

HAS ESTONIAN QUANTITY SYSTEM CHANGED IN A CENTURY? COMPARISON OF HISTORICAL AND CONTEMPORARY DATA

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ABSTRACT

This paper observes the temporal and tonal characteristics of the Estonian three-way quantity system in recordings from the Berlin archives made in 1916-1918 and compares them to the contemporary speech data. The three-way opposition of segmental duration was more pronounced in the historical data, as the additional pitch cues were less contrastive. In the contemporary data, there seems to be more trade-off between the temporal structure and the pitch contrast in the opposition of long and overlong quantities.

Keywords: Estonian quantity, word prosody

1. INTRODUCTION

Estonian is one of the few languages that exhibit a three-level quantity opposition. Rather than an opposition of vowel length only [14], Estonian quantity is a complex prosodic phenomenon manifested in the domain of disyllabic feet.

In Q1 words, the stressed syllable can only be a short open syllable (e.g. [vilu] ‘chilly’). In Q2 and Q3 words, the stressed syllable is long and may be open or closed. In Q2 words, the S1 rhyme can be a long vowel ([vi:lu] ‘slice’, sg.gen.) or a combination of a short vowel and a consonant ([kalʲli] ‘hug’, sg.nom.). In Q3 words, it can be either an overlong vowel ([vi::lu] ‘slice’, sg.part.) or a combination of a short vowel and a long consonant ([kalʲ:li] ‘precious’, sg.gen.). In Q2 and Q3 words, the duration of the stressed syllable rhyme should be similar in the case of both structures.

Although the variation of length in unstressed syllables is not phonological, the duration of S2 varies in the opposite direction to the duration of S1. Thus the quantity can be described by the ratio of the first and second syllable rhyme durations [1, 4, 5, 6, 8, 10], or by comparing the duration of the nucleus of the stressed syllable with the weighted sum of segment durations within a foot [e.g., 16].

Typically, the pitch is level in the first syllable and falling at the syllable boundary in Q1 and Q2, but falling from the beginning of the first syllable in Q3 [1, 6, 8, 10, 15]. Perception tests have shown that the pitch cue is of vital importance for making the distinction between Q2 and Q3 [3, 7, 8, 9, 12, 13], whereas the weight of the pitch cue appears to vary in accordance with the dialectal background of the listeners [11]. Lehiste [8] claims that Estonian is undergoing a prosodic change from a quantity language to an accent language, as the short-long opposition is manifested only by durational means and pitch accent is used for the long-overlong opposition.

Historical recordings give us a unique opportunity to see whether there have been developments in Estonian word prosody during the past century. In this paper, the segmental duration and pitch patterns of disyllabic words from those recordings are analyzed, and compared with data from present-day speakers. In particular, possible quantity-related changes in syllable rhyme duration ratios and pitch patterns are observed.

2. MATERIAL AND METHODS

Phonograph recordings of the Estonian language made during the First World War from interned soldiers in prisoner-of-war camps of the German Empire are analyzed in this study. The total number of the available Estonian sound recordings from that time in the archives of Humboldt University in Berlin is around a few dozen. Historical recordings from 8 speakers were selected (one from Saaremaa, three from Võrumaa and four from Tartumaa; below: ‘the Berlin group’), where the subjects read a fairy-tale or a story from the Bible.

To compare the Berlin data with contemporary Estonian, a group of 8 male speakers (three from Saaremaa, three from Võrumaa and two from Tartu; below: ‘the contemporary group’) were asked to read the story Põhjatuul ja päike (The

north wind and the sun) in Standard Estonian. The recordings were done in 2006-2009.

Table 1: Number of analyzed tokens.

		Number of	Q1	Q2	Q3
	Dialect	speakers			
Berlin	Saaremaa	1	20	13	25
	Võru	3	70	72	77
	Tartu	4	35	71	66
Cont.	Saaremaa	3	16	35	38
	Võru	3	11	32	29
	Tartu	2	5	29	26

A total of 670 disyllabic words with an H*+L pitch accent were analyzed (see Table 1 for details) with Praat [2]. The phoneme boundaries were tagged manually, after which segment durations and pitch contours were extracted with a script. Finally, five pitch points were selected: the beginning of the first vowel, the end of the first syllable, the beginning and end of second vowel, and the over-all peak. The pitch in the selected points was checked manually. To facilitate the comparison of speakers, pitch values were converted from the logarithmic Hertz scale to a linear semitone (st) scale whose zero point lies at 50 Hz.

3. RESULTS AND DISCUSSION

3.1. Temporal characteristics

The speech rate in the Berlin group is approximately 20% slower than that of the contemporary group. This is demonstrated by comparing the mean duration of the words, which is 450 ms for the Berlin group and 370 ms for the contemporary group. A repeated measures ANOVA test shows that the variation between the two groups is significant ($F(1, 10) = 21.95$; $p < .001$) while the difference between dialects is not significant ($F(2, 10) = .97$; $p = .41$).

