

On the quality change of mid vowels in the Võru dialect of Estonian

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ABSTRACT

The present article constitutes a study of the raising of overlong mid vowels in the Võru dialect, which is one of the three dialects in the South of Estonia. Long mid vowels of Võru have split into full-long mid vowels (Q2) and into overlong raised mid vowels (Q3). The formant values of raised mid vowels show that they are much higher than mid vowels and very close to high vowels. A perception test was compiled of the words that constitute minimal pairs and contain raised mid vowels or corresponding high vowels. The test showed that it is hard or even impossible for listeners to identify words without a sentence context. The raising of overlong mid vowels has led to the near-merger of them with overlong high vowels.

1 INTRODUCTION

The present paper presents the results of acoustic measurements of raised mid vowels in Võru, a dialect in the South of Estonia. The results of a perception test will be also presented. The acoustic quality of Võru vowels has been analysed earlier by Karl Pajusalu [2], Merike Parve [3] and Pire Teras [4, 5, 6].

The mid vowels of Võru are characterised by raising. The long mid vowels [e, o, ø, ɤ] of Võru have split into full-long mid vowels [e:, o:, ø:, ɤ:] (Q2) and into overlong raised mid vowels [e:ʔ, o:ʔ, ø:ʔ, ɤ:ʔ] (Q3). Q3 is marked both by a quantity and a quality change. Raising of mid vowels can be found also in other southern and western dialects of Estonian. The more to the South-East of Estonia, the more extensive is the raising. Raised mid vowels and high vowels have become very close in their quality.

William Labov [1] has brought out raising of long vowels as one of the three general principles of vowel shifting. Raising of vowels can cause a chain shift of vowels as it has happened in the history of English, but Labov has maintained that mergers of vowels are much more common in the history of languages than chain shifts [1]. In the case of merger, two vowels fall together. Labov [1] has also described the case of near-merger as a situation where speakers make in the quality of sounds the slight differences that listeners can not hear.

2 MATERIAL AND METHOD

Acoustic measurements are based on words that contained mid vowels, raised mid vowels and high vowels. The words were hidden in a text read by 3 male speakers and 4 female speakers, who come from the South of Estonia.

The words containing the target vowels were picked out from the data of these informants. The words were processed by Kay Elemetrics CSL 4300B. Speech segments were digitized at the sampling rate of 10 kHz. Spectrograms were prepared with the help of a filter with a bandwidth of 293 Hz. Formant frequencies were measured at the end of the first half of the vowel. The formant values in Herzes were converted into Barks (see e.g. [7]).

3 THE QUALITY OF MID, RAISED MID AND HIGH VOWELS

3.1 VOWEL QUALITY IN THE SPEECH OF MALE SPEAKERS

The average formant values of three male speakers are presented in Table 1 and Figure 1.

Vowel (N)	F1		F2		F3	
[e:] (15)	417	4.17	1963	12.89	2668	14.93
[i:] (24)	269	2.71	2206	13.67	3034	15.76
[o:] (21)	418	4.18	780	7.10	2159	13.52
[u:] (24)	298	3.01	647	6.12	2148	13.49
[ɤ:] (10)	423	4.23	1426	10.76	2341	14.75
[ø:] (4)	409	4.10	1746	12.10	2307	13.97
[y:] (4)	305	3.08	1760	12.15	2209	13.68
[e:ʔ] (13)	302	3.05	2191	13.62	2994	15.67
[i:ʔ] (27)	272	2.74	2231	13.74	3099	15.89
[o:ʔ] (26)	304	3.07	625	5.95	2194	13.63
[u:ʔ] (24)	287	2.89	595	5.71	2174	13.49
[ɤ:ʔ] (14)	346	3.49	1487	11.04	2381	14.18
[ø:ʔ] (4)	328	3.31	1715	11.98	2221	13.71
[y:ʔ] (4)	291	2.94	1725	12.02	2198	13.64

Table 1: Average formant values (in Hz and Bark) of full-long mid and high vowels and overlong raised mid and high vowels (N – number of measurements).

