss of syllabic status or there is durational compensation.

EXAMPLES OF REDUCED SYLLABIC STATUS BUT WITH TONAL COMPENSATION

2. 2Q(CV+V) → 1Q(CV) with tonal compensation

e.g. Vẹnda: **mà+ít̯ó → mát̯ó 'eyes' (Note: In all other circumstances the noun prefix is L)

EXAMPLES OF SYLLABIC REDUCTION BUT WITH CONVERSION of V → c̲ *OR WITH TOTAL LOSS OF ONE V:*

3. 2Q(CV+V) → 1Q(Cc̲V)

e.g. Xhosa: uku+enza → ukwenza
uku+akha → ukwakha

4. 2Q(CV+V) → 1Q(C~~c̲~~V)/ . . . 'where two rounded vowels follow each other, but only in combination with C'

e.g. Xhosa: uku+ona → uk~~w~~ona → ukona

A similar process may be observed in Herero where a labial consonant is incompatible with a rounded vowel

e.g. Herero cl. 14 prefix: o~~v~~u- → ou-

5. 2Q(CV+V) → 1 $\overline{\text{(Cc̲V)}}$/ . . . 'where all but rounded vowels follow'

e.g. Xhosa possessive concord: s~~i~~+a → sa- and
b~~a~~+a → ba-, but
lu+a → lwa- except
b~~u~~+a → ba-

(D) *EXAMPLES OF SYLLABIC REDUCTION WITH VOWEL COALESCENCE*

There are many examples of this phenomenon which also involves a latent vowel and includes the substitution of an invariable vowel.

1. Xhosa (coalescence) na+imi- umu- → nemi- nomu-
ạma- nama-

2. Shona (latent vowel, harmonic)
na+mi- mu- → nemi- nomu-
ma- nama-

3. Shona (vowel substitution)

na+mi- —— mu- → nemi- —— nemu-
ma- nema-

4. Xhosa (syllabic vowel-harmonisation)

There are numerous examples in many Bantu languages of the assimilation of a suffixal element though this is done in such a way as to preserve the derivations:

Locative ** -(i)ni	Ci +ini → Cini	Cu+ini → Cwini
	Ce+ini → Ceni	Co+ini → Cweni
	Ca+ini → Ceni	

The bracketed vowel **-(i) is therefore a variable vowel which is
-i-/ . . . 'high vowel'
-e-/ . . . 'low vowel'
and which is preceded by the element
-w-/ . . . 'back vowel'

(E) *EXAMPLES OF REDUCED SYLLABIC STATUS BUT WITH VOCALIC PENETRATION OF C*

With these examples we now return to the consonantal paradigms for Bantu languages. The most varied processes may be found in both suffixal and in prefixal positions. These processes also include consonantal modifications that are not always immediately apparent as changes resembling the allophonic rules but different from them in that they have to be established statistically and that some of them have to be described as the result of the juxtaposition of a vowel-sensitive consonant with certain vowels. Though prefixal examples exist the vocalic penetration of consonants is far more frequently found in suffixal positions.

Nd. hamantu 'it is not a person' cf. ha+ømuntu
haantu 'it is not people' cf. ha+a̸antu
haiyelo 'it is not doors' cf. ha+i̸iyelo
hauyelo 'it is not small doors' cf. ha+u̸uyelo
hangombe 'it is not a cow' cf. ha+øngombe
haongombe 'it is not cows' cf. ha+øongombe

Xh. andinabantwana 'I have no children' cf. andina+a̸bantwana
andinasihlalo 'I have no-seat' cf. andina+i̸sihlalo
andinasana 'I have no baby' cf. andina+u̸sana
andinankomo 'I have no cow' cf. andina+i̸nkomo
'I have no cows' andina+i̸i̸nkomo
andinamalume 'I have no uncle' cf. andina+u̸malume
'I have no uncles' andina+øømalume
nifuna bani? 'Whom do you want' cf. nifuna u̸bani?
nifuna øøbani?

nifuna ntoni? 'What do you want?' cf. nifuna i̸ntoni?
lenkomo 'This cow' cf. le+i̸nkomo
ezinkomo 'These cows' cf. ezi+i̸i̸nkomo
lamadoda 'These men' cf. la+a̸madoda

ababantu 'These people' cf. aba+~~a~~bantu
abafuni zihlalo zintathu uzithengileyo 'They don't want the three chairs you bought' cf. abafuni ~~i~~zihlalo ~~e~~zintathu ø(~~a~~+u)zithengileyo.
These Xhosa examples have an alternative interpretation in the construction of two parallel series of prefixes, one a 'free prefix' and the other a 'junction (or bound) prefix'

(F) 2Q → 1Q with fusion (coalescence), harmonic change (coalescence), and substitution

These rules are best illustrated with the prefixal element na- 'and, together with'. But also see Possessives, nga- 'with' Xh., etc. etc.

