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## THE PHONETICS AND PHONOLOGY OF A DISYLLABIC FOOT IN SOIKKOLA INGRIAN

**Abstract.** This paper examines the durational characteristics of vowels and consonants in contemporary Soikkola Ingrian, discusses the phonological interpretation of durational contrasts, and studies correlations between the duration of different segments in the foot. The object of the study is limited to disyllabic feet with an open second syllable. The acoustic study shows three durational types of vowels both in the first and second syllable, but only two contrastive types, short and long vowels, are distinguished on the phonological level. Intervocalic consonants have five durational types on the phonetic level, and three contrastive types on the phonological level: single consonants vs. short geminates vs. full geminates. The analysis shows that contemporary Ingrian is undergoing a gradual change from a northern to a southern type Finnic language: the quantity opposition of short and long vowels in non-initial syllables is on the way to be replaced by the quality opposition of reduced and full vowels.

**Keywords:** Ingrian, phonetics, phonology, quantity, duration ratios.

### 1. Introduction

The principal aim of this paper is to investigate certain phonetic regularities in contemporary Soikkola Ingrian using experimental techniques, and to discuss their phonological interpretation.

The two most intensively studied Finnic languages — Estonian and Finnish — demonstrate important differences in their prosodic organization. Finnish has a binary quantity opposition of vowels in any position, and a binary quantity opposition of consonants in any intervocalic position (Karls-son 1969; Lehtonen 1970; Suomi, Toivanen, Ylitalo 2008). Estonian demonstrates a tree-way quantity contrast of vowels in the first syllable, and a tree-way quantity contrast of consonants on the border of the first and second syllable in the foot. The duration of the second syllable vowel is not contrastive by itself, but depends on the quantity of the first syllable vowel, so the crucial parameter in describing the Estonian quantity system is the duration ratio of the first to the second syllable in the foot (Lehiste 1997; Ross, Lehiste 2001)<sup>1</sup>.

<sup>1</sup> Not to mention the important role of stress and tone that interact with the duration in Estonian.

It has been suggested that the Estonian prosodic system was once very similar to that of contemporary Finnish, but later transformed significantly due to the apocope, syncope, and other sound changes (Lehiste 2003 : 47–48). Similar processes took place in other Finnic languages, but yielded different results (Viitso 1997). A detailed study of the prosodic structure in different Finnic varieties would provide an insight into the evolutionary pass from a quantity to an accent language. Here, I intend to present and analyze contemporary Ingrian data, and thus to contribute to the study of Finnic prosody.

The object of the study is limited to disyllabic feet with an open second syllable. In particular, I have studied the following aspects:

- durational characteristics of different types of vowels and consonants;
- durational contrasts of vowels in the second syllable;
- durational contrasts of consonants at the border of the first and second syllable;
- correlations between the duration of different segments in the foot.

## 2. Background

The phonetics of Ingrian has previously not been studied in depth. The only works involving experimental research on the subject are by A. Sovijärvi (1944), M. Gordon (2009), and N. V. Kuznecova (Кузнецова 2009b). More information can be found in the works of the principal researcher of Ingrian A. Laanest (Лаанест 1966; 1978; Laanest 1986), but these works do not provide any instrumental measurements. The problem of phonological contrasts was only addressed in a short article (Laanest 1987) and in a recently defended doctoral thesis (Кузнецова 2009a). Except for these two, all the works on Ingrian (including the dictionary Nirvi 1971) use phonetic transcription which is highly diverse and individual depending on the author.

According to the samples of Ingrian speech as presented in the dictionary and other sources, Ingrian has short and long vowels that are phonologically contrastive in any syllable: *kukka* 'flower:Nom' — *kukkā* 'flower:Part', *nokka* 'beak:Nom' — *nokkā* 'beak:Part', etc. The words of CVCV structure are said to have a half-long vowel in the second syllable: *kalā* 'fish:Nom', *madō* 'snake:Nom' (Sovijärvi 1944 : 17), similar to Estonian (Ross, Lehiste 2001 : 44–45) and a part of Finnish dialects (Wiik, Lehiste : 1968).

Like other Finnic languages, Ingrian originally had a binary opposition of single and geminate consonants (Viitso 1997 : 226–227). Later, Ingrian developed the so-called secondary geminates and prolonged consonants (Porkka 1885 : 37–42; Sovijärvi 1944 : 81–95; Лаанест 1978 : 121–136). Both developed from single consonants before long vowels or diphthongs of recent origin. The same lengthening process yielded different results depending on the quantity of the first syllable. If the first syllable was short (i.e. open and contained a short vowel), an originally single consonant changed into a secondary geminate: *\*kalaa* > *kallaa* 'fish:Part' (Лаанест 1978 : 121). If the first syllable was long (i.e. closed by a sonorant or/and containing a long vowel), the consonant became half-long: *\*alkaa* > *alkaa* 'begin:Prs:3Sg', *jootii* > *jootii* 'drink:Imprs:Pst' (Лаанест

1978 : 127). In Laanest 1987 : 291, secondary geminates together with half-long consonants are regarded as separate phonological units contrasting with both single consonants and original geminates. A different opinion is expressed in Gordon 2009 : 94–96, where secondary geminates preceded by a short vowel are durationally not differentiated from the original geminates.

In my previous study (Markus 2010), I showed that in contemporary Soikkola Ingrian secondary geminates are contrasting with the original geminates in foot types with a short first vowel. The opposition is manifested in duration, secondary geminates being clearly shorter than the primary ones. In this study I will look at all the possible disyllabic foot types.

