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## ABOUT THE ACOUSTICS OF LONG AND OVERLONG VOWELS IN THE VÕRU DIALECT

The article presents the results of acoustic measurements of long and overlong vowels in the Võru dialect. This study is a part of the linguistic project "The phonetic, phonological and morphological analysis of vowels in the Võru dialect" (Grant No. 3027 of the Estonian Science Foundation, Project Manager Karl Pajusalu) and "The analysis of the South Estonian vowel system" (ESF Grant No. 3262).

Estonian is rich in vowels. It has nine vowels that can have either a short or long degree of length. It has been thought, however, that an Estonian does not perceive small changes in vowel quality that are related to length alternation (Eek, Meister 1994 : 404). These changes are more noticeable in dialects. The changes have occurred mostly in two directions — the long vowels have either become diphthongized, or the mid vowels are raised in the overlong degree of length (Kask 1980 : 38–44; Ketunen 1962 : 135–139). The diphthongization of long vowels has taken place in the area of North Estonian (with the exception of *i* and *u*). Depending on the dialect this change may occur in both the long and overlong degrees of length or only in the overlong degree of length. Raising can be found in South Estonia, West Estonia and on the islands.

The raising of vowels is not a phenomenon that is only characteristic of Estonian dialects. The raising of mid vowels can be found, for example, in English as well. When Middle English was developing into Standard Modern English, then almost all the vowels underwent extensive changes (Moore 1951 : 132–134). In the case of [ɔ] the following shift occurred: the Middle English long low back vowel [ɔ:] developed into the mid back vowel [o], the mid [o:], however, developed into the high back vowel [u] (e.g. *fode* [foodə] > *food* [fud]). The Middle English mid front vowel [e:] developed into the high front vowel [i] (e.g. *sweete* [swe:tə] > *sweet* [swit]).

The vowels of Standard Estonian have been acoustically described by Georg Liiv and Mart Remmel (1970) and Arvo Eek and Einar Meister (1994). As far as South Estonian dialects are concerned, Karl Pajusalu (1996) has measured vowel quality in the Mulgi dialect (mostly in non-initial syllables, though). An overview concerning the quality of short vowels in the Võru dialect can be found in the bachelor's thesis by Merike Rist (1997). Tiit-Rein Viitso (1990) has studied the vowels in the Setu dialect from the point of view of phonology.

The system of long vowels in the Võru dialect resembles the standard language. In the case of the overlong vowels, however, the long mid vowels  $\bar{e}$ ,  $\bar{o}$ ,  $\bar{e}$  and  $\bar{o}$  are raised accordingly into  $\hat{i}$ ,  $\hat{u}$ ,  $\hat{i}$  and  $\hat{u}$  (e. g. *kül'* : *kēle*, *kül'* : *kōl'i*, *rõm* : *rēmu*,

$\hat{s}\hat{y}\hat{k} : \bar{s}\bar{o}\bar{c}\bar{i}$ ). If  $\bar{e}$ ,  $\bar{o}$  and  $\bar{\bar{o}}$  are raised in all the South Estonian dialects, then  $\bar{e}$  is raised in the Võru and Tartu dialects but only occasionally in the Mulgi dialect. Nor are  $\bar{e}$  and  $\bar{o}$  raised under certain conditions. Thus the raised vowels  $\hat{i}$  and  $\hat{u}$  become opposed to the newer vowels  $\bar{e}$  and  $\bar{o}$  that do not have shorter equivalents: *lõtsk* 'boat', *ēstlane* 'Estonian' (Viitso 1986; 1990). Nor are these vowels raised in words with a certain phonetic structure — e.g. *pēttü*, *vētti* — or in the case of pronunciation errors.

In the current new spelling of Võru the raised vowels are marked as high: *ii/uu/iii/yy*. One should point out, however, that they are pronounced almost in the same way as the corresponding high vowels (Jüvä 1994 : 7). What is most problematic in the Võru vowels with a long degree of length is how the quality of the vowels that come into being as a result of the raising of mid vowels with an overlong degree of length differs from the quality of high vowels (e.g. how  $\hat{i}$  differs from  $\hat{i}$  and  $\hat{u}$  from  $\hat{u}$ ).

## 1. Dialect data and their treatment

The source material of the present study consists of one- to four-syllable words that reveal the corresponding vowels. The informant is a female born in 1925 who is characterized by fluent speech and a clear pronunciation. The recording was made by Ervin Org and Karl Pajusalu at Tabina in Vastseliina Parish in the summer of 1994. It is a free conversation from which I picked out the words that contain the necessary vowels.

