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Phonological regularities of consonant systems across Khoisan lineages

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Conventions for the representation of sounds in the text and in tables

There does not yet exist an agreement among Khoisanists with respect to a phonological analysis, let alone a uniform orthographic representation, of the multiplicity of sounds in general and click accompaniments in particular (see Köhler & al. 1988, Güldemann 1998). My phonological alignments and symbols will be explained in the text. In the tables, they become clear from the labels for lines and columns. The following abbreviations are used:

Af	affricate
Al	alveolar
As	aspiration/aspirate
Dt	dental
EGR	egressive
Gl	glottal(ization)
IGR	ingressive
Lb	labial
Lt	lateral
Ns	nasalization
Pl	palatal
Uv	uvular
Vl	velar

When referring to segments in the text, phonologically intended notations are written within slashes. Symbols used in a cited source will appear in square brackets when different from the former. Types of click accompaniments when referred to in the text will be exemplified with the symbol for the alveolar influx /!/.

The phoneme symbols for table entries are those used in the respective source reference if not stated otherwise. These may deviate considerably from IPA-usage, especially in the case of practical orthographies.

Preface

The ideas presented in this paper emerged during a research visit to Namibia and South Africa while I was trying to come to grips with some of the problems of representing the sound complexity of Khoisan languages in practical orthographies (compare Güldemann 1998). Since the present paper was written several years ago, but the publication of the volume for which it was planned has been delayed, I decided to have it appear as a working paper.

I am particularly grateful to the "Volkswagen-Stiftung" for having made this research possible. My thoughts on the topics to be discussed were shaped in fruitful discussions with Edward D. Elderkin, Wilfrid H. G. Haacke, Jan W. Snyman, Anthony Traill, and Rainer Voßen. It is hard to say how much this paper owes to their first hand expertise on these languages which I am still lacking. Thanks are also due to Klaus Keuthmann, Peter Ladefoged, Gabriele Sommer, and Rainer Voßen for comments on earlier drafts of this paper.

1 Introduction

It is a widespread and certainly justified perception that clicks are complex speech sounds and that they represent in many respects a crosslinguistic quirk. Accordingly, the languages having clicks at the core of their sound systems, in particular all those belonging to the genetic lineages subsumed under the term Khoisan,[1] are believed to range among the phonetically and phonologically most complex ones in the world. This even might entice one to accept any unprecedented extent of difference in sound design and complexity between a language with and one without clicks. As pointed out by Anthony Traill (*inter alia* 1985: 208ff, 1995b), the traditional approach to phonological systems of Khoisan languages is indeed associated with two major typologically unknown peculiarities:

I the consonant inventories of languages with more complex systems are abnormally large,

II the languages possess two disjunct consonant inventories of clicks and non-clicks.

Regarding the first problem, Traill laid as early as 1985 in his *Phonetic and phonological studies of !Xóõ Bushman* the foundation for an analysis of Khoisan languages which brings even the most intricate representatives in line with the range of sound complexity encountered in other parts of the world. I specifically refer to one of the final sections of his study called *Unit analysis or clusters?* (ibid.: 208ff) where he writes:

> "It is abundantly clear in the entire discussion ... that the intractability of the !Xóõ consonants is a function of the assumption that clicks and their accompaniments and the non-click clusters are phonological units. ... it is necessary to question the assumption ... and to explore the consequences of an alternative analysis in terms of clusters."

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1 The term *lineage* is used here for a genetically defined language unit irrespective of its age (according to Nichols 1992: 24f and her ideal distinction between *family* and *stock*). In focusing here on lineages *within* Khoisan I try to stress the fact that this group of languages as a whole has not (yet) been shown to be a genetic unit within the frame of comparative-historical methodology. Accordingly, such an assumption is not implied with the use of the term Khoisan. It rather denominates conveniently those languages which at present can only be defined negatively as not being associated with any well-established genetic lineage but which are geographically restricted to eastern and southern Africa and share properties in their sound systems. According to Güldemann & Vossen (2000), genetic lineages within Khoisan are Hadza, Sandawe, Kwadi, KHOE (= Central), JU (= Northern), ǂHõa, and !UI-TAA (= Southern). Hadza, Sandawe, Kwadi, and ǂHõa are single languages, whose genetic relation is still unclear; the others are fairly well-defined families. Promising hypotheses yield larger units like KHOE-Kwadi (see Güldemann 2001) and JU-ǂHõa. However, the evidence for these groupings is still meagre and/or largely inaccessible to non-specialists.

In this and later studies (cf. Traill 1993), he demonstrates the advantages of a cluster analysis for the majority of ingressive click consonants and some egressive non-click consonants in !Xõo. The most important ones are:

a) an enormous reduction of the consonant inventory, which is crosslinguistically and even in comparison with more simple click languages abnormally large under a unit analysis,
b) a better explanation for the apparent parallels in the inventories of the two subsystems of egressive non-click and ingressive click consonants,
c) a better explanation for various phonetic characteristics of certain consonant types.

He also remarks in the final conclusions of his 1985-study (ibid.: 211):

> "These proposals that a cluster analysis provides the most adequate description of the !Xóõ consonantal complexes represent a break with traditional Khoisan linguistic descriptions. However, there is a great deal of evidence in its favour and it can be extended to the other Khoisan languages."

In view of his well-founded findings it is surprising indeed that the cluster analysis has received so little attention in later studies on Khoisan. I will try to show here that the cluster analysis - as Traill has claimed - *can* be fruitfully applied to other languages as well.

Furthermore, an even higher degree of structural regularity within Khoisan will come to light if the recognition of consonant clusters is combined with another basic assumption regarding the phonological organization in these languages. This relates to the second typological anomaly of Khoisan sound systems mentioned above. Various scholars like Traill (*inter alia* 1997b: 104), Elderkin (1989: 37), and Snyman (forth.: 3, 10ff) have explicitly or implicitly observed striking parallels between the feature distinctions within egressive non-click consonants on the one hand and ingressive clicks on the other. Thus, it seems useful to start, as opposed to the traditional view, from the hypothesis that clicks and non-clicks need not be dealt with in two independent systems. Once the basic difference between these two consonant types has been determined, it is important to recognize that ingressive clicks behave systematically just like egressive stops (and nasals) and are highly integrated in the overall consonant systems of the relevant languages.

The main aim of this paper is to show that the above typological anomalies are indeed artifacts of the traditional phonological analyses of Khoisan languages. I will develop these ideas in Section 2 on the basis of the data on Eastern !Xõo (henceforth just !Xõo; !UI-TAA family, TAA branch) presented in Traill (1985). This is useful for several reasons. First, this work is

the most extensive study of the phonetic and phonological properties of a click language. Secondly, !Xõo has the most complex sound system known thus far. If one succeeds in discovering internal regularity in this system, it is reasonable to assume that similar, but more simple systems possibly conform to the principles established for the former. A general familiarity with the 1985-study and other works by Traill is indispensable to the understanding of the following discussion and it will be useful to have some supplementary reading there. I must and will continuously refer to his works, but cannot repeat in all detail the empirical facts and their interpretation provided there. Section 3 dealing with sufficiently known phoneme systems of languages of other Khoisan lineages attempts to demonstrate that these data are largely compatible with the findings of Section 2 for !Xõo. The languages are: ǂKhomani (!UI-TAA family, !UI branch), Ju|'hoan (JU family), G|ui (KHOE family, Kalahari branch), Kxoe (KHOE family, Kalahari branch), Standard Namibian Khoekhoe (KHOE family, Khoekhoe branch), and Sandawe (isolate).[2] A summary of the results from a cross-Khoisan perspective and some typological considerations of my analysis will be given in Section 4.

2 Language and group names are those officially recognized or used in recent specialist publications. A few orthographic changes are as follows: tone marks are omitted; voicing and nasalization of clicks are symbolized before the click (see Section 2.2 for the motivation of this convention); double vowels are consistently written with vowel symbols, thus 'ui' and 'oe' instead of 'wi' and 'we' respectively.

2 The consonant system of !Xõo (!UI-TAA)

In order to show that ingressive click consonants are not peculiar systematically vis-à-vis other consonants, the internal relations of the latter serve as the starting point of the discussion. After outlining the important systematic relations among egressives, I will then try to show that the features found there also have a match in ingressive distinctions. This will finally lead to the attempt to present all !Xõo consonants in one integrated system.

2.1 The system of egressive consonants (non-clicks)

Table 1 is a version of the egressive chart by Traill (1985: 151) and highlights the relations among consonant subsets thought to be important for an assessment of the whole picture.

	Lb	Al	Al-Af	Vl	Uv	Gl
Non-nasal sonorants						
Plain		(l)				
Fricatives						
Plain	(f)	s		x		h
Simple stops						
Plain	(p)	t	ts	k	q	'
Voiced	b	d	dz	g	(N)G	
Complex stops = simple stops + coarticulation gesture						
Plain + Gl (ejective)		(t')	ts'	kx'/(k')	(q')	
Voiced + Gl (ejective)			dts'	gkx'		
Plain + As	(ph)	th	tsh	kh	qh	
Voiced + As		dth	dtsh	gkh	Gqh	
Stop clusters = simple stops + egressive consonant						
Plain + /x/		tx	tsx			
Voiced + /x/		dtx	dtsx			
Plain + /kx'/	p'kx'	t'kx'	ts'kx'			
Voiced + /kx'/		dt'kx'	dts'kx'			
Simple nasals						
Plain	m	n				
Complex nasals = simple nasals + coarticulation gesture						
Plain + Gl	'm	'n				

Table 1: System of egressive consonants in !Xõo (after Traill 1985: 151)[3]

3 I have added some consonants not listed in Traill's 1985-chart which are marginal, but still distinctive according to Traill (1994a). They are [f], [h], [t'], [k'], [gkh], [Gqh], and [p'kx']. The segment [dts'] does not

A first observation is that stop consonants[4] are the backbone of the egressive system in terms of both number of basic segments and possible phonetic elaboration thereof as the inventory size of stops is almost four times larger than that of all other types together. Accordingly, non-nasal sonorants and fricatives are marginal to most of the following discussion.

Regarding the internal classification of stops, I distinguish three types of segment called here *simple*, *complex* and *cluster*. Before this is explained in more detail, another contrast should be recognized first, namely the feature ±*voice*. It is the most important one because it pervades all the three stop types above. The voiced member of a pair is viewed conventionally and also here as the marked one.

Voiceless consonants lacking any kind of phonetic elaboration, namely /p/, /t/, /ts/, /k/, /q/, /ʔ/, constitute the most basic stop type to which I will give the label *plain*. I combine a plain segment and its counterpart on the voice dimension under the umbrella category *simple* consonant. For example, /p/ and /b/ are the two simple labial stops.

There are two types of stop elaborated by crosslinguistically frequent coarticulations: aspirates and ejectives. The latter are simply viewed here as phonologically glottalized, the motivation of which will become clearer later on. Aspirates and ejectives are subsumed under the second class of *complex* consonants.

Finally, two stop types are considered to be consonant *clusters* in line with Traill (1985: 209). A cluster is a sequence of two consonantal constituents having phoneme status as independent segments which join together in one, more elaborate segment. Clusters stand in a paradigmatic relationship to simple and complex segments and thus serve to distinguish lexical meaning. In the following, I will call the first initial constituent of a cluster the *onset* and the second final one the *offset*. Onsets in the domain of egressives are the anterior stops /p/, /t/, and /ts/. Offsets, which are parallel to elaborating coarticulation gestures, are two posterior obstruents, namely the fricative [x] and the ejective [kx']. The glottalization of the onsets in the second cluster context is a phonetic detail without a consequence for the phonological analysis.

Already Traill considered the systematic place of all affricate stops to be the same as that of plosive stops due to their distributional characteristics. This means that affricates in !Xõo are

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appear in Traill (1994a). Brackets symbolize a marginal status of a consonant which is explained in more detail in Traill (1985: 151f). See also the explanations on the representation of sounds on page 2.