### 3. Data and methods

The overall set of hypothetically possible disyllabic structures is shaped by the combination of short and long vowels both in the first and second syllable, and single consonants, secondary geminates or prolonged consonants, and original geminates on the syllable boundary:<sup>2</sup>

V2	Short	Long
V1		
Short	CVCV	CVCVV
	CVČCV	CVČCVV
	CVCCV	CVCCVV
Long	CVVCV	CVVCVV
	CVVČCV	CVVČCVV
	CVVCCV	CVVCCVV

V — short vowel  
 VV — long vowel  
 C — single consonant  
 ČC — secondary geminate or a prolonged consonant  
 CC — original geminate

However, from the available Ingrian materials and from my previous field research it became clear that of the twelve hypothetically possible structures, only nine are present in contemporary Soikkola Ingrian. The three missing structures are CVČCV, CVVČCV, and CVCVV (those shaded grey in the table above). The CVČCV and CVVČCV feet (i.e. the structures with secondary geminates followed by a short vowel) are impossible, because secondary geminates arose historically only before long vowels or diphthongs, and this rule remains intact in the contemporary language. The CVCVV structure does not occur in Ingrian, because in this structure a single intervocalic consonant changed into a secondary geminate. This is one of the features differentiating Ingrian from Finnish, c.f. standard Finnish *kalaa* and Ingrian *kallaa* 'fish:Part'.

Hence, disyllabic feet in Soikkola Ingrian can be of the following nine structures (examples are given in phonetic transcription):

<sup>2</sup> The list of possible disyllabic structures is longer, if we consider cases with consonant clusters and with diphthongs. I do provide some information on consonant clusters in 4.2, but these structures are not analyzed in detail in this paper.

Foot type	Example	Gloss
CVCV	<i>kaDà</i>	roof:Imp:2Sg
CVVCV	<i>sāDa</i>	accompany:Imp:2Sg
CVVCVV	<i>māDā</i>	sleep:Imprs:Prs
CVCCV	<i>kukka</i>	flower:Nom
CVCCVV	<i>tappā</i>	kill:Prs:3Sg
CVČCVV	<i>maĳkā</i>	sleep:Imp:2Sg
CVVCCV	<i>vūtta</i>	year:Part
CVVCCVV	<i>sāttā</i>	accompany:Prs:3Sg
CVVČCVV	<i>tūĳā</i>	bring:Imp:2Pl

For the present study, I compiled a list of test words containing intervocalic plosives (*k*, *t*, and *p*) in the nine possible disyllabic foot types. The carrier phrases contained the test words in phrase-final and sentence-final positions, like in *kiukāz on va rokka*, *miulle ei taĳpā* 'In the oven there is only soup, it is not enough for me' and *miulle sūkkiä ei taĳpā*, *kiukāz on va rokka* 'There is not enough food for me, in the oven there is only soup'. Altogether there were 60 test words placed both in the phrase-final and sentence-final position.

The carrier phrases were recorded during a field trip to Ingria in the summer of 2010 from two native speakers of Soikkola Ingrian (a female born in 1927, and a female born in 1932). It should be mentioned right away that measuring absolute segmental durations gave different results for the two speakers (most probably due to different speech rates), but the duration ratios of segments in the foot appeared to be the same for both speakers. This fact indicates that the prosodic organization of the foot in Ingrian is strictly determined by the foot structure and does not depend on the speaker's individual pronunciation.

Table 1 gives average measurements for all the nine foot types (N stands for the number of measurements). In particular, it lists average durations of the first vowel, the intervocalic consonant, and the second vowel, the duration ratios of the second vowel to the first vowel and of the consonant to the second vowel, the average duration of the first and second syllables, the duration ratio of the second to the first syllable, and the average foot duration. Syllable durations were calculated in the following way. The duration of the word-initial and syllable-initial consonants was not included<sup>3</sup>, thus the duration of the second syllable always equals the duration of the second syllable vowel. The duration of the first syllable equals the duration of the first syllable vowel in foot types with a single intervocalic consonant (the types *kaDà*, *sāDa*, and *māDā*). In foot types containing a geminate, the duration of the first syllable equals the duration of the first syllable vowel plus the duration of the first part of the geminate. The

<sup>3</sup> First, it allows comparing words both with and without an initial consonant, and second, this way of calculating makes the Ingrian data comparable to the data from other Finnic languages, as syllable-initial consonants are usually excluded from syllable duration (Lehiste 1960 : 54; Lehiste, Teras, Ernštreits, Lippus, Pajusalu, Tuisk, Viitso 2008 : 41; Asu, Lippus, Teras, Tuisk 2009 : 53–54).

latter is calculated by measuring the duration of the geminate and subtracting the average duration of the syllable-initial consonant (= the single intervocalic consonant in *kaDà*, *sāDa*, and *māDā* foot types). The foot duration is calculated by adding the durations of the first vowel, the intervocalic consonant, and the second vowel.

Table 1

**Average durations (in ms) of the first and second vowel, the intervocalic consonant, the first and second syllable, and the foot; standard deviations (in ms); duration ratios of the second vowel to the first vowel, of the consonant to the second vowel, and of the second to the first syllable**

