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TESI DI DOTTORATO

Dynamics of phonetic and phonological quantity in Ingrian and other Finnic languages of Ingria

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Introduction

i. Subject, object, and novelty of the study

The primary focus of this study is on dynamic quantity-related prosodic processes (reduction and lengthening) in the Finnic languages of Ingria, which are situated in the vicinity of St. Petersburg in Russia: Ingrian, Votic, Ingrian Finnish, mixed Siberian Ingrian/Finnish. All of them are severely endangered or moribund: the number of currently living speakers ranges from zero to a couple of hundred. I have been conducting field research on the phonetics, phonology, and morpho(no)logy of these varieties since 2006.

Their phonology is extremely complex, especially from the point of view of phonological quantity and contains several cross-linguistic phonological rarities. The complexity of phonology and a great degree of intra- and interdialectal variability, aggravated by powerful reduction processes, pose major challenges for the development of a consistent phonetic and phonological transcription needed for the documentation, revitalisation, and description of these languages.

The varieties in question are studied unevenly. There exist one or more dictionaries on each but the last one. Several grammatical descriptions have been published on Votic (Ahlqvist 1856; Dmitri Tsvetkov 2008 [1922]; Ariste 1948; Barbera 2012 [1995]; Agranat 2007; E. B. Markus & Rožanskij 2011), For Ingrian, there exists only one normative grammar written in Ingrian (Junus 1936), and all other works, starting from Porkka (1885), describe only some particular aspects of the language. Ingrian Finnish dialects are studied even more fragmentarily. The Siberian Ingrian/Finnish had been barely known in linguistics before a field doctoral study by Sidorkevič (2013b) appeared.

Votic, Ingrian, and Ingrian Finnish have been in intense contact for centuries, and some of their dialects form a Sprachbund (language union) in the Lower Luga area of Western Ingria (Muslimov 2005). Siberian Ingrian/Finnish is spoken in Western Siberia, but originates from Ingria, as its speakers were expelled from the Lower Luga area to the Omsk region in Siberia in 1803-1804. This mixed variety was formed in isolation from its mother languages, but shows many similar phonetic and phonological trends.

There exist many phonetic and phonological studies on quantity in Finnic languages. However, broad comparative typological studies are still missing, with an exception of Viitso (1981, 2008), written in Estonian. His works are insightful yet purely theoretical, as few phonetic studies on these languages were available at that time. Modern technology provides broader possibilities for phonetic studies, and the fact that all these languages are still spoken gives the last chance to study them all simultaneously and run comparable phonetic experiments. Such experiments are urgently needed to complete phonological descriptions and transcription verifications. In particular, none of existing grammatical and other descripions provides a detailed comparative account both on the ongoing transformation of the vocalic length contrast in non-initial syllables under the influence of reduction and on the prosodically-motivated gemination of consonants, observed in all these varieties. Both phenomena occupy a central place in the dissertation.

Comparative work allows to take a glance at the phonetic and phonological evolution of certain aspects of Finnic quantity, as the varieties in question manifest different developmental stages of the same phenomena. Moreover, rare phonological features of Finnic languages are of greater typological and theoretical interest, for example, the ternary quantity consonantal contrast in Estonian, Livonian, and Soikkola Ingrian, reduced voiceless vowels in Lower Luga Ingrian, or prosodically motivated gemination of consonants in di- and trisyllabic foot in Soikkola Ingrian. All these phenomena have never been discussed in general typological and theoretic literature and are addressed in this respect in the dissertation.

In sum, presented results fill some of the most important remaining gaps in the phonetic and phonological description of the Finnic languages of Ingria, contributing to the documentation and revitalisation of vanishing languages, as well as to general phonetic and phonological theory and phonological typology.

Existing gaps in description filled by this study are primarily linked to the quantity-related innovations in these languages, first of all, ongoing vowel reduction in non-initial syllables, which follows an isochronic (compensatory) pattern, and “anti-isochronic” (anti-compensatory) lengthening of sounds before longer sounds, including first of all the so-called secondary gemination of consonants before long vowels. These two phenomena for the first time receive a comprehensive systematic description that embraces their phonetics, phonology, evolution, and various typological and theoretical aspects.