For each vowel I measured at least ten occurrences (with the exception of the long  $\bar{e}$  and  $\bar{u}$  and the overlong  $\bar{\bar{o}}$  and  $\hat{u}$ ). The data were processed by CSL 4300. The speech segments were fed into the computer from the tape at the sampling rate of 10 kHz. The spectrograms were prepared with the help of the broadband filter with the bandwidth of 293 Hz (additionally, the method of linear prediction was used). When making the spectrogram, the word was separated from the context of the sentence and, if necessary, the speech sound was separated from the context of the word. I measured also the lengths of the vowels, ignoring the transition from the previous consonant to the vowel and from the vowel to the next consonant.

## 2. Results of the formant analysis

### 2.1. Long vowels

The mean formant values for long vowels are given in Table 1 (see also Figure 1).

Table 1

Mean formant values of long vowels in Hz with standard deviations

	F1	SD	F2	SD	F3	SD	F4	SD
$\bar{a}$	652	46	1278	45	2512	67	3273	89
$\bar{e}$	473	24	1878	61	2647	117	3338	216
$\bar{i}$	312	20	2158	63	2821	99	3380	148
$\bar{o}$	438	36	925	58	2410	131	3276	142
$\bar{u}$	367	26	853	58	2101	136	3015	73
$\bar{e}$	415	23	1365	119	2316	102	3087	71
$\bar{\bar{a}}$	640	54	1598	116	2441	181	3164	111
$\bar{\bar{o}}$	455	28	1693	40	2503	71	3239	121
$\bar{\bar{u}}$	332	24	1874	62	2529	85	3314	130

Generally speaking, the location of the Võru long vowels in the formant space resembles that of the standard language (cf. Eek, Meister 1994).

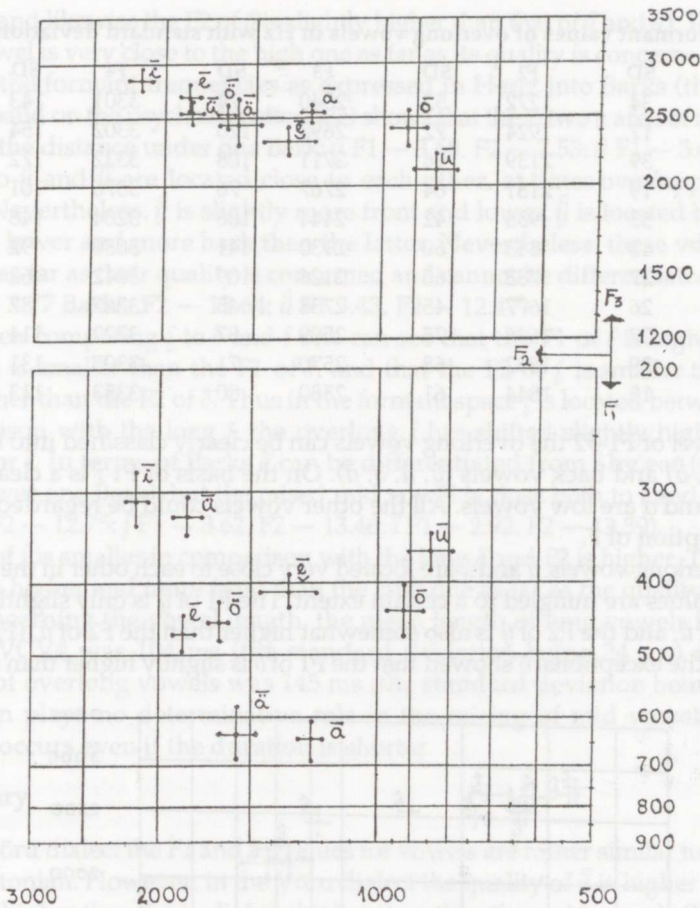


Figure 1. Location of long vowels in the formant space.

Thus the long vowels in the Võru dialect could be classified in the F1-F2 space on the basis of F1 into three degrees of height: high ( $\bar{i}$ ,  $\bar{u}$ ,  $\bar{u}$ ), mid ( $\bar{e}$ ,  $\bar{o}$ ,  $\bar{e}$ ,  $\bar{o}$ ), and low ( $\bar{a}$ ,  $\bar{a}$ ). On the basis of F2 they can be classified into three classes that mark frontness and backness: the front vowels ( $\bar{i}$ ,  $\bar{u}$ ,  $\bar{e}$ ,  $\bar{o}$ ,  $\bar{a}$ ), the central vowel ( $\bar{e}$ ) and the back vowels ( $\bar{u}$ ,  $\bar{o}$ ,  $\bar{a}$ ).