Structure	Position	N	V1	C(C)	V2	V2/V1	CC/V2	Syl1	Syl2	Syl2/Syl1	Foot
<b>CVCV [<i>kaDà</i>]</b>											
Average	PF	10	111	92	198	1.8	0.5	111	198	1.8	402
StDev			19	16	43			19	43		67
Average	SF	10	94	93	174	1.9	0.6	94	174	1.9	360
StDev			18	16	24			18	24		41
<b>Overall Average</b>		<b>20</b>	<b>102</b>	<b>92</b>	<b>186</b>	<b>1.8</b>	<b>0.5</b>	<b>102</b>	<b>186</b>	<b>1.8</b>	<b>381</b>
Overall StDev			18	16	33			18	33		54
<b>CVVCV [<i>sāDa</i>]</b>											
Average	PF	10	226	87	114	0.5	0.9	226	114	0.5	426
StDev			39	20	41			39	41		86
Average	SF	10	197	98	111	0.6	0.9	197	111	0.6	405
StDev			36	22	19			36	18		60
<b>Overall Average</b>		<b>20</b>	<b>211</b>	<b>92</b>	<b>112</b>	<b>0.5</b>	<b>0.9</b>	<b>211</b>	<b>112</b>	<b>0.5</b>	<b>416</b>
Overall StDev			38	21	30			37	30		73
<b>CVVCVV [<i>māDā</i>]</b>											
Average	PF	5	242	113	136	0.6	0.9	242	136	0.6	491
StDev			16	12	9			16	9		13
Average	SF	5	231	100	139	0.6	0.8	231	139	0.6	470
StDev			6	15	6			6	6		5
<b>Overall Average</b>		<b>10</b>	<b>237</b>	<b>107</b>	<b>137</b>	<b>0.6</b>	<b>0.9</b>	<b>237</b>	<b>137</b>	<b>0.6</b>	<b>481</b>
Overall StDev			11	13	5			11	5		9
<b>CVCCV [<i>kukka</i>]</b>											
Average	PF	10	116	282	127	1.1	2.2	301	127	0.4	525
StDev			21	38	13			45	14		58
Average	SF	10	103	291	120	1.2	2.5	297	120	0.4	514
StDev			20	32	19			46	18		53
<b>Overall Average</b>		<b>20</b>	<b>109</b>	<b>287</b>	<b>123</b>	<b>1.2</b>	<b>2.4</b>	<b>299</b>	<b>123</b>	<b>0.4</b>	<b>519</b>
Overall StDev			20	35	16			46	16		56

Structure	Position	N	V1	C(C)	V2	V2/V1	CC/V2	Syl1	Syl2	Syl2/Syl1	Foot
<b>CVCCVV [tappā]</b>											
Average	PF	12	120	285	169	1.5	1.7	308	169	0.6	574
StDev			16	37	28			46	28		65
Average	SF	12	94	296	137	1.5	2.2	293	137	0.5	527
StDev			13	39	25			43	25		63
<b>Overall Average</b>		<b>24</b>	<b>107</b>	<b>291</b>	<b>153</b>	<b>1.5</b>	<b>2</b>	<b>301</b>	<b>153</b>	<b>0.5</b>	<b>550</b>
Overall StDev			15	38	26			44	26		64
<b>CVČCVV [mačkā]</b>											
Average	PF	12	113	220	155	1.4	1.5	236	155	0.7	487
StDev			23	31	36			45	36		74
Average	SF	12	94	227	152	1.6	1.6	224	152	0.7	472
StDev			18	19	27			28	27		52
<b>Overall Average</b>		<b>24</b>	<b>104</b>	<b>223</b>	<b>153</b>	<b>1.5</b>	<b>1.6</b>	<b>230</b>	<b>153</b>	<b>0.7</b>	<b>480</b>
Overall StDev			21	25	31			36	31		63
<b>CVVCCV [vūtta]</b>											
Average	PF	9	186	233	120	0.7	2	322	120	0.4	539
StDev			49	39	24			80	24		101
Average	SF	9	159	251	113	0.7	2.3	313	113	0.4	523
StDev			25	28	19			47	19		65
<b>Overall Average</b>		<b>18</b>	<b>173</b>	<b>242</b>	<b>117</b>	<b>0.7</b>	<b>2.1</b>	<b>318</b>	<b>117</b>	<b>0.4</b>	<b>531</b>
Overall StDev			37	33	21			64	21		83
<b>CVVCCVV [sättā]</b>											
Average	PF	10	196	236	133	0.7	1.9	335	133	0.4	565
StDev			53	23	23			72	23		89
Average	SF	10	174	260	142	0.9	1.9	337	142	0.4	576
StDev			36	33	15			58	15		56
<b>Overall Average</b>		<b>20</b>	<b>185</b>	<b>248</b>	<b>138</b>	<b>0.8</b>	<b>1.9</b>	<b>336</b>	<b>138</b>	<b>0.4</b>	<b>570</b>
Overall StDev			44	28	19			65	19		73
<b>CVVČCVV [tūkā]</b>											
Average	PF	10	170	170	151	0.9	1.2	243	151	0.6	491
StDev			30	17	30			39	30		55
Average	SF	10	182	165	171	1	1	249	171	0.7	517
StDev			26	16	20			40	20		50
<b>Overall Average</b>		<b>20</b>	<b>176</b>	<b>167</b>	<b>161</b>	<b>1</b>	<b>1.1</b>	<b>246</b>	<b>161</b>	<b>0.7</b>	<b>504</b>
Overall StDev			28	17	25			39	25		53

## 4. Results and discussion

### 4.1. Vowel length oppositions in the second syllable

The results of the acoustic measurements of modern Soikkola Ingrian data confirm the traditional opposition of short and long vowels in the second syllable. In all cases, vowels transcribed as short are indeed shorter than vowels transcribed as long, although the difference between the two vowel types is not very big, and there is variation in absolute duration in both types (for short vowels: from 112 ms to 123 ms; for long vowels: from 137 ms to 161 ms).

The half-long vowel in the CVCV [kaDà] foot type appeared to be actually longer than the long V2 (possible reasons for this are discussed below in this section), so synchronically "overlong" would probably be a better term to refer to it.

Figure 1 presents graphically the three types of V2 in modern Soikkola Ingrian:

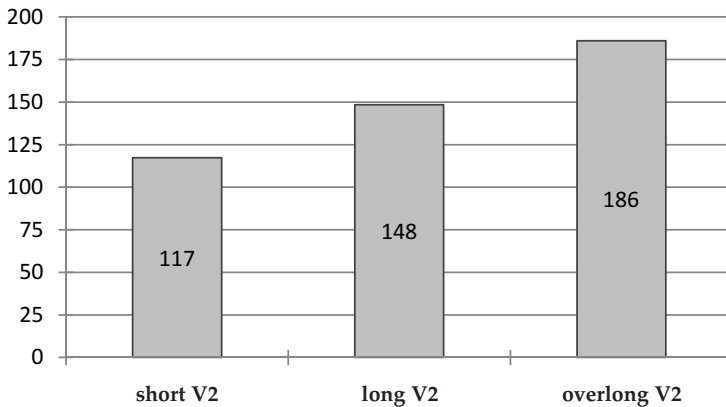


Figure 1. Average duration (in ms) of V2 in the three contrastive types.