At the same time, some tradionally studied quantity-related phenomena, like Finnic grade alternation, are not touched upon in this study. Grade alternation is a historical Proto-Finnic process of quantity reduction in certain structures, related to foot isochrony. It is realtively well-studied for Finnic languages, on the one hand, and does not create issues for the transcription of the Finnic languages of Ingria, on the other hand, so it was of minor importance for the present work.

The study is based on first-hand field data collected by the author and colleagues and includes phonetic experiments designed by the author. Among other things, it uses some novel experimental techniques, such as a phonemic categorisation test for non-written varieties.

ii. Scientific relevance of the study

The project contributes to the understanding of extremely endangered and understudied varieties, most of which still do not have proper grammatical descriptions. This is in line with the latest trend in phonetic and phonological studies: a search for new theoretical inputs in understudied languages (Whalen & McDonough 2019; Tucker & Wright 2020).

It also contributes to general theoretical and typological understanding of sound change and timing mechanisms in languages. In particular, the two experiments described in the study tackle upon the connection between synchronic variability and sound change, still a much-debated issue (e.g. Barnes 2006; Kirby 2010; Kapatsinski 2018). A comparison of phonetic variability to phonemic categorisation, proposed in this strudy, allows us to get an important insight into an exact pivotal point in production where a mental phonemic reanalysis happens.

On the other hand, both experiments also deal with diachronic and dynamic questions and look into fine phonetic details of how certain sound changes happen. Recent shift of focus from static cross-linguistic patterns to the dynamic processes of their emergence brought phonologisation to the center stage of modern functional phonology (Blevins 2004, 2015; Yu 2013) and follows a general interest towards the diachrony and geography of cross-linguistic patterns in modern typological studies (cf. the "what's where why?"of Bickel 2007, 2015).

The project also addresses in detail several cross-linguistic phonological rarities discovered in the Finnic varieties of Ingria: the ternary quantity contrast of consonants and the trisyllabic foot (in Soikkola Ingrian), reduced voiceless vowels (in Lower Luga Ingrian), a complex system of consonantal articulations (plain, palatalised, labialised, labiopalatalised in Siberian Ingrian/Finnish). The study comprising phonological, experimental phonetic and psycholinguistic, and diachronic aspects shows the exact properties, the evolutionary path, and the integration into the whole phonological structure of a language of all these features. Cross-linguistic rarities used to be theoretically marginalised and seen as something unnatural with respect to the "natural" laws of language due to various issues they create for analysis within existing frameworks (Kuznetsova 2020). However, they can also challenge theories in a particularly efficient way (Plank 2000; Simon & Wiese 2011; Wohlgemuth & Cysouw 2010a, 2010b; Round 2019). Moreover, rare but possible features are completely different from the logical point of view from entirely impossible features. Therefore, a trend towards a de-exoticisation of rarities by expanding the theory has emerged in recent years (see examples in phonology in C. Anderson 2016; Kuznetsova 2018a; Blevins 2018; Easterday 2019).

iii. Possible practical applications of the study

The most imminent application of the results of the project is to use them for the development of transcription of the Finnic varieties of Ingria. The results on vowel reduction, for example, have been already implemented in the phonetic and phonological transcription of a text publication in the Lower Luga dialect of Ingrian (N. V. Kuznecova 2020) and in the electronic dictionary of the Soikkola Ingrian dialect (Rozhanskiy & Markus 2020). Besides, the results could serve as case studies in teaching the methods of phonetic field documentation of understudied and endangered languages. They could be, for example, instructive in teaching on which procedures could be applied to decipher complex phonetic and phonological quantitative systems or to study the phonemic categorisation in non-written languages. It could be also used to teach how to design and set up phonetic experiments in the limited conditions of the field, and which challenges field phoneticians meet when they want to apply modern methods of statistical analysis to their often-imperfect data.