Among the high vowels  $\bar{i}$  is the highest one and  $\bar{u}$  is a little lower and more back,  $\bar{u}$  is the lowest one among the high vowels.

Among the mid vowels the F1 of  $\bar{o}$  is smaller than the F1 of  $\bar{e}$  (in the standard language this relationship is the other way round) and the F2 of  $\bar{o}$  is smaller than the F2 of  $\bar{e}$ .  $\bar{e}$  is a mid central vowel that is located in the center of the formant space. The F2 of  $\bar{e}$  is higher than the F2 of  $\bar{a}$ , and the F1 of  $\bar{e}$  is smaller than in the case of the other mid vowels.

In the Võru dialect, the F1 of  $\bar{a}$  is smaller than the F1 of  $\bar{a}$  (here, too, the relationship is different from the standard language) and the F2 of  $\bar{a}$  is higher than the F2 of  $\bar{a}$ . Thus  $\bar{a}$  is a little higher and more front than  $\bar{a}$ .

## 2.2. Overlong vowels

The mean formant values of overlong vowels are given in Table 2 (see also Figure 2).

The overlong primary vowels are located in the formant space of F1-F2 similarly to the long ones (only  $\hat{i}$  is a little higher).

Table 2

Mean formant values of overlong vowels in Hz with standard deviations

	F1	SD	F2	SD	F3	SD	F4	SD
$\hat{a}$	664	34	1272	52	2540	74	3301	143
$\hat{e}$	449	17	1924	72	2698	120	3302	154
$\hat{i}$	359	39	2139	94	2711	108	3322	172
$\hat{\imath}$	289	19	2181	64	2767	76	3376	101
$\hat{o}$	407	53	933	42	2444	106	3204	148
$\hat{u}$	365	43	843	60	2130	141	3030	92
$\hat{u}$	363	27	783	65	2126	109	3042	62
$\hat{j}$	389	26	1677	45	2738	45	3267	87
$\hat{a}$	658	27	1606	75	2509	87	3222	114
$\hat{u}$	374	29	1892	68	2570	71	3305	131
$\hat{u}$	340	15	1844	61	2580	80	3353	113

On the level of F1-F2 the overlong vowels can be clearly classified into the front ( $\hat{i}$ ,  $\hat{u}$ ,  $\hat{\imath}$ ,  $\hat{j}$ ,  $\hat{e}$ ,  $\hat{a}$ ) and back vowels ( $\hat{u}$ ,  $\hat{u}$ ,  $\hat{o}$ ,  $\hat{a}$ ). On the basis of F1  $\hat{i}$  is a clearly high vowel and  $\hat{a}$  and  $\hat{a}$  are low vowels. All the other vowels could be regarded as high with the exception of  $\hat{e}$ .

Of the overlong vowels,  $\hat{u}$  and  $\hat{u}$  are located very close to each other in the formant space; their values are mingled to a certain extent. The F1 of  $\hat{u}$  is only slightly higher than the F1 of  $\hat{u}$ , and the F2 of  $\hat{u}$  is also somewhat higher than the F2 of  $\hat{u}$ . (Five measurements of the exceptional  $\hat{o}$  showed that the F1 of  $\hat{o}$  is slightly higher than the F1 of