4 The term *stop* will be used throughout the paper as a cover term for plosives and affricates.

not secondary, elaborated variants of plosives along the vertical dimension. Instead, they can be aligned systematically with places of articulation on the horizontal dimension. The velar ejective [kx'] is viewed as the glottalized counterpart of the velar plosive. In other words, it is phonologically /k'/ with the additional phonetic detail of weakening the plosive to an affricate - a feature found also in other Khoisan languages.[5] My treatment of the set of consonants called here *alveolar affricate* (Al-Af) is justified by the fact that their internal distinctions are parallel to those found with plosives, especially alveolar ones. Traill recognized this and called these segments *postdental*, thus assigning them terminologically to a separate place of articulation. This keeps his analysis in line with the traditional approach: consonant classes distinguished on the horizontal dimension, which are subject to different manners of articulation and further phonetic elaboration like voicing, aspiration etc. on the vertical dimension, are defined exclusively by place-of-articulation features. That this solution does not appear to be the most plausible one for Khoisan languages in general will receive more support when clicks are included in the discussion. Suffice it to say here that abandoning this traditional approach allows one to describe segments like /ts/, /dz/ etc. conventionally as alveolar affricates. This provides in turn a natural explanation for the consistent gap in this position for fricatives and all types of sonorants: their feature specifications are incompatible with a feature +*stop* in alveolar (and other) affricates.

With regard to nasal consonants, it is important to recognize that it is the voiced variety that is unmarked and thus associated here with the concept of a *plain* segment. Within the subsystem of egressives, this is unproblematic because a marked counterpart does not exist. However, as will be seen below, this is not the case with ingressive clicks. Nasals are the only other egressive consonant type that may cooccur with an additional phonetic gesture: they show a distinction between a *simple* and a *complex*, i.e. glottalized, set. This is viewed as a systematic parallel to the distinction between simple stops and complex ejectives.

5 Traill (1994) also reports a phonetically ejected velar *plosive* [k']. As the latter has only one attestation in the lexicon, it is hard to say whether this is enough evidence for a *phonological* distinction between an affricate /kx'/ and a plosive /k'/. For !Xõo, I will use below the notation /k'/~/kx'/ when referring to the velar ejective as a cluster offset. For those languages that clearly have only one type of velar ejective this is not necessary and my phonological notation /k'/ may correspond to the symbol [kx'] in the respective source reference, if this segment is phonetically affricate.

2.2 The system of ingressive consonants (clicks)

I will now try to match the distinctions found in egressive non-clicks with the features attested for ingressive clicks. For a better orientation, Table 2 presents the accompaniments of clicks and their feature classification in !Xõo as given by Traill (1985: 206, Figure 7a). The numbers at the top of Table 2 correspond to those used in Traill's discussion (cf. ibid.: 124, Figure 14).

	1	2	3	4	5	6	7	8	12	9	11	10	13	15	14	16
Feature	!	!g	!n	!n	!n̥	!q	N!G	!qh	!h	!x	!kx'	!q'	!'	g!h	g!x	g!kx'
Uvular	-	-	-	-	-	+	+	+	-	+	+	+	-	-	+	+
Friction	- -	- -	- -	- -	- -	- -	- -	- -	- -	- +	- +	- -	- -	- -	- +	- +
Voice	-	+	+	+	-	-	+	-	-	-	-	-	-	+	+	+
Aspirated	-	-	-	-	-	-	-	+	+	-	-	-	-	+	-	-
Glottal	-	-	-	+	-	-	-	-	-	-	+	+	+	-	-	+
Ejected	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	+
Nasal	-	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-

Table 2: List and feature classification of clicks in !Xõo (Traill 1985: 206)

In discussing the cluster analysis, Traill (1985: 208) already determined those clicks which have to be analyzed as phonological units under any approach, namely the clicks 1, 2, and 3. Within this set of *simple* clicks one can distinguish between an unmarked and two marked segments. The former, i.e. the voiceless click 1 [!], is the ingressive counterpart of my egressive consonant class *simple plain stops* in 2.1. The voiced click 2 [!g] patterns in a parallel fashion with *simple voiced stops*. Before the systematic status of the nasal click 3 [!n] is dealt with, I will give first a complete treatment of phonologically non-nasal clicks.

The two marked and phonologically relevant features pertaining to the three simple clicks, i.e. voicing and nasalization, have an important characteristic in common vis-à-vis the rest of click accompaniments: they are the only ones that have their phonetic onset *before* the articulation of the click.[6] Such a timing characteristic is intuitively compatible with further

6 Clicks may by phonetically nasalized without any systematic consequences (see below). This has to be kept apart from nasalization as a *phonological* phenomenon. The different phonetic and systematic status of voicing and nasalization of clicks vis-à-vis other accompaniments is also a sound basis for resolving the long-standing problem of representing these features graphically. Writing them before the click, that is, /g!/ and /n!/, which *inter alia* Snyman has repeatedly argued for, is clearly preferable in the light of the above considerations. Accordingly, this solution is applied in my notation.

phonetic elaboration in the form of accompaniments setting in *after* the click articulation. The voicing contrast (achieved by so-called *voice-lead*) is indeed so fundamental in !Xõo that it crosscuts the whole range of click accompaniments. Six ingressive *pairs* are established in Traill's analysis on this dimension. In his numbering they are: the simple oral click pair 1-2, the simple nasal click pair 3-5, and four pairs involving a click-final accompaniment, i.e. 9-14, 11-16, 12-15, and 6-7. A seventh pair is constituted by accompaniment 8 and a voiced click that was only later discovered as the seventeenth accompaniment of !Xõo and symbolized in Traill (1994a) as [G!qh]. The short descriptions and symbols for this and accompaniment 15 in Traill (1994a: 37), which are given in Table 3 below, may appear confusing, but the above pairing on the voice dimension of 12-15 and 8-17 is appropriate according to Traill (p.c.).

Having identified the simple consonants in both the egressive and ingressive system, it is necessary to establish the ingressive counterparts of the two *complex* egressive stop types of Table 1, namely the ejectives and aspirates. The best candidate from the remaining click accompaniments for being the click counterpart of ejectives can be identified in accompaniment 13 [!']. These two associated stop types can be viewed as being both elaborated by the feature *glottalization*. As opposed to egressive ejectives, voiced counterparts do not exist for ingressive clicks.

For aspirated egressives there is more than one plausible match in the ingressive system, viz. the pair 12-15 and the pair 8-17. This reflects the notorious distinction in South African Khoisan between two types of aspirated clicks. For a solution of this problem, I can again refer to Traill's work dealing with this issue in both !Xõo (Traill 1991) and Ju varieties (Traill 1992). There, he offers an adequate picture of internal systematicity of these clicks and also provides the basis for reconciling the problem with the present cluster framework.

Accompaniment 12 [!h] (the type called by Doke *aspiration with inaudible release of the velar closure* and by Snyman *delayed aspiration*) and its voiced counterpart 15 [g!h] are here aligned with the series of *complex aspirated* egressives. The frequently attested nasalization of these click types is shown by Traill to be a systematically irrelevant phonetic detail. Already Traill (1985: 206, cf. Table 2 above) has them with the feature *-nasal*. This is supported again in the discussion of accompaniment 12 by Traill (1991: 17), where he shows that the observed nasal flow is phonetically very distinct from a conventional realization in genuinely nasal clicks. The *inaudible release of the velar closure* identified by Doke is parallel to the lack of prominence of the secondary closure with all simple clicks (Traill 1985: 125f). These lack in

my analysis elaborations with a feature +*stop*. Accordingly, delayed aspiration merely reflects a complex segment *simple click stop* + *aspiration* which is systematically parallel to egressives like /ph/, /th/, /kh/, etc. (cf. also the short discussion of the situation in Ju|'hoan in 3.2 below).

The other aspirated click pair 8-17, [!qh] and [G!qh] with an *audible* posterior closure is viewed as a consonant cluster *simple click stop* + *posterior aspirated stop*. This breaks with the traditional analysis of identifying them with the 'normal' aspirated click type and delayed aspiration as another, somewhat deviant version of aspirated clicks. Nevertheless, it can reconcile phonetic facts with phonological interpretation because the audible posterior closure can be ascribed in a straightforward way to the cluster offset, the posterior stop /kh/~/qh/.

In discussing the clicks with a feature *aspiration* and characterizing the pair 8-17 as clusters, I have entered the domain of the third class of stop consonants. The remaining cases are far less problematic than the former. Recall that a necessary condition for analyzing a segment as a cluster is that the two alleged constituents, i.e. onset and offset, should exist as independent phonemes. This is indeed valid for the former and all following cases. The two cluster offsets already observed in egressives also show up in ingressives: pair 9-14, [!x] and [g!x], is the cluster type *simple click stop* + *posterior fricative* /x/ and pair 11-16, [!kx'] and [g!kx'], is the cluster type *simple click stop* + *velar ejective* /k'/~/kx'/. Two further accompaniments can be analyzed as follows: pair 6-7, [!q] and [N!G], is a cluster type *simple click stop* + *uvular stop* /q/;[7] the single accompaniment 10 [!q'] is a cluster type *simple click stop* + *uvular ejective* /q'/.

I have deliberately postponed the discussion of the three nasal clicks (accompaniments 3, 4, and 5), because they represent in various respects a special case within the hypothesis on egressive-ingressive integration. Recall first that one is confronted again with the markedness reversal as discussed already in 2.1 above in connection with egressive nasals: as voiceless nasals are both in !Xõo and crosslinguistically more marked than voiced ones, the voiced accompaniment 3 is viewed here as the *plain* nasal click and the voiceless accompaniment 5 as its marked counterpart on this dimension. More important and problematic, however, is another point. In traditional approaches, nasal clicks are treated as stops with nasality being an accompanying feature. Trying to find egressive correlates under such an interpretation is

7 Again, nasalization in the voiced accompaniment 7 is according to Traill (1985: 130f) a phonetic detail which can already be observed with the voiced uvular stop as an independent segment (cf. [(N)G] in Table 1).

fruitless because parallel segments like prenasalized stops do not exist in !Xõo.[8] However, if one is prepared to abandon the traditional view on nasal clicks under the assumption that egressives and ingressives are highly integrated phonologically, there exist egressives with a nasal feature that are good systematic matches of nasal ingressives. That is, if clicks with a phonological feature *nasalization* are viewed as basically *ingressive nasals*, the voiced nasal click 3 [!n] goes with the plain egressives /m/, /n/ and accompaniment 4 ['!n] can be related to the preglottalized egressive counterparts /'m/, /'n/. The parallel in the latter set not only exists in the type of the additional feature, but also in its timing characteristic: glottalization is realized phonetically before the nasal gesture in both the egressive and ingressive consonants. This also resolves one complication of the cluster analysis as mentioned by Traill (1985: 210): the pre-glottalized nasal clicks aligned to the glottalized nasal egressives are in my terms complex consonants and not clusters. It appears that clusters do not exist in the domain of nasal consonants, be they egressive or ingressive.

The voiceless nasal click accompaniment 5 [!n̥] is somewhat special because it is the only non-cluster click that lacks an egressive counterpart. While this could be taken as weakening the integration hypothesis, there are a couple of qualifications to be made. First, stems with this accompaniment are relatively rare in the !Xõo lexicon. More important, however, is that all of them show a pharyngeal or glottal feature in the following vowel. Although the voice distinction with nasal clicks is not an allophonic variation according to Traill (p.c.), it is conceivable that the emergence of a marked voiceless counterpart is a later development in !Xõo which is possibly related to the specific phonetic character of the marked stem vowels.

In general, I do not view the nasalization of the clicks 3, 4, and 5 as an elaborating accompaniment but rather as their phonological basis. To speak with Traill (1985: 135), their click component is conceived of as "a click superimposed at the end" of a nasal. To put it differently, these ingressives belong systematically to the class of *nasal* and not *stop* consonants. This also supports an idea adduced to in 2.1 above with respect to the basic four-way distinction of !Xõo consonant types on the vertical dimension relating to the manner of articulation: only stops and - to a much lesser extent - nasals (in this extended perception), but not fricatives and non-nasal sonorants, allow further phonetic elaboration.

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8 I do not agree with Traill (1980: 182) stating, though admittedly from a cross-Khoisan viewpoint, that "In a phonological sense ... !Xóõ [and other languages'] nasal clicks are identical to the pre-nasalized stops."