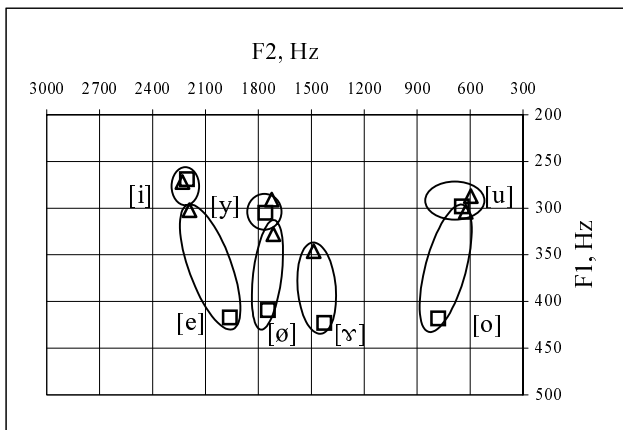


Figure 1: Average formant values of full-long mid and high vowels (□) and overlong raised mid and high vowels (Δ) in the formant space of F1 vs. F2 (three male speakers).

According to the formant values of F1, the vowels can be divided into the following groups: full-long and overlong high vowels [i, y, u], overlong raised mid vowels [ɛ, ø, ɤ, ɐ], full-long mid vowels [e, ø, ɤ, o]. According to the formant values of F2, they are grouped as follows: front vowels [i, ɛ, e, y, ø, ø], central vowels [ɤ, ɤ], and back vowels [u, ɔ, o].

In the text that was read, in the spontaneous speech, and in isolated vowels (see [5], [6]), the raised front mid vowel [ɛ:] is higher and a little more front than the full-long mid vowel [e]. At the same time, the raised front mid vowel is lower and a little more back than the high vowel [i:]. On the psycho-acoustic scale, the distance between F1 of [ɛ:] and [e] is 1.12 Bark and between [ɛ:] and [i:] it is 0.31 Bark. So the raised mid vowel is closer to the high vowel than to the mid vowel.

The raised labial front mid vowel [ø:] is higher and more back than the mid vowel [ø], and lower and a little more back than the high vowel [y:]. On the psycho-acoustic scale, the distance between F1 of [ø:] and [ø] is 0.79 Bark and between [ø:] and [y:] it is 0.37 Bark.

The central raised mid vowel [ɤ:] is higher and a little more front than the central mid vowel [ɤ]. These central vowels are acoustically even closer to the front vowels than to the back vowels. But phonologically, for example in the case of vowels harmony, they behave like back vowels. On the psycho-acoustic scale, the distance between F1 of [ɤ:] and [ɤ] is 0.74 Bark.

The raised labial back mid vowel [ɔ:] is higher and more back than the mid vowel [ɔ]. Compared to the high vowel [u:], it is lower and more front. On the psycho-acoustic

scale, the distance between F1 of [ɔ:] and F1 of [o:] is 1.11 Bark and between F2 of [ɔ:] and F2 of [o:] it is 1.15 Bark. The distance between the corresponding formant values of the raised mid vowel and those of the high vowel does not exceed 1 Bark (0.18 and 0.24 Bark respectively). Also this raised mid vowel is very close to the high vowel.

3.2 VOWEL QUALITY IN THE SPEECH OF FEMALE SPEAKERS

The average formant values of four female speakers are presented in Table 2 and Figure 2.

