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QUANTITY IN LEIVU

Abstract. This paper presents an analysis of the acoustic characteristics of quantity in Leivu. Leivu was an Estonian linguistic enclave in North Latvia. The sound system of Leivu has similarities with that of Hargla dialect of South Estonian and it also reveals language contacts with Latvian. In the present paper spontaneous speech of two male speakers of Leivu is analysed. The quantity ratios of Leivu are compared to the ratios found in Standard and South Estonian. In words expected to be in Q1, the syllable duration ratio is 0.8–1.7. The smaller ratio is similar to the syllable ratio in Estonian Q1 words. Although the bigger ratio is characteristic of Estonian Q2 words, these words have significantly shorter duration of the first syllable than Q2 words. There is an overlap in syllable ratios of Q2 and Q3 words (the ratios are 1.2–2.5 and 1.8–3.1 respectively). However, the ratio under 2 is above all characteristic of Q2 words and the ratio over 2 of Q3 words. A fundamental frequency (F0) analysis shows that Q1 and Q2 words are characterised by a late F0 peak in the first syllable and Q3 words by an early F0 peak. In the case of the loss of short *h* in Leivu Q3 words, *stød* can be expected. The present analysis found only one word of this type which showed an early F0 peak and a laryngealization period.

Keywords: word prosody, quantity, fundamental frequency, Estonian linguistic enclaves, Leivu

1. Introduction

Leivu was an Estonian linguistic enclave in North Latvia. There are no more Leivu speakers left (Nigol 1988). Researchers of Leivu have pointed out that the grammatical structure of Leivu resembles that of Hargla sub-dialect of South Estonian Võru dialect. There are similarities in the vocabulary and sound structure (Nigol 1955 : 149; Pajusalu, Hennoste, Niit, Päll, Viikberg 2002 : 190–191). As to the phonetic features of Leivu, Salme Nigol (1955 : 149) has for example drawn attention to the first half-long component of late diphthongs, where the second component is a raised vowel (e.g. *sòì?* 'wolves', *mäil* 'hill, adess.sg.', *säidä?* 'to set', *pàida?* 'to escape', *läimbede* 'closer to', cf. Estonian *soèd*, *mäèl*, *seàda*, *pacèda*, *lähemale*).

On the other hand, a strong influence of Latvian on Leivu phonetics has been observed.¹ The diphthongisation of short mid vowels (e.g. *t'era*

¹ Leivu linguistic enclave was in the area where Latgalian High Latvian is spoken (Viitso 2009; cf. Gätters 1977; Rudzite 2005).

'grain, seed', *k^uoda* 'hall', *ei^uole* 'it is not', cf. Estonian *terà, kodà, ei ole*),² labialisation of *a* (*a* > *ã* > *o* > *uo*, e.g. *vo^hn* 'old', *kã^hge* 'strong'), diphthongisation of mid vowels in Q2 words (e.g. *ki^ele* 'language, gen.sg.', *pü^örä* 'grinding wheel, gen.sg.', *sku^õli* 'school, gen.sg.', cf. South Estonian *kēle, pō^rä, kō^li*),³ and diphthongisation of long high vowels (e.g. *leⁱm* 'glue' : *leⁱmi* ~ *lⁱmi* 'glue, gen.sg.', *mö^ür* 'wall' : *mö^ürü* ~ *m^ürü* 'wall, gen.sg.', *so^ur* 'big' : *so^urē* ~ *s^urē* 'big, gen.sg.') have been named as due to Latvian influence (Ariste 1931; Niilus 1935; 1937a; Nigol 1955; Tauli 1956; Suhonen 1989; Vaba 1997; cf. Gätters 1977; Rudzite 2005).

What concerns consonants, voicing of short plosives, quality change *l* > *l̥* before back vowels, *s* > *š*, *z* (especially in intervocalic position or before *i*, e.g. *su^ši* 'wolf', *mi ma^šši* 'pay, imperf. 1st pl.', *pü^ššü?* 'gun, nom.pl.'), have been seen as Latvian influences on Leivu pronunciation. Also, the loss of *h* in the weak grade words (e.g. *ve^hm* 'cow' : *ve(̃)mä* 'cow, gen.sg.', *tä^ht* 'star' : *tä^hje* 'star, gen.sg.') has been named as a Latvian influence (Ariste 1931; Nigol 1955; Niilus 1935; 1937a; Tauli 1956; Suhonen 1989; Vaba 1997; cf. Gätters 1977; Rudzite 2005). According to Lembit Vaba (1997 : 41) the loss of *h* from this position is a late phenomenon (in 1920s *h* can be found in transcriptions of Leivu). In late 1920s examples about transcription of words both with and without *h* can be found, but the transcriptions from 1930s point to a wider loss of short *h* (Niilus 1936). Unlike in Võru South Estonian the word-initial *h* has been lost in Leivu (Niilus 1936).⁴ *h* has also been completely lost at the syllable boundary of non-initial syllables (Niilus 1936).