No.	Description by Traill (1994a: 36ff)	Symbol in Traill (1985)	Symbol in Traill (1994a)	Alternative symbol	Description under cluster analysis
Simple stops = basic non-nasal clicks					
1	Basic	!	!	!	Plain
2	Voiced	!g	!g	g!	Voiced
Complex stops = basic non-nasal clicks + coarticulation gesture					
13	Glottal stop	!'	!'	!'	Plain + Gl
12	Delayed aspiration	!h	!h	!h	Plain + As
15	Voiced+aspirated stop	g!h	g!qh	g!h	Voiced + As
Stop clusters = basic non-nasal clicks + egressive consonant					
9	Voiceless+velar fricative	!x	!x	!x	Plain + /x/
14	Voiced+velar fricative	g!x	g!x	g!x	Voiced + /x/
11	Voiceless+velar ejective	!kx'	!kx'	!kx'	Plain + /k'/~/kx'/
16	Voiced+velar ejective	g!kx'	g!kx'	g!kx'	Voiced + /k'/~/kx'/
8	Aspirated stop	!qh	!qh	!kh~!qh	Plain + /kh/~/qh/
17	Voiced+uvular asp. stop	-	G!qh	g!kh~g!qh	Voiced + /kh/~/qh/
6	Voiceless+uvular stop	!q	!q	!q	Plain + /q/
7	Voiced+uvular stop	N!G	!G	g!q	Voiced + /q/
10	Uvular ejective	!q'	!q'	!q'	Plain + /q'/
Simple nasals = basic nasal clicks					
3	Voiced nasal	!n	!n	n!	Plain
5	Voiceless nasal	!n̥	!n̥	nh!	Voiceless
Complex nasals = basic nasal clicks + coarticulation gesture					
4	Pre-glottalized nasal	!'n	!'n	'n!	Plain + Gl

Table 3: System of ingressive consonants in !Xõo (after Traill 1985: 124, 1994: 36ff)

Table 3 presents the complete set of 17 accompaniments found in !Xõo in terms of the above cluster analysis. They are ordered parallel to the classification of egressives given in 2.1. My phonological description in the rightmost column facilitates the comparison with Table 1. All in all, the hypothesis that egressives and ingressives do not behave differently from a systematic viewpoint holds up. All phonetic elaborations identified for egressives are also found with ingressives. They are: *+voice*, *+glottalization*, *+aspiration*, *+cluster offset* /x/, *+cluster offset* /k'/~/kx'/. The major 'peculiarity' of ingressives is that they allow more variety in the range of cluster offsets and thus are somehow 'better' cluster onsets: they additionally show /kh/~/qh/, /q/, and /q'/. However, this is not a difference in principle, but rather one in degree.

It is important to notice that what is commonly subsumed under the term *accompaniment* (or *efflux*) are in fact degrees of click elaboration of a very unequal status regarding their complexity. Parallel to the above organization of egressive consonants, clicks defined by certain accompaniments are grouped within subsets and these subsets in turn build up an implicational hierarchy in the sense that one set can be viewed to be more basic than the other. The two most basic clicks are the plain ingressive stop 1 and the plain ingressive nasal 3. In fact, in the present analytical framework it is odd to speak here of *accompaniments*, because these clicks are not elaborated at all. Their counterparts on the voice dimension, i.e. 2 and 5, still belong to the subset of *simple* segments. The class of *complex* segments is achieved by elaborating simple clicks with the two gestures of glottalization (13) and aspiration (12 and 15). All the rest of the click accompaniments are assigned to the last subset of *cluster* segments where the elaborating coarticulation is a posterior consonant.

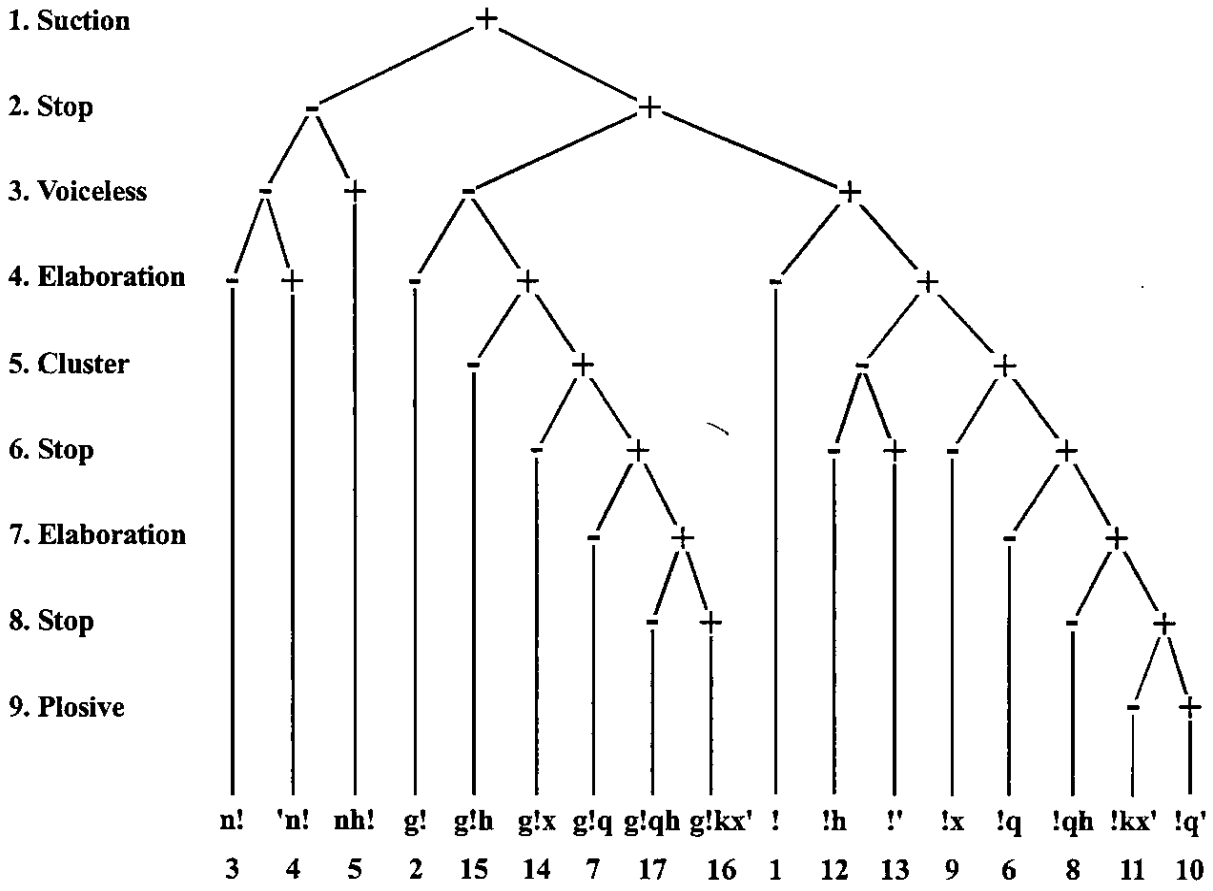

Figure 1: Hierarchical feature diagram of click elaboration in !Xõo

When relating my above classification of segments to Traill's (1979, 1985: 164ff) discussion of consonant *strength* in Khoisan, the enormous range of phonetic elaboration of stops and nasals can be explained in functional terms. For this aim, I give in Figure 1 a hierarchical tree diagram of phonologically intended features of consonant elaboration for the full series of click accompaniments.[9] The left row of positive features are crucial for an understanding of the logic behind the figure. Their common denominator is that they can all be viewed as cumulatively enhancing the strength of clicks, which are as such already phonetically strong. This relates directly to Traill's observation that initial strong consonants are of particular importance for the phonological design of !Xõo and other Khoisan languages and the fact that clicks are confined to the first consonant position of stems.

The first feature *+suction* in Figure 1 captures the fundamental distinction between clicks and non-clicks. Thus, the diagram ignores the possibility of integrating the elaboration of ingressives with the same phenomenon observed with egressive stops and nasals. It takes segments with the basic feature *+suction* as the starting point of all further phonetic elaborations found in !Xõo. This is convenient for the present discussion of clicks, but may not be fully adequate in the integration approach. The next two features pertain to the distinctions within simple clicks. Feature 2 *+stop* refers to the distinction drawn above between click nasals and click stops. Feature 3 *+voiceless* derives the counterpart of a simple click on the voice dimension. Feature 4 *+elaboration* defines the difference between simple clicks and all stronger elaborated clicks. From feature 5 downwards, distinctions only operate within the domain of complex clicks and click clusters. Whether an elaboration has the status of a coarticulation gesture (i.e. glottalization and aspiration) or of a cluster offset is determined by feature 5 *+cluster*. The possibility of re-appearing features is related to the hierarchical classification of accompaniments into subsets and their characterization. That a feature *+stop*, found already in 3, also occurs in 6 and 8 is due to the fact that this distinction exists *within* the set of elaboration gestures with both complex consonants and consonant clusters. Here, of course, the opposition does not exist between *+nasal* and *+stop* as in feature 3; instead the distinctions are between *fricative* /h/ and *plosive* /ˀ/ and between *fricative* /x/ and all other *stop* offsets. In a parallel fashion, the feature *+elaboration* can be used again in feature 7, because cluster offsets themselves can be simple or complex; compare, for example,

9 The symbols used for the clicks are now those proposed as alternatives in the second-last column of Table 3 in order to represent my phonological analysis more transparently.

/q/ vs. /q'/. The last feature 8 is tentatively set as *+plosive* in order to capture the difference in strength between an affricate and a plosive posterior ejective as cluster offset (see however below).

I have always put the positive strength feature at the right branch of a node. This results in a picture where the rightmost node of two parallel ones is consistently more diversified in terms of subsequent strengthening (e.g., there are more voiceless than voiced complex click stops or there are more click clusters with a stop offset than with a fricative offset). Put differently, it is always the stronger variant which is further elaborated toward a yet stronger consonant. The only counterexample is found with click nasals: voiced nasals, which are in my terms weaker, are more elaborated than the voiceless counterpart. However, this can be ascribed to a cross-Khoisan tendency of restricting glottalized segments to their plain series. This is the voiced one for nasals due to the markedness reversal briefly discussed above.

Considering always the stronger feature as positively marked leads to a peculiar order of clicks. This might give the impression that a parallel hierarchy of general markedness and some kind of derivation, for example, of a voiceless from a voiced click or of a click stop from a click nasal is implied. This is not intended, though. It is clear that , for example, voiceless and oral clicks are more basic than their voiced and nasal counterparts. This becomes apparent from the hierarchy established by frequency counts in the phonological inventory and the lexicon: it is *voiceless* > *voiced* and *oral* > *nasal*. The order of clicks in the above diagram just results from the fact that markedness there is exclusively defined in terms of consonant strength. This will sometimes run parallel to canonical markedness and sometimes not. The principle of hierarchizing features, their particular ordering, and thus the resulting tree diagram as a whole may appear arbitrary and, indeed, I still view this only as a first tentative solution. I should point out, though, that the principal approach is not only supported by evidence drawn from a cross-Khoisan comparison of ingressive inventories, but that it has also advantages for the analysis of !Xõo as an individual click language.

When comparing Traill's feature specification of ingressive consonants in Table 2 with mine in Figure 1, a major difference emerges. The number of features is identical (both analyses have nine including the feature *+suction*; Traill's feature *friction* with a timing subspecification in fact contains two features). However, in the hierarchically structured diagram of Figure 1, only a subset of these features is actually needed for specifying the majority of individual click types. The four simple clicks, for example, only need the first four

features. In fact, only the two voiceless clicks with ejective cluster offsets require all nine features. Furthermore, all kinds of further click elaboration after applying the feature *+cluster* can in principle be derived from a parallel diagram found in the egressive system and thus need not be stated independently.

Also, seemingly contradictory phonetic facts in the domain of stop clusters can be better reconciled with some of my phonological specifications. Recall that there are cluster offsets, i.e. /x/ and /k'/~/kx'/, that must be related in a narrow phonological description to *velar* egressives; yet the phonetic realization of offsets is shown by Traill (1985: 125, 135, 139, 141) to be *uvular* throughout. The above diagram can partly resolve this problem. In fact, no click emerges there as *-uvular* or *+velar* by way of feature specification.[10] That is, the features in the diagram do not determine the particular offset in terms of place-of-articulation features. Instead, one can define a cluster in !Xõo in a more neutral fashion as *onset + posterior egressive* as I have done above. This broader phonological specification can be associated on the phonetic side with a velar or a uvular position depending on the range of the egressive inventory. The tendency to prefer the uvular position in the actual realization of an offset is an interesting problem in its own right which would have to be explained outside the phonological argumentation.