Type 1 (the average duration 117 ms) corresponds to the structures with a short V2: CVVCV [sāDa] (V2 = 112 ms), CVCCV [kukka] (V2 = 123 ms), CVVCCV [vūtta] (V2 = 117 ms).

Type 2 (the average duration 148 ms) corresponds to the structures with a long V2: CVVCVV [mādā] (V2 = 137 ms), CVCCVV [tappā] (V2 = 153 ms), CVČCVV [makkā] (V2 = 153 ms), CVVCCVV [sättā] (V2 = 138 ms), CVVČCVV [tūkā] (V2 = 161 ms).

Type 3 (186 ms) corresponds to the structure CVCV [kaDà], where V2 was previously described as half-long.

It can be easily noticed that the difference in the duration of V2 in the contrasting structures (CVCCV [kukka] vs. CVCCVV [tappā], CVVCCV [vūtta] vs. CVVCCVV [sättā], CVVCV [sāDa] vs. CVVCVV [mādā]) is actually quite small: between 20 and 30 ms. However, in modern Ingrian, there is another perceptual cue that distinguishes short and long vowels in the second syllable. This cue concerns not the length, but the quality of the vowels: often, short vowels in the second syllable are reduced to schwa, while long vowels never are. Phonetically, the pair *kukka* 'flower:Nom' —

*kukkaa* 'flower: Part' is realized as [kukkə] — [kukkà], which makes an easily perceivable opposition.

The degree of reduction varies considerably among the speakers and depends also on the speech rate. In slow and distinctive pronunciation the reduced vowels are pronounced as full, thus it is not yet justified to claim ə as a phoneme. Apparently, Soikkola Ingrian is currently in an intermediate state: the quantity opposition of short and long vowels in non-first syllables is on the way to be leveled out and replaced by the quality opposition of reduced and full vowels. A similar process took place in the neighbouring Votic dialects, and went further developing into a full apocope in Jõgõperä Votic, cf. *kukke* 'flower: Nom' — *kukka* 'flower:Part' (Jõgõperä Votic), *kukkə* 'flower:Nom' — *kukka* 'flower:Part' (Luutsa Votic) (Маркус, Рожанский in print).

There are no available acoustic data on the duration of long vowels of the second syllable in Ingrian from earlier periods, but if the short—long opposition used to be manifested in the same way as in Standard Finnish, then long vowels should have been at least twice as long as short vowels. If this was the case, then the long vowels in the second syllable were longer than 200 ms, and V2 in the CVCV [kadà] type (186 ms) was indeed half-long. In modern Ingrian, long vowels in the second syllable are considerably reduced, while the half-long vowel preserved its duration. This hypothesis explains why the half-long vowel is longer than the long vowels in the analyzed data.

Phonetically, the second vowel in the CVCV [kadà] type is clearly long. However, its length is not contrastive in Ingrian, as there is no structure that would provide a context for a phonological opposition. Thus, both short and long interpretations of the second vowel in the CVCV structure are possible. I will transcribe it as phonologically short in order not to violate the traditional interpretation, and not to contradict the historical rule of changing single consonants into secondary geminates before long vowels.

Another issue that I would like to address here is whether the length of V2 is the only feature differentiating the foot types CVCCV [kukka] vs. CVCCVV [tappā], CVVCCV [vūtta] vs. CVVCCVV [sättā], and CVVCV [sāda] vs. CVVCCVV [mādā]. It was noted in Кузнецова 2009b : 37—38 that the lengthening of the second vowel causes also the lengthening of the segment that closes the first syllable. However, my own results cannot be directly compared with the results obtained by N. Kuznetsova, as she was measuring words containing sonorants, consonant clusters, and diphthongs in the first syllable (structures of the types *sūlā* 'salt:Part', *linnā* town:Part', *kūlmā* 'cold:Part', *kuivā* 'dry:Part').

An instrumental analysis of the words with intervocalic plosives gave the following results.

The foot types CVCCV [kukka] vs. CVCCVV [tappā] are opposed only by the duration of V2, while the length of the geminate and V1 is the same in both types.

The foot types CVVCCV [vūtta] vs. CVVCCVV [sättā] are opposed by the duration of V2, the length of the geminate is the same in both types, and V1 is 12 ms longer in the CVVCCVV [sättā] foot.

In the foot type CVVCCVV [mādā], not only the duration of V2, but also the duration of V1 is 26 ms longer than in the type CVVCV [sāda]. Additionally, the duration of the intervocalic consonant is 15 ms longer in CVVCCVV [mādā]:



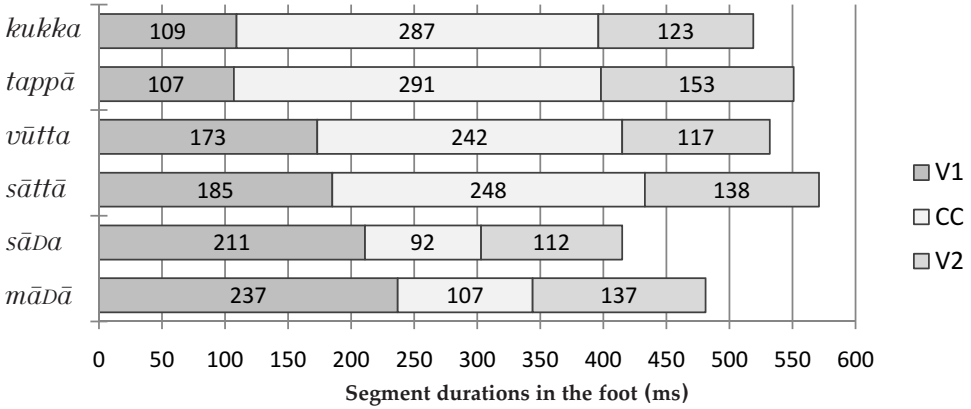


Figure 2. Average durations (in ms) of V1, C(C), and V2 in foot types contrasted by the duration of V2.