Besides, the results of the project could be useful for the linguistic typology courses, especially for teaching phonological typology. The latter used to be marginalised within mainstream typology but is gaining popularity in recent years (cf. Gordon 2016; Hyman & Plank 2018).

iv. Structure and overview of the study

The thesis is organised as follows. Chapter 1 provides a brief dialectal, sociolinguistic and historical introduction to the Finnic minorities of Ingria. Chapter 2 presents main descriptive facts and a cross-linguistic background of two typological rarities in the phonology of the Ingrian language: a ternary quantity contrast and reduced voiceless vowels. Chapter 3 gives a descriptive overview of different stages of vowel reduction observed in the Finnic languages of Ingria and adjacent varieties. Reduced voiceless vowels in Ingrian are just one of the stages of this reduction. Chapters 4 and 5 constitute the core experimental part of the thesis. Chapter 4 is dedicated to phonetic production and mental categorisation of the different stages of vowel reduction in the Finnic languages of Ingria, introduced in Chapter 3. Chapter 5 gives a comprehensive overview of a temporal structure of the trisyllabic foot in Soikkola Ingrian, with a focus on vowel reduction and consonantal gemination (the latter had triggered the emergence of the ternary quantity contrast of consonants at an earlier historical stage). The main findings and conclusions of each chapter are summarised below.

Chapter 1 introduces the Finnic minorities of Ingria (Votes, Ingrians, and Ingrian Finns), their languages with a dialectal subdivision, and some main facts about their current sociolinguistic situation, language attitudes, and revitalisation efforts. It also overviews the historical processes which caused currently observed language and even identity shifts. In Soviet times, these ethnic groups underwent stronger and longer-lasting repressions, compared to average situations of the minorities of the Soviet Union. They resided in border areas with Finland and Estonia, used to receive some cultural support from these countries, and consequently were seen by the Soviet authorities as directly connected to hostile foreign states.

Additionally, a current sociolinguistic situation and its historical background also manifest some particular features for each language and its speakers. Votic, the oldest autochtonous language of Ingria, used to have a lower prestige for its speakers than the neighboring Finnic languages. Therefore, already before massive Russification, Votic speakers used to shift both their language and their ethnic identity into Ingrian and sometimes Ingrian Finnish. On the other hand, during the 20th century, Votic was attracting significantly more attention and interest of linguists and other scholars than the other two languages. Therefore, although there are no fluent Votic speakers any more, the prestige of language is still relatively high and the community attitudes towards it are in general positive. As for Ingrian, there are no strong factors that would support the prestige of the language today. On the other hand, Ingrian has been under the least pressure from closely related languages, as compared to Votic and Ingrian Finnish. Therefore, Ingrians show the least unambiguous ethnic identity among the Finnic ethnic groups of Ingria, but the prestige of the language for its speakers is nowadays lower than in the case of Votic. Ingrian Finns, in turn, were the latest newcomers to Ingria (from the 17th c.) and remained Lutherans (unlike Votes and Ingrian, who became Orthodox like the surrounding Russian majority). Ingrian Finns have enjoyed the strongest support from Finland out of all the minorities of Ingria. On the other hand, their linguistic variety has been always perceived as a non-standard variant of the Finnish language rather than a separate language. The latter fact solicited a mass shift into Standard Finnish among younger speakers, as well as their frequent emigration to Finland. Also at present, Ingrian Finnish enjoys less revitalisation and support efforts than Votic or Ingrian, and is in general less described than the other two languages.

Chapter 2 provides a structural and typological introduction into the two cross-linguistically rare phonological phenomena related to the development of prosodically motivated lengthening and reduction in the two still living dialects of the Ingrian language. The first one is attested in the Soikkola dialect, and involves a phonological ternary quantity contrast of consonants. The second exists in the Lower Luga dialect, and involves a phonological contrast of full modal and reduced voiceless vowels. First, brief phonetic, phonological and typological profiles of these contrasts are given. Furthermore, their historical development, phonetic and phonological structure are analysed, as well as their likely further evolution against the typological background of similar phenomena in genetically related and unrelated languages. In the end, the question of stability and maintenance forces of these contrasts, as well as their place within the general prosodic development of the Soikkola and Lower Luga dialects, are discussed.

In particular, the Soikkola Ingrian ternary quantity contrast of consonants stands out at the background of other known languages with such a contrast (Estonian, Livonian, Saami). In the latter languages, the contrast is always significantly reinforced by auxiliary phonetic features: a voicing contrast in some consonants and an inverse ratio of the second syllable vowel to the first syllable ternary length. Moreover, due to the loss of the vowel length contrast in the second syllable of the foot, the ternary contrast of preceding consonants can be phonologically analysed in these languages through a combination of two binary quantity contrasts. In Estonian, for example, it would be a combination of a contrast on the segmental level (short vs. long phonemes) and a contrast on the suprasegmental level (light vs. heavy lexicalised foot accents).