However, this view must face in one case the problem that an offset specification is not the same as the differentiation between egressive consonant units. The distinction of *affricate* /kx'/ vs. *plosive* /k'/ and /q'/ chosen as the last feature in Figure 1 is at best a minor one in egressive ejectives; the important distinction is certainly *velar* /k'/~/kx'/ vs. *uvular* /q'/. Thus, one would have to state that *friction* with egressive ejectives, which is phonologically very marginal in velar consonant units, is exploited as a distinctive feature in cluster offsets. The above problem would cease to exist if one was using the distinction *velar* vs. *uvular* as the defining criterion of feature 9. Then, however, one would have to explain the explicit contradiction between the phonological feature *-uvular* and the observed phonetic property *+uvular* for the cluster offset /k'/~/kx'/. The problem will not find a solution here (see below for related questions in other languages).

10 The fact that the choice is only between two types of offsets, i.e. in velar or uvular position, reflects a constraint on cluster formation to be discussed in 2.3 below.

2.3 The integration of egressive and ingressive consonants

It will have been noticed that the above discussion concentrated on the parallelism between egressive and ingressive consonants on the vertical subdimension which is relevant for stops and nasals and called here *phonetic elaboration*. This phenomenon, so highly integrated for clicks and non-clicks, can be considered to serve the phonetic strengthening of and the proliferation of distinctions in the first consonant position of stems. This provides evidence for the hypothesis that clicks are at least from a systematic viewpoint not at all peculiar and can well be treated within one unitary system of consonants. Before presenting such an integrated consonant chart the internal consistency of the horizontal dimension and some details of the encountered clusters will be addressed.

The internal systematic relations of !Xõo consonants demonstrated in 2.1 and 2.2 strongly motivate a systematic alignment of fairly diverse segments. They are: a) those defined by place-of-articulation features like labial, alveolar etc.; b) the alveolar-affricate segment type; and c) the five click types. An important consequence of this line of reasoning is a horizontal feature dimension which is no longer sufficiently divided up by the traditional criterion *place of articulation*, because affricates and clicks are sounds not exhaustively defined in such terms. One would need at least the two features ±*friction* and ±*suction* in order to specify the segment types not sufficiently defined by conventional place-of-articulation features. However unusual this approach may appear, it is not only corroborated by the apparent uniformity of all the above consonant types in terms of their further phonetic elaboration on the vertical dimension, but also by the fact that it yields a natural explanation for structural gaps in the overall inventory. The observation that there are no fricatives and non-nasal sonorants in the columns for clicks and affricates can be motivated by apparently contradictory feature specifications, because the former are inherently -*stop* and the latter +*stop*. An important question to be answered in the future is how such additional features as +*friction* for alveolar egressive stops and some clicks and +*suction* for all clicks can be integrated in a dimension designed conventionally by the various places of articulation.

The following remarks concern the internal consistency of cluster segments. A first, minor observation is that the voice contrast is not available in the offset independently from the onset. That is, there cannot be conflicting voice values between onset and offset in a phonological sense. The best explanation for this situation seems to be that voicing operates over a fully elaborated segment, which seems compatible with Traill's concept of voice-lead.

More important are the specific place-of-articulation features of onset and offset in the clusters of !Xõo. Already Traill (1985: 210) observed "that the clusters are of a highly restricted type, with an anterior consonant followed by one articulated further back." I will not dwell on the typological significance of such a restriction, but discuss this characterization only vis-à-vis the nature of clicks. Recall that onsets encountered in the domain of egressives are alveolar plosive, alveolar affricate, and marginally, labial plosive, while the offsets are velar or uvular obstruents. Restricting oneself to the egressive domain, one could define a possible cluster in Traill's fashion as a sequence *simple anterior stop + posterior obstruent*, whereby posterior would mean a position from the velar place backwards.

Such a definition, however, becomes problematic when it is to be extended to ingressives. The consonant inventory shows that clicks can only occur as onsets, but never as offsets. In fact, as both the inventory and frequency of clusters tell us, clicks are the cluster onset par excellence. So the behavior of clicks with respect to cluster formation appears to be straightforward. However, the problem for specifying cluster onset and offset becomes more complex. This is due to the phonetic description of a click in general and its suction mechanism in particular. A click is viewed by almost all scholars as involving two different closures, one at an anterior position and a secondary at the velum.[11] It is the latter posterior closure that presents a problem for the above characterization of onsets as *+anterior* as it poses the question as to whether a *phonetic* feature of a segment type is also relevant for its *systematic* behavior. How does this closure relate to the click's being *the* cluster onset, but an impossible offset? If it is relevant for the behavior of a click as a cluster constituent, that is, a click is *+velar* and hence *+posterior*, it should be a prototypical offset rather than a prototypical onset.

Several solutions to this problem come to mind. Assuming the relevance of this velar closure would demand a different definition for a possible cluster. One first of all needs to circumvent the requirement *+anterior* for click onsets, for example, in a specification relating first to the egressive-ingressive distinction and only then (for the subset of egressive onsets) to the place of articulation. This would enable clicks to be onsets irrespective of their place-of-articulation feature. On the other hand, a feature *-suction* would have to be stated for offsets in order to rule out that the then posterior clicks can occur as second cluster constituents. The more complex definition of a possible cluster would then run as follows:

11 Sands et al. (1996: 180f) report for Hadza - the second East African language commonly classified as Khoisan - that the position of the secondary closure can extend further backwards.

Cluster onset	+	**Cluster offset (and elaboration gesture)**
+ *stop*		+ *obstruent*
+ *simple*		± *simple*
± *suction* [-*suction* >]		- *suction*
+ *anterior* (up to palatal place)		+ *posterior* (from velar place backwards)

A second possibility is a more precise qualification of the status of the secondary velar closure of ingressives. If it was possible to show that this closure is phonologically irrelevant or at least has a different status from that of velar egressives, clicks could be viewed as +*anterior* (the first closure of clicks is always located at an anterior place) and the first cluster definition, which is more elegant for both onset and offset, could be retained. For this purpose it is essential to compare the phonetic properties of clicks analyzed here as simple and complex segments with the characteristics of clicks that are viewed as clusters. For the former, that is, /!/, /!h/, and /!'/, Traill (1985: 125f, 135, 143) makes the observation that the velar closure is *silently released*. According to Ladefoged & Traill (1994: 53f, 57f) the lack of a salient velar closure is even possible with /!x/. In clusters with a stop offset, however, a posterior closure is *audible*. This phonetic indication conforms nicely with purely theoretical expectations of the cluster analysis. The prominence of a posterior closure reflected by its audibility can be attributed to the feature +*stop* of cluster offsets. The closure that is inherent to the suction mechanism, however, has an apparently different status, both phonetically and phonologically. This problem has also been addressed by Snyman (forth.: 3ff) who argues that "the back of the tongue may, on release of the posterior part of the circular closure, incidentally be responsible for the articulation of a barely audible, non-distinctive velar plosive." In the present phonological approach and given the above phonetic observation, such a view is indeed feasible for clicks that are not elaborated by a stop offset, namely simple and complex clicks as well as /!x/. However, it cannot be generalized for all click accompaniments. For the great majority of clusters, a posterior closure does exist phonetically and is explained phonologically by the cluster analysis.

Apart from the phonetic facts, the special status of the posterior click closure can also be discerned when its function is compared to the role played by the various places of articulation of egressives on the *anterior-posterior* dimension. These define systematic distinctions on the horizontal feature axis. As opposed to this, the posterior closure of a click does in no way contribute to the internal phonological differentiation among ingressive consonants. It is

certainly a prerequisite for achieving the suction mechanism, but distinctions between click influxes are accomplished by the variable position and type of movement of the *anterior* tongue body. Accordingly, the available evidence leads to the following preliminary conclusion regarding the character of a click as a cluster constituent: when compared to an egressive consonant like /k/, a velar feature of an ingressive click, even if relevant from a phonetic viewpoint, does not imply its phonological classification as +*posterior*.

There is yet another consideration: the place-of-articulation features of onset and offset need not be defined in absolute terms, independently from each other. The essential requirement is that the offset in any individual cluster is posterior vis-à-vis its respective onset. In this respect, it is significant that the actual realization of many offsets in !Xõo is regularly uvular. This place of articulation is posterior to all cluster onsets under any analysis. The problem certainly needs to be studied in more detail and I will not decide here which proposal is the most feasible.[12] It seems, however, that a complicated cluster definition recognizing the posterior click closure as phonologically relevant can be avoided.

12 That ingressives are placed on the horizontal axis of Table 4 before velar egressives is not intended as a specification +*anterior*. It only makes the fundamental observation graphically more visible that phonetic gestures serving the elaboration of simple consonants are all recruited from posterior places of articulation.

(43 + 83)	EGR Lb	EGR Al	EGR Al-Af	IGR Lt	IGR Dt	IGR Al	IGR Pl	IGR Lb	EGR Vl	EGR Uv	EGR Gl
Non-nasal sonorants (1)											
Plain		l									
Fricatives (4)											
Plain	f	s							x		h
Simple stops (11 + 10)											
Plain	p	t	ts	‖	|	!	ǂ	ʘ	k	q	'
Voiced	b	d	dz	‖g	|g	!g	ǂg	ʘg	g	G	
Complex stops (14 + 15)											
Plain + Gl		t'	ts'	‖'	|'	!'	ǂ'	ʘ'	kx'/k'	q'	
Voiced + Gl									gkx'		
Plain + As	ph	th	tsh	‖h	|h	!h	ǂh	ʘh	kh	qh	
Voiced + As		dth	dtsh	g‖qh	g|qh	g!qh	gǂqh	gʘqh	gkh	Gqh	
Stop clusters (9 + 43)											
Plain + /x/		tx	tshx	‖x	|x	!x	ǂx	ʘx			
Voiced + /x/		dtx	dtshx	g‖x	g|x	g!x	gǂx	gʘx			
Plain + /k'/~/kx'/	p'kx'	t'kx'	ts'kx'	‖kx'	|kx'	!kx'	ǂkx'	ʘkx'			
Voiced + /k'/~/kx'/		dt'kx'	dts'kx'	g‖kx'	g|kx'	g!kx'	gǂkx'	gʘkx'			
Plain + /kh/~/qh/				‖qh	|qh	!qh	ǂqh	ʘqh			
Voiced + /kh/~/qh/				G‖qh	G|qh	G!qh					
Plain + /q/				‖q	|q	!q	ǂq	ʘq			
Voiced + /q/				‖G	|G	!G	ǂG	ʘG			
Plain + /q'/				‖q'	|q'	!q'	ǂq'	ʘq'			
Simple nasals (2 + 10)											
Plain	m	n		‖n	|n	!n	ǂn	ʘn			
Voiceless				‖n̥	|n̥	!n̥	ǂn̥	ʘn̥			
Complex nasals (2 + 5)											
Plain + Gl	'm	'n		'‖n	'|n	'!n	'ǂn	'ʘn			

Table 4: Integrated consonant system of !Xõo[13]

13 In this and all following phoneme charts, the sum of segments for a consonant subclass is given behind its label; if applicable, first the number of egressives, then the number of ingressives. The entire inventory appears at the top left of a table. Cluster offsets are indicated by frames. Their number corresponds to the number of lines in the subdomain of clusters. Combining velar and uvular consonant in one frame refers to the possible underspecification of an offset regarding its place of articulation as discussed in 2.2.

That the placement of clicks on the horizontal dimension cannot yet be handled in a more conclusive way is not least due to a more recent perspective on this consonant type. It is apparent at the conventional labels of the different clicks that place-of-articulation features traditionally have always played a prominent role in their description. However, the situation is much more complex than these labels make one believe. Traill (1994b, 1995b) and Ladefoged & Traill (1994) discussed this problem extensively. One interesting observation is that clicks do associate themselves with conventional places of articulation, however, not in any straightforward way through their commonly recognized articulatory features, but instead on account of their *acoustic* properties. Considering this kind of evidence, the resulting consonant classification for !Xõo is according to Traill (1995b: 127) as follows:

bilabial (p) - dentopalatal (|, t, ǂ, tʃ) - velar (!, ||, k) - uvular (q)

This classification raises many new and challenging questions which cannot be pursued here. One of Traill's subsequent observations should, however, be mentioned in this context:

> "The most startling aspect of this grouping from the articulatory perspective is the separation of the coronal sounds [|, ||, !, ǂ] into one class that is strictly coronal and another that is velar; but, as we have attempted to show, the articulation features obscure the linguistic patterns."