Vowel (N)	F1		F2		F3	
	Hz	Bark	Hz	Bark	Hz	Bark
[ɛ:] (19)	434	4.33	2451	14.37	3044	15.78
[i:] (35)	331	3.34	2644	14.87	3204	16.10
[o:] (25)	447	4.26	764	6.99	2358	14.11
[u:] (37)	345	3.48	638	6.05	2263	13.84
[ɤ:] (15)	435	4.34	1418	10.72	2698	15.00
[ø:] (4)	445	4.43	1747	12.10	2620	14.81
[y:] (4)	371	3.74	2038	13.14	2477	14.44
[ɛ:] (19)	346	3.49	2625	14.82	3266	16.22
[i:] (35)	319	3.22	2690	14.98	3280	16.25
[ɔ:] (34)	372	3.75	648	6.13	2198	13.64
[u:] (30)	334	3.37	661	6.23	2251	13.80
[ɤ:] (21)	380	3.82	1441	10.83	2686	14.97
[ø:] (3)	367	3.70	1850	12.49	2503	14.50
[y:] (4)	378	3.80	2076	13.26	2572	14.68

Table 2: Average formant values (in Hz and Bark) of full-long mid and high vowels and overlong raised mid and high vowels (N – number of measurements).

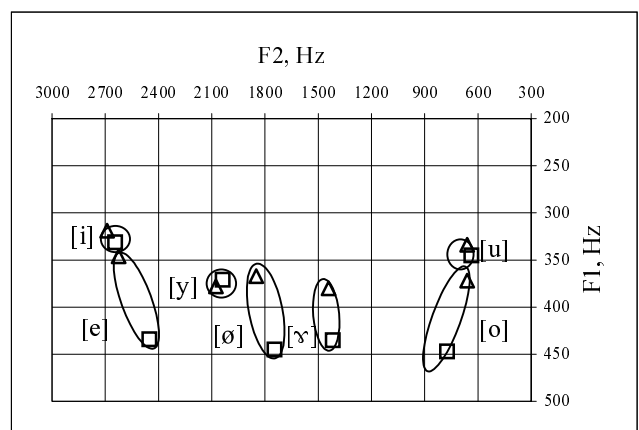


Figure 2: Average formant values of full-long mid and high vowels (□) and overlong raised mid and high vowels (Δ) in the formant space of F1 vs. F2 (four female speakers).

According to the formant values of F1 of female speakers vowels can be divided into the same groups as those of

male speakers: full-long and overlong high vowels [i:, y:, u:], overlong raised mid vowels [ɛ̄, ø̄, ʏ̄, ɤ̄], and full-long mid vowels [e, ø, ʏ, o]. According to the formant values of F2, they are grouped as follows: front vowels [i, ɛ̄, e, y, ø, ø], central vowels [ʏ, ʏ], and back vowels [u, ɤ̄, o].

Both in the speech of male and female speakers, the raised front mid vowel [ɛ̄:] is higher and more front than the full-long mid vowel [e:]. Only in the speech of female speakers the extent of raising is smaller. The raised front mid vowel [ɛ̄:] is lower and a little more back than the high vowel [i:]. On the psycho-acoustic scale, the distance between F1 of [ɛ̄:] and [e] is 0.84 Bark and between [ɛ̄:] and [i:] it is 0.27 Bark. This distance does not exceed 1 Bark although the raised mid vowel is closer to the high vowel than to the mid vowel.

The raised labial front mid vowel [ø̄:] is higher and a little more front than the labial mid vowel [ø:]. The raised mid vowel is even a little higher and more back than the high vowel [y:]. On the psycho-acoustic scale, the distance between F1 of [ø̄:] and [ø:] is 0.73 Bark and between [ø̄:] and [y:] it is 0.1 Bark. The distance between the corresponding values of F2 is 0.77 Bark and 0.39 Bark.

The central raised mid vowel [ʏ̄:] is higher and a little more front than the central mid vowel [ʏ:]. On the psycho-acoustic scale, the distances between F1 and F2 of [ʏ̄:] and [ʏ:] are 0.52 and 0.11 Bark. So the difference between these vowels is even smaller than in the speech of male speakers.