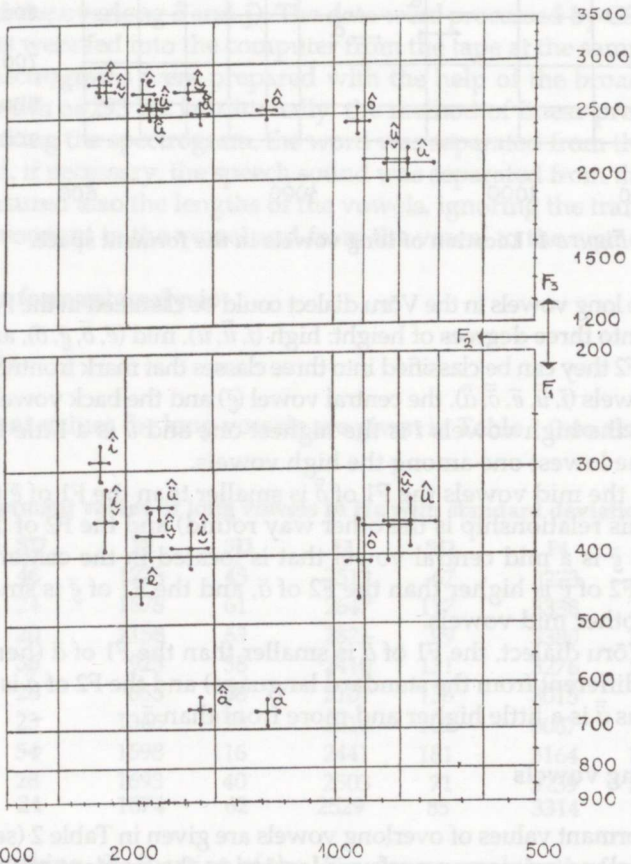


Figure 2. Location of overlong vowels in the formant space.

both *u*, and likewise the F2 of  $\hat{o}$  is slightly higher than that of  $\hat{y}$  and  $\hat{u}$ ). Thus, the raised mid vowel is very close to the high one as far as its quality is concerned. The conversion of the formant frequencies as expressed in Hertz into Barks (the units of the critical band on the psychoacoustic scale) shows that these two *u* are not distinguishable by ear (the distance under one Bark:  $\hat{y}$  F1 — 3.68, F2 — 7.53;  $\hat{u}$  F1 — 3.66, F2 — 7.12).

Also  $\hat{y}$  and  $\hat{u}$  are located close to each other, at times overlapping with each other. Nevertheless,  $\hat{y}$  is slightly more front and lower.  $\hat{y}$  is located between  $\hat{y}$  and  $\hat{i}$ , being lower and more back than the latter. Nevertheless, these vowels, too, are similar as far as their quality is concerned and cannot be differentiated by ear either ( $\hat{y}$  F1 — 3.77 Barks, F2 — 12.64;  $\hat{u}$  F1 3.43, F2 — 12.47).

When comparing  $\hat{i}$  to  $\hat{e}$  and  $\hat{i}$  one can see that the F1 of  $\hat{i}$  is higher than the F1 of  $\hat{i}$  but is smaller than the F1 of  $\hat{e}$ , and that the F2 of  $\hat{i}$  is smaller than the F2 of  $\hat{i}$  but higher than the F2 of  $\hat{e}$ . Thus in the formant space  $\hat{i}$  is located between  $\hat{i}$  and  $\hat{e}$ . In comparison with the long  $\bar{i}$ , the overlong  $\hat{i}$  has shifted slightly higher, providing space for  $\hat{i}$ . In terms of Barks  $\hat{e}$  can be differentiated from  $\hat{i}$  by ear (the difference being over one Bark), but the raised mid vowel is close both to  $\hat{i}$  and  $\hat{e}$  ( $\hat{e}$  F1 — 4.47 Barks, F2 — 12.75;  $\hat{i}$  F1 — 3.62, F2 — 13.46;  $\hat{i}$  F1 — 2.92, F2 — 13.59).

F1 of  $\hat{i}$  is smaller in comparison with the long  $\bar{e}$  and F2 is higher. Thus, the overlong  $\hat{i}$  is higher and more front than the long one as far as the quality is concerned.

Concerning the vowel length, the mean length of long vowels in words with the CVVCV# was 104 ms (the standard deviation being 24 ms) and the mean length of overlong vowels was 145 ms (the standard deviation being 31 ms). The duration plays no determinative role in the raising of mid vowels because the raising occurs even if the duration is shorter.

## Summary

In the Võru dialect the F1 and F2 values for vowels are rather similar to those in Standard Estonian. However, in the Võru dialect the quality of  $\hat{a}$  is higher than that of  $\bar{a}$ , and  $\hat{o}$  is higher than  $\bar{o}$ .  $\bar{e}$  is slightly higher than the other mid vowels (F1 is lower).

The mid vowels behave differently when they are raised in the overlong degree of length. Among the raised vowels  $\hat{i}$  is clearly distinguishable from  $\hat{i}$  and  $\hat{e}$  although  $\hat{i}$  is not distinguishable from  $\hat{i}$  by ear.  $\hat{i}$  could be regarded as a vowel that has become raised independently. At the same time,  $\hat{y}$  and  $\hat{u}$  and also  $\hat{y}$  and  $\hat{u}$  are very close to each other as far as the quality is concerned. Therefore, the former could be regarded as allophones of the latter. In addition to raising, the front vowels and the central vowel will become fronted and the back vowel retracted.

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