Unlike in these languages, in the Soikkola Ingrian disyllabic feet, consonantal quantity classes 2 and 3 (i.e. short geminates and long geminates) can alone produce minimal pairs. Additionally, Soikkola Ingrian disyllabic feet still retain the phonological constrast of short and long vowels in the non-initial syllables. An inverse ratio of the following long vowel duration to the length of consonants is an emerging but still insignificant trend. Therefore, the Soikkola ternary quantity contrast of consonants cannot be that easily represented as a combination of two binary contrasts. A true ternary quantity contrast is rather to be postulated, like a three-way vocalic length contrast in the African languages Dinka and Shilluk.

A three-way quantity contrast is generally regarded as perceptually instable due to the crowding in the perceptual space. It shows a cross-linguistic trend either to the binarity restoring or to the development of auxiliary phonetic contrasts which reinforce it. Both trends are observed in the Ingrian language. In case of the binarity restoring, a cross-linguistically frequent trend is that the middle length caterogy merges with the longest one. Core Ingrian dialects (Soikkola, Hevaha, Oredež) generally follow this trend, but the Lower Luga dialect shows a deviation. Here, the middle length category had apparently merged back with the shortest class (singleton consonants) in most cases. As said, this dialect is a part of a Sprachbund between very closely related languages (Ingrian, Votic, Ingrian Finnish, Estonian). The deviation in the Lower Luga dialect seems anomalous from the typological point of view, but could be explained by the analogous pressure from these very similar cognate languages, which contain singleton consonants in place of geminates in respective prosodic positions.

Typologically rare voiceless vowels in the Lower Luga dialect are a result of vowel reduction in the non-initial syllables. A contrast of long and short vowels has transformed here into the contrast of short and reduced vowels. These reduced vowels are often realised as voiceless. However, this is not always the case, and there are also positions where these vowels are qualitatively and durationally reduced but never voiceless. Therefore, this is not an entirely pure case of voiceless vowels — these vowels should be rather phonologically treated as reduced.

The full cycle of the transformation of the length contrast in the non-initial syllables (from long vs. short vowels to short vs. no vowels) could be observed in the still living Finnic varieties of Ingria and adjacent areas, and *Chapter 3* traces this evolutionary path through all its stages. Existing descriptive sources and the author’s own field data serve as a basis for this comparison. Among other things, the changes in various types of ratios between long and short vowels are described in those varieties which are more innovative than Standard Finnish (the most conservative stage). As compared to Standard Finnish, all Finnic varieties of Ingria manifest a more developed foot structure and a stronger tendency towards foot isochrony.

Two main types of prosodic positions, which radically differ in their evolutionary paths, are clearly distinguished:

(1) after a short/light syllable (open, with a short vowel): *kan**a*** ‘hen’ vs. *kan**ā*** ‘hen:PRT’;

(2) after a long/heavy syllable (other syllable types): *linn**a*** ‘fortress’ vs. *linn**ā*** ‘fortress:PRT’.

In the position after a light syllable, a short second vowel undergoes prominent phonetic lengthening (this is a so-called “half-long vowel”, known for many Finnic languages). This lengthening is more developed in more prosodically innovative Finnic varieties. The contrast of short and long vowels tends to disappear in this positon through one of the two sound changes:

(1) phonologically long vowels shorten and merge with “half-long” phonologically short vowels (e.g. in Estonian, partially in Votic);

(2) singleton consonants before a phonologically long vowel undergo secondary gemination into short geminates: *ka**n**ā* > *ka**n̆n**ā* ‘hen:PRT’ (e.g. in Soikkola Ingrian), and these short geminates later merge with long geminates in most varieties (*ka**n̆n**ā* > *ka**nn**ā* ‘hen:PRT’).