In most examples, the loss of short *h* has caused stød at the syllable boundary, e.g. *rã^à ~ rã* 'money', *vã^àmb* 'less', *nã^à* 'skin, gen.sg.', *pã^à* 'head, illat.sg.', *ta^a* 'I want', *tu^a?* 'ash, nom.pl.', *vi^a?* 'rain, nom.pl.' (Ariste 1931; Nigol 1955; Niilus 1935; 1937a; Tauli 1956; Suhonen 1989; Vaba 1997; Winkler 1999). This can be compared to stød in Latvian and Livonian.⁵ However, the intervocalic short *h* can also be lost completely or replaced by the approximant *j* (e.g. *riã* 'rake', *püãbã* 'Sunday', *jaijē* 'chilly', *vaijē* 'maple', Niilus 1936).

S. Nigol (1955) has pointed to the Latvian influence on Leivu quantity relations. Valter Niilus (1935) mentions that in Leivu, the vowels of the short first syllable are pronounced longer than in Standard Estonian (e.g. *mùⁿã* 'egg', *kãⁿã* 'chicken', *pi^eza* 'nest', cf. Standard Estonian *munã, kanã, pezã*). His transcriptions of Leivu show variation in vowel durations of this type of words: *sęzãr*, *sęzãr* 'sister', *sęzara* 'sister, gen.sg.' (Niilus 1937b). According to V. Niilus (1935), the lengthening of vowels can also be found in other word types: e.g. *ęng* 'fishhook', *kü^rm* 'secluded place', *pėrv* 'brink'.

² The diphthongisation of short *e* can also be found in High Latvian dialects (Rudzite 2005) and the diphthongisation of short *o* is characteristic of Standard Latvian. However, S. Suhonen (1989) finds that the diphthongisation of short *e* and *o* is not necessarily a Latvian influence. According to T.-R. Viitso (2009) the breaking of short mid vowels took place by analogy with the breaking of long mid vowels.

³ In Q3 words, as in other South Estonian dialects, mid vowels are raised, e.g. *kⁱl* 'language', *p^ur* 'grinding wheel', *sk^ul* 'school' (see Teras 2003).

⁴ V. Niilus (1936) finds that the word-initial *h* has already been lost since the 19th century.

⁵ In addition to laryngealization Leivu, like South Estonian Võru dialect, has a glottal stop. A sporadic loss of glottal stop has also been noticed (e.g. Vaba 1997).

There are no earlier acoustic phonetic studies of Leivu phonetics. A preliminary analysis of the speech of one speaker (Teras 2007) showed considerable variation in syllable duration ratios of Q1 words. The duration ratios of Q2 and Q3 words had some overlap, but the fundamental frequency turning point in the first syllable of Q2 words was late and of Q3 words early. While the speech of only one speaker was analysed a question arose whether similar tendencies also occur in the speech of other Leivu speakers.

In the following, the acoustic phonetic characteristics (duration ratios and fundamental frequency movement) of Leivu Q1, Q2 and Q3 words in the pronunciation of two Leivu speakers will be analysed. Answers to the following questions will be sought:

- 1) What are the duration ratios of the first two syllables in words in spontaneous Leivu?
- 2) Is there any difference in pitch contours associated with differences in syllable ratios?
- 3) What are the acoustic characteristics of words where *stød* is expected?

The results will be compared to studies on quantity of Estonian and South Estonian (cf. Lehiste 1960; 1997; Liiv 1961; Krull 1993; Asu, Lippus, Teras, Tuisk 2009; Pajusalu, Parve, Teras 2001; Parve 2003), and Latvian and Livonian (Lehiste, Teras, Ernštreits, Lippus, Pajusalu, Tuisk, Viitso 2008).

2. Material and method

Spontaneous speech of two male speakers of Leivu was analysed. The speaker Peeter Melec (PM) was born in 1867. He lived in Soosaare (Sūzari) village and was recorded by Valmen Hallap in 1956 (tape EMH0003a in the archive of Estonian dialects at the Institute of the Estonian Language). The speaker Anton Bok (AB) was born in 1908. He lived in Pajušilla (Kärklupe) village. He was recorded in 1971 by Paulopriit Voolaine (tape F-158 in the archive of Estonian dialects and related languages at the University of Tartu). His mother tongue was Leivu and he acquired Latvian at school. He has been called the last Leivu speaker; he died in 1988 (Nigol 1988).

Disyllabic quantity 1 (Q1), quantity 2 (Q2) and quantity 3 (Q3) words were selected from spontaneous speech. The analysed material consisted of 309 words in total (Q1 141 words, Q2 89 words, Q3 79 words). When the first syllable was long (Q2 and Q3 words), it contained either a long monophthong or a diphthong as a syllable nucleus or a short vowel followed by a voiced consonant (the first part of a geminate consonant or consonant cluster). The analysed words were in phrase-initial (79 words), internal (166 words) or final (64 words) position. All words carried sentence-level stress. Some examples of analysed words: *tare* 'room, farmhouse', *terä* 'grain, seed', *eza* 'father', *nāne* 'woman, wife', *skuõlin* 'school, iness.sg.', *talve* 'winter, gen.sg.', *peima* 'milk, part.sg.', *lamba* 'sheep, gen.sg.', *saanna* 'sauna, part.sg.'.

