Pharyngealization and Pharyngeals in Tsez

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Tsez (Dido) is a Nakh-Daghestanian language spoken in the Tsunta district of the Republic of Daghestan (Russian Federation) by approximately 7000 speakers (Koryakov 2006).
It has been shown that the language employs pharyngealization of stops phonemically (Kibrik & Kodzasov 1990). Pharyngealized stops occur in Tsez with pulmonic and glottalic initiation, mainly as bilabial and as uvular stops in all three positions (initial, medial and final). Pharyngeals occur as voiceless (epiglottal) plosive and as voiceless pharyngeal fricative. Although pharyngeals of that type occur in other Caucasian languages, pharyngalization working as contrastive feature is restricted to only a very few languages of the area.
This paper seeks to broaden the empirical bases in terms of providing on the one hand acoustic data of pharyngealized stops and pharyngeals, and on the other hand in terms of providing data on the distribution of pharyngealization and pharyngeals in the lexicon.
The data originates from one speaker (the third author) of the Tsezic Mokok Dialect of the town Kidero. Recordings were carried out as wordlist elicitations of A) a specific wordlist exploring the obstruent system of Tsez asking for the word in isolation and in a carrier (3 tokens per type, 3 repetitions) and B) as elicitation of dictionary entries as words in isolation (2 repetitions) of the Tsez-Russian dictionary of Khalilov (1999).
For the analysis of acoustic characteristics of pharyngealized stops we were applying measurements of the release noise as well of the following vowel. Measurements were primarily carried out on tokens with initial uvular ejectives and pulmonic stops contrasting in the feature ‘glottalized’ and ‘pharyngealized’, but also on others in medial and final position.

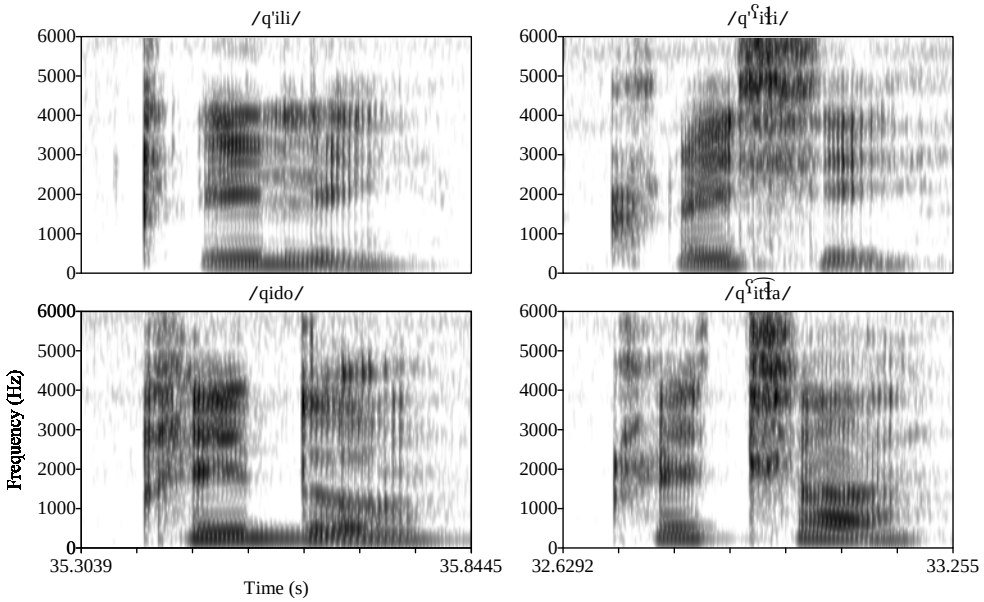

Figure1: Spectrograms of minimal oppositions contrasting initially by modus and pharyngealization

