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QUANTITY IN LIVONIAN: PRELIMINARY RESULTS

Abstract. The paper describes work done up to now with Livonian, the southernmost Finnic language. The study proceeds within the framework of the Finno-Ugric Prosody Project: a set of test sentences is recorded by a number of native speakers, an acoustic-phonetic analysis is carried through of the recordings, the measurements are subjected to statistical treatment, and the results are analyzed from the point of view of their role in the manifestation of Livonian prosodic structure. The paper deals primarily with the role of quantity and its phonetic manifestation. Foot isochrony is attested and an areal background of the results is discussed.

Keywords: Livonian, prosody, quantity, tone, contact.

1. Introduction

The current paper presents results of our study of the prosody of Livonian, following the pattern established in our earlier studies of Erzya and Meadow Mari. It is an ongoing project, and we expect to publish the complete results within the foreseeable future; but the study of quantity is more or less complete, and the results appear extensive as well as reliable enough to make them available to a wider community of scholars. The study has several authors, whose role has been the following. The test words were chosen and sentences formulated by Tiit-Rein Viitso. Recordings were conducted by Pärtel Lippus. Acoustic analysis was carried out by Tuuli Tuisk and Sander Pajusalu. Principal analysis of data was done by Pire Teras, Karl Pajusalu and Tuuli Tuisk. The interpretation of results and the phonological analysis was primarily the task of Ilse Lehiste.

There are some earlier acoustic-phonetic studies on Livonian prosody (cf. Vihman 1971 (1 speaker); Pajupuu, Viitso 1986 (1 speaker); for phonological treatments see Viitso 1981; Wiik 1989). The aim of current project is to provide a description of Livonian prosody that is supported by experimental evidence. The questions for which answers are sought in this part of the project concern the role of quantity in Livonian prosody. Since Livonian is a minority language in Latvia and all speakers are bilingual in Livonian and Latvian, the question of language contact is also considered.

2. Research material and method

The methodology for the study of Livonian prosody is similar to that used for the analysis of Erzya and Meadow Mari prosody (cf. the survey article in this issue). A set of test sentences was recorded from ten speakers (8 female and 2 male) on several occasions in the years 2000, 2004, and 2005. The speakers can be divided into three groups according to their age:
1) two older speakers (born 1914 and 1921)
2) three middle-aged speakers (born between 1940 and 1957), and
3) five younger speakers (born between 1971 and 1990).

The material consists of carrier phrases where the test words appear in phrase-final and sentence-final positions. The test words were chosen on the basis of their sound structure and number of syllables. An example might be *"Kui võib sōdõ ne'i je'n rō'dõ"* 'How can one get so much money?' and *"Ne'i je'n rō'dõ äb või sōdõ"* 'So much money one cannot get'. It has to be mentioned that 9 speakers read one list of test sentences (the older male speaker reading the list twice), and one older female speaker read a longer list of test sentences. For this reason, there can be differences in the number of measurements.

The test words were analyzed acoustically using the Praat analysis system. The duration of all segments was measured. Fundamental frequency (F0) measurements were taken at the beginning and end of each vowel, and at the peak of the F0 curve. The location of the peak relative to the beginning of the syllable nucleus was also established. Vowel quality was analyzed by measuring the first three formants.

The project is still in progress; the present paper offers data obtained from the speech of eight informants — seven female and one male. Duration patterns will be described in several types of disyllabic words. There are two tables for almost each word type — one for test words in which the first syllable did not contain laryngealization ("broken tone"), and one for similar test words with laryngealization. A detailed description of syllable nuclei carrying the broken tone will be offered in the forthcoming later publication.

Livonian orthography marks some vowels as long by placing a macron above the vowel. This suggests a long—short opposition in vowels. We will use the symbol $\bar{V}$ for a stressed vowel marked as long, and $\grave{V}$ for an unstressed vowel spelled with a macron.

3. Disyllabic words with a short open first syllable

Table 1 presents averaged data of eight speakers' productions of words with a first syllable containing a short vowel and a short lowering diphthong, and a second syllable whose vowel is marked as long by the use of a macron. There are no words in Livonian where both syllables would be short. Words of this type have a longer vowel in the second syllable than in the first syllable; the structure resembles an Estonian word in short quantity, where the second syllable is half-long. Both the short vowel and the short diphthong are followed by a second syllable of the same kind of half-long duration. Examples: *kadūb* 'it disappears', *ma äb viedā* 'I don't drag/carry'.

The table offers average durations of the vocalic syllable nuclei, the ratio of V1 to V2, and the average duration of the metric foot measured from the beginning of the first syllable nucleus to the end of the second syllable nucleus. (Since the duration of word-initial and syllable-initial consonants is not contrastive, the ratio of vowel durations represents syllable duration ratios and can also be symbolized as S1/S2.) Phrase-final and sentence-final averages are given, as well as overall averages. Data for short vowels and short diphthongs are presented separately.