In the position after a heavy syllable, the contrast between structures with originally short and long second syllable vowels is always preserved. However, the short vowels eventually disappear and the long ones become short: *linn**a*** > *linn* ‘fortress’, *linn**ā*** > *linn**a*** ‘fortress:PRT’. After the loss of the short vowels, the system goes through a transitory stage, where preceding consonants retain aspiration after the loss of *a*, *ä*, *e*, palatalisation after the loss of *i*, labialisation after the loss of *u*, *o*, *ö*, and labiopalatalisation after the loss of *ü* as distinctive phonemic features. This stage is documented for Siberian Ingrian/Finnish, and such a consonantal system is also a typological rarity. Palatalisation is further retained longer than labialisation, but also shows a tendency towards eventual loss (as seen e.g. in Estonian).

As a final result of all these sound changes, there is a situation where synchronic phonetic duration of the second syllable vowels does not correspond to their original phonological length any longer. All phonologically long vowels eventually shorten and even reduce (as in Estonian), while the "half-long" (phonologically short) vowel becomes durationally the longest out of all non-initial vocalic allophones. This situation has created concerns for synchronic phonological descriptions of a number of Finnic varieties.

The qualitative reduction, devocing, and loss of non-initial short vowels in the Finnic varieties of the Lower Luga area (with the Sprachbund of closely related languages) is further experimentally studied in *Chapter 4.* This study presents a comparison of phonetic production and phonemic categorisation of eliding reduced vowels by the speakers of Finnic varieties of Ingria at different stages of vowel reduction. During any sound change, two processes happen: a change in the structure of the pool of realisations and a categorical reanalysis in speakers' minds. This experiment aims at providing some answers to the question about the temporal and causal correlations between these two processes. Besides, it looks into whether vowels of different quality undergo reduction and loss along the same or different trajectories.

Chosen Finnic varieties are ranged from the least to the most susceptible to reduction in the following way: Kurkola Ingrian Finnish > Votic and Central Lower Luga Ingrian > Southern Lower Luga Ingrian > Siberian Ingrian/Finnish. A possibility to trace, document, and phonetically describe several steps of the same process of vowel reduction can allow us to build more naturalistic sound change models.

Open disyllables ending in the three corner vowels types, *a*, *i*, *u*, after both voiced and voiceless singleton consonants were studied in the phrase-initial and -final position, to cover a wide range of possible realisations (altogether 3744 tokens in 6 speakers). The ratios of the following seven types of vowel reflexes within the pool of realisations were subsequently counted: (1) full modal, (2) qualitatively reduced modal, (3) partially and (4) fully devoiced vowels, (5) heavy segmental aspiration (over 35 ms) after the consonant, (6) consonantal palatalisation or labialisation left after the vowel loss, (7) complete vowel loss without traces.

In a parallel test on the categorisation of reduced vowel reflexes, the speakers had to write down the carrier words from the phonetic questionnaire (altogether ~78) in any preferred orthography the way they perceived them. Neither variety studied in this test has a literary standard, and speakers have hardly ever written in it. Therefore, such an experiment more or less directly represents their intuitions about the presence or absence of a vowel segment word-finally. The speakers, who have mostly received their school instruction in Russian, typically chose Cyrillic orthography, though some preferred Latin letters (e.g. **lintu* 'bird' could be written as *линту/lintu* or *линт/lint*). The ratios of final vowel presence vs. absence for each speaker were subsequently counted.

Correlated results showed that if a vowel was pronounced in more than 70% of cases, its started loss was not yet perceived, apart for certain frequent words. However, after more than 70% of loss, a vowel was not perceived any longer. A split of 50/50 between the presence and the loss of vowel in production correlated to a similar split in categorisation. At the beginning of a sound change, the production is, therefore, more innovative, but after a categorical reanalysis the categorisation becomes more innovative and further leads the change.

Vowel qualities showed some differences as regards the process of reduction and loss. These differences were interpreted to be grounded in their acoustics, articulation and perception. The study also showed that the phonological markedness hierarchy of corner vowels *a*, *i*, and *u* can differ from the markedness hierarchy of the vowel reflexes on consonants left after vowel loss.

The hierarchy of vowels themselves, from the most to the least innovative, was *a* > *i* > *u*. The vowel *a* underwent strong qualitative reduction into schwa and rapidly disappeared both from the production and the mental categorisation of speakers. The vowel *u*, on the contrary, was the most conservative both in terms of production and categorisation. The vowel *i* was categorised as conservatively as *u*, but was produced in nearly as innovative a manner as *a*, and was accompanied by the development of a robust cluster of consonantal palatalisation. No similar robust cluster of labialisation was formed for *u*, and the segmental vowel was rather directly lost in this case.

