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PRIMARY AND SECONDARY GEMINATES IN INGRIAN*

Abstract. The paper provides empirical evidence on the status of primary and secondary geminates in Soikkola Ingrian. The material for the study was recorded during the summer of 2009 from present-day speakers of Ingrian. The paper focuses on secondary geminates after a short vowel as compared to primary geminates occurring in the same environment. Experimental results confirm the ternary opposition of consonants: singletons vs. secondary geminates vs. primary geminates. The opposition between the two types of geminates is manifested in duration. Another feature distinguishing the two types is the duration ratio of a geminate to the following vowel. Both the duration of geminates and the degree of difference between the two types correlate significantly with the structure of the word, being greatest in disyllabic words with an open second syllable, medium in disyllabic words with a closed second syllable, and smallest in trisyllabic words.

Keywords: Ingrian, phonetics, primary geminates, secondary geminates, duration.

1. Introduction

The present paper reports the results of an acoustic study of geminates in contemporary Soikkola Ingrian. This research intends to clarify the status of secondary geminates as compared to primary geminates and single consonants, and investigate the influence of the foot type on the duration of geminates.

Primary, or original geminates, occurred already in Proto-Finnic and were preserved in all Finnic languages except for Central and South Veps (Viitso 1997 : 226—227). Secondary geminates arose from single consonants as the result of a gemination process. Gemination began as phonetic lengthening of single consonants before a long vowel or a diphthong of recent origin. Later this change progressed further so that sometimes a lengthened consonant approached the length of an original geminate consonant. The phonetic environment that used to cause gemination often changed, and thus in many Finnic dialects new geminated consonants acquired phonological status.

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Certain types of gemination are found in Finnish dialects, in some Estonian dialects, in Votic, Ingrian, Livonian, and Saami. For more information regarding the dialectal and structural distribution of gemination see (Kettunen 1940; Nahkola 1987; Palander 1987; Paunonen 1973) regarding Finnish dialects; (Kettunen 1930 : 119–122; Viitso 1964) regarding Votic; (Галахова 1979) regarding Ingrian Finnish; (Porkka 1885 : 37–42, Лаанест 1966 : 22–30; Laanest 1986 : 57–64) regarding Ingrian; (Tauli 1956 : 142–156; Viitso 2003 : 193–194) regarding Estonian; (Posti 1942 : 151–152, 162–163, 174) regarding Livonian. Gemination does not necessarily take place in all the dialects of a language. Furthermore, the phonological context where gemination occurs can vary through dialects. The main distinction is traditionally based on the nature of the phoneme preceding a secondary geminate. One type of gemination (fin. *yleisgemmaatio*) describes the formation of secondary geminates from single consonants preceded by a short vowel (Ingrian *kuttoo* from **kutoo* 'to weave:Prs3Sg'). Another type (fin. *erikoisgemmaatio*) concerns the gemination (or, more often, lengthening) of single consonants preceded by a long vowel or a consonant (Ingrian *jootii* from **jootii* 'to drink:ImprsPst', *jalkaa* from **jalkaa* 'foot:Part¹'). This paper focuses on the secondary geminates that arose after a short vowel, and compares them to primary geminates occurring after a short vowel, for example Ingrian *ottaa* 'to take:Prs3Sg'.

There is great variation among the Finnic dialects concerning the position of secondary geminates in the phonological system. Much depends on the degree to which a consonant was lengthened. If we put aside the diachronic development and attempt to describe the phonology of a language synchronically, we will either have to associate secondary geminates with one of the existing phonological classes of consonants, or consider them independently. There are, in principle, three possible options. First, secondary geminates can be viewed as allophones of single consonants. Second, they can be treated as allophones of primary geminates; in this case, the phonological system contains only singletons as opposed to geminates, irrespective of their primary or secondary origin. Third, it is possible to treat secondary geminates independently from both singletons and primary geminates. Obviously we need to have solid phonetic and phonological grounds for claiming such a ternary opposition.

2. Previous study of Ingrian gemination

There are quite few sources of information on Ingrian phonetics and phonology, and there are only two works involving the experimental study of Ingrian speech (Sovijärvi 1944) and (Gordon 2009). Basic types of gemination in Ingrian were first described in (Porkka 1885) and later confirmed in (Sovijärvi 1944) and (Лаанест 1966; 1978; Laanest 1986).