The raised labial back mid vowel [ɤ̄:] is higher and more back than the mid vowel [o:]. The extent of raising is smaller than in the speech of male speakers. Compared to the high vowel [u:], the raised mid vowel is lower and a little more back. On the psycho-acoustic scale, the distance between F1 of [ɤ̄:] and that of [o:] is 0.51 Bark and between F2 of [ɤ̄:] and that of [o:] it is 0.86 Bark. The distance between the corresponding formant values of the raised mid vowel and those of the high vowel [u:] does not exceed 1 Bark (0.38 and 0.1 Bark respectively).

4 THE PERCEPTION OF VÕRU VOWELS

In the current perception test, words cut out of the text that was read were used as stimuli. The program Cool Edit was used for editing. The perception test consisted of seven parts (seven speakers). There were 26 words in each part. The words were ordered randomly.

The acoustic analysis of Võru vowels showed that all raised mid vowels are very close to high vowels, being only a little lower than the latter are. The aim of the perception test was to find out whether listeners could

differentiate between words with raised mid vowels and words with high vowels when the words are taken out of context. In other words, whether raised mid vowels could be considered to be independent phonemes or have they almost merged with high vowels, being allophones of them.

Among the participants of the perception test there were 13 women (born in 1946-1981) and 7 men (born in 1955-1978). They all come from the South of Estonia and speak Võru more or less regularly in their everyday life. The word-list was given to the listeners. They were instructed to listen to a word and to choose between two meanings given for each word.

The following minimal pairs appeared in the test: keel [kɛ̄:l] 'language' – kiil [ki:l] 'wedge', leem [lɛ̄:m] 'soup' – liim [li:m] 'glue', peet [pɛ̄:tʰ] 'beet' – piit [pi:tʰ] 'jamb' (though some speakers palatalized also the final consonant of the second word); hool [hø̄:lʰ] 'care' – huul [hu:lʰ] 'lip', koori [kø̄:ri] 'shell, part.pl.' – kuuri [ku:ri] 'shed, part.sg. or ill.sg.', tool [tø̄:lʰ] 'chair' – tuul [tu:lʰ] 'wind', kooli [kø̄:lʰi] 'school, part.sg. or ill.sg.' – kuuli [ku:lʰi] 'bullet, part.sg. or ill.sg.', kooli [ko:lʰi] 'school, gen.sg.' – kuuli [ku:lʰi] 'bullet, gen.sg.'; söötä [sø̄:ttæ] 'to feed' – süütä [sy:ttæ] 'to scratch'; riim [ri:m] 'rhyme' – rõõm [rø̄:m] 'joy', liir [li:r] 'lira' – lõõr [lø̄:r] 'flue'.

The percentage of dividing of the perception of words containing [ɛ̄:] and [i:] is presented in Figure 3. The identification of these vowels remains between 36-68%. The percentage of misidentification for these words is between 32-64%. These results show that most of the times listeners fail to identify the word correctly. In most cases the vowels of the words of minimal pairs had a little acoustic difference (mainly the formant value of F1 of the raised mid vowel was higher than that of the high vowel).

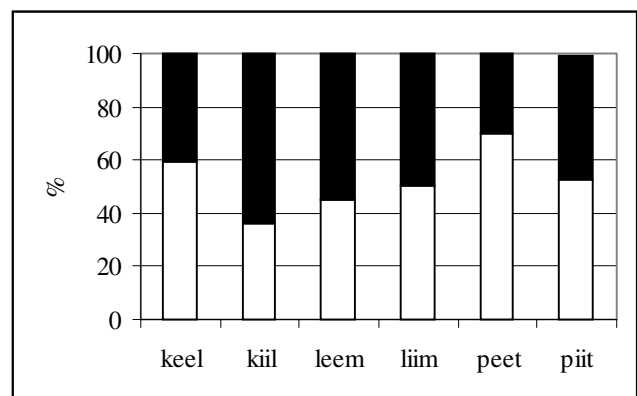


Figure 3: The percentage of dividing of perception of [ɛ̄:] and [i:] (■ – misidentified, □ – identified)