Consonantal palatalisation left after the loss of *i* changed the primary articulation of consonants towards the palatal region of the vowel tract (especially in case of *l'* and *t'*). Labialisation, the result of *u* loss, in turn, affected only the final aspirated portion of the consonant, which was subsequently eliminated over the course of ongoing reduction. These differences in the re-phonologisation of *i* and *u* into secondary consonantal localisations stipulated a different markedness hierarchy in the outcomes of vowel loss (from the least to the most salient effects): **a* > **u* > **i*. Palatalised consonants are also cross-linguistically much more frequent in the world's languages than the labialised ones.

Vowel reduction is one of the principal tools of introducing higher phonological complexity into languages, by forming more complex syllable structures and elaborated consonantal inventories. It has been hypothesised that once a higher degree of such complexity is introduced into the system, it is difficult to fully remove it (Easterday 2019: 322), i.e. languages in general develop in the direction of increasing complexity. However, the present case shows that a complex consonantal inventory with many additional articulatory elaborations, introduced into a system through vowel reduction, can be also rapidly simplified, as many of those features turn out not salient enough for production and perception to be fully phonologised and further maintained in the language.

Finally, this study offers new insights to the debate over the two generally distinguished paths of vowel reduction, centripetal (centralisation towards schwa) and centrifugal (dispersion towards the three corner vowel qualities *a*, *i*, *u*). This distinction still raises certain conceptual issues, e.g. the validity of centrifugal reduction as a general mechanism is contested by Kapatsinski et al. (2020). Some authors also doubt that the two mechanisms can co-exist in the same language system (Crosswhite 2004; Harris 2005). In our study, both types of reduction were observed in similar varieties but at different stages of vowel reduction and loss: an initial rise from mid to high vowels and a later centralisation of all corner vowels into schwa.

A comprehensive acoustic study on the trisyllabic foot in *Chapter 5* specifically addresses the most complex phonological system in the Finnic varieties of Ingria: the one of Soikkola Ingrian. Its trisyllabic foot has never been acoustically studied before and shows prosodic differences from both the disyllabic foot, addressed in Chapter 2, and the combination of a disyllabic and a monosyllabic foot. Namely, it manifests two idiosyncratic phenomena: specific types of prosodically motivated gemination and ongoing reduction of second syllable long vowels, which are in the focus of discussion.

The interaction of phonological length and foot structure in segmental durations of 22 trisyllables, four of which were additionally compared to similar disyllables (altogether 4259 tokens in 5 speakers), was explored with the help of mixed linear regression modelling. Both synchronic timing patterns and their precursors in earlier language history were addressed.

The main claim is that both can be explained through an interaction of two main phonetic tendencies: isochrony and “anti-isochrony”. Isochrony is a cross-linguistically known trend for poly-subconstituent shortening: the longer the prosodic domain (syllable, foot, word) is, the shorter the duration of its lower-level constituents becomes. In Finnic languages, however, isochrony also includes the lengthening of short vowels after a light (C)V stressed syllable (the “half-long” vowel): *kana* [ˈkan**a**ː] ‘hen’. “Anti-isochrony”, less known outside Finnic languages, implies the lengthening of segments before longer sounds, most notably of consonants before the following long vowels.

The most evident isochronic effect in this study was an ongoing phonological shortening of long second syllable vowels in most trisyllables, apart for the two shortest ones. Disyllables as shorter feet, in turn, still maintain this long vowel (cf. also Chapters 2, 3). Vowel shortening in trisyllables clearly follows isochronic rules and is described in the study as a decrease of an overall durational limit of the Soikkola Ingrian foot. Shorter structures (disyllables and short trisyllables) still fit the “box” and, therefore, keep the original duration and length of the second syllable vowel. Longer structures, which exceed the new limit, undergo the reduction of the second syllable long vowel to different degrees, depending on the overall length of any particular structure. Long vowels disappear first from the longest foot structures (containing the highest number of segments and the longest segments) and are better preserved in the shorter ones.