Soikkola, Oredzhi and Hevaha Ingrian developed the following four types of gemination.

1. Gemination of a consonant after a short stressed or secondary stressed syllable before a long vowel or a diphthong that originated from contrac-

¹ Here and below lengthened consonants are transcribed as single consonants with a grave accent marker; short geminates are transcribed as double consonants with a breve over the first component; full geminates are transcribed as double consonants with no diacritics.

tion: *avvān* 'open:Prs1Sg' (Лаанест 1978 : 122), *kirjuttamā* 'write: Sup'(Sovijärvi 1944 : 12).²

2. Consonant lengthening or gemination after a long syllable³ before a long vowel or a diphthong that originated from contraction: *jōti* 'drink:Imprs:Pst' (Лаанест 1978 : 127), *revideltti* 'tear apart:Imprs:Pst' (Porkka 1885 : 39).

3. Gemination in trisyllabic (and five-syllable) words with a short first syllable. If originally the first and the second syllables were short, then the vowel of the second syllable lengthened and the preceding consonant geminated. Later the lengthened vowel could become short again, and the number of syllables could decrease: *pačkēni* 'escape:PST3SG' (Лаанест 1978 : 134), *kuttōnd* 'weave:PrtAct' (Лаанест 1978 : 135), *koivikkollōja* 'birchwood:Pl:Part' (Sovijärvi 1944 : 82).

4. Gemination in trisyllabic (and five-syllable) words with a long first syllable. If originally the first syllable was long but all the rest conditions the same as in type 3, then the consonant of the second syllable lengthened, and the vowel remained intact: *ompelen* 'sew:Prs1Sg', (Лаанест 1978 : 134), *künttelen* 'listen:Prs1Sg' (Лаанест 1978 : 134), *osseksenttelin* 'buy:Pst1Sg' (Porkka 1885 : 39).

Lower Luga Ingrian has only one type of gemination occurring in disyllabic words after a short vowel: *rahhā* 'money:Part' (Лаанест 1978 : 122), *makkan* 'sleep:Prs1Sg' (Лаанест 1978 : 122).

The relationships between primary and secondary geminates in Ingrian have only been explicitly discussed in (Laanest 1987) and (Gordon 2009). Useful information can also be found in (Sovijärvi 1944), which reports the first-ever instrumental research of Ingrian. The data come from the author's own recordings made in 1932–1934 of a speaker from the Soikkola dialect (the village of Metsäkylä). A. Sovijärvi measured the duration of vowels and consonants in different phonological environments. He presents the duration of short single consonants in opposition to the duration of secondary geminates (which he calls either geminates with a short first component or half-long consonants, depending on the nature of the preceding syllable). Occasionally A. Sovijärvi also provides the duration of primary geminates for the same word structures. The monograph contains 7 examples of words demonstrating the three-way consonant contrast. The examples and consonant durations are presented in Table 1. Average durations for the three consonant types, standard deviations and the duration ratios of geminates to singletons have been calculated by the author of this article. It should be noted that all the examples represent word structures where the measured consonant is preceded by a short vowel.

The difference in durations implies that Soikkola Ingrian has a ternary opposition: single vs. secondary (= short) geminates vs. primary (= full) geminates.

A. Laanest's research on Ingrian does not provide any instrumental measurements. However, he claimed that in Soikkola Ingrian secondary geminates are mostly shorter than primary, although the difference is being neutralized in some idiolects, especially in the eastern part of the area

² All the examples in this section represent Soikkola Ingrian; the authors' spelling is preserved.

³ A long syllable is the one containing a long vowel or a diphthong, or ending in a consonant.

Table 1

Duration (in ms) of single consonants vs. secondary vs. primary gemimates in words of different structure (data from Sovijärvi 1944 : 12, 14)

Examples			Durations				
C	ČC	CC	C	ČC	CC	ČC/C	CC/C
<i>kalàl</i>	<i>kallà</i>	<i>hallà</i>	120	200	230	1.7	1.9
<i>kirjuttamàz</i>	<i>kirjuttaimà</i>	<i>hülcäizimmä</i>	82.5	130	162.5	1.6	2.0
<i>icävükseD</i>	<i>ikkävüz</i>	<i>rikkoizin</i>	90	205	217.5	2.3	2.4
<i>sogìa</i>	<i>sokkìa</i>	<i>vokkìa</i>	100	202.5	302.5	2.0	3.0
<i>tomù</i>	<i>toimùa</i>	<i>tammà</i>	105	190	242.5	1.8	2.3
<i>tabaizid</i>	<i>tappaizín</i>	<i>tappaizin</i>	105	160	215	1.5	2.0
<i>lühendämizèz</i>	<i>lühendäimìn</i>	<i>kattselemma</i>	100	122.5	152.5	1.2	1.5
Average			100	173	218	1.7	2.2
StDev			12	35	50	0.3	0.5

