LABIAL-VELAR STOPS IN DAGBANI

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ABSTRACT

The consonantal system of Dagbani language shows phonological contrasts among labial-velar, labial and velar stops. Labial-velars are described as having three possible articulatory and airstream mechanisms: in fact they are considered either as implosives or as bilabial clicks or as double articulations with two simultaneous closures. The experimental data allow us to exclude that Dagbani labial-velars are characterized by either a glottalic or a velaric airstream mechanism.

INTRODUCTION

Dagbani language belongs to the Gur group of Sudanic languages, exactly to the Noltaic subfamily of the Congo-Kordophanian family. Dagbani is spoken in North-eastern Ghana.

It is well known that in Dagbani, as in many other West African languages, there are voiceless and voiced labial-velar stops, that are orthographically indicated by the digraphs /kp/ and /gb/. They are generally defined as double articulations.

In phonetic literature the main difference between double and secondary articulations is that the latter are associated with a constriction ranking lower than the main articulation and having a lesser degree of stricture than the primary articulation, while the former are characterized by two simultaneous constrictions having the same degree of stricture [1] [2] [3] [4].

Ladefoged [5] considers the double articulations as secondary articulations. He says: "...unlike Pike, we will also consider sound which have two equal articulatory strictures at different places of articulation to consist of a primary articulation which is closer to the glottis and a secondary articulation which is further away from it". According to him all the double articulations involve the action of the lips that he defines "secondary articulators" because they are further from the glottis than the other stricture.

Labial-velars are described as having two simultaneous closures, one at the lips and one at the velum. According to Ladefoged [6], they can have three different airstream mechanisms: the first one, similar to the velaric mechanism used to produce clicks, is characterized by an ingressive airflow due to the decrease of intraoral pressure; the second one, similar to the glottalic mechanism used to produce implosives, is given by a lowering of the whole larynx with the closed glottis; the last possibility consists in a pulmonic egressive airflow. In some languages two or three of these mechanisms can be simultaneously employed.

However, it is useful to underline that, notwithstanding the similarities, the three mechanisms are substantially different. In fact in the velaric mechanism, there is the cooccurrence of two closures, only one of them, the lips, having an articulatory function; in the glottalic mechanism there are three simultaneous closures, two of them, the lips and the velum, having an articulatory function; in the pulmonic egressive mechanism, the two closures have an articulatory function.

The purpose of this research is to clarify, through spectrografic and electro-aerometric analysis, the articulatory mechanism of production of labial-velar stops in Dagbani.

MATERIAL

From a large corpus of about 1400 meaningful words and 6 prose passages, 500 words have been selected in order to have labial, velar and labial-velar stops in initial and intervocalic position. The whole corpus has been read in a silent room by a male speaker, aged 31, from Tamale. The dialect of Tamale has been chosen because nowadays it is considered as the standard pronounciation of Dagbani language.

Each word has been analyzed through the DSP Sonagraph 5500 KAY, using the Pitch Display program that allows to visualize the broad band spectrogram from 0 to 8000 Hz and the f_o tracing.

In order to describe the articulatory mechanism of double articulations, it is useful to compare them with labial and velar stops in intervocalic position.

DISCUSSION

Figure 1 shows the spectrograms of the words "sagbani" "sagani" and "dabari", where the tendency of the second formants of the adjacent vowels is clearly detectable because of the voiced nature of the consonants. Let us firstly consider the shifting in frequency of the second formant of the preceding vowel: it shows a slight rising transition both before [gb] and [g] and a strongly falling transition before [b]. These different trends allow us to say that the labial-velar stop starts with a velar closure. The F2 of the following vowel shows an opposite trend: it starts with a strongly or slightly rising transition after [gb] and [b] respectively and with a strongly falling transition after [g]. This means that the articulatory mechanism of [gb] ends with a labial opening.

The different rate of change of the F2 rising transition reflects a greater shifting of the tongue in [gb] than [b]. In the former, at the moment of the labial release the back of the tongue is still raised, so that it needs more time to reach the vowel configuration. On the contrary, in the latter the tongue has already reached the vowel position at the moment of the release. This is why, when [gb] is followed by a back vowel, the difference in rate of F2 transition is neutralized.

One more difference concerns the duration, being [gb] about 30% longer than [g] and [b].

All these remarks can be made also for the voiceless labial-velar stops.

The spectrographic data offer clear

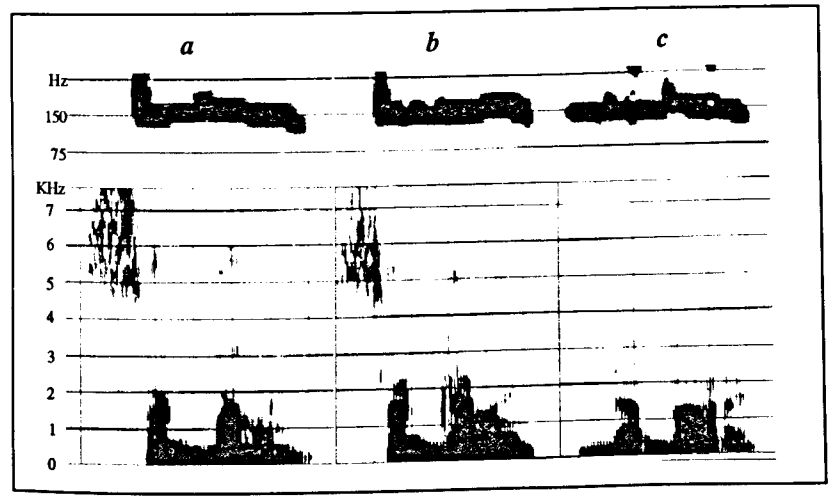

Figure 1. Broad band spectrograms and pitch display of the words "sagbani" (a), "sagani" (b), "dabari" (c).