The comparison of syllable durations shows that the foot types CVCCV [*kukka*] vs. CVCCVV [*tappā*] are opposed by the duration of the second syllable. In case of the foot types CVVCCV [*vūtta*] vs. CVVCCVV [*sāttā*] and CVVCV [*sādā*] vs. CVVVCVV [*mādā*], both the first and the second syllable are longer in the foot type including a long V2:

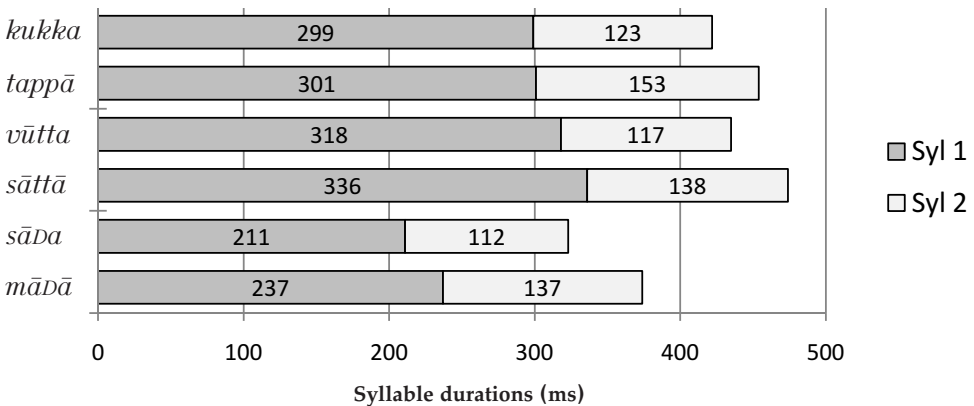


Figure 3. Average durations (in ms) of Syl1 and Syl2 in foot types contrasted by the duration of V2.

#### 4.2. Durational contrasts of intervocalic consonants

From the phonetic point of view, there are two cues to the opposition between different types of consonants in Soikkola Ingrian.

The first one is easily perceivable without any acoustic measurements: single consonants in the CVCV [*kadā*], CVVCV [*sādā*], and CVVVCVV [*mādā*] foot types are half-voiced, unlike all other consonant types. The exact pronunciation of a single intervocalic stop varies among the speakers from fully voiced to unvoiced, but the comparison of several pronunciations of the same word from different speakers easily classifies the consonant type. On the other hand, prolonged consonants in the CVVČCVV [*tūkā*] type are never voiced.

The second phonetic feature carrying the opposition between different types of consonants is the duration. In my acoustic data there are five clearly defined types of consonants according to their duration:

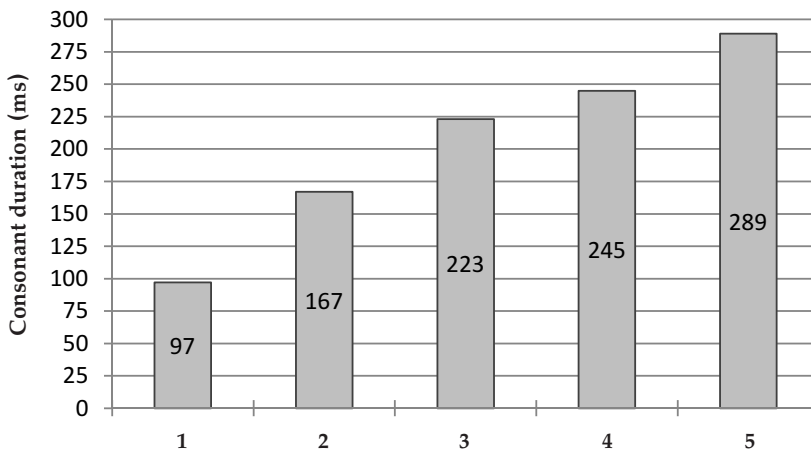


Figure 4. Average duration (in ms) of intervocalic consonants in five contrastive types.

Type 1 (the average duration 97 ms) includes the structures with a single half-voiced consonant: CVCV [*kadà*] (C = 92 ms), CVVCV [*sāda*] (C = 92 ms), CVVCVV [*mādā*] (C = 107 ms).

Type 2 (167 ms) corresponds to the structure CVVČCVV [*tūkā*] with a prolonged consonant preceded by a long vowel.

Type 3 (223 ms) corresponds to the structure CVČCVV [*mačkā*] with a secondary geminate preceded by a short vowel.

Type 4 (the average duration 245 ms) includes the structures with original geminates preceded by a long vowel: CVVCCV [*vūtta*] (CC = 242 ms), CVVCCVV [*sättā*] (CC = 248 ms)

Type 5 (the average duration 289 ms) includes the structures with original geminates preceded by a short vowel: CVCCV [*kukka*] (CC = 287 ms), CVCCVV [*tappā*] (CC = 291 ms).

