AN ACOUSTIC DESCRIPTION OF HIGH VOWEL SYNCOPE IN LEZGIAN

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ABSTRACT

This paper reports on a preliminary acoustic description of high vowel syncope in one dialect of Lezgian, a NE Caucasian, Daghestanian language. Acoustic data from one speaker confirm the absence of a vowel in the syncope context, but traces of it remain visible (and audible) in the preceding stop release or fricative noise. This raises the question of possible vowel devoicing. It also suggests that a relevant account for the facts should be based on gestural overlap rather than deletion. In support of this hypothesis, two types of measurements are reported. First, vowel duration shows that even non-high vowels are considerably shortened when stress is shifted away from them, participating in a similar process as high vowels. Second, the duration of the inter-burst interval in resulting stop sequences varies depending on the stop place of articulation.

Keywords: syncope, vowel devoicing, gestural overlap

1. INTRODUCTION

Lezgian is a North East Caucasian language belonging to the Lezgic branch of the Daghestanian family, spoken in Southern Daghestan and Northern Azerbaijan. An interesting phonological change has taken place in Lezgian over the past century, reported in [6, 8]: pretonic high vowels [i, y, u] are lost after voiceless obstruents. This change took place in some words earlier than in others, and this is reflected in the current orthography, where some words preserve the lost vowel, while others do not.

The present study is an acoustic description of the Lezgian syncope facts. This is a preliminary study based on the speech of one native speaker of the dialect of the village of Yargun, in Northern Azerbaijan. Section 2 contains information on the phonological background of the language, and the description of the syncope facts. Section 3 presents the acoustic study, which consists of a qualitative description of the data, and measurements of vowel duration and inter-burst interval in stop sequences resulting from syncope. Section 3 contains a general discussion of the implications of this preliminary study for the phonological analysis of the facts.

2. PHONOLOGICAL BACKGROUND

The vowel system of Lezgian consists of: [i, y, u, e, æ, a]. The low vowels may have long counterparts due to compensatory lengthening. The three high vowels are reported to be lost in pretonic position and following a voiceless obstruent. The very detailed description of the facts given in Haspelmath's [6] grammar for the standard (Güne) dialect served as starting point for this study. The examples listed below are from the Yargun dialect. There are slight differences between the two dialects.

(1) Examples of syncope – Yargun dialect

	absolutive sing.	absolutive plural
'flower'	tʃyk^{h}	tʃ^{q}k^{hw}-ér
'knife'	tʃ^{hw}k'úl /tʃ^{h}uk'ul/	tʃ^{hw}k'ul-ár
'purse'	k^{hj}sé /k^{h}ise/	k^{hj}se-jár
'onion'	tʃ^{hj}tʃág /tʃ^{h}itʃag/	tʃ^{hj}tʃag-ár

As indicated by the transcription, the syncopated high vowels are reported to be maintained as secondary palatalization, labialization, or both, on the preceding obstruent. Non-high vowels are not reported to undergo syncope: [meg] / [mek-ér] 'hair'.

As a result of high vowel syncope, word-initial obstruent clusters become very common in the Lezgian lexicon. Such clusters are not otherwise typical of NE Caucasian languages, but rather of the other branches, Northwest Caucasian (e.g., Kabardian) and Southern (e.g., Georgian). This syncope is indeed reminiscent of how some word-initial obstruent clusters developed in Georgian.

The Lezgian consonant inventory is listed in (2):

(2) Lezgian consonant inventory

voiced	*aspirated*	*unaspirated*	*ejective*
b	p^h	p	p’
d	t^h, t^{hw}	t, t^w	t’, $t’^w$
	ts^h, ts^{hw}	ts, ts^w	ts’, $ts’^w$
	$tʃ^h$	tʃ	tʃ’
g, g^w	k^h, k^{hw}	k, k^w	k’, $k’^w$
	q^h, q^{hw}	q, q^w	q’, $q’^w$
	f		
z, z^w	s, s^w		
ʒ	ʃ		
	x		
ʁ, $ʁ^w$	χ, χ		
m, n, l, r			
w, j, h, ʔ			

Underived obstruent sequences are attested in Lezgian, but only in word-internal position. The new resulting sequences may therefore have important consequences for the phonotactics of the language. In the next section we investigate qualitatively a series of acoustic records of syncope, and we test two hypotheses regarding two factors that affect syncope.

3. ACOUSTIC DATA

Data from one speaker of the Yargun dialect of Lezgian were recorded in a quiet room using an Edirol R-1 digital recorder, at 16 bit, 44 kHz sampling rate. An external microphone was used (Sony stereo condenser mic, model ECM-MS907). The target words were embedded in the carrier phrase [vavá: ___ sadrá luhú ʒedá] ‘you say ___ once’. The sentences were read in randomized order. Five repetitions of each target word were recorded. The .wav files were analyzed in Praat.

The speaker is the second author. She is in her 20s and has lived in France for the past two years. In addition to her native language, she also speaks Azeri, French, and Russian fluently. The Yargun dialect is her native language, and it is the only language she speaks at home with her family. The speaker has no known speech or hearing problems.