The recordings were analysed using the Praat software for speech analysis (Boersma, Weenink 2007–2009). The duration of all segments was measured. Syllable durations and duration ratios were calculated. When the first syllable (S1) is open, syllable duration equals that of the syllable nucleus. When the syllable is closed, the duration of the coda consonant is added

to the duration of the syllable nucleus. The second syllable (S2) duration equals the duration of the second syllable vowel. Fundamental frequency measurements were taken at the beginning and end of each syllable, and at the peak or turning point of F0 curve within the first syllable. The location of the F0 peak relative to the beginning of the first syllable was also established and will be given in percentages.

3. Duration and fundamental frequency in Q1, Q2 and Q3 words

3.1 Durations and duration ratios in Q1, Q2 and Q3 words

Average syllable durations and duration ratios of syllables in Q1, Q2 and Q3 words are given in Table 1 and Table 2. In Table 1, syllable durations and duration ratios of all words independent of their position in the sentence are presented. In Table 2, words in the phrase-initial (79 words), phrase-internal (166 words) and phrase-final (64 words) position are given separately.

Table 1
Average syllable durations (in ms), duration ratios and standard deviations (s.d.) of Q1, Q2 and Q3 words (N — number of measurements, Q1/Q2/Q3)

Speaker		N	Q1			Q2			Q3		
			S1	S2	S1/S2	S1	S2	S1/S2	S1	S2	S1/S2
PM	Average	75/48/52	131	126	1.15	212	111	2.07	250	104	2.55
	s.d.		35	37	0.54	61	36	0.74	55	33	0.78
AB	Average	66/41/27	119	101	1.27	169	105	1.67	199	87	2.33
	s.d.		28	36	0.36	58	35	0.53	61	22	0.60
All	Overall average	141/89/79	125	113	1.21	191	108	1.87	224	96	2.44
			32	37	0.45	60	35	0.63	58	28	0.69

In Q1 words, average durations of the first and second syllable are 125 ms and 113 ms, and the average duration ratio is 1.21 (s.d. 0.45) (see Table 1). Depending on the position of the word in the phrase, the average duration of the first syllable is 122 ms (phrase-initial), 121 ms (phrase-internal), 137 ms (phrase-final), and of the second syllable 119 ms, 107 ms, 133 ms respectively. The average duration ratios of syllables in Q1 words are 1.15, 1.24 and 1.13 respectively (see Table 2). The influence of phrase-final lengthening on vowel duration can be noticed — the duration of the second syllable vowel is longest in phrase-final words. Standard deviations show that there is a large variation in the duration ratios of Q1 words. The average duration ratio in words with a short open first syllable can vary between 0.76 and 1.66 (see Table 1).

Due to variation, words expected to be in Q1 (short first syllable both in Standard and South Estonian) were divided into two groups. The first group consists of words where the ratio was less than or equal to one (the second syllable vowel was longer than the first syllable vowel, or both vowels were of equal length, 54 words). The second group consists of words where the ratio was larger than one (the first syllable vowel was longer

Table 2

**Average syllable durations (in ms), duration ratios
and standard deviations (s.d.) of Q1, Q2 and Q3 words
in phrase-initial, phrase-internal and phrase-final position
(N — number of measurements, Q1/Q2/Q3)**

Speaker		N	Q1			Q2			Q3		
			S1	S2	S1/S2	S1	S2	S1/S2	S1	S2	S1/S2
PM	Phrase-initial	12/15/8	124	138	1.04	208	111	2.02	261	95	2.82
	s.d.		37	55	0.53	80	43	0.75	72	17	0.81
AB	Phrase-initial	28/10/6	121	99	1.27	152	100	1.54	203	81	2.48
	s.d.		26	26	0.28	39	21	0.42	77	20	0.47
All	Overall average	40/25/14	122	119	1.15	180	105	1.78	232	88	2.65
			32	40	0.40	59	32	0.58	74	19	0.64
PM	Phrase-internal	45/27/26	128	120	1.16	207	108	2.08	232	103	2.40
	s.d.		36	29	0.58	58	32	0.82	52	33	0.80
AB	Phrase-internal	30/24/14	114	93	1.33	166	95	1.80	171	77	2.30
	s.d.		29	38	0.41	54	28	0.53	46	15	0.74
All	Overall average	75/51/40	121	107	1.24	186	101	1.94	201	90	2.35
			32	34	0.49	56	30	0.68	49	24	0.77
PM	Phrase-final	18/6/18	143	132	1.18	246	124	2.12	270	110	2.65
	s.d.		32	39	0.45	66	40	0.75	42	38	0.74
AB	Phrase-final	8/7/7	132	134	1.07	204	150	1.41	253	112	2.28
	s.d.		31	45	0.39	87	42	0.60	45	19	0.46
All	Overall average	26/13/25	137	133	1.13	225	137	1.76	261	111	2.46
			32	42	0.42	76	41	0.68	43	28	0.60

than the second syllable vowel, 87 words). Average syllable durations and duration ratios of syllables in these two groups of words are given in Table 3.