(Лаанест 1978 : 123; Laanest 1986 : 58; 1987 : 289). In his remarks about the phonological system of Ingrian, A. Laanest concluded that secondary gemimates in Soikkola Ingrian should constitute separate phonological units, which are opposed both to single consonants and to primary gemimates (Laanest 1987 : 291).

Thus, both A. Sovijärvi and A. Laanest recognized a ternary opposition for Soikkola Ingrian consonants. However, a recent paper (Gordon 2009) presents a different opinion. The author investigated a recording of a narrative made in 1964 of a speaker from the Soikkola dialect (the village of Saarove). Data in Figure 8 (Gordon 2009 : 94) show that there is no opposition of primary gemimates (a *kattoo* type in Gordon's data) and secondary gemimates (a *kallaa* type) after a short vowel, with secondary gemimates being even a little longer than primary gemimates. The same is claimed explicitly in the text: "The absence of a length difference between the lengthened consonant (= secondary geminate — *E.M.*) in CVCVV and the underlying geminate in CVC₁C₁VV means that these structures are durationally undifferentiated" (Gordon 2009 : 96).

3. Experimental study of gemimates in contemporary Ingrian

This paper presents the results of a pilot acoustic study examining gemimates in a set of test words recorded from speakers of the Soikkola Ingrian during the summer of 2009.

The main goal of the study is to answer the following questions:

- 1) Does contemporary Soikkola Ingrian demonstrate an opposition of primary and secondary gemimates after a short vowel?
- 2) If the two types of gemimates are opposed, what are the main cues of the opposition?
- 3) Does the phonological structure of the word influence the duration of the gemimates?

3.0. Materials and methods

This study only examines the stops (*k*, *t*, and *p*). The set of test words contained geminates of different diachronic origin occurring after a short vowel. The words with geminates were of the following three types:

- 1) disyllabic words ending in a long vowel;
- 2) disyllabic words with a closed second syllable containing a long vowel;
- 3) trisyllabic words with open second and third syllables; all the words of this type ended in a long vowel, but there were both short and long vowels in the second syllable.

In order to provide better comparability, all the structural types were represented by verbal forms of the same lexemes. Words containing non-geminated stops were taken from the same lexeme paradigms. Examples of the test words of different structure are the following:

	Disyllabic		Trisyllabic	Singletons
	open 2 nd syllable	closed 2 nd syllable		
Secondary geminates	<i>maĳkaa</i>	<i>maĳkaan</i>	<i>maĳkaamaa</i>	<i>maĳajaa</i> ⁴
	'to sleep:Imp'	'to sleep:Prs1Sg'	'to sleep:Sup'	'to sleep:Prs3Sg'
Primary geminates	<i>kattaa</i>	<i>kattaaŋt</i>	<i>kattamaa</i>	<i>kava</i>
	'to roof:Prs3Sg'	'to roof:PrtAct'	'to roof:Sup'	'to roof:Imp'

The test words were placed in carrier phrases both in phrase-final and sentence-final positions. This technique is believed to provide the articulation of words in a maximally differentiated style, where all the oppositions are optimally manifested. It was used in experimental studies of the prosodic structure of Finno-Ugric languages (see Lehiste 2007 for the overall description of the project). An example of the carrier phrases would be "*siä vähemp l ä k k ä ä*, *miä noisen l u k o m a a*" '(You) talk less, I will read' and "*miä noisen l u k o m a a*, *siä vähemp l ä k k ä ä*" 'I will read, (you) talk less'. Altogether there were 90 test words pronounced both in a phrase-final and sentence-final position.

The carrier phrases were recorded during a field trip to Ingria in the summer of 2009. The background of the speakers is as follows (all the speakers represent the Soikkola Ingrian):

Speaker 1: female born in 1927 in the village of Viistina.

Speaker 2: female born in 1926 in the village of Viistina.