As a result, the trisyllabic foot now represents a more innovative stage of prosodic development, as compared to the disyllabic one: the length contrast in the second syllable vowel was lost, and its duration became significantly reverse to the first syllable length. In this respect, Soikkola Ingrian trisyllables resemble other languages with a ternary quantity contrast of consonants (Estonian, Livonian, and Saami; cf. Chapter 2). Disyllables still appear more prosodically archaic, as they are mostly distinguished just by the different duration of the consonant in the three length classes.

“Anti-isochrony”, in turn, is best represented in the study by the historical prosodic gemination of singleton consonants before long vowels, widespread also in other Finnic varieties (**kanā* > *ka**n̆n**ā* ‘hen:PRT’, see also Chapter 3). Such gemination is present both in di- and trisyllables and gave rise to the middle length class of consonants. The robust ternary contrast of consonants in synchrony was confirmed for both trisyllables and disyllables.

However, the Soikkola Ingrian trisyllabic foot manifests gemination also before two light syllables *-CVCV(C): **murkina* > *mur**k̆k**ina* ‘breakfast’. Soikkola Ingrian gemination before a short vowel is unique in Finnic space. Together with the second syllable long vowel reduction, this feature indicates an independent prosodic status of the trisyllabic foot in Soikkola Ingrian, which is also an extreme typological rarity.

Subtler phonetic manifestations of both isochrony and “anti-isochrony” in other foot positions confirmed that the two tendencies are still active in the language. These effects include e.g. shorter vowel durations before longer length classes of consonants, shorter consonantal durations after long vowels (isochrony), or phonetic lengthening of consonants before long V_2 (“anti-isochrony”). A comparison of effect sizes across prosodic positions indicated isochrony strengthening towards the end of the foot. In general, isochrony appeared as a very global phonetic tendency showing its effects at various levels of prosodic hierarchy: syllable, foot, word. “Anti-isochronic” lengthening was a more local tendency subordinate to isochrony.

Many of the findings present challenges for current phonological models, both formal and physiologically-motivated (articulatory) ones. Trisyllabic foot is often contested in formal phonological accounts, while our case shows two phonological processes clearly pertinent to the trisyllabic foot only. Our results are also challenging for the Articulatory Phonology / Task Dynamics model. For example, they show that the degree of poly-subconstituent shortening is regulated by the phonological length of segments and that the strength of isochrony is not equal in all foot positions. Local "anti-isochronic" lengthening is also difficult to account for in this theoretical framework.

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The idea, the supervision, the main conclusions, and the submitted final draft texts of all the publications related to the dissertation, as well as the design of the reported phonetic experiments belong to the author. Citations from publications in languages other than English are translated into English by the author. Statistical analysis, visualisation of the phonetic results on graphs and spectrograms (apart for a figure in Appendix 5.3 designed by the author and executed by Irina Brodskaya), and maps in Figures 1.3, 4.0b, were also executed by the author.

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Finally, all of this would have been impossible were it not for the willingness of the speakers of the languages of Ingria to remain in a long-lasting collaboration since 2006, and for the extreme support and love of my family: Alessandro, Martin, Kristofer, Svetlana, Viktor.

vi. Publications on the topic of dissertation

1. Kuznetsova, Natalia, Elena Markus, Mehmed Muslimov (2015) Finnic minorities of Ingria: the current sociolinguistic situation and its background. Heiko Marten, Michael Riessler, Janne Saarikivi, Reetta Toivanen (eds.). *Cultural and linguistic minorities in the Russian Federation and the European Union* [Multilingual Education 13: Comparative studies on equality and diversity]. Berlin: Springer, 127-167 (https://doi.org/10.1007/978-3-319-10455-3_6).
2. Kuznetsova, Natalia (2015) Two phonological rarities in Ingrian dialects. Martin Hilpert, Jan-Ola Östman, Christine Mertzlufft, Michael Rießler, Janet Duke (eds.). *New trends in Nordic and general linguistics* [Linguae & Litterae 42]. Berlin: De Gruyter, 91-117 (https://doi.org/10.1515/9783110346978.91).
3. Kuznetsova, Natalia (2016) Evolution of the non-initial vocalic length contrast across Finnic varieties of Ingria and the adjacent areas. *Linguistica Uralica*, 52(1), 1-25 (http://dx.doi.org/10.3176/lu.2016.1.01).
4. Kuznetsova, Natalia, Verkhodanova Vasilisa (2019) Phonetic realisation and phonemic categorisation of the final reduced corner vowels in the Finnic languages of Ingria. *Phonetica*, 76, 2-3, 201-233, Special Issue “Constancy and variation in speech”, ed. by Calbert R. Graham and Brechtje Post (https://doi.org/10.1159/000494927).
5. Kuznetsova, Natalia, Cormac Anderson (2020) Vowel reduction and loss: challenges and perspectives. In: *Italian Journal of Linguistics*, 32(1), 3-16, Special Issue “The dynamics of vowel reduction and loss in phonetics and phonology”, ed. by Cormac Anderson and Natalia Kuznetsova (https://doi.org/10.26346/1120-2726-145).
6. Kuznetsova, Natalia, Irina Brodskaya, Elena Markus. Temporal structure of the Soikkola Ingrian trisyllabic foot. Under revision in *Journal of Phonetics*.