In the first group, the average syllable durations are 108 ms (S1) and 139 ms (S2) which gives a duration ratio of 0.81 (see the first part of Table 3). This ratio is similar to that of Estonian Q1 words. In the second group, the average syllable durations are 138 ms (S1) and 98 ms (S2), and the duration ratio is 1.46 (see the second part of Table 3). This ratio is much bigger than in Estonian Q1 words and resembles that of Estonian Q2 words where the ratio is 1.5 (cf. Lehiste 1960; 1997; Liiv 1961). An ANOVA shows that the difference is significant at $p < 0.0001$ level.

In Leivu Q2 words, the average syllable durations are 191 ms (S1) and 108 ms (S2), and the average duration ratio is 1.87 (see Table 1). Average syllable durations in different sentence positions are as follows: 180 ms (S1) and 105 ms (S2) (phrase-initial), 186 ms (S1) and 101 ms (S2) (phrase-internal), 225 ms (S1) and 137 ms (S2) (phrase-final) (see Table 2). The average duration ratios are 1.78, 1.94, and 1.76 respectively. The influence of phrase-final lengthening can also be noticed in Q2 words. The duration of both S2 and S1 is longest in this position which may point to the influence of sentence stress on syllable duration. Standard deviations of duration ratios show that variation is also quite large in Q2 words. Standard

Table 3

**Average syllable durations (in ms),
duration ratios and standard deviations (s.d.)
in Q1 words presented in two groups
(N — number of measurements)**

Speaker	Duration ratio	N	S1	S2	S1/S2
PM	S1/S2 ≤ 1	33	104	148	0.73
	s.d.		18	37	0.17
AB	S1/S2 ≤ 1	21	112	131	0.89
	s.d.		28	44	0.14
All	Overall average	54	108	139	0.81
			23	40	0.16
PM	S1/S2 > 1	42	152	109	1.47
	s.d.		31	27	0.50
AB	S1/S2 > 1	45	123	87	1.45
	s.d.		28	21	0.29
All	Overall average	87	138	98	1.46
			29	24	0.39

deviation shows that the average syllable ratio in Q2 words varies between 1.24 and 2.5 (see Table 1).

In Q3 words, the syllable durations are on an average 224 ms (S1) and 96 ms (S2), and the duration ratio 2.44 (see Table 1). Average syllable durations in different sentence positions are 232 ms (S1) and 88 ms (S2) (phrase-initial), 201 ms (S1) and 90 ms (S2) (phrase-internal), 261 ms (S1) and 111 ms (S2) (phrase-final) (see Table 2). The average duration ratios are 2.65, 2.35, and 2.26 respectively. Phrase-final lengthening is also present in Q3 words: the duration of S2 is longest in this position. Standard deviation shows that the average duration ratio varies between 1.75 and 3.13 in Q3 words (see Table 1).

Standard deviations of duration ratios of Q2 and Q3 words indicate that there is some overlap of duration ratios in these words. In both quantities, duration ratios smaller than or equal to two and larger than two can be found. Table 4 and Table 5 present average syllable durations and duration ratios in these two groups of Q2 and Q3 words.

64% of the Q2 words and 29% of the Q3 words have a duration ratio smaller than two (1.47 and 1.7 respectively). 36% of Q2 and 71% of Q3 words have a ratio larger than two (2.54 and 2.76 respectively). Although the ratio varies, it can be seen that Q2 words are characterised by a smaller and Q3 words by a larger ratio. It is quite probable that the location of F0 turning point can differentiate such Q2 and Q3 words where the duration ratios are similar. Fundamental frequency contours of Q1, Q2 and Q3 words will be dealt with next.

Table 4
**Average syllable durations (in ms),
duration ratios and standard deviations (s.d.)
in Q2 words presented in two groups
(N — number of measurements)**

Speaker	Duration ratio	N	S1	S2	S1/S2
PM	S1/S2 ≤ 2	24	188	132	1.46
	s.d.		36	30	0.27
AB	S1/S2 ≤ 2	33	160	110	1.49
	s.d.		60	37	0.39
All	Overall average	57	174	121	1.47
			48	33	0.33
PM	S1/S2 > 2	24	237	90	2.67
	s.d.		72	30	0.52
AB	S1/S2 > 2	8	206	87	2.42
	s.d.		29	17	0.34
All	Overall average	32	221	89	2.54
			51	24	0.43

Table 5
**Average syllable durations (in ms),
duration ratios and standard deviations (s.d.)
in Q3 words presented in two groups
(N — number of measurements)**

Speaker	Duration ratio	N	S1	S2	S1/S2
PM	S1/S2 ≤ 2	14	222	136	1.68
	s.d.		50	41	0.24
AB	S1/S2 ≤ 2	9	158	91	1.72
	s.d.		58	27	0.26
All	Overall average	23	190	114	1.70
			54	34	0.25
PM	S1/S2 > 2	38	260	93	2.87
	s.d.		53	20	0.65
AB	S1/S2 > 2	18	220	84	2.64
	s.d.		55	20	0.48
All	Overall average	56	240	89	2.76
			54	20	0.57

3.2 Fundamental frequency contours of Q1, Q2 and Q3 words

Average F0 values in the beginning and end of each syllable and at the turning point (or peak) are given in Table 6. The location of F0 turning point in relation to the total duration of the first syllable was also calculated and is given in percentages. Words in all quantities were divided into two groups: the first group consists of words where the turning point was

in the first half of the syllable (an early peak) and the second group includes such words where the turning point was in the second half of the syllable (a late peak).