Speaker 3: female born in 1936 in the village of Viistina, a sister of Speaker 2.

Speaker 4: female born in 1932 in the village of Venakontsa.

Speaker 5: female born in 1933 in the village of Hamala.

Speaker 6: female born in 1935 in the village of Mäkkülä.

⁴ In intervocalic positions Ingrian single stops are pronounced as half-voiced or voiced.

It should be said that Ingrian is not a written language, so most of the speakers can not read in Ingrian. Only Speakers 2 and 4 were able to read the carrier-phrases; the rest were translating phrases from Russian.

This paper presents a preliminary analysis of a subset of words from all six speakers. This analysis reveals general tendencies and enables one to make basic conclusions. Subsequently, the entire set of test words recorded from one speaker is studied more thoroughly.

The data were recorded on a Sony mini-disk recorder MZ-RH910 and digitized as a WAV file with a sampling rate of 44.1 kHz. Acoustic analyses were carried out using Praat. Segmentation criteria were those conventionally used in phonetic research: boundaries between vowels and consonants were determined on the basis of abrupt changes in amplitude. The measurement of consonant duration encompassed the closure, the release burst and voice onset time.

3.1. Durational oppositions

Experiment 1

The first experiment examined data from all six speakers. The duration of both types of gemimates was measured in 5 test words pronounced in phrase-final and sentence-final positions. Altogether 20 words were examined from each speaker, resulting in a total analysis of 120 words. All the test words had the same CVCCVV structure (disyllabic, with an open second syllable). An example is *rikkoo* 'break:Prs3Sg' (with a primary geminate) vs. *tekköö* 'do:Prs3Sg' (with a secondary geminate). Among the investigated test words there was a minimal pair *tappaa* 'kill:Prs3Sg' vs. *täppaa* 'be.enough: Imp'.

Table 2 presents average durations of secondary and primary gemimates, and the duration ratio of primary to secondary gemimates for the six speakers.

The results are quite definite. All the speakers pronounce secondary gemimates shorter than primary gemimates. However, the duration ratio of the two types of gemimates varies from 1.1 to 1.5, depending on a speaker. This indicates that for some of speakers the difference in the duration of the two types of gemimates is really significant, while for the other speakers the gap between the two types is narrower. These results correspond with A. Laanest's observation that in some idiolects (speakers 3 and 4) the opposition of secondary and primary gemimates is becoming neutralized, but for other idiolects (speakers 1, 2, 5, and 6) the opposition is clearly preserved.

An analysis of variance ANOVA confirmed that the difference between primary and secondary gemimates is very significant ($p < 0.001$).

There is no apparent correlation between the speaker's origin and their pronunciation. Although Speakers 2 and 3 are siblings, one of them opposes the two types of gemimates, while the other has quite similar durations for both types. Age might play an important role here: speaker 3 is 10 years younger than speaker 2. Still, more statistics are needed to further clarify this question.

Table 2

**Average durations of primary and secondary geminates,
standard deviations (in ms), duration ratios of primary to secondary geminates
in words produced by 6 speakers**

	Position	Speaker1	Speaker2	Speaker3	Speaker4	Speaker5	Speaker6
Primary geminates (CC)							
Average	PF	256	378	272	251	251	178
StDev		26	43	44	39	23	44
Average	SF	274	423	309	289	284	247
StDev		41	69	20	27	8	20
Overall Average		265	401	291	270	268	213
StDev		34	56	32	33	16	32
Secondary geminates (ČC)							
Average	PF	197	293	239	221	176	136
StDev		24	29	56	13	27	21
Average	SF	170	290	285	226	184	164
StDev		21	39	16	29	17	15
Overall Average		184	292	262	224	180	150
StDev		23	34	36	21	22	18
Ratio CC/ČC							
Average	PF	1.3	1.3	1.1	1.1	1.4	1.3
Average	SF	1.6	1.5	1.1	1.3	1.5	1.5
Overall Average		1.5	1.4	1.1	1.2	1.5	1.4

Experiment 2

We have selected Speaker 1 as a typical representative of contemporary Ingrians, who clearly opposes the two types of geminates, and measured the duration of segments in the whole set of recorded test words (altogether 174 words).

Table 3 shows average durations of single consonants, secondary geminates and primary geminates, and duration ratios of geminates to singletons. The singletons averaged 75 ms, secondary geminates 186 ms, and primary geminates 211 ms. The average duration ratio of a primary geminate to a singleton was 2.8, and of a secondary geminate to a singleton 2.5.