Previous acoustic-phonetic analysis of another speaker of Tsez (Maddieson et al. 1996) had shown for uvular stops a “significantly shorter closure duration than the other three places”. In contrast the data from our speaker do not support this. But regarding the distinction between glottalic and pulmonic initiation we get for uvular stops, for example, significant differences ($df=54$, $p<0.001$) in the means for closure time ($F=0.03$, $t=4.2$), burst time ($F=2.6$, $t=8$), and post-burst lag (PBL; $U=17$, $p<0.001$) but not for VOT ($t=1.8$, $p=0.075$).
Although we also observe slight differences in timing for pharygealized vs. non-pharyngealized stops, none of these differences is significant. The only remarkable tendency is a small PBL (ca. 10ms) in pharyngealized and a large PBL (ca. 80ms) for bilabial stops in initial position, though PBL in the

non-pharyngealized glottalic and pharyngealized pulmonic (aspirated) variants behave the same (ca. 60ms). For uvular stops these differences are even smaller.
Regarding the burst spectra, we find a tendency for pharyngealized bursts to show raising of F1 and damping of F1 amplitude and a concentration between F2 and F3, which are unsurprisingly the characteristics of pharyngealized vowel portions. Thus there is relatively little energy in the lower part of the spectrum (0-500Hz) of pharyngealized bursts in comparison with the upper region (500Hz-4000Hz). By comparison, for non-pharyngealized stops, energy is more evenly spread throughout the whole spectrum. The following vowel portions show a "r-colored" "centralization", as already described in Catford (1983).
In order to assess possible distinctions on the bases of acoustic characteristics of the bursts, the burst spectra have been investigated in terms of intensity measures (RMS, relative intensity) and energy distribution (COG and band energy differences) and burst slope in terms of skewness and kurtosis. For the band differences of 0Hz to 500Hz and 500Hz to 4000Hz and the band amplitude differences Amid-Ahi after Suchato (2004) have been selected. Although the burst time shows recognizable differences e.g. in form of shorter BT for velar and uvular ejectives, none of those measures showed significant effects so far.
However, the distributional analysis reveals a predominance (approx. 70%) of pharyngealized uvular affricates, although also other non-stop contexts (/r/,/n/,/m/) can be found.

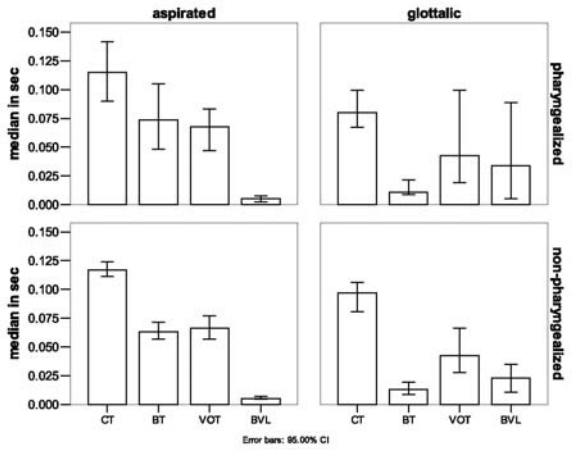

Figure 2: Measures of closure time, burst time (release to noise offset), voice onset time and burst voice lag (post-burst lag = burst offstet to voice onset) in uvular stops of medial position

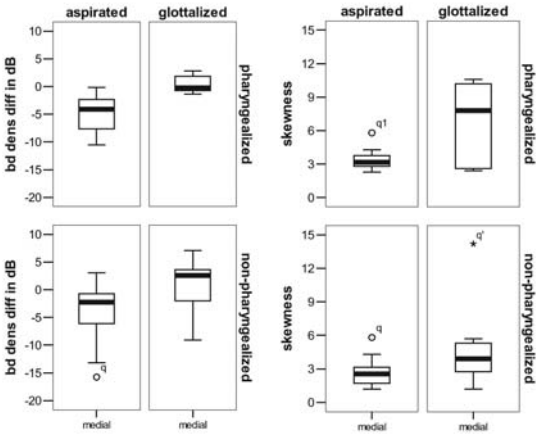

Figure 3: Measures of band energy density difference (0 to 500Hz vs. 500 to 4000Hz) [left] and skewness [right] of burst spectra for pharyngealized vs. non-pharyngealized and uvular stops in medial position in Tsez

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