3.1. Qualitative study

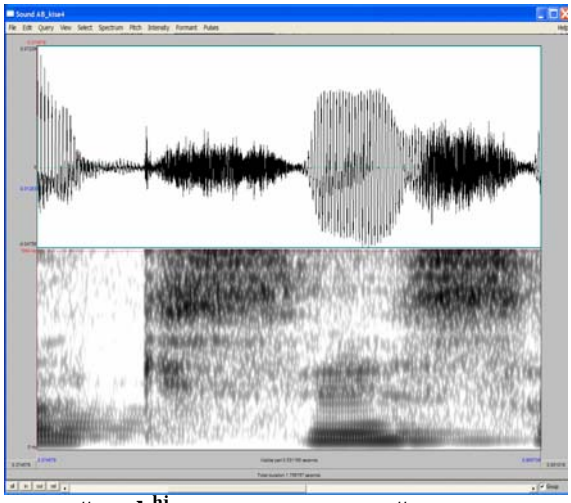
A wordlist (3) containing the target words was read by the speaker, written by herself in Cyrillic orthography. Next to the IPA transcription we indicate the missing vowel, or the mention “no V”, according to the speaker’s intuition. In the first case the vowels are always present in the orthography.

(3) Wordlist

	abs. sing.	abs. plural	
‘flower’	$tʃyk^h$	$tʃ^qk^{hw}$-ér	/y/
‘knife’	$tʃ^{hw}$k’úl	$tʃ^{hw}$k’ul-ár	/u/
‘place’	$tʃ^h$k’á	$tʃ^h$k’a-jár	no V
‘purse’	k^{hj}sé	k^{hj}se-jár	/i/
‘dog’	k^hitʃ’	k^{hj}itʃ’-ár	/i/
‘book’	k^{hj}táb	k^{hj}tab-ár	/i/
‘store’	$t^{hq}k^w$en	$t^{hq}k^w$en-ár	/y/
‘grandson’	p^htul	p^htul-ár	no V
‘ring’	t^{hw}p’ál	t^{hw}p’al-ár	/u/
‘fox’	sik’	s^jk’-ár	/i/
‘braid’	k^hef	k^{hj}f-ér	/i/
‘cloud’	$tʃ^h$uf	$tʃ^{hw}$f-ár	/u/
‘sponge’	p^{hj}né	p^{hj}ne-jár	/i/

A qualitative investigation of waveforms and wideband spectrograms confirmed the absence of a vowel (Figure 1).

Figure 1: Waveform and spectrogram: [k^{hj}se] ‘purse’.



No periodicity or modal voice is seen in any of the records. In all examples the palatalization or labialization on the preceding consonant is clearly audible. Even in the absence of systematic measures of coarticulation we can observe the effect of the high vowel on the preceding obstruent. This is most clearly seen if we compare, for example, the spectra of the noise of a preceding affricate in words such as [$tʃ^h$k’a] ‘place’ (no V) and [$tʃ^{hw}$k’ul] ‘knives’ (/u/). The spectrum falls to low frequencies in both cases, possibly due to a fair amount of lip rounding in the palatal affricate/fricative. In the first word, however, the lowest frequency of the frication noise can fall to anywhere between 1,000-2,000 Hz, while in the

second word, with more lip rounding, it stays low, between 1,000-1,200 Hz.

The absence of modal voicing in the acoustic records brings up the possibility of devoiced vowels in Lezgian. While we are reluctant to draw any conclusions based on data from only one speaker, it is worth keeping in mind the fact that the syncope environment reported for Lezgian is similar to the devoicing environment observed for well studied languages with vowel devoicing, such as Japanese and Korean: devoicing occurs in the vicinity of at least one voiceless obstruent, when the vowel is unaccented and high. Depending on the language, non-high vowels either do not devoice at all, or only rarely, as in Japanese [9].

If we are to follow the hypothesis of devoiced vowels, however, a more relevant case for comparison in our opinion is that of Quebec French, whose high vowel devoicing has been mentioned in the literature for a long time [5, 2]. Quebec French has similar types of morphological alternations involving stressed voiced and unstressed devoiced high vowels: [pik] 'stings' vs. [pi̥k-ã] 'spicy'; [tis] 'weaves' vs. [ti̥sy] 'fabric'. It is also worth mentioning that instances of vowel devoicing have been reported in Turkish [7] and Azeri [4], two languages with which Lezgian is in contact.

3.2. The effect of stress on vowel duration

It is known that unstressed vowels are shorter than stressed vowels, and cross-linguistically vowels are reported to be lost in either pre- or post-tonic position. We hypothesized that in Lezgian the duration of all vowels can be affected by morphological alternations involving stress shift, but that syncope is only reported for high vowels, because they are intrinsically shorter, and the effect of their further shortening can be perceived as deletion.

In order to test this hypothesis we recorded a set of data containing roots with non-high vowels [e, a] in morphological alternations: absolutive singular vs. absolutive plural (*-ár, -ér*) vs. ergative singular (*-íni*).