An ANOVA indicated that the difference between secondary and primary geminates is statistically significant ($p = 0.002$).

However, results presented in Table 3 differ from the results for the same speaker achieved in Experiment 1 based on the limited set of words. While the average duration of secondary geminates is roughly the same, the average duration of primary geminates is now 54 ms less. The most probable explanation is that in the previous experiment all the measured words had the same structure, but in the overall corpus there were disyllabic words both with an open and a closed second syllable, and also trisyll-

Table 3

Average durations of single consonants, primary and secondary gemimates, standard deviations (in ms), duration ratios of gemimates to singletons in words produced by Speaker 1

(N marks the number of measured words for each type of consonant)

	Position	C	N	CC	N	ČC	N	CC/C	ČC/C
Average	PF	76	23	215	33	198	33	2.8	2.6
StDev		23		54		58			
Average	SF	73	23	207	29	175	33	2.8	2.4
StDev		17		55		34			
Overall average		75	46	211	62	186	66	2.8	2.5
Overall StDev		20		55		46			

labic words (see the examples in 3.0). The duration of the gemimates, as well as the degree of difference between the two types of gemimates could be influenced by the structure of the word. This question is studied more thoroughly in 3.3.

Our results have confirmed A. Sovijarvi's and A. Laanest's observations that the two types of gemimates differ in duration. The terms *primary* and *secondary* reflect the diachronic development of gemimates, but they are not good for describing synchronic phonology of the language. Thus below primary gemimates will be referred to as *full*, and secondary — as *short*.

3.2. Correlation between the duration of a geminate and the following vowel

A more detailed study of the interrelations of segments within a foot revealed that duration is not the only cue that opposes words with short and full gemimates. Another stable cue distinguishing the two types of words is the duration ratio of a geminate to the following vowel.

Experiment 3

The first experiment testing this cue utilized the same 20 test words recorded from six speakers. Table 4 presents average durations of the first vowel, the geminate, the second vowel, and the duration ratios of the geminate to the second vowel for words with full and short gemimates.

For all of the speakers the CC/V2 ratio is greater in words containing full gemimates, than in words with short gemimates. However, there is a variation among the speakers in the degree of the difference. For some of the speakers the difference in the duration ratios is well defined (2.0 in words with full gemimates vs. 1.5 in words with short gemimates for Speaker 1; 2.3 vs. 1.4 for Speaker 2; 3.2 vs. 2.2 for Speaker 3; 3.3 vs. 2.3 for Speaker 5). For other speakers the difference is smaller (1.8 vs. 1.5 for Speakers 4 and 6).

Table 4

Average durations of the first and second vowels, intervocalic geminates, standard deviations (in ms), duration ratios of geminates to the following vowel in words with short and full geminates produced by 6 speakers

Speaker	Full geminates (CC)						Short geminates (ČC)				
		Position	V1	CC	V2	CC/V2	V1	ČC	V2	ČC/V2	
Speaker 1	Average	PF	109	256	146	1.9	85	197	155	1.4	
	StDev		31	26	38	0.6	25	24	49	0.5	
	Average	SF	75	274	131	2.1	70	170	113	1.5	
	StDev		29	41	23	0.2	20	21	17	0.2	
	Overall Average			92	265	139	2.0	78	184	134	1.5
	StDev			30	34	31	0.4	23	23	33	0.4
Speaker 2	Average	PF	112	378	182	2.3	116	293	237	1.3	
	StDev		20	43	55	0.8	12	29	40	0.3	
	Average	SF	100	423	188	2.3	92	290	203	1.5	
	StDev		19	69	20	0.3	21	39	39	0.3	
	Overall Average			106	401	185	2.3	104	292	220	1.4
	StDev			20	56	38	0.6	17	34	40	0.3
Speaker 3	Average	PF	89	272	95	2.9	88	239	115	2.2	
	StDev		17	44	11	0.6	15	56	26	0.9	
	Average	SF	83	309	90	3.5	95	285	129	2.2	
	StDev		17	20	15	0.7	18	16	20	0.3	
	Overall Average			86	291	93	3.2	92	262	122	2.2
	StDev			17	32	13	0.7	17	36	23	0.6
Speaker 4	Average	PF	100	251	141	1.9	107	221	144	1.6	
	StDev		9	39	38	0.5	14	13	25	0.3	
	Average	SF	94	289	172	1.7	85	226	158	1.4	
	StDev		21	27	27	0.4	10	29	20	0.1	
	Overall Average			97	270	157	1.8	96	224	151	1.5
	StDev			15	33	33	0.5	12	21	23	0.2
Speaker 5	Average	PF	89	251	101	2.7	81	176	89	2.1	
	StDev		4	23	28	1.0	13	27	35	0.7	
	Average	SF	70	284	74	3.9	75	184	75	2.5	
	StDev		7	8	8	0.4	11	17	11	0.4	
	Overall Average			80	268	88	3.3	78	180	82	2.3
	StDev			6	16	18	0.7	12	22	23	0.6
Speaker 6	Average	PF	93	178	131	1.4	81	136	104	1.5	
	StDev		12	44	41	0.4	18	21	44	0.7	
	Average	SF	78	247	116	2.2	71	164	117	1.5	
	StDev		12	20	15	0.4	11	15	20	0.3	
	Overall Average			86	213	124	1.8	76	150	111	1.5
	StDev			12	32	28	0.4	15	18	32	0.5