evidence of the behaviour of the glottis, both for voiced and voiceless stops. First of all we have to say that when a voiced labial-velar stop occurs in intervocalic position, there is an uninterrupted periodical signal from vowel to vowel, through the consonant. An example of this is given by the spectrogram (*a*) of figure 1: in this case the fundamental frequency is at about 150 Hz and it is very similar to the f_o tracings of the spectrograms (*b*) and (*c*), which are produced with a pulmonic mechanism. So, we can say that also labial-velars are realized with an egressive steady flow through the glottis. The electro-areometric tracings confirm that our informant has never produced them with an ingressive airstream.

As regards the voiceless stops the spectrographic analysis points out a noticeable difference in VOT between labial-velar and labial and velar consonants. Figure 2 shows the broad band spectrograms of the words "kpali" "karili" and "pali", where [kp] [k] and [p] are in initial position followed by the stressed vowel [a].

As we can see, [k] and [p] are characterized by an aperiodic segment of about 80 ms occurring between the release and the following vowel. This turbulent airstream is generally ascribed to a delay of the glottal closing in relation to the supraglottal events: if at the moment of the release the glottis is still wide open, the stop will be aspirated, eitherwise it will be unaspirated [6] [7]. In other words, this means that in [kp] at the moment of the labial release the vocal folds are already close together and they can immediately start vibrating. Therefore, in the presence of two asyncronous releases, the glottis synchronizes itself with the velar opening rather than with the labial one. This can be explained by considering that the musculature of the glottis is more strictly related to that of the tongue rather than to that of the lips. On this subject it is enough to think about the phenomenon of Intrinsic Pitch of vowels. In fact, even though many different hypotheses have been formulated to explain this phenomenon, nevertheless in all of them the direct relationship between tongue and glottis is admitted.

CONCLUSIONS

In conclusion, the data gathered in this experimental research point out that the labial-velars in Dagbani are produced with two asyncronous closures and openings and with an egressive airstream mechanism. The diagram of figure 3 illustrates the temporal articulatory sequence of labial-velars: at the instant 1

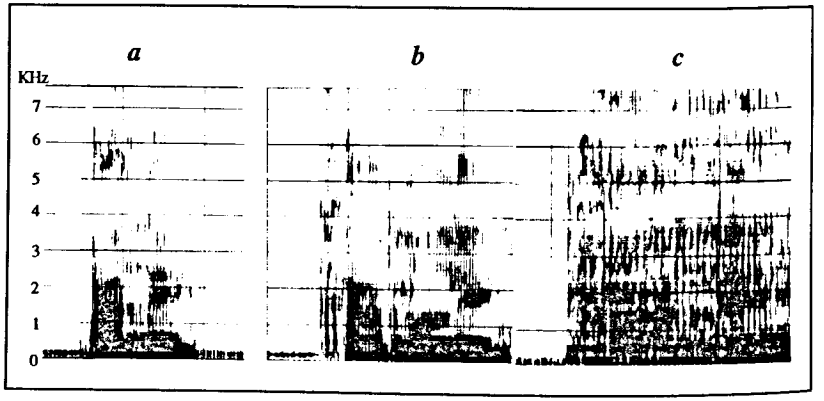

Figure 2. Broad band spectrograms of the words "kpali" (a), "karili" (b), "pali (c).

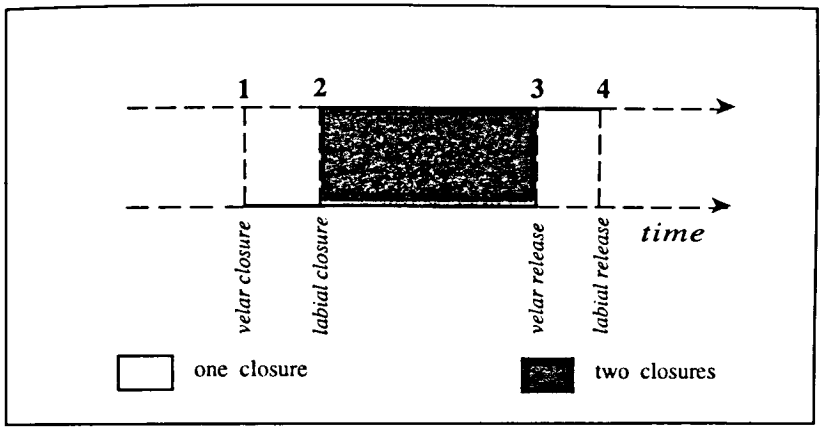

Figure 3. Temporal sequence of articulatory mechanism of labial-velars.

the velar closure is realized, at the instant 2 the labial closure is realized, from 2 to 3 there is cooccurrence of the two closures, at the instant 3 the velar closure is released, at the instant 4 the labial closure is released. In relation to this we can exclude that labial-velars are realized as bilabial clicks. In fact, even though labial-velars and clicks are produced with cooccurrent labial and velar closures, the former release the velum first, the latter the lips first.

We can also exclude that the labial-velar stops are realized as implosives, as the glottalic mechanism would cause either an interruption or a drastic drop of the vocal fold vibrations, because of the compensation between subglottic and supraglottic pressure.

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