By warning us against an exclusive assessment of clicks in terms of articulatory parameters, this approach brings us closer to more conclusive answers to some of the questions addressed above and the possibility of further integrating egressive and ingressive consonants on the horizontal dimension, which must still be treated in this paper in an ad-hoc fashion.

3 The consonant systems of other Khoisan languages

I now try to demonstrate that the above analysis of the consonantal phoneme system of !Xõo can be applied to Khoisan languages of other genetic lineages. Such an assumption is in principle reasonable insofar as these languages have already been shown to share surprising details in their overall phonetic and phonological design like, for example, their phonotactic restrictions in stem formation.

Admittedly, one major problem in the following discussion arises from the fact that phonetic data on other languages are often not available or at least not laid out as extensively as for !Xõo. However, the establishment of systematic associations between certain consonants or consonant types must have a foundation in the language-specific phonetic facts. Without their availability one can only make such phonological alignments by taking recourse to typologically informed regularity, which makes the argument partly circular. This is of course not a new problem in the study of these languages. Nevertheless, earlier comparisons have never questioned the possibility of, for example, subsuming click accompaniments of two different languages under an abstract category. Future research must show in every particular case whether my systematic interpretations are corroborated or falsified by more reliable phonetic evidence. The following sections deal with representatives of all remaining families of South African Khoisan (!Ui, Ju and Khoe) and with Sandawe of East Africa.

3.1 ǂKhomani (!Ui-Taa)

It is difficult to find a language from the !Ui subbranch of !Ui-Taa which is suitable for this comparison. All attested varieties are poorly documented for modern linguistic standards. Phonetics and phonology in particular were still in their infancy as disciplines at the time when the data were recorded. Nobody could possibly think of the extreme sound complexity found in this area. One can be almost certain that in all earlier studies on click languages (with the exception of Beach (1938)) important phonetic and phonological details were missed.

This is also the case with the analysis of ǂKhomani by Doke (1937) - the only study dedicated exclusively to the phonetics and phonology of a !Ui variety. The sound system of this language will turn out to be dramatically smaller than that of !Xõo begging the question why this is so. On the one hand, it might simply reflect an older situation whereby !Ui as a branch always had a much simpler sound inventory. However, it is certainly suspicious that a geographically near and genetically related language like !Xõo has such a proliferation of

phonologically relevant distinctions. It is significant in this respect that earlier accounts of TAA and !UI varieties do not reveal any important differences in phonetic and phonological complexity and that it took Traill, who was equipped with sophisticated technical means and an advanced theoretical knowledge, more than a decade of intensive research to discover the extreme complexity of !Xõo. All this suggests that at least one other factor has contributed to the relative simplicity of the ǂKhomani system to be presented below, namely the short time Doke was exposed to the language and the limited amount of data he could possibly gather. The assumption that his phoneme inventory is incomplete will partly be corroborated below.

(23 + 41)	EGR Lb	EGR Al	EGR Pl	IGR Lt	IGR Dt	IGR Al	IGR Pl	IGR Lb	EGR Vl	EGR Gl
Non-nasal sonorants (3)										
Plain	w	ɾ	j							
Fricatives (3)										
Plain		s							x	h
Simple stops (8 + 10)										
Plain	(p)	t	c	ǁk	ǀk	!k	ǂk	ʘk	k	'
Voiced	b~ʊ		ɟ	ǁg	ǀg	!g	ǂg	ʘg	g	
Complex stops (3 + 9)										
Plain + Gl		ts'		ǁ'	ǀ'	!'	ǂ'	ʘ'	kx'	? k'
Plain + As		th			? ǀʰ	? !ʰ	ǂʰ		? kh	
Voiced + As					? ǀɲɦ	!ŋɦ				
Stop clusters (2 + 14)										
Plain + /x/		tx	cx	ǁkx	ǀkx		ǂkx			
Plain + /kx'/				ǁkx'	ǀkx'	!kx'				
Plain + /k'/				ǁk'	ǀk'	!k'				
Plain + /kh/				ǁkh	ǀkh	!kh	ǂkh	ʘkh		
Simple nasals (4 + 5)										
Plain	m	n	ɲ	ǁŋ	ǀŋ	!ŋ	ǂŋ	ʘŋ	ŋ	
Complex nasals (0 + 3)										
Plain + Gl					ˈǀŋ	ˈ!ŋ	ˈǂŋ			

Table 5: Consonant system of ǂKhomani (after Doke 1937: 70, 78 and Traill 1997a: 7f)[14]

14 The symbols for the alveolar flap /ɾ/ and all additional phonemes as discussed in the text are mine.

The consonant chart in Table 5 differs in some respects from Doke's account and the establishment and phonological interpretation of some consonants must certainly remain questionable. Note first that the information in Doke's text occasionally contradicts his click chart (ibid.: 78). For the two last effluxes of his chart one finds in the text rather [|ŋfi], [!ŋfi] (cf. ibid.: 76, 84) and [|'h], [ǂ'h] (cf. ibid.: 79, 86). Table 5 gives all different segments; problematic ones are preceded by a question mark.

Traill (1997a: 7) proposes to add to Doke's consonant inventory the complex nasal click with glottalization /'n!/ and at least the alveolar aspirate stop /th/ on account of his own auditory analysis of recorded samples of ǂKhomani speech. Traill (ibid. and 1995a: 513ff) also re-classifies [|'h] and [ǂ'h], which are called by Doke (ibid.: 79) "ejective click followed by an aspiration", as merely aspirated clicks. All these analyses are incorporated in the above table.

Doke distinguishes in the click subsystem between two ejected accompaniments /k'/ and /kx'/, which would in my terms be viewed as a distinction between two clusters: one with a plosive and the other with an affricate ejective offset. Doke (ibid.: 72) does not consider this to be a "significant" distinction for egressive consonants. He also gives a click type to be analyzed here as a cluster with an aspirate offset /kh/, but fails to identify an aspirate velar egressive. The absence of /k'/ and /kh/ as single phonemes (in Table 5 they are preceded by a question mark) presents a problem for the cluster analysis because one would be confronted with clusters the offsets of which are not attested as consonant units. This cannot be resolved here.

Doke's clicks [|ŋfi] and [!ŋfi] pose another problem since they have no obvious counterparts in other languages and also have an unclear phonological status within ǂKhomani. I will give here two possible interpretations in line with the present analytic account, fully aware of the fact that these are highly speculative. Note first that there are only two attested lexemes and that both are said to involve nasalization of the click as well as an "increased breath-force" of the succeeding vowel (ibid.: 76). Thus, one possible assumption is that the breathiness is an exclusive feature of the vowel so that the click is a plain nasal ingressive.[15] An alternative analysis relates to the above observation that nasalization can be a phonetic detail of the

15 This hypothesis appears to be supported by the different auditory analyses and spellings of the verb 'speak a/own San language': [|nu] (Maingard 1937: 245), [ŋ|fiu] (Westphal 1971: 381), and [|ŋu^{h}:] (Traill 1974: 42). Available comparative data from other !Uǀ languages also corroborate this for one of Doke's two items: what he represents in the stem 'see' as [|ŋfi] is found elsewhere to be a plain nasal click /n|/.

complex aspirated click and, as will be shown in 3.2 below, can be particularly salient with the voiced counterpart. This consideration leads to the hypothesis that these two segments are voiced aspirated clicks /g!h/. Although I consider this second analysis to be less likely, it is reflected in Table 5 because it represents Doke's clicks as a potentially separate accompaniment.

However restricted the reliability of the data and their analysis are, the general picture can be interpreted in terms of the integrated analysis proposed in 2.3. The most important differences of ǂKhomani vis-à-vis !Xõo are as follows: it has only one clear series of voiced stops and lacks uvular segments and the click clusters which could result from such potential offsets.

3.2 Ju|'hoan (JU)

The analysis of the sound system of Ju|'hoan is based on empirical data that are qualitatively equivalent to those for !Xõo due to the extensive study by Snyman (1975) and various subsequent papers by the same author. My interpretation of these data is given in Table 6.

Apart from cluster analysis and egressive-ingressive integration, my phonological analysis of individual sounds is not very different from that by Snyman and Dickens. The major deviation lies in another interpretation of the four aspirated clicks found in this language, in particular the controversial relation between the two clicks symbolized as [!'h] and [n!h]. As experimental data presented in Traill (1992) show, both clicks are not only aspirated, but also nasalized. Their essential difference is that nasalization is voiceless in the click with *delayed aspiration* [!'h], while it is voiced and auditorily salient in the click [n!h]. These *auditory* facts lead Snyman (*inter alia* forth.: 13ff) to state that nasalization in the former is a coarticulatory gesture without a distinctive function but that it is phonologically relevant in the latter. This view, however, disrupts the convincingly established pairing of these two aspirated clicks on the voice dimension according to Traill (1992: 357f) and supported by Miller-Ockhuizen (p.c.).[16] Thus, although delayed aspiration in Ju|'hoan is phonetically slightly different from that in !Xõo, its phonological status appears to be identical. This fits in well with the present analysis according to which the click with delayed aspiration [!'h] and the audibly nasal click with aspiration [n!h] constitute the pair of complex segments *simple click stop* + *aspiration* /!h/ and /g!h/. The clicks which are orthographically symbolized in Ju|'hoan as [!h] and [g!h]

16 Miller-Ockhuizen states that [n!h], as opposed to the voiceless [!'h], causes a depressor effect lowering the pitch on the following vowel, which is a regular property of voiced consonants of this language.

and thus seem at first glance to be elaborated by plain aspiration turn out to be the cluster type *simple click stop + velar aspirated stop* - in my notation /!kh/ and /g!kh/. Snyman (forth.: 14) has recently coined the terms *weak* for delayed and *strong* for 'normal' aspiration with audible posterior closure. This reflects in fact the intuition that a complex stop which is merely aspirated should be 'weaker' than a cluster segment constituted by two stops.

(44 + 48)	**EGR** Lb	**EGR** Al	**EGR** Al-Af	**EGR** Pl	**IGR** Lt	**IGR** Dt	**IGR** Al	**IGR** Pl	**EGR** Vl	**EGR** Gl
Non-nasal sonorants (3)										
Plain	w	r		y						
Fricatives (8)										
Plain	(f)	s		c					x	h
Voiced	(v)	z		j						
Simple stops (9 + 8)										
Plain	p	t	ts	tc	ǁ	ǀ	ǃ	ǂ	k	
Voiced	b	d		(dj)	gǁ	gǀ	gǃ	gǂ	g	
Complex stops (15 + 12)										
Plain + Gl			tz	tj	ǁ'	ǀ'	ǃ'	ǂ'	kx	
Voiced + Gl			ds	dc						
Plain + As	ph	th	tsh	tch	ǁ'h	ǀ'h	ǃ'h	ǂ'h	kh	
Voiced + As	bh	dh	dsh	dch	nǁh	nǀh	nǃh	nǂh	gh	
Stop clusters (7 + 24)										
Plain + /x/		tx	tsx	tcx	ǁx	ǀx	ǃx	ǂx		
Voiced + /x/		dx	dzx	djx	gǁx	gǀx	gǃx	gǂx		
Plain + /k'/		tk			ǁk	ǀk	ǃk	ǂk		
Voiced + /k'/					gǁk	gǀk	gǃk	gǂk		
Plain + /kh/					ǁh	ǀh	ǃh	ǂh		
Voiced + /kh/					gǁh	gǀh	gǃh	gǂh		
Simple nasals (2 + 4)										
Plain	m	n			nǁ	nǀ	nǃ	nǂ		

Table 6: Consonant system of Ju|'hoan (after Dickens 1994: 9ff)[17]

17 The symbols in the table are those of the officially recognized Ju|'hoan orthography. Note that these were designed for practical purposes and do not always correspond to the phonological character of the respective speech sounds.