Table 1

Vowel durations, standard deviations (ms) and V1/V2 duration ratios in disyllabic CV.CV̀ and C^{V}V.CV̀ words produced by 8 speakers

(^{V}V — short lowering diphthong, PF — phrase-final position, SF — sentence-final position, N — number of measurements)

CV.CV̀					
Position	**N**	**V1**	**V2**	**V1/V2**	**Foot**
PF	18	106	213	0.5	410
		10	34		44
SF	18	99	204	0.5	397
		17	23		27
Overall average	**36**	**103**	**208**	**0.5**	**403**
		13	**29**		**36**
C^{V}V.CV̀					
Position	**N**	**V1**	**V2**	**V1/V2**	**Foot**
PF	9	143	218	0.7	456
		6	15		10
SF	9	145	184	0.8	440
		24	8		28
Overall average	**18**	**144**	**201**	**0.7**	**448**
		15	**11**		**19**

In disyllabic words of the CV.CV̀ and C^{V}V.CV̀ type, the short diphthong is on an average 41 ms longer than the short vowel; as shown by ANOVA, the difference is statistically significant at the $p < 0.001$ level. The duration ratios, however, are similar — on an average, 0.5 and 0.7. The position of short diphthongs in Livonian prosody will be considered further in a later section of this paper.

4. Disyllabic words with a long open first syllable

A long open first syllable is usually followed by a short syllable. Examples: *võrõd* 'strangers', *pū'dõd* 'clean' (Nom.Pl.), *aigõ* 'time' (Part.Sg.), *āigal* 'at the time', *jo'ugõ* 'into river', *luoimõ* 'thread' (Part.Sg.), *lūoimad* 'thread' (Nom.Pl.), *kuo'igõ* 'ship' (Gen.Sg.). The durations and duration ratios of vowels in words having an open long first syllable (long monophthong, long diphthong or triphthong) are given in Tables 2, 3, and 4. Words with and without laryngealization are presented separately (laryngealization is symbolized with the apostrophe).

As becomes obvious from the tables, words with a long open first syllable and a short second syllable vowel have similar V1/V2 ratios, ranging from 2.6 to 3.3. The durations of long vowels, long diphthongs, and triphthongs (269, 281, and 299 ms) are not significantly different; the same applies to the durations of unstressed second syllable vowels (102, 90, and 91 ms). The difference between short diphthongs and long diphthongs (144 and 281 ms) is significant at the $p < 0.0001$ level.

Table 2

Vowel durations, standard deviations (ms) and V1/V2 duration ratios in disyllabic CV̄.CV words produced by 8 speakers

CV̄.CV					
Position	**N**	**V1**	**V2**	**V1/V2**	**Foot**
PF	24	261	108	2.4	435
		26	19		58
SF	26	277	97	2.9	445
		36	16		37
Overall average	**50**	**269**	**102**	**2.6**	**440**
		31	**18**		**47**
CV̄ˀ.CV					
Position	**N**	**V1**	**V2**	**V1/V2**	**Foot**
PF	32	267	94	2.8	459
		27	20		38
SF	34	267	90	3.0	467
		32	14		49
Overall average	**66**	**267**	**92**	**2.9**	**463**
		29	**17**		**43**

Table 3

Vowel durations, standard deviations (ms) and V1/V2 duration ratios in disyllabic CVV.CV words produced by 8 speakers (VV — long diphthong)

CVV.CV					
Position	**N**	**V1**	**V2**	**V1/V2**	**Foot**
PF	47	271	89	3.0	449
		30	19		43
SF	46	291	91	3.2	488
		38	17		49
Overall average	**93**	**281**	**90**	**3.1**	**468**
		34	**18**		**46**
CVˀV.CV					
Position	**N**	**V1**	**V2**	**V1/V2**	**Foot**
PF	27	249	92	2.7	447
		37	16		33
SF	26	296	88	3.4	502
		49	16		61
Overall average	**53**	**272**	**90**	**3.0**	**474**
		43	**16**		**47**

Table 4

Vowel durations, standard deviations (ms) and V1/V2 duration ratios in CVVV.CV words produced by 8 speakers (VVV — triphthong)

CVVV.CV					
Position	**N**	**V1**	**V2**	**V1/V2**	**Foot**
PF	10	298	96	3.1	490
		46	15		49
SF	10	300	85	3.5	474
		51	22		73
Overall average	**20**	**299**	**91**	**3.3**	**482**
		49	**18**		**61**
CVV'V.CV					
Position	**N**	**V1**	**V2**	**V1/V2**	**Foot**
PF	7	276	105	2.6	480
		40	24		77
SF	9	278	98	2.8	483
		39	24		68
Overall average	**16**	**277**	**101**	**2.7**	**482**
		31	**20**		**46**

There are a number of words in Livonian where an open long first syllable is followed by a half-long vowel in the second syllable. In some of them the vowel of the second syllable is provided with a macron in spelling, but in some words we found the half-long vowel in words where the second syllable was not marked as long. The materials contained three such words: *vȭrõz* 'stranger' and *kīraz* 'ax' without laryngealization, and *pū'dõz* 'clean' with laryngealization. Data on these words are presented in Table 5.