Table 6

Average fundamental frequency (in Hz) and standard deviations (s.d.) in Q1, Q2 and Q3 words (N — number of measurements, TP — turning point)

Quantity	Speaker	N	S1beg.	TP	%	S1end	S2beg.	S2end
Q1, early peak	PM	13	203	212	38	194	188	173
			48	51	13	39	35	38
	AB	13	186	184	18	147	148	137
			41	44	15	42	51	50
	All	26	194	198	28	171	168	155
			44	48	14	40	43	44
Q1, late peak	PM	62	191	204	76	195	188	173
			24	28	15	26	23	22
	AB	53	154	161	79	155	155	149
			23	26	15	23	26	29
	All	115	173	182	77	175	172	161
			23	27	15	25	25	25
Q2, early peak	PM	14	194	204	41	185	180	168
			13	17	8	15	14	13
	AB	8	185	188	30	145	138	130
			45	44	13	26	23	22
	All	22	190	196	35	165	159	149
			29	31	10	20	19	17
Q2, late peak	PM	34	185	202	75	193	187	179
			19	24	16	22	22	19
	AB	33	161	175	78	164	163	150
			33	35	15	31	25	30
	All	67	173	188	76	179	175	165
			26	30	15	26	23	24
Q3, early peak	PM	42	201	219	34	197	192	187
			28	34	10	30	30	32
	AB	19	183	185	23	134	133	123
			38	37	14	25	23	24
	All	61	192	202	28	165	163	155
			33	36	12	27	27	28
Q3, late peak	PM	10	189	211	64	197	192	182
			18	20	9	20	24	19
	AB	8	149	163	79	155	160	154
			30	34	15	32	27	26
	All	18	169	187	71	176	176	168
			24	27	12	26	25	23

Q1 words are characterised by a late F0 turning point which is located at 77% of the total duration of the first syllable. F0 is falling in the second syllable. In 18% of the analysed Q1 words, F0 was falling during the whole word and the F0 turning point occurred on average at 28%. The F0 turning point was also late in most Q2 words (at 76% of the total duration of the first syllable). However, in 25% of the analysed Q2 words there was an early F0 turning point (at 35%). Q3 words are characterised by an early F0 turning point occurring at 28% of the total duration of the first syllable (in 23% of the analysed words there was a late F0 turning point occurring at 71% of the total duration of the first syllable). Since F0 is falling already during the first syllable, it reaches its lower values in the end of the first syllable. In Q2 words with a late F0 peak, the F0 value in the end of S1 is 179 Hz and in S2 the F0 values are 175 and 165 Hz. In Q3 words with an early F0 peak the corresponding values are 165, 163 and 155 Hz.

As all the analysed Q1, Q2 and Q3 words could be divided into two groups according to their duration ratios, F0 contours of these groups will be analysed separately. The results are given in Tables 7–9 (where Q1, Q2 and Q3 words are presented separately).

Q1 words where the duration ratio was 0.81–1.46 (see Table 3) are characterised by a late F0 turning point which occurred both in words with a smaller and larger duration ratio (see Table 7). It can be seen that Q1 words with the duration ratio larger than one are phonetically similar to Q2 words with the duration ratio smaller than two (see part 4 of Table 7 and part 3 of Table 8).

Table 8 shows that the duration ratio of Q2 words can also be quite large, whereas the F0 turning point still occurs in the second half of the first syllable in most cases. In words where the duration ratio was larger than two, the F0 turning point was late in 73% of the cases, and in words with the duration ratio smaller than two it was late in 75% of the cases.

Like Q2 words, also Q3 words had a varying duration ratio. However, the analysis of F0 contours indicates that Q3 words, regardless of their duration ratio, are characterised by an early F0 turning point. When the duration ratio was smaller than two, only two words had a late F0 peak (see part 3 of Table 9). When the duration ratio was larger than two, 73% of the words had an early F0 turning point.

The data contained only one disyllabic word where the loss of short *h* between vowels has caused laryngealization: *rǎ'aca* 'money, comit.sg.' (Speaker PM, see Figure 1). The durations of syllables are 254 ms (S1) and 89 ms (S2), the duration ratio 2.85. The duration of the laryngealization period is 32 ms. There is an early F0 peak occurring at 13% of the first syllable. In the speech of speaker AB, the word *pāt'* 'tell, imperf. 3rd sg.' occurred two times. Although the loss of *j* had not caused laryngealization, there was an early F0 peak in both cases.