Traill (1992: 357) classifies the click pair of JU with delayed or weak aspiration as *+nasal* and uses this feature to distinguish it from the other pair with strong aspiration which is specified as *-nasal*. This is at variance with his characterization of delayed aspiration in !Xõo as *-nasal*. Within the present framework and in accordance with the discussion in 2.2 it is unnecessary to interpret nasalization in aspirated clicks as phonologically relevant; the distinction of two aspirated series is taken care of by the contrast between different types of posterior elaboration and the resulting consonant classes, that is, *complex* vs. *cluster* segments.

A remarkable detail in Ju|'hoan and a difference to !Xõo is the fact that the simple posterior stop, which is only available at the velar position, is not exploited as a cluster offset. Yet, a velar stop *is* an offset if it is itself elaborated by aspiration or glottalization. What causes a complex velar stop to be more suitable as a cluster offset than its simple counterpart? In future studies, this question should be investigated in relation to the tendency in !Xõo to avoid phonetically velar articulations in this context.

I have not given in Table 6 the existing syllabic nasals of Ju|'hoan because they appear to pattern in their range of distinctions with vowel segments. This is parallel to the treatment in Snyman (1975: 126ff).

Having made these amendments the Ju|'hoan system turns out to be highly comparable to the !Xõo one. This is even more significant in view of the fact that among all the languages considered here Ju|'hoan comes closest to the complexity of the latter language. The differences between the two do again not consist in the *kind* of internal systematic relations, but merely in the lack or addition of various distinctive features. Ju|'hoan has an additional palatal, but lacks a uvular place of articulation and the labial click series. Furthermore, clicks show a more restricted range of clusters, which is apparently related to the lower number of posterior stops as available cluster offsets.

3.3 G|ui (KHOE)

Nakagawa (1996a, b) provides sufficient information on G|ui so that this fairly complex KHOE language could be included in this comparison. The interpretation of the system under a cluster analysis is given in Table 7. I will only discuss briefly the most important phenomena which were not yet encountered, or only to a lesser extent, in the languages discussed above.

A general characteristic of KHOE languages is the very restricted range of voiced consonants: G|ui has only a voiced counterpart in simple stops and the click cluster with a stop offset /q/.

Also, almost all posterior stops are also distinctive as offsets in the domain of clusters, which accounts for the fact that G|ui has more accompaniments than Ju|'hoan despite its low number of voiced clicks. First, the velar and uvular places of articulation are not neutralized. Second, even the rare distinction in velar ejectives between an affricate /kx'/ and a plosive /k'/ is retained in clusters.[18] In fact, the only distinction in posterior egressives that is not exploited in the domain of cluster offsets is that between the velar and the uvular simple stop. Once more, this supports the idea that a simple velar stop /k/ is not a suitable offset.

(38 + 52)	EGR Lb	EGR Al	EGR Al-Af	EGR Pl	IGR Lt	IGR Dt	IGR Al	IGR Pl	EGR Vl	EGR Uv	EGR Gl
Non-nasal sonorants (3)											
Plain	w	r		y							
Fricatives (3)											
Plain		s								χ	h
Simple stops (13 + 8)											
Plain	p	t	ts	c	k‖	k|	k!	k‡	k	q	'
Voiced	b	d	dz	ɟ	g‖	g|	g!	g‡	g	G	
Complex stops (12 + 8)											
Plain + Gl		(t')	ts'	c'	ŋ̣‖'	ŋ̣|'	ŋ̣!'	ŋ̣‡'	kx' k'	q'	
Plain + As	ph	th	tsh	ch	ŋ̣‖h	ŋ̣|h	ŋ̣!h	ŋ̣‡h	kh	qh	
Stop clusters (4 + 32)											
Plain + /x/		tχ	tsχ		q‖χ	q|χ	q!χ	q‡χ			
Plain + /kx'/		tχ'	tsχ'		q‖χ'	q|χ'	q!χ'	q‡χ'			
Plain + /k'/					k‖'	k|'	k!'	k‡'			
Plain + /kh/					k‖h	k|h	k!h	k‡h			
Plain + /q/					q‖	q|	q!	q‡			
Voiced + /q/					G‖	G|	G!	G‡			
Plain + /qh/					q‖h	q|h	q!h	q‡h			
Plain + /q'/					q‖'	q|'	q!'	q‡'			
Simple nasals (3 + 4)											
Plain	m	n			ŋ‖	ŋ|	ŋ!	ŋ‡	(ŋ)		

Table 7: Consonant system of G|ui (after Nakagawa 1996a, b)

18 See Traill (1980: 183) for a possible scenario how a distinction between /kx'/ and /k'/ may have evolved.

A final point relates again to the status of nasalization in clicks: Nakagawa observes a nasal feature in three accompaniments. The click [ŋ!] does not pose any problem because its nasalization is clearly the phonologically distinctive characteristic of a plain nasal click. As opposed to this, the usually voiceless nasalization with the other two click types turns out to be a phonetic detail. The click [ŋ!'] is identified by Nakagawa as the familiar glottalized click and thus represents the ingressive counterpart of ejected egressive segments. The interpretation of the third nasal click which is aspirated and represented by the symbol [ŋ!h] is more complex. However, on account of its phonetic properties, Nakagawa (1996a: 44) explicitly regards it "as a variation of the 'delayed aspiration' accompaniment" of other well-described languages. Interestingly, he continues to show that the voiceless nasalization has an allophonic voiced realization. In fact, [ŋ!h] and [ŋ!ɦ] exist in free variation. Given the fact that voicing in KHOE in general and G|ui in particular is hardly distinctive, it is not too surprising that this is possible. In any case, for the present discussion it is important to note that the characteristics of this accompaniment establish quite clearly its association with conventional delayed aspiration or, in my terms, the complex aspirated click.

3.4 Kxoe (KHOE)

Kxoe, another KHOE language described by Köhler (1981: 486f), displays a more simple variant of the G|ui system. It has also very few voiced stops, has one less anterior place of articulation and only half as much cluster types. There are some other minor details to be mentioned.

First, the velar fricative /x/ is only inadvertently absent in Köhler's chart; it was also found by him to be a Kxoe phoneme. Moreover, according to Mathias Schladt (p.c.), the stop represented by Köhler as [kx] is in fact an aspirated velar plosive /kh/ with friction being a phonetic detail. In a parallel fashion, the ejectives symbolized as [ts'] and [kx'] are the glottalized counterparts of the alveo-palatal stop [tɕ] and the velar stop [k] respectively.

The status of the palatalized velars [ky], [gy], and [kxy] in Köhler's chart as phonemes or allophones does not become totally clear from his description. In any case, they can be related to the plain velars and I have omitted them from Table 8.

Another problem will not find a solution here. Köhler distinguishes between two types of nasalized clicks symbolized as [n̰] and [!̰]. Such a situation is also described by Voßen (1997)

for the KHOE family in general. Unfortunately, there is no phonetic information about the relevant Kxoe clicks or sufficient comparative data that would help to ascertain their relation to click accompaniments in KHOE languages whose sound systems are better understood. The analyses available to me, namely Beach (1938) for Khoekhoe, Kagaya (1978) for Naro, and Nakagawa (1996a, b) for G|ui, do not identify two distinctive nasal ingressives. Thus, any search for a conclusive systematic assignment of a second nasal click in Kxoe must remain mere speculation.

(33 + 36)	EGR Lb	EGR Al	EGR Al-Pl	IGR Lt	IGR Dt	IGR Al	IGR Pl	EGR Vl	EGR Uv	EGR Gl
Non-nasal sonorants (3)										
Plain	w	r~ɾ	y							
Fricatives (5)										
Plain	(f)	(s)	ç					x		h
Simple stops (10 + 7)										
Plain	p	t	tç	ǁ	ǀ	ǃ	ǂ	k	q	ʼ
Voiced	b	d	dj	ǁ̬	ǀ̬	ʔǃ̬	ǂ̬	g		
Complex stops (9 + 8)										
Plain + Gl		tʼ	tsʼ	ǁʼ	ǀʼ	ǃʼ	ǂʼ	kxʼ		
Plain + As	ph	th		ǁh	ǀh	ǃh	ǂh	kx		
Voiced + Ns	(mb)	(nd)						(ŋg)		
Stop clusters (2 + 12)										
Plain + /x/		tx	tçx	ǁx	ǀx	ǃx	ǂx			
Plain + /kʼ/				ǁxʼ	ǀxʼ	ǃxʼ	ǂxʼ			
Plain + /q/				ǁq	ǀq	ǃq	ǂq			
Simple nasals (4 + 4)										
Plain	m	n	ny	ǁ̃n	ǀ̃n	ǃ̃n	ǂ̃n	ŋ		
Other (0 + 4)										
ʔ				ǁ̃	ǀ̃	ǃ̃	ǂ̃			

Table 8: Consonant system of Kxoe (after Köhler 1981: 486f)

This becomes even more serious in view of the fact that phonetic nasalization in a click has been shown to be variable regarding its systematic importance in every language discussed so far: it can be a phonological feature or just a phonetic detail. Yet another complication for the

systematic evaluation of nasality in Kxoe clicks comes from the existence of prenasalized stops. These sounds are quite rare across Khoisan and can be ascribed in Kxoe to the apparent influence of Bantu languages. Nevertheless, once integrated in the language, one could imagine that such a feature exerts some systematic pressure in domains that formerly lacked such a phenomenon (cf. in this connection the existence of prenasalized clicks in Bantu languages like Nguni, which as such were not borrowed from Khoisan). For all these reasons, I have merely listed the two nasal click accompaniments at the end of the chart and consider only one of them as being the counterpart of simple nasal egressives without proposing any systematic place for the other.[19]

3.5 Standard Namibian Khoekhoe (KHOE)

Namibian Khoekhoe as the last KHOE language to be treated here has in terms of inventory size one of the most simple consonant system in southern Africa. It was described phonetically and phonologically fairly early by Beach (1938). He worked with Nama which had become the basis of the first standardization efforts by missionaries.

In this variety, the voice contrast is absent even in all simple stops and the orthographic distinctions [p] vs. [b], [t] vs. [d], and [k] vs. [g] merely refer to tonal properties of the stem. Thus, it is the most extreme case of a tendency that is generally observed in the KHOE family.

Some of my phonological alignments apparently disagree with the orthographic representation of phonemes, which calls for some clarifications. First, some remarks regarding egressive aspirates: The sound represented orthographically as [ts] derives historically from a complex aspirated plosive which can be shown by a regular correspondence with !Ora, a southern Khoekhoe language. That aspirates show an affricate gesture is a general feature of Namibian Khoekhoe. However, this is reflected in the orthography only for /th/, hence [ts], but not /kh/.

Second, it can be fairly safely established that the only consonant cluster [!kh] is phonologically rather *simple click stop* + /x/. Phonetically, the accompaniment is consistently reported to have friction and it is even contested by some authors (e.g., Essen 1966: 56f) that an audible velar closure after the click is always present and thus phonologically relevant.

19 Note that Güldemann (1998: 36) associated the second nasal accompaniment with the aspirated stop type due to the recurrent phenomenon of non-systematic nasalization in the ingressives of this series. The aspirated clicks were consequently viewed as clusters with an aspirated stop offset. This interpretation was certainly made too rashly.

From the above fact that aspirated egressive stops are phonetically affricate, it becomes clear that the task to determine whether the cluster offset is the fricative /x/ or the aspirate plosive /kh/ with friction depends on the identification and status of a velar closure. It is in fact worth further studying whether [!kh] in Namibian Khoekhoe represents from a historical viewpoint the merger of two clusters /!kh/, which would be phonetically [!kx], and /!x/. In any case, many lexemes of Standard Khoekhoe involving this click type regularly correspond to words with [!x] in the notation of other KHOE varieties.[20]

Another well-known peculiarity of the Khoekhoe orthography is to represent the glottalized click without any sign for glottalization with the result that the symbol *g* with simple clicks does not indicate voicing but instead the absence of a glottal stop.

(12 + 20)	EGR Lb	EGR Al	IGR Lt	IGR Dt	IGR Al	IGR Pl	EGR Vl	EGR Gl
Non-nasal sonorants (1)								
Plain		r						
Fricatives (3)								
Plain		s					x	h
Simple stops (4 + 4)								
Plain	p/b	t/d	ǁg	ǀg	!g	ǂg	k/g	ʼ
Complex stops (2 + 8)								
Plain + Gl			ǁ	ǀ	!	ǂ		
Plain + As		ts	ǁh	ǀh	!h	ǂh	kh	
Stop clusters (0 + 4)								
Plain + /x/			ǁkh	ǀkh	!kh	ǂkh		
Simple nasals (2 + 4)								
Plain	m	n	ǁn	ǀn	!n	ǂn		

Table 9: Consonant system of Namibian Khoekhoe (after Beach 1938)[21]

20 Compare, for example, the entries for 'Flußpferd', 'halten', 'öffnen', and 'Pfeife' in the appendix of Voßen (1997: 413ff).