Table 5

Vowel durations, standard deviations (ms), and V1/V2 duration ratios in a set of disyllabic CV̄.CV̀ and CV̄'.CV̀ words produced by 8 speakers

CV̄.CV̀					
Position	**N**	**V1**	**V2**	**V1/V2**	**Foot**
PF	18	268	145	1.9	460
		23	16		34
SF	17	249	133	1.9	434
		27	12		29
Overall average	**35**	**258**	**139**	**1.9**	**447**
		25	**14**		**31**
CV̄'.CV̀					
Position	**N**	**V1**	**V2**	**V1/V2**	**Foot**
PF	8	213	122	1.7	431
		24	13		48
SF	8	228	134	1.7	461
		30	24		38
Overall average	**16**	**220**	**128**	**1.7**	**446**
		27	**19**		**43**

There was one word having a long diphthong (*aigā* 'shore') and one word with a triphthong in the first syllable (*kuoigīd* 'ships') and a half-long vowel in the second syllable, spelled with a macron. (Two speakers mispronounced the word *aigā* and one speaker the word *kuoigīd*.) Data for these words are presented in Table 6.

Table 6

Vowel durations, standard deviations (ms), and V1/V2 ratios in disyllabic CVV.CV̀ and CVVV.CV̀ words produced by 6 and 7 speakers

CVV.CV̀					
Position	**N**	**V1**	**V2**	**V1/V2**	**Foot**
PF	6	205	218	0.9	520
		42	42		74
SF	6	198	181	1.1	485
		50	16		74
Overall average	**12**	**202**	**200**	**1.0**	**502**
		46	**29**		**74**
CVVV.CV̀					
Position	**N**	**V1**	**V2**	**V1/V2s**	**Foot**
PF	8	213	202	1.1	500
		59	49		69
SF	8	206	201	1.0	510
		52	43		81
Overall average	**16**	**210**	**202**	**1.0**	**505**
		55	**46**		**75**

As can be seen from Tables 5 and 6, at least some words with a long; open first syllable can be followed by second vowels with different durations, resulting in different V1/V2 ratios. This raises the question whether the duration of the vowel of the second syllable can be independently contrastive. The problem will be considered in some detail in a later part of the paper.

5. Disyllabic words with a closed first syllable

Livonian can have three kinds of intervocalic consonants: short single consonants and short and long geminates. The syllable preceding a short intervocalic consonant is open; geminates close the preceding syllable. The duration of a closed syllable is calculated by measuring the duration of the vowel and the part of the geminate or consonant cluster preceding the syllable boundary. The position of the syllable boundary in the geminate is calculated by measuring the duration of the geminate and subtracting the part that constitutes the initial consonant of the following syllable. This is established by measuring the duration of single word-initial and syllable-

initial consonants. A word-initial consonant is longer than a syllable-initial consonant; the duration of a syllable-initial consonant is approximately 70% of a word-initial consonant (the duration of a voiceless plosive cannot be measured in sentence-initial position, but can be established in a voiced environment). The total duration of the geminate is included in the tables for comparative purposes; it is also included in the total duration of the metric foot given in the last column.

The words containing a long first syllable closed by the first part of a short voiceless geminate or a corresponding voiceless cluster have a half-long vowel in the second syllable. Examples*:* *katāb* 'he/she covers', *ma äb pietā* 'I do not deceive', *mõtsā* 'forest' (Nom.Sg.). Data concerning this type of words are given in Table 7.

Words of this type have duration ratios (S1/S2 0.8—1.0) similar to those presented in Tables 5 and 6 — words with a long open first syllable and a half-long vowel in the second syllable (V1/V2 1.0—1.9).