(4) Wordlist – vowel duration

	abs. sing.	abs. plural	ergative singular
'hair'	meg	mek-ér	mek-íni
'cradle'	q'eb	q'ep'-ér	q'ep'-íni
'intestine'	rad	rat^{h}-ár	rat^{h}-íni
'clay'	tʃ^{h}eb	tʃ^{h}ep^{h}-ér	tʃ^{h}ep^{h}-ini

In order to control for the overall number of syllables per utterance, three different carrier phrases were used, as illustrated below.

(5) Carrier phrases with example target words
[vavá: ***mekíni*** sadrá luhú ʒedá]
'you say ___ once'
[vavá: ***mekér*** rugúdra luhú ʒedá]
'you say ___ six times'
[vavá: ***még*** tsi-rugúdra luhú ʒedá]
'you say ___ 16 times'

Thus all carrier phrases have 11 syllables, and the only factor that affects the duration of the target vowel is stress. Notice that these alternations affect the voicing of the obstruent following the vowel. It is known that vowels are longer before voiced obstruents than before voiceless ones, but it is not clear to what extent this difference holds cross-linguistically. Moreover, in these data the voiced obstruent is a coda consonant, which would also shorten the preceding vowel, while the voiceless obstruent is an onset consonant, which should leave the preceding vowel longer. Therefore the duration differences we observe can, to a reasonable extent, be attributed only to stress.

Table 1: Mean vowel durations (ms) and standard deviations as a function of stress.

stress absol. sg. n=20	no stress absol. pl. n=20	no stress ergative sg. n=20
128.1 23.7	**70.15** 13.3	**64.6** 11.9

The results confirm that, everything else being equal, stress shift away from the vowel affects vowel duration to a large extent, even in the case of non-high vowels. These duration patterns suggest that in the absence of stress, a vowel gesture tends to be overlapped by the adjacent consonantal gestures. They are consistent with the proposal made in Articulatory Phonology [1], that syllable positions are defined by specific modes of coordination between the gestures involved. According to this view gestural units are viewed as oscillators coupled in pairwise fashion. An onset consonant gesture and the following vowel gesture are coupled in a synchronous, in-phase mode. When the vowel gesture is long (e.g., stressed) a full CV sequence is produced. When the V is considerably shortened (e.g., high and unstressed) it can be entirely hidden, producing the percept of syncope. For non-high vowels, their gestures are

also overlapped, but because they are longer they are not completely hidden.

While the gestural overlap account explains why no syncope is systematically reported for non-high vowels, it may also explain the voicing alternations in the data. If, as a result of stress shift, the two consonant gestures become more overlapped, their respective glottal gestures may also overlap more, resulting in various timing patterns. The result may be a predominant glottal opening gesture, leading in turn to a preference for aspirated obstruents, or a default glottal gesture which would favor voiceless unaspirated obstruents in a sequence. This remains an interesting hypothesis that can only be tested with articulatory data from more speakers.

3.3. The effect of consonant place on duration

Syncope is a source of word-initial obstruent clusters. Several studies on different languages [e.g., 3, 10] found that the amount of overlap between the gestures in a two-stop cluster, measured as the inter-burst interval (IBI), vary as a function of the order of place of articulation of the stops. Front-to-back clusters (*tk*) have a shorter IBI (are more overlapped) than back-to-front clusters (*kt*). We hypothesized that similar patterns may be found in Lezgian, if the resulting obstruent sequences are gesturally organized as CC rather than CVC. In other words, we propose to test the phonologization of newly formed clusters as revealed in specific IBI duration patterns. Only a few tokens were amenable to this comparison.

(6) Wordlist – order of place

[kt] vs. [tk]

'book'	k^{hj}táb	/i/	'store'	$t^{hq}k^{w}$en	/y/
	k^{hj}tab-ár			$t^{hq}k^{w}$en-ár	

[tp] vs. [pt]

'grandson'	p^{h}tul-ár		'ring'	t^{hw}p'al-ár	/u/
	(no V)				

As predicted, front-to-back clusters (*tk*, *pt*) have a shorter IBI than back-to-front clusters (*kt*, *tp*).

Table 2: Mean IBI durations (ms) and standard deviations as a function of obstruent order of place.

	front-to-back	back-to-front
tk vs. kt	**132.6** (11.5) n=9	**148.8** (12.5) n=10
pt vs. tp	**137.8** (11.3) n=5	**151.4** (12.7) n=5

Obviously, these results need to be backed up by additional data from more speakers before any reliable conclusions can be reached. Moreover, there may be a confounding factor in the *pt-tp* pair: the IBI for *pt* may be shorter either because of the front-to-back order, or because it is lacking a vowel, according to the speaker's intuition.

4. CONCLUSIONS

This preliminary study shows the typological importance of the Lezgian data. Further experimental investigations of the syncope alternations and accompanying voicing alternations contribute to typological studies of syncope and vowel devoicing. Reliable conclusions can only be drawn based on combined acoustic and articulatory experiments, but the present acoustic study allows us to formulate several very specific hypotheses: (i) syncope is the result of gestural overlap, all vowels are overlapped, but only the shortest ones (high vowels) can be entirely hidden; (ii) gestural overlap gives rise to word-initial clusters whose phonologization can be synchronically tested.

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