4. Discussion

The average duration ratio (1.21) in Leivu Q1 words is on average much larger than in Estonian Q1 words where it is around 0.6 (cf. Lehiste 1960; 1997; Liiv 1961). Standard deviation shows considerable variation in the duration ratio of Q1 words. Q1 words show two kinds of tendencies in

**Average fundamental frequency (in Hz) and standard deviations (s.d.)
in Q1 words divided into two groups
(N — number of measurements, TP — turning point)**

Speaker	Duration ratio	N	Q1, early peak					
			S1beg.	TP	%	S1end	S2beg.	S2end
PM	S1/S2 ≤ 1	7	193	197	37	179	173	165
	s.d.		34	37	14	21	16	16
AB	S1/S2 ≤ 1	4	171	175	31	139	133	114
	s.d.		46	47	29	43	45	45
All	Overall average	11	182	186	34	159	153	140
			40	42	21	32	30	30
PM	S1/S2 > 1	4	224	232	36	212	207	192
	s.d.		75	79	14	58	56	68
AB	S1/S2 > 1	9	179	176	11	140	136	133
	s.d.		41	41	11	45	46	50
All	Overall average	13	201	204	23	176	171	163
			58	60	13	51	51	59
Speaker	Duration ratio	N	Q1, late peak					
			S1beg.	TP	%	S1end	S2beg.	S2end
PM	S1/S2 ≤ 1	26	193	197	78	192	187	170
	s.d.		27	25	16	25	24	21
AB	S1/S2 ≤ 1	17	159	167	73	160	163	151
	s.d.		27	29	17	28	38	33
All	Overall average	43	176	182	76	176	175	161
			27	27	17	27	31	27
PM	S1/S2 > 1	38	190	209	72	199	189	175
	s.d.		22	29	15	27	22	22
AB	S1/S2 > 1	36	154	161	81	154	155	151
	s.d.		23	26	14	23	26	30
All	Overall average	74	172	185	76	176	172	163
			23	28	15	25	24	26

their duration ratios: the second syllable vowel can be pronounced longer or as long as the first vowel, or the first syllable vowel is pronounced longer than the second syllable vowel (see Figure 2). The second type is like a mirror image of the first type. The pronunciation where the first vowel is longer than the second vowel can point to influences from Latvian. In Latvian, when the two syllables of a disyllabic word are short then the first syllable is pronounced longer than the second syllable (duration ratio 1.2–2.0, cf. Lehiste, Teras, Ernštreits, Lippus, Pajusalu, Tuisk, Viitso 2008). A correlation analysis shows a very small positive correlation ($r = 0.1$) between the duration of the first and the second syllable vowel: when the first syllable vowel lengthens then also the second syllable vowel is longer.

Table 8

Average fundamental frequency (in Hz) and standard deviations (s.d.)
in Q2 words divided into two groups
(N — number of measurements, TP — turning point)

Speaker	Duration ratio	N	Q2, early peak					
			S1beg.	TP	%	S1end	S2beg.	S2end
PM	S1/S2 ≤ 2	8	197	211	39	189	184	171
	s.d.		14	11	10	6	6	11
AB	S1/S2 ≤ 2	6	177	178	28	141	131	123
	s.d.		42	41	14	28	23	22
All	Overall average	14	187	194	34	165	158	147
			28	26	12	17	14	17
PM	S1/S2 > 2	6	189	196	43	180	174	164
	s.d.		9	21	4	21	20	15
AB	S1/S2 > 2	3	211	216	34	156	157	150
	s.d.		60	56	6	22	15	1
All	Overall average	9	200	206	39	168	165	157
			35	38	5	21	17	8
Speaker	Duration ratio	N	Q2, late peak					
			S1beg.	TP	%	S1end	S2beg.	S2end
PM	S1/S2 ≤ 2	16	185	201	81	194	192	183
	s.d.		14	23	15	23	24	21
AB	S1/S2 ≤ 2	27	161	174	77	163	161	148
	s.d.		33	37	14	31	26	31
All	Overall average	43	173	188	79	178	176	165
			24	30	14	27	25	26
PM	S1/S2 > 2	18	185	202	69	192	183	177
	s.d.		23	26	15	22	19	17
AB	S1/S2 > 2	6	162	175	81	173	172	157
	s.d.		37	31	18	27	20	24
All	Overall average	24	173	189	75	183	177	167
			30	28	16	25	20	21

Although there is no significant difference in the duration ratio in Q1 words in the second type and Q2 words with a duration ratio smaller than two (the third pair of columns in Figure 2, the duration ratios 1.46 and 1.47), there is a significant difference both between the duration of S1 and S2 of these two types of words ($p < 0.001$). Significantly shorter durations of syllables in Q1 words with a larger duration ratio (138 and 98 ms) than in Q2 words with a smaller duration ratio (174 and 121 ms) may cause a word to be recognised as a Q1 word.

There is an overlap of syllable durations of Q2 and Q3 words (see Figure 2). This can be due to spontaneous speech. Such an overlap has also been found in Estonian spontaneous speech (Asu, Lippus, Teras, Tuisk 2009).