Table 7

Syllable durations, standard deviations (ms), and S1/S2 duration ratios in disyllabic words containing a short voiceless geminate consonant or consonant cluster and a half-long vowel in the second syllable (8 speakers)

CVC.CV̀							
Position	**N**	**V1**	**CC**	**S1**	**S2 = V2**	**S1/S2**	**Foot**
PF	30	112	135	166	212	0.8	459
		29	11	31	24		46
SF	27	108	147	175	198	0.9	453
		27	19	38	27		45
Overall average	**57**	**110**	**141**	**170**	**205**	**0.8**	**456**
		28	**15**	**35**	**26**		**45**
CVC1.C2V̀							
Position	**N**	**V1**	**C1C2**	**S1**	**S2 = V2**	**S1/S2**	**Foot**
PF	35	87	216	198	207	1.0	510
		23	20	39	32		45
SF	38	82	216	200	191	1.0	489
		17	27	39	30		50
Overall average	**73**	**84**	**216**	**199**	**199**	**1.0**	**499**
		20	**24**	**39**	**31**		**47**

Words containing a long voiceless geminate or consonant cluster are presented in Table 8. These words have a long voiceless geminate or consonant cluster and a short second syllable vowel. Examples: *kattõ* 'to cover', *mõtsõ* 'forest' (Part.Sg.).

Words of the type presented in Table 8 have syllable ratios (S1/S2 2.9—3.1) similar to those found in words presented in Tables 2, 3, and 4 — words with a long open first syllable and a short vowel in the second syllable (V1/V2 2.6—3.3).

Table 8

Syllable durations, standard deviations (ms), and duration ratios in disyllabic words containing a long voiceless geminate consonant or consonant cluster and a short vowel in the second syllable (8 speakers)

CVC.CV							
Position	**N**	**V1**	**CC**	**S1**	**S2 = V2**	**S1/S2**	**Foot**
PF	31	127	248	295	103	2.9	478
		40	34	56	20		61
SF	32	121	266	306	90	3.4	477
		38	29	52	24		50
Overall average	**63**	**124**	**257**	**301**	**97**	**3.1**	**478**
		39	**32**	**54**	**22**		**56**
CVC1.C2V							
Position	**N**	**V1**	**C1C2**	**S1**	**S2 = V2**	**S1/S2**	**Foot**
PF	32	110	266	258	100	2.6	476
		22	33	52	16		51
SF	30	101	320	298	93	3.2	513
		25	28	47	15		48
Overall average	**62**	**105**	**293**	**278**	**96**	**2.9**	**494**
		23	**31**	**50**	**16**		**49**

6. Syllabic ratios reflecting word structure

The prosodic identity of a disyllabic word in Estonian is determined by the relationship between the durations of the two syllables. To explore the potential parallel with Estonian, the syllabic ratios of Livonian words have been calculated for twelve word types, presented in Tables 1—8. For purposes of comparison, they are presented here as Table 9. Values found both for medial position and final position are presented, to illustrate the range that is possible for the same word type.

A survey of the S1/S2 ratios shows, first of all, that there are six word types whose syllabic ratios are similar to those of Estonian Q3 words. These are word types where the first syllable is decisively longer than the second syllable, resulting in ratios ranging from 1.9 to 3.5. There are also three word types that resemble Estonian Q1 words — with the second vowel longer than the first and ratios of 0.5 to 0.9. But three word types have ratios that suggest that the two vowels have more or less equal duration. In Estonian Q2 words, the first syllable is definitely longer, and the ratios are around 1.5. In Estonian, Q2 and Q3 words are distinguished not only by duration, but also by a different F0 contour. It Livonian, it is the distinction between Q1 and Q2 that would require additional support to continue to be maintained.

The symbolization of Livonian word types, as it stands in Table 9, does not take into account a possible three-way distinction between them. There are word types with first syllables looking identical, but with different second syllable durations and different S1/S2 ratios. For example, a word

Table 9

S1/S2 ratios of Livonian words averaged over 8 speakers

Table	Word type	S1/S2 ratio	
		PF	**SF**
1.	CV.CV̀	0.5	0.5
	C^{V}V.CV̀	0.7	0.8
2.	CV̄.CV	2.4	2.9
3.	CVV.CV	3.0	3.2
4.	CVVV.CV	3.1	3.5
5.	CV̄.CV̀	1.9	1.9
6.	CVV.CV̀	0.9	1.1
	CVVV.CV̀	1.1	1.0
7.	CVC.CV̀	0.8	0.9
	CVC1.C2V̀	1.0	1.0
8.	CVC.CV	2.9	3.4
	CVC1.C2V	2.6	3.2

type CVV.CV̀ has the ratios 0.9 and 1.1 in words where the orthography signals a long second syllable vowel, and a word type symbolized as CVV.CV has the ratios 3.0 and 3.2. The symbolization of the first syllables suggests identity, which in turn would mean that the two word types are distinguished by contrastively different second vowel durations. This would be the case, if the first syllable durations were in fact the same, but in words with a long second vowel the average duration of the long diphthong is 202 ms (ratios 0.9 and 1.1), and in words with a long diphthong and a short second vowel, the duration of the long diphthong is 281 ms (ratios 3.0 and 3.2). This suggests that the two syllables of the word are mutually defining — the duration of the second syllable is not automatically controlled by the duration of the first syllable, but the duration of both syllables and their relation to each other determines the prosodic identity of the word. This demonstrates also that segmental length oppositions are insufficient to describe the prosodic identity of Livonian words.

