

ON THE PHONETIC REPRESENTATION OF CLICKS: SOME EXPERIMENTAL PHONETIC CONSIDERATIONS

JC Roux* and G Dogil**

**Research Unit for Experimental Phonology, University of Stellenbosch, South Africa*

***Institute for Computational Linguistics, University of Stuttgart, Germany*

Abstract: This paper evaluates some aspects of current tendencies regarding the phonetic representation of clicks in Bantu languages such as Xhosa and Zulu in view of some principles set by the IPA for phonetic transcriptions. It presents some experimental phonetic evidence to argue for a revised representation of certain sounds in these languages for the sake of phonetic naturalness and simplification.

Keywords: IPA, phonetic transcriptions, clicks, EPG

1. PHONETIC TRANSCRIPTIONS

By this time it is well known that the symbols traditionally used by the IPA to represent clicks were replaced by a new set at the Kiel convention in 1989. This "new set" corresponded in many respects to that which was used by Africanists for a large part of this century. This new set, however, only comprised the basic representations with the assumption that language specific descriptions would assign appropriate diacritics to these symbols where applicable. It is, however, also true that Africanists, especially those working with the Khoisan languages have held quite divergent views on how clicks could and should be represented (cf Snyman, nd; Traill & Ladefoged 1994:50). This situation is to be expected in view of the extreme phonetic complexities of these sounds and their accompaniments.

ISBN: 0 08 043 438X

In 1994 Ladefoged and Traill (henceforth L&T) published a seminal paper on clicks and their accompaniments as found in Khoisan and in languages such as Xhosa and Zulu. In their representation of clicks they state that "There cannot be a click without an accompaniment of some kind, and our transcriptions of clicks will always include a way of symbolising this part of the sound. The posterior closure is usually in the velar region, so that most clicks include a velar plosive [k] or [g] or a velar nasal [ŋ] as one of their attributes." (L&T 1994:46). Applied to a language such as Xhosa the following representations prevail (orthographic forms in brackets; "Trad" refers to traditional representations):

Table 1 Phonetic representations of clicks

		Dental			**Alveo-palatal**			**Lateral**	
		Trad	**L&T**		**Trad**	**L&T**		**Trad**	**L&T**
Voiceless	(c)	**|**	**k|**	(q)	**!**	**k!**	(x)	**‖**	**k‖**
Aspirated	(ch)	**|h**	**|h**	(qh)	**!h**	**!h**	(xh)	**‖h**	**‖h**
Voiced	(gc)	**|g**	**g|**	(gq)	**!g**	**g!**	(gx)	**‖g**	**g‖**
Nasal	(nc)	**ŋ|**	**ŋ|**	(nq)	**ŋ!**	**ŋ!**	(nx)	**ŋ‖**	**ŋ‖**
Voiced/nasal	(ngc)	**ŋ|g**	**ŋ|**	(ngq)	**ŋ!g**	**ŋ!**	(ngx)	**ŋ‖g**	**ŋ‖**

It is our contention that although this practice seemingly systematises the 53 possible click sounds and their accompaniments in !Xóõ in a neat way, it obscures phonetic realities in a language such as Xhosa and unnecessarily complicates its phonetic representation by the addition of extra symbols. We base our view on electro-palatographic and acoustic evidence as described below. For the sake of brevity we will only consider the case of voiceless and voiced clicks.

2. VOICELESS CLICKS

The relatively simple representation of **voiceless clicks** as respectively [|], [!] and [‖], are complicated by the addition of a [k] to end up digraphs [k|], [k!] and [k‖] without any real phonetic motivation. The argument pursued by L&T is that clicks are produced by an anterior and posterior occlusion and this posterior closure needs to be represented as "...part of the sound." This part of the sound is then presented by a voiceless velar stop [k] in the initial position of the digraph.