The mean segment durations are presented in Table 2. In both groups, the S1 rhyme for Q2 is about 1.8 times longer than for Q1. For Q3, the S1 rhyme is longer in words with a closed than with an open syllable. In the Berlin group, the open S1 rhyme for Q3 is 2.4 times longer than S1 rhyme for Q1, and the closed S1 rhyme for Q3 is 2.6 times longer. In the contemporary group, the difference is even larger: the open S1 for Q3 is 2.0 times longer, while the closed S1 is 2.8 longer than for Q1.

The mean duration of V2 progressively decreases with the increase of S1 rhyme: in the

Berlin group, $\bar{x} = 120$ ms for Q1, $\bar{x} = 90$ ms for Q2, and $\bar{x} = 75$ ms for Q3 words. Averages in the contemporary group are 90 ms for Q1, 60 ms for Q2, and 50 ms for Q3.

Table 2: Mean segment durations as measured for the two groups. 'Q2 V' and 'Q3 V' mark the word with open S1 (vocalic quantity), 'Q2 C' and 'Q3 C' the words with closed S1 (consonant quantity).

		Berlin		Contemp.	
		mean	s.d.	mean	s.d.
S1 onset	Q1	75	22	77	28
	Q2 V	75	25	59	16
	Q2 C	72	21	59	22
	Q3 V	71	18	65	14
	Q3 C	69	19	53	21
S1 rhyme	Q1	91	25	65	19
	Q2 V	164	32	112	13
	Q2 C	159 (99+60)	33	125 (74+51)	19
	Q3 V	213	43	131	20
	Q3 C	236 (106+130)	46	183 (74+109)	41
S2 onset	Q1	60	15	48	13
	Q2 V	59	16	41	10
	Q2 C	56	14	42	14
	Q3 V	65	18	60	15
	Q3 C	62	14	58	16
S2 nucl.	Q1	123	32	94	29
	Q2 V	88	25	59	13
	Q2 C	88	29	67	22
	Q3 V	76	17	57	13
	Q3 C	75	22	54	19

In both the Berlin and the contemporary group the ratio of syllable rhyme durations (S1/S2 ratio) for Q1 is .8 and for Q2 2.0. This difference is significant ($F(1, 14) = 47.678$; $p < .001$), and there is no significant difference between the Berlin and the contemporary groups ($F(1, 14) = 2.74$; $p = .12$) and no significant difference between the words with open and close S1 ($F(1, 14) = 1.56$; $p = .23$). The S1/S2 ratio for Q3 is different in words with open and closed S1 ($F(1, 14) = 13.93$; $p < .005$): in the Berlin group, the values are 2.9 and 3.6, and in the contemporary group, 2.4 and 3.8, respectively.

The opposition of Q1 vs. Q2 is rather similar in both groups, but the opposition of Q2 vs. Q3 is less marked in the contemporary group in words with an open S1, which leads to searching for additional characteristics (e.g. the pitch).

3.2. Tonal characteristics

The mean pitch in the Berlin group was 25 semitones (214 Hz), while in the contemporary group it was only 16 st (128 Hz), with standard deviation being 4 st in both groups. This suggests that 100 years ago Estonian was spoken or at least read with a considerably higher pitch.

The pitch in the Berlin group is rising-falling, with the F0 peak in average located at 110 ms from the V1 beginning in Saaremaa, at 95 ms in Võru, and 77 ms in Tartu dialect for all quantity degrees. The difference is significant between the dialects ($F(2, 5) = 4.1$; $p < .05$), but not between the quantity degrees ($F(2, 5) = 3.11$; $p = .13$). Proportionally, the peak is located at the second half of the S1 in Q1 and Q2 words, and at the first half of the S1 in Q3 words, but this is due to the variation in S1 duration, as the peak is linked with the absolute duration of a syllable.

Table 3: The contemporary group: number of words with the pitch peak at the first half of S1 or later.

Location of peak	Saaremaa			Tartu			Võru		
	Q1	Q2	Q3	Q1	Q2	Q3	Q1	Q2	Q3
Early	6	10	28	2	20	21	5	16	22
Late	10	25	10	3	9	5	6	16	7