From the phonological point of view, one should first of all look at the opposition of different consonant types in the same environment. The foot types that are present in contemporary Soikkola Ingrian are distributed between the four possible vowel contexts in the following way:

V2	Short	Long
V1		
Short	CVCV [ <i>kadà</i> ]	CVČCVV [ <i>mačkā</i> ]
	CVCCV [ <i>kukka</i> ]	CVCCVV [ <i>tappā</i> ]
Long	CVVCV [ <i>sāda</i> ]	CVVCVV [ <i>mādā</i> ]
	CVVCCV [ <i>vūtta</i> ]	CVVČCVV [ <i>tūkā</i> ]
		CVVCCVV [ <i>sättā</i> ]

The context between two long vowels demonstrates a three-way opposition of consonants, thus the minimal number of contrastive consonant types is 3. As shown in Figure 4, original geminates have two durational variants: they are shorter after a long vowel and longer after a short vowel. The same effect is observed with secondary geminates and prolonged consonants: the former occur after a short vowel, and the latter after a long vowel. In both cases, the shorter and longer variants are never contrastive in the same foot structures, and thus we can combine the shorter and longer allophones into one phoneme (types 2 and 3 correspond to short geminates; types 4 and 5 — to full geminates). Treating prolonged consonants as phonological geminates is fully justified from the functional point of view: they make a shorter counterpart of secondary geminates and thus make an exact match to the shorter and longer allophones of original geminates (see also next section for more arguments). Thus, I think it is justified to propose a three-way phonological opposition of plosives in contemporary Soikkola Ingrian: single stops vs. short geminates vs. full geminates. If we symbolize the plosives as /g/ vs. /k/ vs. /kk/ and the like, the oppositions listed above can be phonologically transcribed as

- /kada/ vs. /kukka/
- /tappaa/ vs. /makaa/
- /saada/ vs. /vuutta/
- /maadaa/ vs. /tuukaa/ vs. /saattaa/

Apart from the intervocalic position, different types of plosives are opposed in Ingrian in consonant clusters starting with a sonorant (in all other contexts the opposition is neutralized). I do not yet have enough acoustic data to illustrate the duration of plosives as a part of clusters, but the distribution of different consonant types among possible foot structures is the following (R stands for a sonorant in the consonant cluster):

V2	Short	Long
V1		
Short	CVRCV [jalga] 'foot:Nom'	CVRCVV [valgia] 'white:Part'
	CVRCCV [kirkkō] 'church:Nom'	CVRĀCCVV [jalĀ] 'foot:Part'
		CVRCCVV [kirkkō] 'church:Ill'
Long	CVVRCV [kārdo] 'rainbow:Nom'	CVVRCVV [tūldui] 'ventilate:Pst:3Sg'
		CVVĀRĀCCVV [kārĀ] 'rainbow:Ill'

It is noteworthy that I have not found a single example in Nirvi 1971, nor in any other source, where the first long vowel would be followed by a cluster with a full geminate. It seems that this structure is impossible in Ingrian, probably because the first syllable would have become too long.

The distribution of plosives as part of clusters among the possible contexts differs from the distribution of intervocalic plosives, but the triple opposition of consonant types is nevertheless preserved (the context between the short V1 and long V2).

### 4.3. Correlations between segment durations in the foot

The results of the acoustic measurements reveal a strong mutual correlation between the duration of the first vowel and intervocalic consonant in the foot.

#### 4.3.1. Vowels

The duration of the short first vowel remains approximately the same irrespective of the foot type. An ANOVA indicates no significant difference between the duration of V1 in four possible foot types:  $F(3; 84) = 0.275$ ;  $p = 0.843$  (CVCV [*kadà*] (V1 = 102 ms), CVCCV [*kukka*] (V1 = 109 ms), CVCCVV [*tappā*] (V1 = 107 ms), CVČCVV [*maĳkĳā*] (V1 = 104 ms)). Thus there is no effect of foot type on the duration of the short V1.

However, the duration of the long V1 correlates strongly with the foot type. It is shorter before geminates (both full and short): CVVCCV [*vuutta*] (V1 = 173 ms), CVVCCVV [*sättā*] (V1 = 185 ms), CVVČCVV [*tūkā*] (V1 = 176 ms), and longer before singletons: CVVCV [*sāda*] (V1 = 211 ms), CVVCVV [*mādā*] (V1 = 237 ms). An ANOVA indicates significant difference between the duration of V1 in foot types with geminates vs. foot types with singletons:  $F(1; 84) = 18.120$ ;  $p < 0.001$ . There is no statistical difference between the duration of V1 in words with prolonged consonants (CVVČCVV [*tūkā*]) vs. full geminates (CVVCCV [*vuutta*], CVVCCVV [*sättā*]):  $F(1; 55) = 0.099$ ;  $p = 0.753$ . This is another argument for treating prolonged consonants as geminates, but not as single consonants.

The durational contrasts of V1 are summarized in Figure 5:

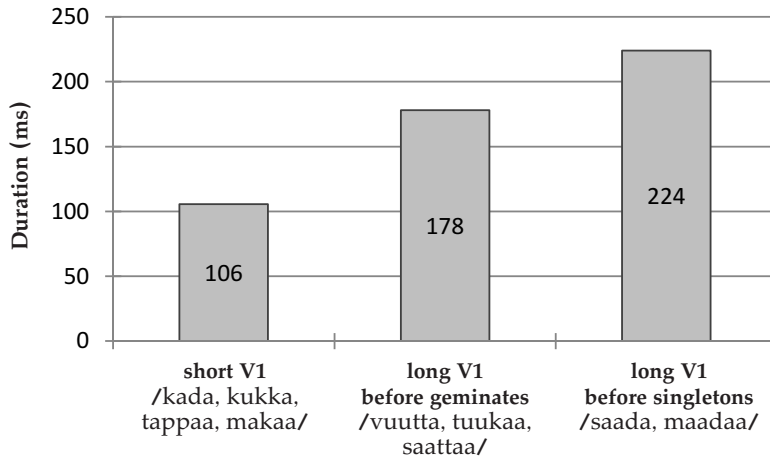


Figure 5. Average duration (in ms) of V1.