**Average fundamental frequency (in Hz) and standard deviations (s.d.)
in Q3 words divided into two groups
(N — number of measurements, TP — turning point)**

Speaker	Duration ratio	N	Q3, early peak					
			S1beg.	TP	%	S1end	S2beg.	S2end
PM	S1/S2 ≤ 2	14	197	213	35	193	187	176
	s.d.		29	36	12	30	30	26
AB	S1/S2 ≤ 2	7	167	167	26	131	131	119
	s.d.		31	26	15	18	16	17
All	Overall average	21	182	190	31	162	159	147
			30	31	13	24	23	22
PM	S1/S2 > 2	29	203	221	34	199	194	192
	s.d.		27	33	10	30	31	33
AB	S1/S2 > 2	12	193	196	21	136	134	126
	s.d.		40	40	14	29	27	28
All	Overall average	41	198	208	28	167	164	159
			33	37	12	29	29	30
Speaker	Duration ratio	N	Q3, late peak					
			S1beg.	TP	%	S1end	S2beg.	S2end
AB	S1/S2 ≤ 2	2	174	178	59	166	161	159
	s.d.		61	81	10	77	55	49
PM	S1/S2 > 2	9	187	211	63	198	193	181
	s.d.		17	21	10	22	25	20
AB	S1/S2 > 2	6	141	158	85	152	160	152
	s.d.		13	15	9	15	20	22
All	Overall average	15	164	184	74	175	176	167
			15	18	9	18	23	21

However, an ANOVA shows that there is a significant difference between the duration ratios of Q2 and Q3 words at $p < 0.0001$ level. The average duration ratios (1.87 and 2.44) in these words are comparable to those found in South Estonian spontaneous speech: 1.6 and 2.9 in the Hargla sub-dialect of Võru dialect and 1.5 and 3.08 in Setu dialect (Pajusalu, Parve, Teras 2001, Parve 2003). They are also comparable to the duration ratios of Q2 and Q3 words in spontaneous speech of Standard Estonian: 1.72 and 3.21 (Krull 1993), 1.7 and 2.3 (Asu, Lippus, Teras, Tuisk 2009).

The characteristic fundamental frequency contours of Leivu Q1, Q2 and Q3 words (see Figure 3) are also comparable to the F0 contours found in South Estonian (cf. Parve 2003) and Standard Estonian (Asu, Lippus, Teras, Tuisk 2009).

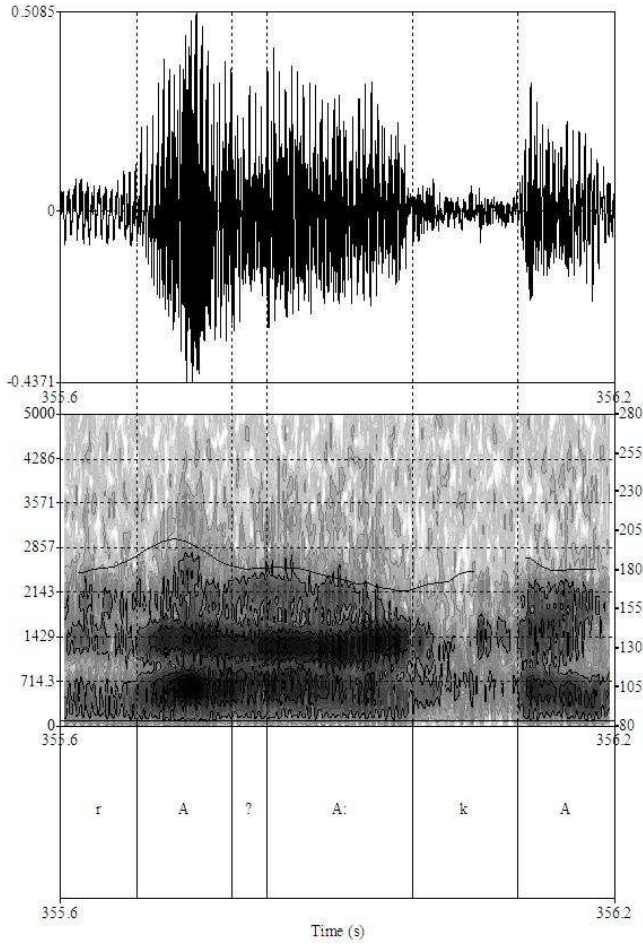


Figure 1. The waveform, spectrogram and F0 curve of the word *rằaca* 'money, comit.sg.' (Speaker PM) (SAMPA transcription: A = a, ? = laryngealization).

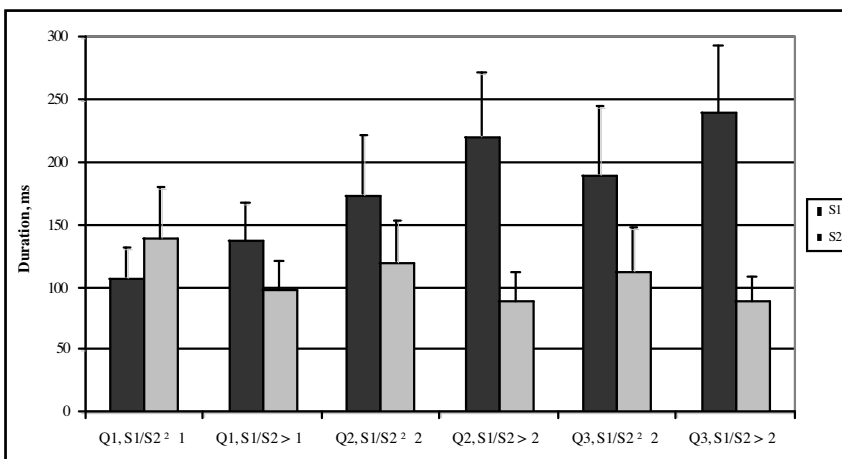


Figure 2. The duration of S1 and S2 and standard deviation (in ms) in Q1, Q2 and Q3 words divided into two groups according to their duration ratios.