21 The symbols conform to the official standard orthography of Namibian Khoekhoe according to Native Language Bureau (1977). Only the glottal stop is added by me.

A phonetic detail of the two complex click types already encountered in G|ui (at least with aspirates also in other Khoisan languages) is attested in Khoekhoe, too: if preceded by a vowel these clicks are realized with an audible nasal coarticulation having the effect of nasalizing also this preceding vowel (cf. Beach 1938 and Ladefoged & Traill 1984: 6).

In general, it can be observed through a comparison with the languages treated above that it is especially the sparsity of clusters which is responsible for the smaller inventory size of Namibian Khoekhoe. That an earlier chronolect possessed at least a second cluster, i.e. *simple click stop* + /k'/ (phonetically affricate [kx']), becomes evident when Namibian Khoekhoe is again compared with !Ora (and other KHOE languages of the Kalahari branch). A regular sound correspondence shows that in the former the velar ejective /k'/ changed to a plain glottal stop /'/ as both independent segment and cluster offset. With clicks, this led to the merger of the cluster *click* + /k'/ and the complex segment *click* + *glottalization*. As observed already by Traill (1985: 211, 1993: 138), this historical detail is additional evidence that the cluster analysis has explanatory power for phonological phenomena in the languages under consideration.

3.6 Sandawe (Isolate)

The last language in this comparative treatment is Sandawe. It clearly reveals its different areal context in eastern Africa on account of various phonetic and phonological characteristics. Regarding its phoneme inventory, the obvious differences to South African Khoisan languages are the lack of palatal clicks, the complete absence of clusters, and the existence of a series of lateral egressives.

Nevertheless, the general structure of its sound system can also be described in terms of the integrated approach pursued here. In fact, Elderkin (1989: 37) presents his phoneme chart in a very similar fashion. Although he still separates clicks from non-clicks, he acknowledges such possibly controversial systematic alignments on the vertical dimension as between egressive ejectives and ingressive glottalized clicks or between egressive and ingressive nasals.

(29 + 15)	EGR Lb	EGR Al	EGR Al-Af	EGR Lt	IGR Lt	IGR Dt	IGR Al	EGR Vl	EGR Gl
Non-nasal sonorants (4)									
Plain	w	r	j	l					
Fricatives (5)									
Plain	f	s		ɬ				x	h
Simple stops (11 + 6)									
Plain	p	t	ts	tl	ǁ	ǀ	ǃ	k	ʼ
Voiced	b	d	dz	dɮ	gǁ	gǀ	gǃ	g	
Complex stops (7 + 6)									
Plain + Gl			ts'	tɬ'	ǁ'	ǀ'	ǃ'	k'	
Plain + As	p^h	t^h	ts^h		$ǁ^h$	$ǀ^h$	$ǃ^h$	k^h	
Simple nasals (2 + 3)									
Plain	m	n			nǁ	nǀ	nǃ		

Table 10: Consonant system of Sandawe (after Elderkin 1989: 37)[22]

22 The changes in the representation of Sandawe phonemes vis-à-vis Elderkin's conventions are as follows: Click symbols are given in the current IPA usage. No diacritics are used for the simple clicks. Voicelessness is not marked by a special symbol. The voiced and nasal clicks are given as /gǃ/ and /nǃ/ respectively.

4 Cross-Khoisan and typological implications

The systematic framework to describe the sound systems of Khoisan languages which was developed on the basis of the very complex situation in !Xõo and shown to be applicable in other languages has two major aspects. On the one hand, it serves to clarify the phonological character of individual speech sounds and clicks in particular in individual Khoisan languages. This in turn reveals and partly motivates an even greater similarity in phonological design than has heretofore been believed to hold across this group of languages. On the other hand, it helps to embed the phonetic and phonological properties of Khoisan in a crosslinguistic comparison of sound systems without having to assume that several features are exotic quirks. These two topics will be briefly discussed now.

4.1 Cross-Khoisan regularities in phonological design and phonetic detail

One may ask first what is achieved with the attempt to describe individual Khoisan sound systems within a unified and fairly restricted feature matrix. My view is that, provided such a framework is not an unworkable procrustean bed, but does justice to the empirical facts, it can help to determine more easily how their sound systems relate to each other synchronically and which linguistic features they have in common and which not. This in turn is an important precondition for a more reliable assessment of the nature of the concept of Khoisan as a group of languages. It is clear that the above approach assumes the position that Khoisan languages can be compared fruitfully and do share a considerable amount of phonological regularity.

A token of the homogeneity of Khoisan with respect to the internal organization of their phoneme systems is the possibility to establish a cross-Khoisan consonant chart. This is given in Table 11. Almost all of the phonemic segments attested above are contained and interpreted in the analytical approach pursued here. Only two accompaniments with nasality in ǂKhomani and Kxoe still remain opaque. The phoneme systems of !Xõo, ǂKhomani, Ju|'hoan, G|ui, Kxoe, Namibian Khoekhoe, and Sandawe are basically *subsets* of the abstract maximal system of Table 11. This chart will serve to recapitulate the recurrent structural principles of phoneme systems observed across the Khoisan languages treated above.[23]

23 It is clear that this phonological systematicity, provided it is valid, has important implications for the much disputed orthographic representation of Khoisan consonantal segments. How the above findings can be exploited for a practically oriented cross-Khoisan orthography is exemplified in this consonant chart. The underlying orthographic principles are discussed more extensively in Güldemann (1998: 22ff).

One advantage of the analytical combination of cluster analysis and egressive-ingressive integration is the possibility to characterize more precisely the internal organization of a subdomain of features called here *phonetic elaboration*, which pertains to the vertical dimension and which is relevant for stops and nasals. While different click accompaniments (and egressive elaborations) were merely presented in a largely unstructured list of phonological distinctions in most previous accounts, it is essential to the present approach to differentiate in this domain between hierarchically organized subclasses called here *plain*, *simple*, *complex*, and *cluster* segments. They constitute an implicational cross-Khoisan hierarchy of consonant types that runs as follows:

plain	>	**simple**	>	**complex**	>	**clusters**
+nasal		+voice		+glottalization +aspiration		+posterior egressive (various)

The set of consonants called *simple* is constituted by those segments which are not elaborated by a final coarticulation. If they show an additional phonologically relevant feature like ±*voice*, this is initiated before or with the articulation of the consonant. That plain segments vis-à-vis other simple segments and simple segments vis-à-vis complex segments and clusters are indeed basic can be discerned from their consistent presence across Khoisan as well as from their language-internal distribution. All languages encountered so far conform to the generalization that complex and cluster consonants imply the existence of simple consonants. The latter are usually also more frequent in the lexicon.[24]

Accordingly, the two subgroups labeled *complex* and *clusters* have in common that the distinctive elaborating feature sets in only after the articulation of the simple consonant. There is only one exception in the case of both egressive and ingressive nasals where glottalization *precedes* the simple segment. While elaboration types identified here as yielding complex and cluster consonants are mutually exclusive, they cooccur with the features pertaining to simple consonants, namely voicing and partly nasality.

A regularity within the domain of complex consonants observed in the Khoisan languages discussed is that voiced glottalized segments are very rare. So far, glottalized clicks are never voiced. In fact, only Ju|'hoan and !Xõo, due to their extensive exploitation of the mechanism of voice lead, have egressive stops that are phonologically simultaneously voiced and glottalized. Usually, such a combination does not exist.

24 This does not hold for Sandawe (Elderkin p.c.) and Namibian Khoekhoe (Haacke 1999).

	EGR Lb	**EGR** Al	**EGR** Al-Af	**EGR** Pl	**IGR** Lt	**IGR** Dt	**IGR** Al	**IGR** Pl	**IGR** Lb	**EGR** Vl	**EGR** Uv	**EGR** Gl
Non-nasal sonorants												
Plain	w	l/r		y								
Fricatives												
Plain	f	s		c						x		h
Voiced	v	z		j								
Simple stops												
Plain	p	t	ts	tc	‖	|	!	ǂ	ʘ	k	q	'
Voiced	b	d	dz	dj	g‖	g|	g!	gǂ	gʘ	g	gq	
Complex stops												
Plain + Gl		t'	ts'	tc'	‖'	|'	!'	ǂ'	ʘ'	k(x)'	q'	
Voiced + Gl			dz'	dj'						g(x)'		
Plain + As	ph	th	tsh	tch	‖h	|h	!h	ǂh	ʘh	kh	qh	
Voiced + As	bh	dh	dzh	djh	g‖h	g|h	g!h	gǂh	gʘh	gh	gqh	
Stop clusters												
Plain + /x/		tx	tsx	tcx	‖x	|x	!x	ǂx	ʘx			
Voiced + /x/		dx	dzx	djx	g‖x	g|x	g!x	gǂx	gʘx			
Plain + /q/					‖q	|q	!q	ǂq	ʘq			
Voiced + /q/					g‖q	g|q	g!q	gǂq	gʘq			
Plain + /kh/					‖kh	|kh	!kh	ǂkh	ʘkh			
Voiced + /kh/					g‖kh	g|kh	g!kh	gǂkh	gʘkh			
Plain + /qh/					‖qh	|qh	!qh	ǂqh	ʘqh			
Plain + /k(x)'/	px'	tx'	tsx'		‖x'	|x'	!x'	ǂx'	ʘx'			
Voiced + /k(x)'/		dx'	dzx'		g‖x'	g|x'	g!x'	gǂx'	gʘx'			
Plain + /k'/					‖k'	|k'	!k'	ǂk'	ʘk'			
Plain + /q'/					‖q'	|q'	!q'	ǂq'	ʘq'			
Simple nasals												
Plain	m	n		ny	n‖	n|	n!	nǂ	nʘ	ng		
Voiceless					nh‖	nh|	nh!	nhǂ	nhʘ			
Complex nasals												
Plain + Gl	'm	'n			'n‖	'n|	'n!	'nǂ	'nʘ			

Table 11: Integrated cross-Khoisan consonant chart

The distinction between complex and cluster consonants has been made for two reasons. It is first of all motivated by the consideration that aspirated and glottalized segments are far more frequent crosslinguistically than those classified here as clusters. The second reason which is related to the former aspect concerns again the cross-Khoisan distribution and language-internal frequency of the consonants under discussion. The inventories encountered above clearly suggest the above hierarchy: clusters only occur if the segments classified as complex also exist. One can observe that there are individual systems without a single cluster, but none without the two complex consonant types, which as egressives can even be cluster offsets. Note also that the only non-simple nasals are glottalized and thus belong to the complex subset of consonants - a fact which suggests a preliminary generalization that there are no native clusters in Khoisan with a nasal onset. Finally, aspirated and glottalized segments are usually also more frequent than clusters in the lexicon of individual languages.

However, it should be taken into account that from a purely phonological viewpoint aspirated and glottalized consonants do qualify for being classified as clusters. They usually meet the minimal precondition that the two constituents of a purported cluster should exist as independent consonants, because the glottal stop and the glottal fricative appear to be phonemes in the languages treated above. This indicates that the distinction between complex and cluster segments is not as clear-cut as one might wish to have it. The arguments brought forward in favor of such a discrete grouping, that is, crosslinguistic and language-internal distribution, are after all rather quantitative than qualitative in nature.

What becomes clear from the evidence so far available regarding clusters is the important observation that the cluster inventory of an individual language is a direct function of its system of simple and complex consonants. The more distinctions a language has in these two subclasses of segments, the higher the probability that its inventory of clusters is fairly large. Apart from the extensive manipulation of voicing found in !Xõo and Ju|'hoan, languages with a higher number of clusters exploit their different contrasts for places of articulation as well as coarticulation features like glottalization and aspiration. Another phonological detail is worth mentioning here: So far a cluster *click + posterior simple stop* seems only possible, where such an offset is phonologically available at the *uvular* place of articulation. Put differently, a simple uvular stop is an attested offset, while the simple velar counterpart is not. This can be inferred from the fact that ǂKhomani, Ju|'hoan, and Khoekhoe simultaneously lack uvular consonants and such a click accompaniment, while !Xõo, G|ui, and Kxoe possess a uvular

stop and this particular click cluster. A first line of investigation could be to relate this phenomenon to the existence of the secondary posterior closure associated with the suction mechanism of a click. It appears that if a velar segment is used as a cluster offset only a fricative or a complex stop are somehow sufficiently distinguished from the above click gesture. It is also significant in this respect that complex clicks with glottalization - a feature which is removed articulatorily even further from the secondary click closure - are so common in Khoisan.