Two arguments may be presented to query this situation. Firstly, Snyman (nd:4) points out that there is no real reason why preference should be given for specifying the velar closure as a click cannot be produced without a full circular closure of the tongue entrapping a certain volume of air. The point is that lateral closure of the tongue is phonetically just as important and he argues that the description of the articulation of clicks should only commence "... when the volume of air enclosed by a single circular closure of the tongue has been sufficiently rarefied to produce a click of the loudness required for normal speech."

ISBN: 0 08 043 438X

This view of Snyman can be supported when considering the following EPG representation of the closure phase of the dental click [|] in the Zulu word -cima [|ima] "extinguish"[1]:

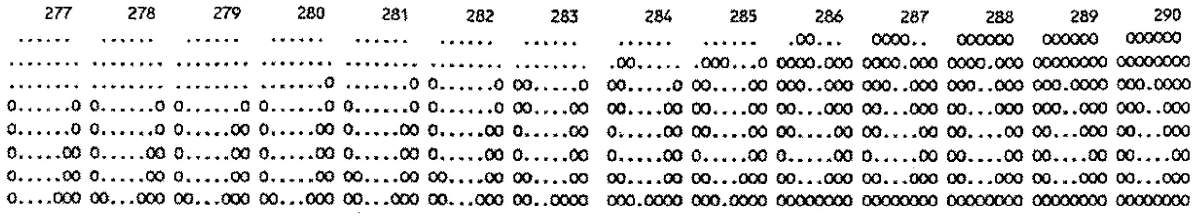

Figure 1 Electropalatographic (EPG) representation of the dental click [|] in Zulu.

The frame sequence 277-287 represent various stages in the closure phase of the click, whilst full closure is reached in frame 288. Note that in this stage lateral contact takes place concomitantly with velar contact and this lateral contact is well developed at full velar closure in frame 286. There is obviously no *a priory* reason to assign a symbol specifically for velar closure.

A second objection to this practice lies in the question - why symbolise the velar closure as the first element of a digraph? This question is even more relevant when it is taken into account that IPA transcriptions and symbols reflect a form of temporal ordering: cf [t^{h}] where aspiration follows the occlusion and [ts] where frication follows occlusion in affricates. Phonetically it is unclear what a representation such as for instance [k!h] should represent when it is also stated that in some cases ".. the velar release is so soon *after the click* that it is *not audible*" (L&T 1994:52) (Our emphases, GD & JCR). A principle of temporal ordering clearly is violated in this instance and a non-audible sound is assigned a symbol. The issue on temporal ordering becomes even more interesting when voiced clicks are considered.

3. VOICED CLICKS

In line with the assignment of a voiceless velar stop [k] as the first member of a digraph representing voiceless clicks, a voiced velar stop [g] is introduced to symbolise voiced clicks. These representations [g|], [g!] and [g||] are mirror images of traditional representations (see (1)) where the voiced velar stop follows the click. For Xhosa L&T claim that these forms are "murmured" and hence the velar stop is underscored by a dieresis [g!]. Their example of a waveform (p.47) illustrating this murmured click in Xhosa does, however, not show any breathy voice during the closure phase. They acknowledge this but continue the argument by stating that "[t]he murmured clicks in Xhosa (....) are part of a set of depressor consonants, which are marked by the lowering of the tone of the following vowel." (p 46). The point here is that a phonological reason is presented to justify the presence (or rather absence) of a particular phonetic quality. While it may be true that tonal depression occurs after these consonants, this is a weak argument to argue for the presence of some form of breathiness/murmur in the click itself. It will be illustrated below that a reason for this depression can easily be found in the temporal ordering of the constituent parts of voiced clicks in Xhosa.

[1] The assistance of Dr Katrina Hayward of SOAS in obtaining this data is gratefully acknowledged.