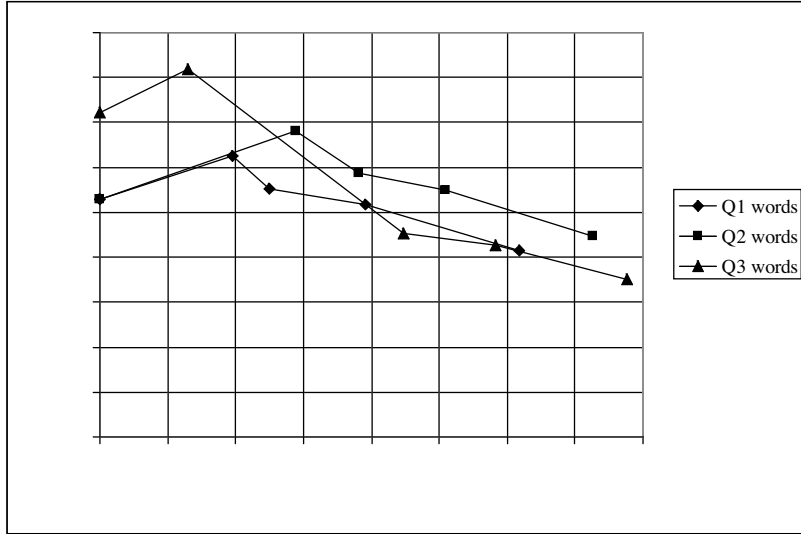


Figure 3. F0 contours characteristic of Q1, Q2 and Q3 words. F0 values in the beginning, turning point and end of the first syllable, and in the beginning and end of the second syllable.

5. Conclusion

The Leivu sound system has similarities with that of the South Estonian Hargla sub-dialect. It also gives evidence of language contacts with Latvian. In the present study spontaneous speech of two male speakers of Leivu was analysed. Standard deviations of syllable duration ratios in disyllabic Q1, Q2 and Q3 words showed considerable variation. In words expected to be in Q1, the syllable duration ratio was 0.8–1.7. The smaller ratio is similar to the syllable ratio in Estonian Q1 words. Although the bigger ratio is characteristic of Estonian Q2 words, these words have a significantly shorter first syllable than Q2 words. The bigger ratio may indicate a Latvian influence on Leivu pronunciation. In Latvian, when both syllables in a disyllabic sequence are short the first vowel is pronounced longer than the second syllable vowel. There was an overlap in syllable durations of Q2 and Q3 words (the ratio is 1.2–2.5 and 1.8–3.1 respectively) in Leivu. However, a ratio under 2 was characteristic of Q2 words and a ratio over 2 of Q3 words. The fundamental frequency analysis showed that Q1 and Q2 words were characterised by a late F0 peak in the first syllable and Q3 words by an early F0 peak. Even if the duration ratios in Q2 and Q3 words overlapped, the two quantities were differentiated by the location of F0 peak. Only one word pronounced with laryngealization was found in the present data. Thus, further research including more recordings of Leivu is needed to investigate this aspect.

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ПИРЕ ТЕРАС (Хельсинки—Тарту)

КОЛИЧЕСТВО В ГОВОРЕ ЛЕЙВУ

В данной статье рассматриваются акустические признаки количества в лейвуском говоре эстонского языка. Лейву — это эстонский языковой островок в Северной Латвии. Его фонетическая система, с одной стороны, имеет сходные черты с фонетической системой южноэстонского говора Харгла, а с другой, испытала влияние контактов с латышским языком. Автор статьи анализирует речь двух мужчин — носителей лейвуского говора. Количественные отношения говора сопоставляются с таковыми эстонского общеупотребительного языка и южноэстонского языка. В словах, которые предположительно имеют первую степень долготы (ударный краткий открытый слог), соотношение длительностей слогов составляет 0,8—1,7. Меньшее соотношение напоминает эстонские слова с первой степенью долготы. И хотя большее соотношение характерно для эстонских слов со второй степенью, долгота их гласного первого слога существенно короче, чем в словах с чередованием второй степени. Соотношения длительностей между словами второй и третьей степеней долготы частично совпадают (соответственно 1,2—2,5 и 1,8—3,1). Соотношение ниже двух все же характерно прежде всего для слов второй степени, а соотношение выше двух — для слов с третьей степенью. Анализ основного тона показывает, что слова с первой и второй степенями долготы характеризуются поздним, а слова третьей степени — ранним пиком основного тона. В том случае, если между гласными утрачен краткий *h*, в словах с третьей степенью долготы можно ожидать стёд. В материале данного исследования встретилось лишь одно слово с основным тоном раннего пика и в периоде ларингализации.