#### 4.3.2. Consonants

An ANOVA indicates no significant difference between the duration of single intervocalic consonant in different foot types:  $F(2; 45) = 1.977$ ;  $p = 0.15$  (CVCV [*kadà*] (C = 92 ms), CVVCV [*sāda*] (C = 92 ms), CVVCVV [*mādā*] (C = 107 ms)). Hence, the foot type has no effect on the duration of single consonants.

As already indicated above, the duration of full geminates correlates strongly with the foot type, being shorter after a long vowel: CVVCCV [*vũtta*] (CC = 242 ms), CVVCCVV [*sũttũ*] (CC = 248 ms), and longer after a short vowel: CVCCV [*kukka*] (CC = 287 ms), CVCCVV [*tappũ*] (CC = 291 ms). An ANOVA indicates a significant difference between the consonant duration in feet with a short V1 vs. feet with a long V1:  $F(1; 80) = 31.512; p < 0.001$ .

Similarly, short geminates are shorter after a long vowel: CVVČCVV [*tũkũ*] (CC = 167 ms), and longer after a short vowel: CVČCVV [*mũkkũ*] (CC = 223 ms). An ANOVA shows a very significant effect of foot type on the duration of short geminates:  $F(1; 42) = 59.060; p < 0.001$ .

Figure 6 plots the duration of intervocalic consonants and the preceding vowel (for geminates) in different foot types:

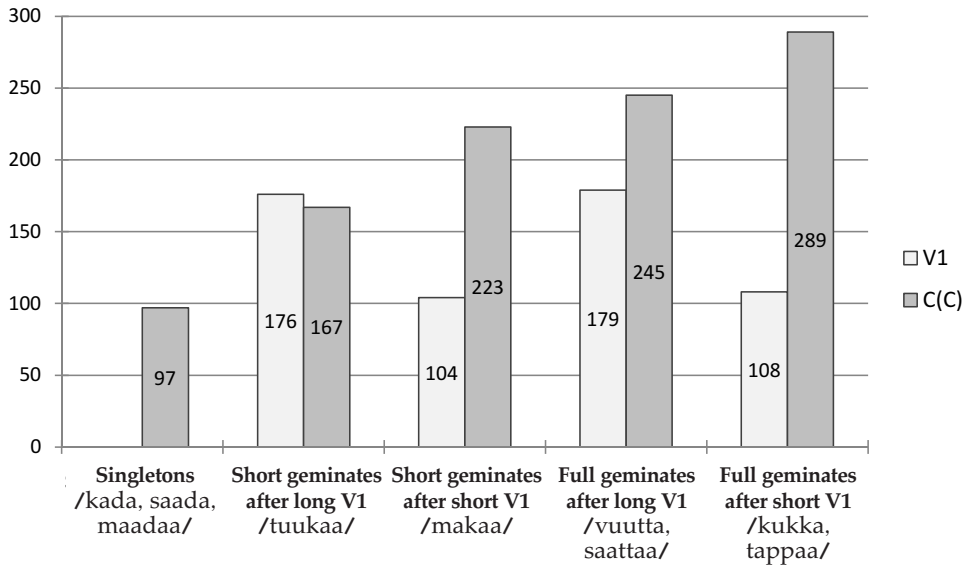


Figure 6. Average duration (in ms) of different consonant types as compared to the duration of the preceding vowel.

### 4.3.3. Foot

The observed tendency to redistribute length between V1 and the following geminate explains the fact that foot types with the same type of V2 and intervocalic geminate, but different type of V1 have very similar foot durations and almost identical ratios of the second to the first syllable:

	Foot type	Foot duration	Syl2/Syl1 ratio
1	CVCCV /kukka/	519 ms	0,4
	CVVCCV /vuutta/	531 ms	0,4
2	CVČCVV /maka/	480 ms	0,7
	CVVČCVV /tuukaa/	504 ms	0,7
3	CVCCVV /tappaa/	550 ms	0,5
	CVVCCVV /saattaa/	570 ms	0,4

Figures 7 and 8 represent graphically the foot durations and syllable ratios for the compared three types of structures:

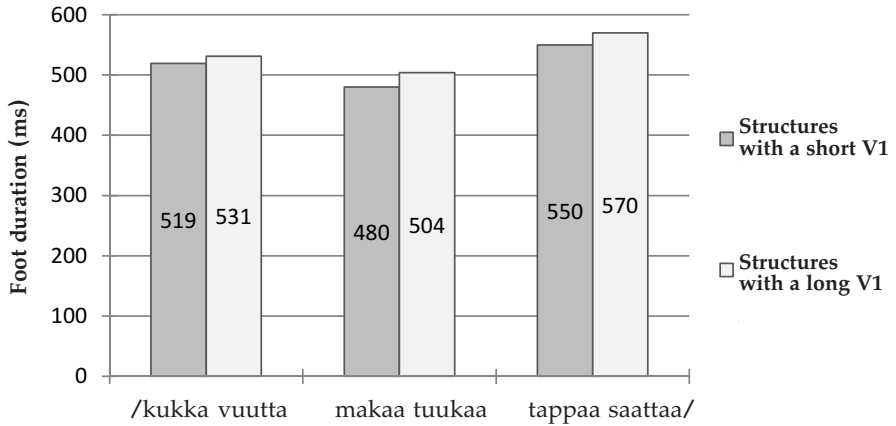


Figure 7. Average foot duration (in ms) for structures with the same type of V2 and CC, but different type of V1.