The similarity of Livonian quantity patterns to those of Estonian is least obvious in patterns that would correspond to the Estonian Q2 — the long quantity. We hypothesized that there might be a generational difference in play — that the realization of the long quantity in the speech of an older generation might have been more similar to the situation found in Estonian.

A comparison of the quantity patterns in words produced by representatives of three generations is offered in Table 10. Table gives average durations of V1, V2, V1/V2 ratios, and metric foot durations in the words *kīraz*, *vȭrõz* (word type CV̄.CV̀), and *sōdõ*, *vȭrõd*, and *kȭrõd* (word type CV̄.CV), produced by three speakers. VB was born in 1921, ZS in 1950, and JS in 1978.

Table 10

Duration patterns in five Livonian words (3 speakers)

Word type	Speaker	V1	V2	V1/V2	Foot
CV̄.CV̀					
PF	VB	321	208	1.5	616
	ZS	327	151	2.5	482
	JS	228	156	1.5	423
CV̄.CV					
PF	VB	332	165	2.0	593
	ZS	303	123	2.5	486
	JS	228	113	2.0	411
CV̄.CV̀					
SF	VB	332	214	1.5	634
	ZS	292	112	2.6	434
	JS	243	176	1.4	459
CV̄.CV					
SF	VB	326	126	2.6	547
	ZS	369	94	3.9	505
	JS	280	104	2.7	457

The table shows that in CV̄.CV̀ words, expected to correspond to Estonian Q2 words (long quantity, V1/V2 = 1.5), speakers VB and JS have duration ratios of 1.5 and 1.4 both in phrase-final and sentence-final position. In CV̄.CV words, expected to correspond to Estonian Q3 words (overlong quantity, V1/V2 = 2.0 or higher), the oldest speaker VB has ratios of 2.0 (phrase-final position) and 2.6 (sentence-final position). Speaker JS, whose productions of the words where a longer V2 was expected, agreed with the productions of VB, has also in CV̄.CV words similar ratios of 2.0 (phrase-final position) and 2.7 (sentence-final position). Speaker ZS, representative of an intermediate generation, makes no distinction in the durational patterns. Her V1/V2 ratios are always greater than 2 (2.5, 2.5, 2.6, 3.9).

The generational difference hypothesis is not supported by these data. The speakers of Livonian do not constitute a cohesive settlement any more; the language is being transmitted within family groups. The usage presented in Table 10 reflects individual family history and background. The oldest speaker, VB, learned Livonian as first language and acquired Latvian as a second language in school. It appears reasonable to assume that his language is closest to Livonian when it was the first language of a larger community. JS comes from a family with a tradition of using Livonian in extended family communication; she seems to have acquired a pronunciation transmitted by older relatives. ZS, however, comes from a family where Latvian is spoken at home.

Having found that the difference between individual speakers can be categorical rather than gradual — a feature is either present or absent, rather than features merging into an intermediate form — we looked again

at the individual characteristics of the speakers whose productions were averaged in Tables 2 and 5, left out two speakers who did not distinguish between CV̄.CV̀ and CV̄.CV words, and recalculated the tables for six speakers. The new tables are presented here as Tables 11 and 12.

Table 11 (*Table 2*)

Vowel durations and standard deviations (ms) and V1/V2 duration ratios in disyllabic CV̄.CV̀ words produced by 6 speakers

CV̄.CV̀					
Position	**N**	**V1**	**V2**	**V1/V2**	**Foot**
PF	14	253	151	1.7	454
		28	19		44
SF	13	241	141	1.7	438
		17	12		22
Overall average	**27**	**247**	**146**	**1.7**	**446**
		23	**15**		**33**

Table 12 (*Table 5*)

Vowel durations and standard deviations (ms) and V1/V2 duration ratios in disyllabic CV̄.CV words produced by 6 speakers (PF — phrase-final words, SF — sentence-final words, N — number of measurements)

CV̄.CV					
Position	**N**	**V1**	**V2**	**V1/V2**	**Foot**
PF	16	248	109	2.3	423
		22	14		54
SF	26	260	101	2.6	434
		32	18		38
Overall average	**42**	**254**	**105**	**2.4**	**428**
		27	**16**		**46**

As may be seen from the tables, the two word types are clearly distinguished on the basis of V2 duration and V1/V2 ratios (as shown by ANOVA, the both differences (between V2 duration and V1/V2 ratios) are statistically highly significant at the $p < 0.0001$ level).