The data on the dividing of the perception of words containing [ɤ̄:], [u:], [o:] and [u:] is given in Figure 4. The

identification of [ɔ:] and [u:] remained between 21-74% (misidentification, accordingly, 28-79%). In the case of the minimal pairs *hool – huul* and *tool – tuul* averagely half of the stimuli was identified correctly. In the case of the minimal pairs *koori – kuuri* and *kooli – kuuli* the division of identifications was uneven. The listeners seem to prefer the word with the high vowel (*kuuri*) in the first pair and the word with the raised mid vowel (*kooli*) in the second pair. The listeners can have chosen the words that occur more frequently in speech. There was also one minimal pair, in which the words were pronounced in Q2 (*kooli – kuuli*). Listeners rarely failed to identify the word *kooli* (with the mid vowel). 94% of stimuli were identified. At the same time they had difficulties in identifying the word *kuuli*, considering it to be the form of the word *kool* [kɔ:l]. It shows, that here the quality of the vowel was more important than the quantity of the vowel for the listeners.

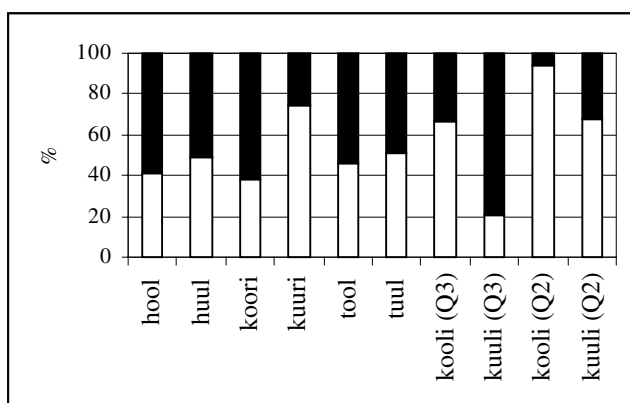


Figure 4: Dividing of perception of [ɔ:], [u:], [o:] and [u:] (■ – misidentified, □ – identified).

There was only one minimal pair with the labial raised mid vowel and the labial high vowel (*söötä – süütä*). The first of them was lower or more back than the second one. However, averagely only 53% of stimuli with raised mid vowels and 56% of stimuli with high vowels were identified. There was the biggest acoustic difference between the vowels of the minimal pairs *riim – rööm*, *liir – lõör*. The words with high front vowels were chosen because no corresponding words with high central vowel can be found. In the case of the high vowel 94% of stimuli and in the case of raised central mid vowel 99% of stimuli were identified.

Four speakers who read the text also participated in the perception test. They all made a little acoustic difference between raised mid vowels and high vowels in their speech. One speaker managed quite well to identify the words that she had pronounced herself. She identified 81% of the words. At the same time, she had difficulties in identifying words of other speakers (depending on a speaker the percentage of identification was 50-77%). The other speakers had difficulties in identifying the words produced by themselves and by of other speakers. The percentage of identification in the former case was 65%, 54% and 46% respectively. In the latter case it was 46-

77% (depending on a listener and a speaker).

5 CONCLUSIONS

Raised mid vowels of Võru are acoustically very close to high vowels, although they remain a little lower. The extent of raising of two primary mid vowels is bigger than that of two secondary mid vowels. In the speech of male speakers the extent of raising is bigger than in the speech of female speakers. On the psycho-acoustic scale, the distances between the values of F1 of raised mid vowels and those of high vowels are small, but the distances between the values of F1 of raised mid vowels and those of mid vowels can sometimes exceed 1 Bark. Minimal pairs containing raised mid vowels and high vowels used as stimuli in the perception test appeared to be difficult to identify without a context. Situations like this were described as near-mergers by William Labov. In the result of raising mid vowels alternate with raised mid vowels that differ acoustically a little from high vowels, but are not distinguishable from them by listeners.

6. ACKNOWLEDGEMENTS

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