Future studies will show whether the above hierarchy remains valid when the many still poorly known Khoisan languages are sufficiently described. As soon as this is the case, it is worth pursuing whether even more fine-grained subhierarchies can be established. For example, a hypothesis compatible with the above data is that the cluster with a velar fricative offset /x/ takes precedence over all other types. I have given a very detailed hierarchical structure for the click accompaniments in !Xõo in Figure 1 of Section 2.2. At this point, I do not claim that the particular identity and order of features there is the only possible analysis of the situation found in this language, let alone a universal cross-Khoisan matrix of phonetic elaboration of consonants. I expect, however, that the order of features of higher branching are similar across Khoisan, while in the features of lower branching, especially in the domain of cluster differentiation, languages demonstrate more variation.

It is important to recognize that Khoisan languages not only share a significant amount of phonological regularity, but also some recurrent phonetic details. One repeatedly discussed phenomenon is the variable status of nasalization. It is clear that it is a phonological feature with various segments in Khoisan, *inter alia* 'true' nasal clicks. However, voiced or voiceless nasalization was found to be a systematically irrelevant phonetic detail with at least three consonant types. They are the voiced uvular stop /gq/ ([G]) as simple egressive and cluster offset in !Xõo, the glottalized ingressive /!'/ in G|ui and Namibian Khoekhoe, and the aspirated ingressive /!h/ (alias click with delayed or weak aspiration) in at least !Xõo, Ju|'hoan, G|ui and Khoekhoe.[25]

Another fairly frequent phenomenon is the lenition of complex egressive plosives to affricates both as units and cluster offsets. In some KHOE languages like Kxoe and Khoekhoe, *aspirated*

25 Could the nasal click with uvular fricative [ɴ̃χ] found by Voßen (1986: 327ff) in ǁAni be related to this complex?

plosives show phonetically a fricative gesture. Far more widespread in Khoisan is that the *glottalized* velar /k'/ is phonetically realized as an affricate [kx']. Accordingly a phonological distinction between an ejected velar plosive and an ejected velar affricate is so far found to be rare across Khoisan. In fact, the only case where it is explicitly said to be of importance is G|ui. In !Xõo and ǂKhomani, it is very marginal or doubtful altogether.

A final point closely related to a problem discussed already above is the situation in languages like !Xõo and G|ui, where in the domain of cluster offsets the uvular position is exploited phonetically more often than predicted by phonological distinctions in the egressive system. Again, it must be investigated in the future whether and, if so, why uvular segments are phonetically 'better' cluster offsets than velar ones.

All these phenomena have important repercussions for the phonological analysis of an individual language, especially in the domain of click clusters. The notorious problem of ascertaining what is phonetic and what systematic is a sufficient reason to acknowledge duly that a conclusive phonological analysis of a language crucially depends on a synthesis of data drawn simultaneously from the study of lexical oppositions determined by sound features, from an extensive phonetic investigation, and last but not least from considerations about expectable sound patterns in Khoisan.

A major question for future research will be how the considerable similarity of Khoisan languages in phonetic and phonological properties can be explained best. Scholars believing in the 'Macro-Khoisan' hypothesis can always view this as a feature inherited from a however remote proto-language. Partly due to the sparsity of evidence from other linguistic domains, the quirkyness of clicks and the shared restrictions in the stem formation of South African Khoisan tend to serve as essential *evidence* in favor of such a genetic interpretation. However, this line of reasoning reverses the argumentation insofar as features which are conventionally viewed only as typological diagnostics are seen as "individual-identifying" in the genetic sense (see Nichols 1996).[26] This was repeatedly noted by Westphal (see, e.g., 1971: 369f) who strictly opposed any genetic relations above the level of obvious language families within Khoisan and denied in particular the relevance of clicks for a genetic classification of African

26 See, however, Traill (1995/6) where it is shown that structural similarities between languages (or even subgroups) in regard to their sound systems may reach such an extent that the plain typological argument does not seem tenable anymore.

languages. Those taking like him a more conservative stance on a genetic unit Khoisan have to entertain areal approaches for the fact that languages share this rare sound type.

However, the two explanations were mostly invoked in the past without a sufficient insight into the complexity of the situation found within Khoisan. The most important point in this respect is that not everything is shared by all languages or subgroups. This has already been shown by Traill (1980) and is corroborated by the present comparison of consonant inventories. Even today, the kind and degree of similarity or variation are not sufficiently known for *all* subsets of languages to be reasonably considered and falling under the disputed group Khoisan. Is a particular feature common to a clearly genetic subgroup or rather to an areal set? Is Khoisan internally *heterogeneous* along genetic or areal lines? Such questions have to be answered before similarity in phonetic and phonological features can be evaluated and employed for the purpose of language classification.

In any case, I would like to add a third consideration in view of some of the observations made in this paper: Some recurrent features in the sound design of the different languages may not be independent from other more basic Khoisan-specific or universal principles. Accordingly, systematic motivations for some of the similarities found across phoneme systems in the Khoisan group should also be entertained. A conclusive assessment of the nature of Khoisan unity in sound design will be a very complex task which must take all the above lines of reasoning into account, but for which some of the necessary empirical facts and theoretical tools may still be lacking.

4.2 How exotic are clicks and how exotic are Khoisan languages phonologically?

One of the major goals of the above discussion was to demonstrate that ingressive clicks resemble in many respects 'normal' consonants, in particular egressive stops and nasals, and that they are quite unspectacular segments in this respect. The systematic alignments I have made above are always related to phonetic characteristics and thus do not appear to be far-fetched. I should repeat that the major difference that comes to light in the phonological behavior between clicks and non-clicks is rather one of degree than one in kind. All that is systematically special to clicks is that they are more regular with respect to phonetic elaboration, in particular, being consistently more frequent as cluster onsets (see below). This does not take anything away from the uniqueness of clicks in regard to their articulatory, acoustic, and auditory properties.

Trying to relate the types of speech sounds special to Khoisan to crosslinguistic 'normality' is closely tied to the attempt to compare whole sound systems of Khoisan with the structure and amount of complexity in other language groups of the world. Here, one must return to the important *phonological* quirks of Khoisan under the traditional analysis. These were formulated in the introduction and are repeated here:

I two disjunct consonant inventories of clicks and non-clicks,

II abnormally large consonant inventories, if their system is complex.

Both these anomalies nearly cease to exist if the two assumptions about the existence of clusters and egressive-ingressive integration are accepted. I will leave the exercise to the reader to determine the highly reduced number of segments of the above languages under a cluster analysis and merely cite Traill's (1985: 208) statement "that a cluster analysis immediately brings !Xóõ [and other Khoisan languages] in line with other languages in regard to this typological characteristic [i.e. inventory size]." It is also unnecessary to justify again the validity of the observation that clicks as phonemes do not behave differently from non-click consonants.

What, however, about the fact that South African Khoisan as a group has clusters in the first place and many of its languages also a high number of consonantal non-cluster units? Note in this respect that one can derive the complex consonant systems in Khoisan from crosslinguistically 'normal' patterns in an abstract sense by evoking a limited number of processes by way of which distinctions on both the horizontal and vertical feature dimension are multiplied.[27] On the horizontal axis, these are an *increase in the number of places of articulation* (especially the existence of a uvular position) and more importantly the undoubtedly quirky introduction of the *suction gesture* leading to a number of up to five ingressive types. On the vertical axis, these are the typologically unremarkable *posterior coarticulations* of glottalization and aspiration as well as the less common phenomenon of *clustering posterior offsets*. All these mechanisms involve some form of articulatory posteriorization as a common denominator. In connection with a tendency of employing available features in maximal combinations, these phenomena give rise to the extraordinarily large consonant inventories of some of the languages considered here.

27 This also holds for the relationship between consonant systems with varying complexity *within* Khoisan. Cf. in this respect the approach in Traill (1980).

Traill (1979, 1985: 164ff) demonstrates that this proliferation of consonant distinctions itself is not totally arbitrary. Instead, it can be shown to ultimately serve a very concrete linguistic function, i.e. the *optimization of the phonetic strength of* and the *multiplication of distinctions in* the initial consonant position of stems (cf. the discussion in 2.2 above). One must ask now why languages should focus so much on this particular segmental slot. An answer can partly be sought in the canonical design of the great majority of stems in South African Khoisan languages and - as a residual phenomenon - also in Sandawe: it is characterized by a fairly high amount of restrictions. The following phonotactic pattern which incorporates the heretofore uncommon cluster analysis will illustrate this:

$C(C)_1$ -	V_1 -	C_2 -	V_2
Stop or fricative	Short, oral, back	Nasal or non-nasal sonorant or voiced stop	Short, oral

It can be observed that all non-initial positions have a highly reduced inventory of possible segments, while the initial stem position has recourse to the very large number of what can be conveniently subsumed under the umbrella term *strong consonant*. If one considers in addition that lexical stems are not complemented in many languages by a large amount of morphology, it becomes obvious how immense the functional load of this single phonotactic position is for the necessary distinction of meaning. Thus, it is not far-fetched to hold to a certain extent this uneven distribution of consonants in lexemes responsible for the fact that *a high number of phonological distinctions in stops* and achieving this via *strengthening* - in accordance with the crosslinguistically valid *optimal syllable principle* (cf. Traill 1985: 166ff) - are imperatives for the dynamics of Khoisan sound design. It also relates to the above mentioned fact that clicks are the most suitable targets of further strengthening. They are - as Traill (1985: 170ff) convincingly argues - the strongest of all encountered consonants. As an optimal syllable has the strongest segment in initial position, a click is only likely to be further elaborated by a following weaker coarticulation, but unlikely to serve itself as a strength-enhancing gesture.

This argumentation rests on the assumption that stem phonotactics can indeed influence the range of phonological distinctions. Certainly, this cannot be the only factor for the multiplicity of stops in some Khoisan languages. Otherwise one would not find languages like Khoekhoe with such a phonotactic pattern, but with a consonant inventory that is less than a third in size

compared to that of !Xõo. Nevertheless, if this preliminary hypothesis can be shown to be only partially valid, it would offer a new perspective on the multiplicity of *strong* consonants in this language group.

The consequence of the above points is clear: Khoisan languages *are* first of all 'exotic' in having this rare, though natural, phonotactic stem pattern and - from the perspective how the human speech organs are exploited to produce sounds - in possessing clicks and other uncommon segments elaborated by posterior articulatory gestures. However, the internal make-up of their phoneme systems does not appear to be affected in any remarkable way by this enormous proliferation of distinctive segments. That is, from a phonological viewpoint, they are quite ordinary languages.

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Phonological regularities of consonant systems across Khoisan lineages

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English Summary

Based on Anthony Traill's ground-breaking description of the phonologically most complex Khoisan language, !Xõo (!Uǂ-TAA family, TAA branch), this paper challenges two basic assumptions connected with the traditional analysis of consonants in this language group. The common sense up to now has been that (1) even the phonetically most complex segments are consonant units and not clusters and (2) ingressive clicks and egressive non-clicks constitute two separate consonant phoneme systems. In this paper, I will present a different approach to these issues which can do away with two major typological anomalies of Khoisan phoneme systems under the traditional view, namely that the consonant inventories of languages with more complex systems are abnormally large and that all these languages possess two disjunct consonant inventories. An attempt is made to show that such an approach can be applied to Khoisan languages as a group. For this purpose, the alternative analysis will not only be exemplified with the !Xõo data, but also with the data from languages of other genealogical groups such as ǂKhomani (!Uǂ-TAA family, !Uǂ branch), Ju|'hoan (JU family), G|ui (KHOE family, Kalahari branch), Kxoe (KHOE family, Kalahari branch), Standard Namibian Khoekhoe (KHOE family, Khoekhoe branch), Sandawe (isolate).

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