7. Foot isochrony

There is one further aspect where the similarity between Livonian and Estonian prosodic systems is much too great to be attributed to chance, and this is foot isochrony. As in Estonian, a longer first syllable is followed by a shorter second syllable, and vice versa, resulting in approximately equal duration of the S1 + S2 sequence.

Figure 1 illustrates the relationships between the two syllables of disyllabic words (cf. according overall averages in Tables 1, 11, 12, 3, 6, 7, 8). In six two-column pairs, the syllable duration equals the duration of the vocalic syllable nuclei. The last two pairs represent words with intervocalic geminates; they will be discussed later.

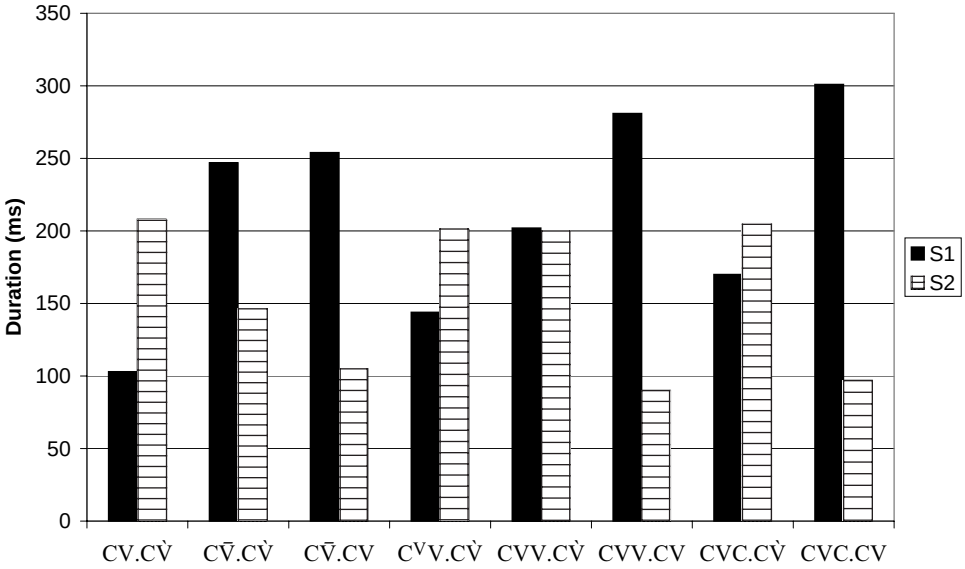

Figure 1. **Syllable durations (ms) of different word types.**

The first pair represents words with a short first syllable and a long second syllable. This type corresponds to Estonian Q1 words. The symbolization suggests that the second vowel of the words shown as the next pair should differ in the duration of the first vowel, but have identical long second vowels; in fact the lengthening of the first vowel is accompanied by considerable shortening of the second vowel. This word type corresponds to Estonian Q2 words. The third pair — corresponding to Estonian Q3 words — has the longest first vowel and the shortest second vowel.

This structure is almost identical with the word type shown as the sixth pair — long diphthong in the first syllable followed by a short syllable. The two pairs preceding it show short and long diphthongs followed by a long second syllable. The second vowels in words with a short diphthong are clearly longer than the first syllable nucleus, and the type the word resembles closest is the type with a short first syllable. (The short diphthong is longer than the short vowel, but this is a segmentally conditioned difference, as is the case with long vowels and long diphthongs — where there is no difference between average durations).

It should be noted also that the long diphthong followed by a long vowel is considerably shorter than a long diphthong followed by a short vowel, illustrating again the tendency to balance syllable durations to arrive at foot isochrony.

Figure 2 summarizes the information about foot duration (cf. overall averages in Tables 1, 11, 12, 3, 6, 7, 8). Duration is measured from the onset of the first syllable nucleus to the end of the second syllable nucleus. The durations of feet with a monophthong in the first syllable are shown in the first set of three columns; durations of feet with a diphthong in the first syllable are given in the second set of three. Words containing short and long geminates are represented by the last two columns (they will be discussed later).