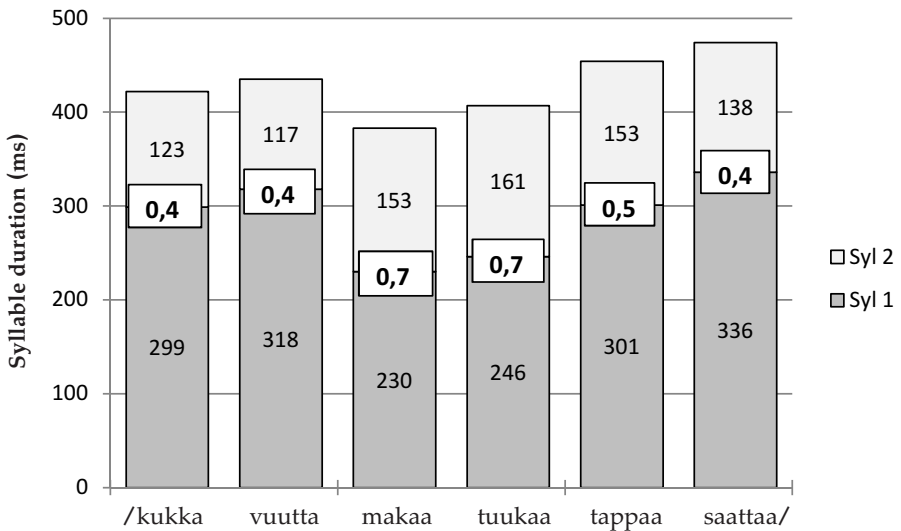


Figure 8. Average syllable durations and syllable ratios (in white boxes) for structures with the same type of V2 and CC, but different type of V1.

## 5. Conclusions

An acoustic study of contemporary Soikkola Ingrian data defined the durational characteristics of vowels and consonants in disyllabic feet, and provided empirical evidence for their phonological interpretation.

On the phonetic level, there are three durational types of vowels both in the first and second syllable. However, only two contrastive types — short and long vowels — are distinguished on the phonological level. Long vowels

of the first syllable have shorter and longer allophones depending on whether they are followed by a geminate or by a single consonant. Short vowels of the first syllable preserve approximately the same duration irrespective of the following consonant.

Vowels of the second syllable can be either short or long. The overlong second vowel in the CVCV foot type is not phonologically contrastive, and is conventionally transcribed as short. Hypothetically, the reason why the second vowel in the CVCV foot is longer than the long vowels is that the latter were considerably shortened in modern Ingrian.

Soikkola Ingrian consonants have five durational types on the phonetic level, and three contrastive types on the phonological level: single consonants vs. short geminates vs. full geminates. Both short and full geminates have shorter allophones if preceded by a long vowel, and longer allophones if preceded by a short vowel.

A ternary contrast of consonants is typologically quite a rare phenomenon. Among the related languages, it was previously attested only in Estonian and Livonian (Lehiste, Teras, Ernštreits, Lippus, Pajusalu, Tuisk, Viitso 2008 : 94), both of which belong to the southern group of Finnic languages. Ingrian, a northern Finnic language, demonstrates the same ternary opposition, though of a different historical origin.

The Ingrian prosodic system is comparable neither with Finnish nor with Estonian types. Like Finnish, Ingrian has the opposition of short and long vowels in non-first syllables. However, this opposition is becoming neutralized in Soikkola Ingrian: the quantitative vowel contrast is being changed into a qualitative opposition of reduced and full vowels. In Ingrian, this process is still on the way, while in the neighbouring Votic dialects the opposition of short and long vowels in non-first syllables has recently been totally lost. Most probably, the tendency to level out the vowel length contrast in non-first syllables is an areal phenomenon. Thus, the little that remains of the Finnic languages spoken in modern Ingria provides a unique living illustration of a gradual transition from a northern to a southern type Finnic language.

The acoustic study also showed that the prosodic organization of the foot in Ingrian is strictly determined by the foot structure. The duration ratios of segments in the foot are preserved even when the absolute duration varies due to different speech rates.

### **Acknowledgements**

The present research was partly supported by the Estonian Science Foundation grant JD100, and Ministry of Education and Science of the Russian Federation state contract no. 02.740.11.0595. I am grateful to Fedor Rozhanskiy and Karl Pajusalu for their valuable comments and to Eva Liina Asu for language editing this paper.

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### Abbreviations

**2** — 2nd person, **3** — 3rd person, **C** — singleton, **ĀC** — short geminate (= secondary geminate or a prolonged consonant), **CC** — full geminate (= original geminate), **III** — Illative, **Imp** — imperative, **Imprs** — impersonal, **Nom** — Nominative, **Part** — partitive, **PF** — phrase final, **Pl** — plural, **Prs** — present, **Pst** — past, **SF** — sentence final, **Sg** — singular, **Syl1** — first syllable, **Syl2** — second syllable, **V** — short vowel, **VV** — long vowel, **V1** — vowel of the 1st syllable, **V2** — vowel of the 2nd syllable.

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## **ФОНЕТИКА И ФОНОЛОГИЯ ДВУСЛОЖНОЙ СТОПЫ В СОЙКИНСКОМ ДИАЛЕКТЕ ИЖОРСКОГО ЯЗЫКА**

В статье изучаются фонетические закономерности организации двусложной стопы в ижорском языке и обсуждается фонологический статус выявленных долготных противопоставлений. Материал для исследования был записан в 2010 году от носителей сойкинского диалекта ижорского языка.

Результаты акустического анализа показывают, что на фонетическом уровне гласные первого и второго слога имеют три степени долготы, однако фонологически противопоставлены только два типа гласных: краткие и долгие. Согласные имеют пять степеней долготы на фонетическом уровне, которые распределяются в три фонологически противопоставленных типа: одиночные согласные, краткие геминаты и долгие геминаты.

В статье показано, что просодическая организация стопы в ижорском языке строго определяется структурой стопы. Соотношение длительности сегментов в стопе оказывается более принципиальным, чем абсолютная длительность сегментов.

Сойкинский диалект ижорского языка в настоящее время находится в переходном состоянии от северного к южному типу прибалтийско-финских языков: противопоставление долгих и кратких гласных в непервых слогах постепенно нейтрализуется и заменяется на противопоставление полных и редуцированных гласных.