Experiment 4

Although the general tendency is the same, the correlation between the duration of segments in a foot should be studied using a larger corpus of data. The second experiment involved again the entire set of test words recorded from Speaker 1. The duration of segments was analysed separately for disyllabic words with an open second syllable and for disyllabic words with a closed second syllable. Trisyllabic words were excluded, because the foot structures were different for words with full and short geminates (a full geminate was mostly followed by a short vowel (e.g. *ottamaa* 'take:Sup'), while a short geminate was mostly followed by a long vowel (e.g. *makkaamaa* 'sleep:Sup').

Table 5 provides average durations of the first syllable vowel, second syllable vowel, the intervocalic geminate, foot duration⁵, and the duration ratios of the geminate to the second vowel in words of identical foot structure differing only in the type of geminate.

In both foot structures the ratio of a full geminate to the following vowel is 2.1, while the ratio of a short geminate to the following vowel is 1.5. The ratios are different not only because the duration of a short geminate is less than the duration of a full geminate, but also because a shorter geminate is followed by a longer vowel. In disyllabic words with an open 2nd syllable the average durations of full geminates and the following vowel

Table 5

Average durations of the first and second vowels, intervocalic geminates, foot durations, standard deviations (in ms), duration ratios of geminates to the following vowel in disyllabic (C)VCCVV and (C)VCCVVC words with short and full geminates produced by Speaker 1

		Full geminates						Short geminates					
		Position	V1	CC	V2	Foot	CC/V2	N	V1	ČC	V2	Foot	ČC/V2
Disyllabic words with an open 2nd syllable													
Average	PF	113	263	155	531	1.8	12	108	225	166	499	1.5	14
StDev		37	53	41	101	0.5		36	71	47	116	0.6	
Average	SF	70	256	108	434	2.5	12	72	185	127	384	1.5	14
StDev		26	48	28	89	0.5		22	35	29	60	0.4	
Overall Average		92	260	132	483	2.1	24	90	205	147	442	1.5	28
Overall StDev		32	51	35	95	0.5		29	53	38	88	0.5	
Disyllabic words with a closed 2nd syllable													
Average	PF	100	214	117	431	1.9	14	120	180	140	440	1.3	14
StDev		22	28	26	54	0.5		28	39	37	81	0.4	
Average	SF	73	213	98	383	2.3	14	81	177	117	375	1.6	14
StDev		19	21	21	41	0.6		23	30	33	67	0.5	
Overall Average		86	214	107	407	2.1	28	101	178	129	407	1.5	28
Overall StDev		20	25	24	47	0.6		26	34	35	74	0.5	

⁵ A more correct term would be the duration of the foot nucleus, since the duration of initial and final consonants was excluded from the overall foot duration.

is 260 ms and 132 ms respectively; the average durations of short geminates and the following vowel is 205 ms and 147 ms respectively. In disyllabic words with a closed 2nd syllable the average durations of full geminates and the following vowel is 214 ms and 107 ms respectively; the average durations of short geminates and the following vowel is 178 ms and 129 ms respectively.