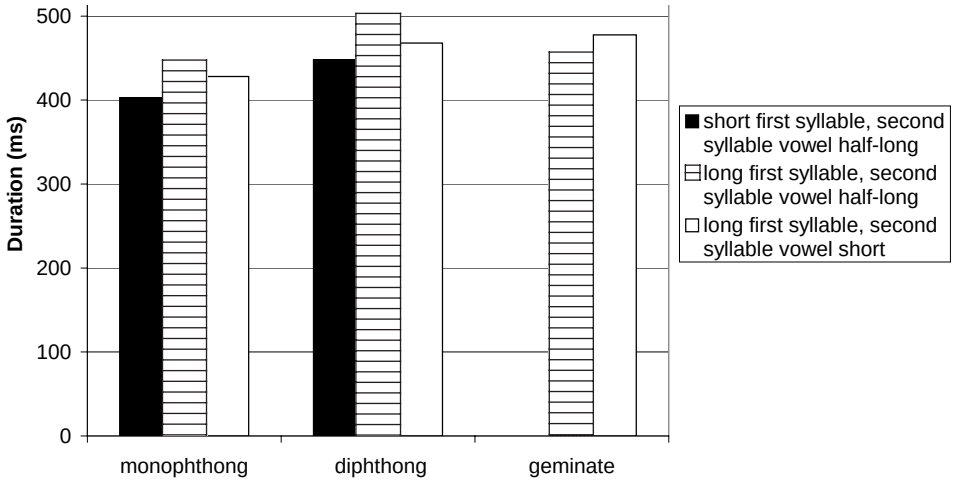

Figure 2. **Average duration of feet (ms) containing monophthongs, diphthongs, and geminate consonants.**

The durations of feet with short and long monophthongs and half-long or short second syllable vowels are 403, 446, and 428 ms. Durations of feet with short or long first syllable diphthongs and half-long or short second syllable vowels are 448, 502 and 468 ms. Durations of feet with a first syllable closed by a geminate and a half-long or short second syllable are 456 and 478 ms. The differences in duration may be assumed to be below the perceptual threshold.

8. Consonant quantity in Livonian

Livonian has been shown to have both single consonants and geminates in intervocalic position. The geminates, in turn, can be short and long, which establishes a three-way quantity opposition in consonants. There is also a long-short opposition in final position. This corresponds to the situation in Estonian, with a long-short opposition in final position, and single consonants and geminates in intervocalic position. In both languages, the geminates can be short or long.

Geminate resonants constitute a special case. The first part of the voiced geminate resonant functions as part of the syllable nucleus; when preceded by a short vowel, the sequence of vowel + resonant constitutes a long complex syllable nucleus. Evidence for this comes both from duration and from the distribution of the Livonian broken tone.

The proper comparison of V + R syllable nuclei is with syllable nuclei consisting of long diphthongs, since these, too, are phonetically complex. The average duration of first syllable nuclei in words of the type CVV.CV is 281 ms; the duration of V + R is 267 ms. This difference is well within one standard deviation, and quite probably also below the perceptual threshold.

The evidence from the distribution of tone consists of the fact that V + R syllable nuclei can serve as the domain of the broken tone, while

sequences of short vowel + first part of a voiceless geminate cannot carry broken tone.

Now in Estonian, the difference between short and long geminate plosives involves not only segmental duration, but also differences in the duration of the vowel of the second syllable, resulting in a difference between Q2 and Q3 — the long and overlong quantities. The situation is similar in Livonian. In words of the type CVC.CV̀ (Table 7, *katāb*), the duration of the vowel of the second syllable is 205 ms, and the S1/S2 ratio is 0.8; in words of the type CVC.CV (Table 8, *kattõ*), the vowel of the second syllable has the duration of 97 ms, and the S1/S2 ratio is 3.1. The *kattõ*-type words correspond to the Estonian Q3 words, while the *katāb*-type words show a S1/S2 relationship similar to what was observed for Livonian words constituting the category between short and overlong. (Cf. also Figure 1, the last two double columns.)

The short plosives are written with symbols for voiced plosives in Livonian orthography — as they are in Estonian orthography. In Estonian, these consonants are phonetically voiceless (and giving them a fully voiced pronunciation instantly identifies the speaker as having a foreign accent). In Livonian, they appear phonetically voiced — which introduces a voiced/voiceless opposition into the consonant system. However, the voicedness of the voiced plosive geminates is supported by the fact that syllable nuclei preceding a voiced plosive geminate can carry the broken tone, which in turn means that the sequence of short vowel + voiced plosive is treated as a long syllable nucleus.

9. Tone in Livonian

A major difference between Livonian and Estonian is the presence of tone in Livonian, which has been attributed to contact with Latvian. Our study was not designed to provide a direct answer to the question about the origin of tone in Livonian. A comparison with Latvian is nevertheless illuminating.

It should be noted, first of all, that Latvian dialects are not uniform with regard to their prosodic structure. A survey article by L. Balode and A. Holvoet (2001 : 14—15) states that some of the central dialects have a system of three tones, but that this system is variously reduced in most Latvian dialects. In High Latvian (or Latgalian), the 'falling' and 'drawn' tones have merged, which results in an opposition of 'falling' vs. 'broken'. But since they say this is only a difference in glottalization, tone has actually become neutralized in this dialect, and there is only an opposition between presence and absence of *stød*, which is a situation comparable to that in Danish.