ISBN: 0 08 043 438X

This point on temporal organisation in the case of voiced (murmured) clicks may be clarified by viewing the results of an experimental analysis of Dogil, Roux & Wokurek (1995) implementing Wigner Distribution Analysis. Closer inspection of the acoustic signals of these sounds reveal two clearly discernible bursts. Consider the waveforms Figure 2 below of, respectively, renditions of "gca", "gqa" and "gxa" as produced by a male speaker of Xhosa;

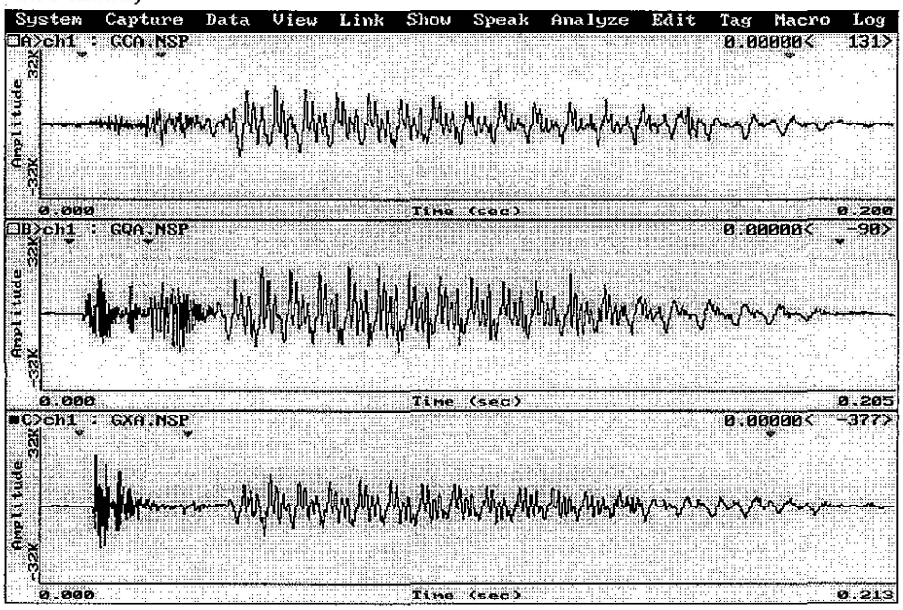

Figure 2 Waveforms of sequences of voiced clicks in Xhosa

Selective editing of these sound waves reveal the following: the first portion of each wave (from the first to the second tag, i.e. ▼ ▼) is heard as a voiceless click; the second portion again is heard as a voiced velar stop followed by a vowel. From a production point of view it is clear that the traditional descriptions **[|g], [!g]** and **[||g]** are closer to phonetic reality than the proposed mirror image representations of L&T. The latter transcriptions convey a distorted view of the actual **articulatory events** in a language such as Xhosa. On the other hand, in listening to the full sequence of each sound wave (i.e. from the first to the last tag) these two distinct bursts are **auditorily perceived** as a single sound i.e. as a click with simultaneous voicing. In this case a phonetic transcription utilising the voice diacritic [͡] of the IPA would be more appropriate : [ǀ͡g] [!͡g] [ǁ͡g]. This observation brings to the fore a clash between transcriptions which are **articulatory based** or **perceptually based**. In his preview of the new IPA Handbook, Nolan (1995:4) points out that underlying IPA transcriptions are a number of theoretical assumptions including the following: "The phonetic description of consonants and vowels can be made with reference to how they are produced and to their auditory characteristics." This view obviously needs to be refined. It has become clear that the use of additional phonetic symbols to distinguish voiceless and voiced clicks in Xhosa are phonetically unjustified and it leads to misrepresentations of both the articulatory and auditory qualities of these sounds.

REFERENCES

Dogil, G, Roux, JC & Wokurek, W (1995) Click articulations in Xhosa: New perspectives through Wigner Distribution Analysis. *Proceedings of the XIIIth ICPhS*, Stockholm, **2**: 74-577.

ISBN: 0 08 043 438X

Ladefoged, P & Traill, A (1994) Clicks and their accompaniments. *Journal of Phonetics* **22,** 33-64.

Nolan, F (1995) Preview of the IPA Handbook. *Journal of the International Phonetic Association* **25.1,** 1-39.

Snyman, JW (nd) A proposal for revising consonant orthographic conventions in Bushman and Hottentot languages. Unpublished manuscript.

ISBN: 0 08 043 438X