While the average duration of the first vowel remains roughly the same, the change in the duration of a geminate provokes an inverse change in the duration of the second vowel. We are far from making any sweeping conclusions, but the analyzed data from Speaker 1 demonstrate a tendency towards foot isochrony. A longer first syllable (in case of full geminates) is followed by a shorter second syllable and vice versa (in case of short geminates), thus the duration of the foot tends to be preserved constant. In disyllabic words with a closed 2nd syllable the average foot duration was exactly the same (407 ms) for words both with full and short geminates. In disyllabic words with an open 2nd syllable the average foot duration was 483 ms for words with full geminates and 442 ms for words with short geminates. Experiment 3 did not yield similar results (see Table 4 above). This discrepancy needs to be studied more thoroughly with more words, speakers and foot structures involved.

Foot isochrony has been found in Estonian (Lehiste 1997 : 27–30; Ehala 1999 : 378–380; Ross, Lehiste 2001 : 44–48), and Livonian (Lehiste, Teras, Ernštreits, Lippus, Pajusalu, Tuisk, Viitso 2008 : 64–67), which are southern Finnic languages. Ingrian is a northern Finnic language but in many respects it demonstrates similar prosodic features with the southern group.

3.3. Influence of the foot type on duration

Experiment 5

The final part of this study investigates the influence of foot type on the duration of geminates. This analysis only utilizes the data from Speaker 1. The set of test words contained full and short geminates in disyllabic words with an open 2nd syllable (e.g. *kattaa* 'to roof:Prs3Sg', *makkaa* 'to sleep:Imp'); full and short geminates in disyllabic words with a closed 2nd syllable (e.g. *kattaant* 'to roof:PrtAct', *makkaan* 'to sleep:Prs1Sg'); full geminates in trisyllabic words where the vowel of the 2nd syllable was short (e.g. *kattamaa* 'to roof:Sup'); and short geminates in trisyllabic words where the vowel of the 2nd syllable was long (e.g. *makkaamaa* 'to sleep:Sup').

Table 6 shows average durations of short and full geminates and duration ratios of the two types of geminates in different foot types.

It appears that the duration of the geminates of both types correlates significantly with the type of foot. The duration is longest in disyllabic words with an open second syllable, followed by disyllabic words with a closed second syllable, and is smallest in trisyllabic words. An ANOVA indicated a highly significant effect of foot type on the duration of the full geminate ($p < 0.001$), and a significant effect of foot type on the duration of the short geminate ($p = 0.01$).

The difference in full and short geminates duration also decreases depending on the foot type. The data in the table show that the difference

Table 6

Average durations of primary and secondary gemimates, standard deviations (in ms), duration ratios of full to short gemimates in words of different structure produced by Speaker 1

	Position	CC	N	ČC	N	CC/ČC
(C)VCCVV (e.g. <i>kattaa, maĳkaa</i>)						
Average	PF	263	12	225	14	1.2
StDev		53		71		
Average	SF	256	12	185	14	1.4
StDev		48		35		
Overall Average		260	24	205	28	1.3
Overall StDev		51		53		
(C)VCCVVC (e.g. <i>kattaant, maĳkaan</i>)						
Average	PF	214	14	180	14	1.2
StDev		28		39		
Average	SF	213	14	177	14	1.2
StDev		21		30		
Overall Average		214	28	178	28	1.2
Overall StDev		25		34		
(C)VCCVCVV (e.g. <i>kattamaa</i>)				(C)VCCVVCVV (e.g. <i>maĳkaamaa</i>)		
Average	PF	166	12	164	6	1.0
StDev		29		32		
Average	SF	163	13	160	6	1.0
StDev		37		36		
Overall Average		165	25	162	12	1.0
Overall StDev		33		34		

is best manifested in disyllabic words with an open second syllable (CC/ČC = 1,3), and becomes smaller in disyllabic words with a closed second syllable (CC/ČC = 1.2). In the first foot of trisyllabic words the difference between the two types of gemimates is neutralized (CC/ČC = 1).

These results show that the opposition of full and short gemimates is not universal, and is manifested only in certain foot types.

4. Conclusions

The present article provides some empirical evidence on the status of primary and secondary gemimates in Soikkola Ingrian. The material for this study has been recorded from present-day speakers of Ingrian and reflects the most recent state of the language.