The same kind of situation prevails in Livonian: contrastive is the presence and absence of the broken tone (while duration measurements of syllable nuclei in words with a broken tone are included in the previous tables, phonetic data about the realization of the broken tone will be presented in another context.) Curious is the fact that geographically, the dialect of Latvian for which this situation is described is the one farthest away from territories originally inhabited by Livonians. Of course, historically the Livonian territory extended much farther toward the East, and

it is not impossible that the Latvian adstratum influenced the developments in Livonian. The hypothetical influence depends in turn on dating the corresponding change in the Latgalian dialect, which may or may not have been completed while the Livonians were still inhabiting their original extended territory.

The alternative is to assume that the broken tone developed in spontaneously, without any influence from Latvian. A precedent for this in the Baltic Sea environment is the development of the *stød* in Danish.

10. Livonian in the contact area

This leads to the position of Livonian in the group of languages spoken in the contact area — the area around the Baltic Sea. The area has long been considered to constitute a *Sprachbund* — first described by Roman Jakobson in his article "Über die phonologischen Sprachbünde" (1931). Jakobson stated that the languages of the countries surrounding the Baltic Sea constitute a "Sprachbund" characterized by polytonicity. He included the following languages: Swedish, Norwegian (with the exception of northwestern dialects), most Danish dialects, some north German dialects, North Kashubian, Lithuanian and Latvian, Livonian and Estonian. In most of these languages and dialects one finds what Jakobson termed *Tonverlaufskorrelation*: distinctive tonal movements on accented syllables. According to R. Jakobson, the rest of the languages and dialects in the area are characterized by the presence of *Tonbruchkorrelation* — contrastive presence and absence of a glottal modification similar to the Danish *stød*.

Livonian and Latvian provide a classificatory problem, since in some dialects — or according to some interpretations — their prosodic systems have both *Tonverlaufskorrelation* and *Tonbruchkorrelation*. The specific problem with Livonian is the fact that it is a Finno-Ugric language, and no other Finno-Ugric language has tone. The question arises whether the Livonian prosodic system acquired its distinctive structure spontaneously or through contact with Latvian — or even more broadly, through its membership in the *Sprachbund* around the Baltic Sea.

This is a question that cannot be solved using the methodology of acoustic phonetic research, and we are not attempting to do this. However, we can draw conclusions from observations. To be sure, what is called the broken tone in Livonian is found also in Latvian, and Latvian is a neighboring language. But stød is also found in Danish, and Danish is not a contiguous language. If the stød could arise spontaneously in Danish, it might just as well have arisen spontaneously in Livonian. And one might then continue speculating and propose that the stød moved from Livonian to Latvian, not vice versa. After all, initial stress in Latvian is commonly accepted as having arisen due to contact with Livonian!

More seriously, Livonian shares prosodic characteristics with both Latvian and Estonian. Contacts with Latvian have been closer in recent history, but the basic structure of the prosody is more similar to that of Estonian. Again, there is no reason not to admit the possibility that the changes in Livonian happened spontaneously, without Estonian influence. Either way, Livonian constitutes a link in the circle of polytonicity around the Baltic Sea.

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КОЛИЧЕСТВО ЗВУКА В ЛИВСКОМ ЯЗЫКЕ. ПРЕДВАРИТЕЛЬНЫЕ РЕЗУЛЬТАТЫ

В статье описан акустико-фонетический анализ просодии ливского языка, самого южного из прибалтийско-финских. Он осуществляется в рамках исследования просодии финно-угорских языков. В основу работы легли тестовые предложения, начитанные на магнитофонную ленту носителями ливского языка.

Тестовые слова анализировались в акустико-фонетическом плане и данные обрабатывались статистически. В центре внимания авторов — количественные характеристики ливских двусложных слов. Ливские слова с кратким открытым первым слогом характеризуются полудолготой второго слога, как и в эстонском языке, однако в ливском произношении гласный второго слога ощутимо длительнее, чем в эстонском (V1/V2 = 0,5). Среди слов с долгим открытым первым слогом выделяются две группы. В одной из них гласный в 1,4—1,9 раза, в другой же в 2,9—3,5 раза длиннее, чем гласный второго слога. На две группы распределяются и слова с долгим закрытым первым слогом, в одной из них значение соотношения длительностей меньше (гласный второго слога полудолгий), в другом — больше (гласный второго слога краткий). Общие длительности стоп демонстрируют изохронию стоп в ливском языке. В статье обсуждается также ареальный фон полученных результатов.