1. 2Q(CV'+V") → 1Q(CV"') + fusion of two vowels

Xh. nomntu 'and the person' cf. na+umntu
nesihlalo 'and the chair' cf. na+isihlalo
nezintle 'and the good ones' cf. na+ezintle
nomhle 'and the good one' cf. na+omhle

na+i +u → ne- no-
+e +o ne- no-
+a na-

2. 1Q(CV') → 1Q(CV") + substitution of harmonic vowel (for -a-)

Sh. nomunhu 'and the person' cf. na+munhu
navanhu 'and the people' cf. na+vanhu
nemiti 'and the trees' cf. na+miti

na+Ci na+Cu → ne no
na+Ca na

3. 1Q(CV') → 1Q(CV") + substitution of invariable vowel (for -a-)

Sh. nemunhu 'and the person'
nevanhu 'and the people'
nemiti 'and the trees'

na+Ci na+Cu → ne ne
na+Ca ne

4. 2Q(CV++V") → 1Q(C<u>c</u>'V"')
1Q(CV"')

There are many other sequences of vowels than those of (a+V). These are too numerous to list from the various languages with VCV-prefixes and only one is brought here from the Locative forms of nouns in Xhosa

Loc. Xh. **(i)ni

Ci+ini Cu+ → Cini Cwini
Ce+ Co+ Ceni Cweni
Ca+ Ceni

umthi 'tree' emthini, abantu 'people' ebantwini, intonga 'stick' entongweni, umdlalo 'game' emdlalweni, indlebe 'ear' endlebeni.

The bracketed vowel **(i) is therefore a variable vowel which is determined as -i-/ . . . '+high vowel'
-e-/ . . . '+low vowel'
and which is preceded by
-w-/ . . . '+back vowel'

(G) 2Q → 1Q with modification of consonants and with vowel penetration. With these examples we now return to the consonantal paradigms for the Bantu languages. The most varied processes may be found in both prefixal (e.g. cl. 14 utywala 'beer' in Xh.) and suffixal (e.g. diminutive, passive, locative) positions. These processes of consonantal change may also include consonantal modifications that are not always immediately apparent. They resemble the allophonic rules but differ from them in that they have to be established statistically and by the absence of certain vowel sequences after given consonants.

These changes all have the pattern of:

2Q(C'V'+V''/c̲V'') → 1Q(C''¢̲V''/c̲V'') in which C'' is the modified C

The modifications are of the following kinds:

Labialisation:	C(Ⱡ)+V)	cf.	Ve.	retroflexion
Alveolarisation	C(₳)+V)	cf.	So.	lefifi/lefitshwana
Retroflexion	C(Ɍ)+V)	cf.	Ve.	ulisa/uliswa [ʂ]
Palatalisation	C(₱)+V)	cf.	Xh.	umlaṃbo/umlanjana
Velarisation	C(₩)+V)	cf.	So.	molamu/molańgwana

The following are manner of articulation modifications:

Implosivisation	C(=̂)+V)	cf.	Sh.	ɗombo/matombo
Vocalisation	C(V̿)+V)	cf.	Ve.	dombo/matombo
Devocalisation	C(V̶)+V)	cf.	Xh.	**ubu+ani → utyani

These modifications are far too numerous to describe in detail in this paper but they are processes that will generate a great many sets of new consonants. A detailed statement of one example will suffice to illustrate these modifications:

Xh. umlambo+ana/umlanjana dim. 'river'
ɸu-mm̲-la:-mbo + ana → ɸu-mm̲-la-mbw+a-na
→ ɸu-m̄m̲̄-la-mb(₱)w̸a-na
→ ɸu-mm̲-la-nja:-na

The intrusive element in the above examples is a semivowel. It is not necessarily the velar semivowel though the result of the modification would appear to be the same (in several languages) for both W/Y.