Experimental results have confirmed the ternary opposition of consonants claimed by A. Laanest. Secondary gemimates in disyllabic words are opposed both to singletons and to primary gemimates. The opposition

between the two types of geminates is manifested in duration. Thus, Soikkola Ingrian has both full and short geminates.

The absolute durations of geminates vary considerably among the speakers, but the ratio of a full to short geminate is always more than 1. On the basis of duration ratios speakers can be classified into two groups. The first group has a very definite opposition of the two types of geminates. The second group of speakers tends to have more similar durations for both types. These results also agree with A. Laanest's observations that for a part of Soikkola Ingrian speakers, the opposition of full and short geminates is becoming neutralized.

Preliminary results suggest that age might play an important role in the degree to which a speaker distinguishes the two types of geminates. Older speakers have a more stable opposition. It can be noted here, that Ingrian faced a drastic change in its social status after the World War II. The after-war language policy of the Soviet Union was aimed at enforcing the Russian language upon all the minor nationalities, so the use of Ingrian in everyday life was rapidly decreasing. Thus, it could be important how old a person was before the war started. This question needs further investigation.

There could be several different reasons why M. Gordon found no opposition of primary and secondary geminates after a short vowel. The most likely explanation is that his speaker's idiolect indeed had no opposition of the two types. Another issue is that M. Gordon analyzed words from a narrative, and it could well be that the opposition is becoming neutralized in spontaneous speech. It is also worthy to note that the village of Saarove (where the narrative was recorded) is located in the southern part of the Soikkola peninsula, which is closer to the area where the opposition of full and short geminates is completely lost.

Duration is not the only feature that distinguishes short and full geminates. Another feature is the duration ratio of a geminate to the following vowel. This ratio is greater in words with full geminates than in words with short geminates. An experiment involving the comprehensive set of test words produced by a single speaker showed that a longer geminate is followed by a shorter vowel and vice versa. Such a correlation implies a tendency to foot isochrony. However, these results are to be treated with caution and must be checked by a large corpus of data from many speakers.

Both the opposition of short and full geminates and foot isochrony are characteristics of the southern Finnic languages: Estonian and Livonian (we do not have enough information on Votic prosody). Although the historical origin of both phenomena is different from those in Ingrian, it is nevertheless interesting that the synchronic phonological system of Ingrian has many similarities with the southern Finnic languages.

The present research has also demonstrated that the manifestation of the opposition between the two types of geminates depends upon the structure of the foot. Both the duration of geminates and the difference between the two types is greatest in disyllabic words ending in an open syllable.

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Abbreviations

1 — 1st person, **3** — 3rd person, **C** — singleton, **ČC** — short (= secondary) geminate, **CC** — full (= primary) geminate, **Imp** — imperative 2nd person singular, **Imprs** — impersonal, **N** — number of words, **Part** — partitive, **PF** — phrase final, **Pl** — plural, **Prs** — present, **PrtAct** — active participle, **Pst** — past, **SF** — sentence final, **Sg** — singular, **Sup** — supine, **V1** — vowel of the 1st syllable, **V2** — vowel of the 2nd syllable.

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ПЕРВИЧНЫЕ И ВТОРИЧНЫЕ ГЕМИНАТЫ В ИЖОРСКОМ ЯЗЫКЕ

В статье представлены результаты акустического исследования геминат в современном ижорском языке. Целью работы является определение статуса вторичных геминат по сравнению с первичными геминатами и одиночными согласными. Также исследуется влияние типа стопы на длительность геминат.

Материал для данного исследования был записан летом 2009 года от современных носителей сойкинского диалекта ижорского языка.

Результаты акустического исследования подтвердили наличие в сойкинском диалекте тройного противопоставления согласных: вторичные геминаты противопоставлены как одиночным согласным, так и первичным геминатам. Параметрами, противопоставляющими два типа геминат, являются 1) длительность геминат; 2) соотношение длительности геминаты с длительностью последующего гласного. В словах с первичными геминатами отношение длительностей больше, чем в словах с вторичными геминатами.

Оппозиция кратких и долгих геминат проявляется по-разному в зависимости от структуры слова. Как длительность обоих типов геминат, так и степень различия обоих типов являются максимальными в двусложных словах с открытым вторым слогом. В двусложных словах с закрытым вторым слогом и длительность, и степень различия кратких и долгих геминат уменьшаются. В трехсложных словах геминаты имеют наименьшую долготу, а противопоставление кратких и долгих геминат нейтрализуется.