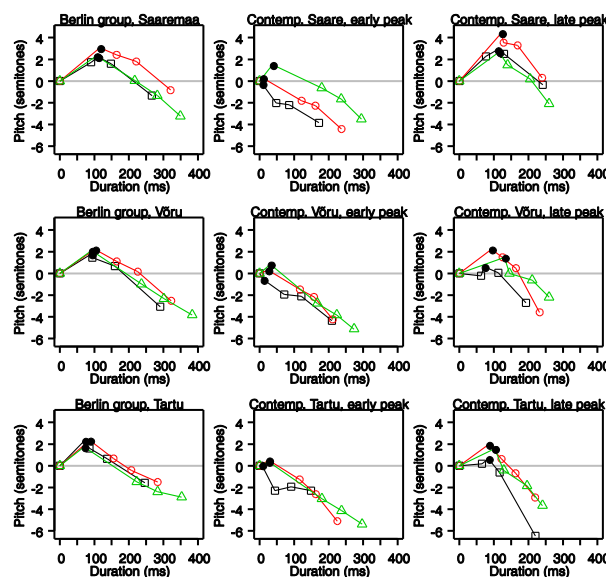
In the contemporary group the speakers seemed to produce two patterns: in some words the F0 peak is in the very beginning of S1 and in others the peak is moved to the middle of the word. To see the regularities, the pitch patterns in the contemporary group were divided into two sets: the words where the peak was in the first half of S1 and those where the peak occurs later. In Table 3 we can see that in each dialect group the pattern is different. In Saaremaa, the peak in most Q1 and Q2 words occurs later in the word while the peak in most Q3 words is in the first half of S1 (differences are significant for the quantity degrees: $\chi^2(2, N = 89) = 15.9$; $p < .001$). In Tartu, the peak usually appears in the beginning of the word and there are no significant differences between quantity degrees ($\chi^2(2, N = 60) = 3.63$; $p = .16$). In Võru, words with Q1 and Q2 showed a random distribution of early and late peaks ($\chi^2(1, N = 43) = .068$; $p = .795$), whereas in Q3 the peak tended to appear in the beginning of the word (the distribution for Q2 and Q3 words was significantly different: $\chi^2(1, N = 29) = 4.33$; $p < .05$).

If the peak is not in the beginning of the word, the pitch is rising-falling, with the peak in average at 118 ms from the beginning of V1 in the

contemporary Saaremaa dialect or at 95 ms from the beginning of V1 in Tartu and Võru. There is no significant difference between quantity degrees ($F(2, 5) = 1.367$; $p = .34$).

In Berlin group, the pitch rises about 2 st from the V1 beginning to the peak. In the contemporary group it rises about 3.7 st in the Saaremaa dialect, and in the Tartu and Võru dialect, it does so by 1.7 st. The difference between Saaremaa vs. Tartu and Võru is significant ($F(2, 5) = 9.397$; $p < .05$). In both the Berlin and the contemporary group, the pitch range from the peak to the end of the foot seems to vary in accordance with the quantity of the word ($F(2, 13) = 4.86$; $p < .005$). The pitch falls by 3.6 st in Q1 words, by 4.3 st in Q2 words and by 4.8 st in Q3 words.

Figure 1: Pitch curves for the Berlin and contemporary groups. The zero corresponds to the beginning of V1 (black squares Q1, red circles Q2, and green triangles Q3). Peaks are marked with black filled circles.



Apparently, the differences in quantity realization between the dialects are rather small. In both groups the peak occurs the latest in Saaremaa and the earliest in Tartu, with the Võru dialect falling in the middle. In the contemporary Saaremaa dialect, the rising-falling pattern now appears to be regularly used in Q1 and Q2 words, while Q3 words tend to be frequently produced with the falling pattern. In the contemporary Võru dialect the two patterns are equally used with Q1 and Q2 words, whereas the falling pattern is more frequent in Q3 words. Only in the Tartu dialect is the falling pattern preferred with all quantity degrees, making the rising-falling pattern the less

frequently used one. These results confirm the conclusions drawn on the basis of a series of perception tests [11] which showed that Estonian speakers from North and West Estonia preferred to judge quantity by reference to the pitch cue while speakers from East and South Estonia based their decisions mainly on temporal cues.

4. CONCLUSION

The syllable duration ratio introduced by Ilse Lehiste in early 1960s for describing the Estonian three-way quantity system has turned out to be its most stable characteristic. It is surprising, however, to see the similarity in the syllable ratios derived from the Berlin data from the beginning of the 20th century and in contemporary data. At the same time, the reading style has changed: in the contemporary data, the speech rate is considerably faster and the pitch is lower than in the Berlin data.

Since the first experimental studies of Estonian quantity in the early 1960s the pitch contour has been claimed to be the descriptive feature that, in terms of discriminating Q3 from Q2, was second in importance only to the syllable duration ratio mentioned above. Yet, in the Berlin data from the beginning of 20th century, the pitch contour had less contrastive power as the pitch was linked with the absolute time scale. In the contemporary data, on the other hand, the difference between Q2 and Q3 is smaller in the temporal domain, but different pitch patterns are often used to emphasize the opposition. The two different pitch patterns are used with all quantity degrees, although the contour with the peak in the beginning of the word is more frequently used with Q3 words.

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