(H) 2Q(C+CV) → (CCV)

These are perhaps the most interesting and most widespread and best-known of the sound changes in Bantu languages. They include 'nasalisation' (classes 9/10) and the many interesting effects arising from the loss of the class 5 prefix though this prefix may often be reinstated together with its effects. The presence of these changes means that classes 9/10 and class 5 virtually have their own greatly restricted phonology as indicated elsewhere in this paper.

Nasalisation in classes 9/10

The term 'nasalisation' represents a great variety of changes in not all of which there is invariably a nasal. These changes may be found with classes 9/10, with the reflexive (in Sotho), with the object concord (in Sotho, Pedi, etc.), and in isolated cases elsewhere.

The prefix is hypostatised as Ꞥ which, for the Southern Bantu languages certainly, is a velar nasal with a possible latent vowel element. It is the velar aspect together with the vowel that is the basis of the formations which include the reflexive with no nasal element in Sotho perhaps in the following starred SB** forms:

SB** Ꞥ+CV	→ 1Q(ꞤCV) for cl. 9/10	
NꞤ+CV	→ 2Q(N<u>N</u>+ꞤCV) for the object concord in Sotho	
G¥I+CV	→ 2Q(GI+¥CV) for the reflexive infix in Sotho	

The details are too numerous to exemplify and the following is no more than a comparative survey to mark the different kinds of stages of Southern Bantu 'nasalisation' illustrated from the labial only:

Ꞥ + CV →	1Q(ꞤCV)	Yei: N+p → mp
	1Q(Ꞥ+effect+CV)	Nkhumbi: N+p → mhp
	1Q(ꞤC+effect+V)	Chewa: N+p → mph
		Xhosa: N+p → mp'
	1Q(ꞤC+effect+V)	Sotho: Ꞥ+p → m̥ph
	1Q(ꞤȻ+effect+V)	Shona: N+p̸ → mp̸h
	1Q(ꞤC+effect+V)	Herero: N+p → mb (also N+b → mb)
	1Q(ꞤC+effect+V)	Sotho: Ꞥ+b → m̥p'

<u>Effects of Class 5 prefixal elements</u>

The effects that require description here are of two kinds viz. (1) a glottalisation process (implosion and voicing) in Shona and Venda and (2) a yotization process that will differentially summarise the shifts to alveolars and to labials (where *ų is involved) in Venda and in Sotho. The shifts of the consonants can very incompletely be summarised as follows:

(1)	Shona	¥+	p → ɓ̂	t → ɗ̂	k → ĝ	(Implosive, Voice)
	Venda	¥+	p → b	t → d	k → g	(Voice)
(2)	Venda	ǂ +	ϕ → ·	r → ʃ	h → ʃ	
			ϕu → fu	ru → pfhu	hu → fu	
			β → v	l → dz	ϕ → dz	
			βu → vu	lu → dzu	ϕu → ·	
	Sotho	ǂ +	f → tshw	r → s,ʃ	h → s	
			b → ts	l → ts	ϕ →	

The processes are experimentally stated as follows:

Qp + Q' → (Qp) + Q'' where Qp is the prefix syllable and Q'' is the modified form of Q'

Qp(C€i) + Q(CV) → (Qp(ϕ) + Q(€CV) where € is the consonantal process and where the Qp or prefix syllable shows three Venda and Sotho forms

(Qp(lȳi)

(Qp(li)

€Ci → (¥Ci

(ǂCi and ɄCi/ . . . '+labialised vowel [u]'

¥Ci → C¥i

ǂCi → Cǂi and CɄi

From these latter forms it will now become evident why the results of the consonantal modifications are so similar to those of *CŷV in these two languages.

Examples of these shifts include such as the following: (1) Venda shambo/marambo 'bone', shubi/marubi 'ruin', fumi/mahumi 'ten', shaḓa/mahada 'shoulder', dzuvha 'pumpkin flower' cf. maluvha 'flower', vele 'seedgrain' cf. mavhele 'grain, maize', luvhele 'millet', vudzi/mavhudzi 'hair' (2) Sotho: lesapo – lerapo 'bone', lesome 'ten' letsopa 'clay' cf. Ve. vumba, letsoho 'arm', letshwafu 'lung'. In Lovhedu, Dogwa, Pulana, and Pedi and in Birwa many further changes will be found.

The centralising (Alveolarising, Palatalising) and frontalising (Labialising) effects of this prefix are ascribed to the elements **ɨ and **ʉ and for this reason the effects of the process resemble those of **ŷ and **ŵ (in passives occasionally, and diminutives frequently).

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