Chapter 1: Sociolinguistic and dialectal features of the Finnic languages of Ingria

1.1. Introduction

Ingria is a historical territory with the western border along the river Narva (Narova)[1] and the lake Peipus (Čudskoje), the northern border along the Gulf of Finland and the river Rajajoki (Sestra); the eastern border is the lake Laatokka (Ladoga) and the river Lavajoki (Lava), and the southern border more or less corresponds to the southern borders of the Jaama (Kingisepp), Volossova (Volosovo), Hatsina (Gatčina) and Tusina (Tosno) districts of the Leningrad region (Figure 1.1). It generally corresponds to the current St. Peterburg region.

At present, Ingria is home to four Finnic ethnic groups: Votes, Ingrians, Ingrian Finns and Estonians (Figure 1.2). A convenient way to distinguish between their languages is by comparing the verb 'to speak', as it has different stems in each language: *pajatta-* in Votic, *läkkǟ-* in Ingrian, *hāsta-/huasta-*, *lāti-/luati-/loati-* or *uhhō-* in Ingrian Finnish, and *rǟǩki-* in Estonian. This distinction generally corresponds to the traditional classification based on linguistic criteria.[2] Votic and Ingrian are considered independent languages (for a different view on Ingrian see, for example, Kettunen 1957). Votes are the oldest autochtonous group in this region (at least since the 10-11th cc.), and Ingrians were originally a branch of Korela (Karelian) tribes which were gradually migrating through Ingria since the 11-12th cc. (Laanest 1966a; R'abinin 1997; Lang 2018). Ingrian Finnish is as a group of Finnish dialects on the territory of Ingria: in 1617, Swedes took Ingria in possession and relocated a part of Finnish population here (Laanest 1966a). Estonians living in Ingria speak a variety of Standard Estonian, with several minor distinct features. There are many common features in the history of these languages in the 20th century, and they greatly influenced each other through intensive language contacts. The current sociolinguistic situation still shows individual characteristics for each language. Unfortunately, we do not have enough material on the current state of Estonian in Ingria,[3] thus only Votic, Ingrian, and Ingrian Finnish will be discussed below.

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[1] For geografical objects, original Finnic names are given first, and Russian names follow in parentheses when the place is mentioned for the first time. When later mentioned, only Finnic variants are given. If the Finnic name coincides with the Russian one, it's not doubled in parentheses. There are no universal standards for Finnic hydronyms and toponyms in Ingria. Below, we generally follow the Finnish variants of names given in the maps of Ingria by Mustonen (1933) and Randefelt (1992). For the names not indicated in these maps we give variants found in other sources or recorded from the speakers of the corresponding languages.

[2] A classification based, for example, on endonyms or exonyms of Finnic people in Ingria in some cases gives different results (Muslimov 2005: 45-71). The ethnic identity of a person in this area does not always correspond to the language (s)he speaks (some examples will be mentioned below).

[3] On the history of this group see a fundamental work by Musajev (2009). In 2012-2013, Mehmed Z. Muslimov together with V'acheslav S. Kulešov examined the present state of Estonian varieties in Ingria. Estonian has almost disappeared from this territory; Muslimov and Kulešov found only a dozen semi-speakers and a couple

Figure 1.1: Ingria on the map (Kuznetsova, Markus & Muslimov 2015: 128)

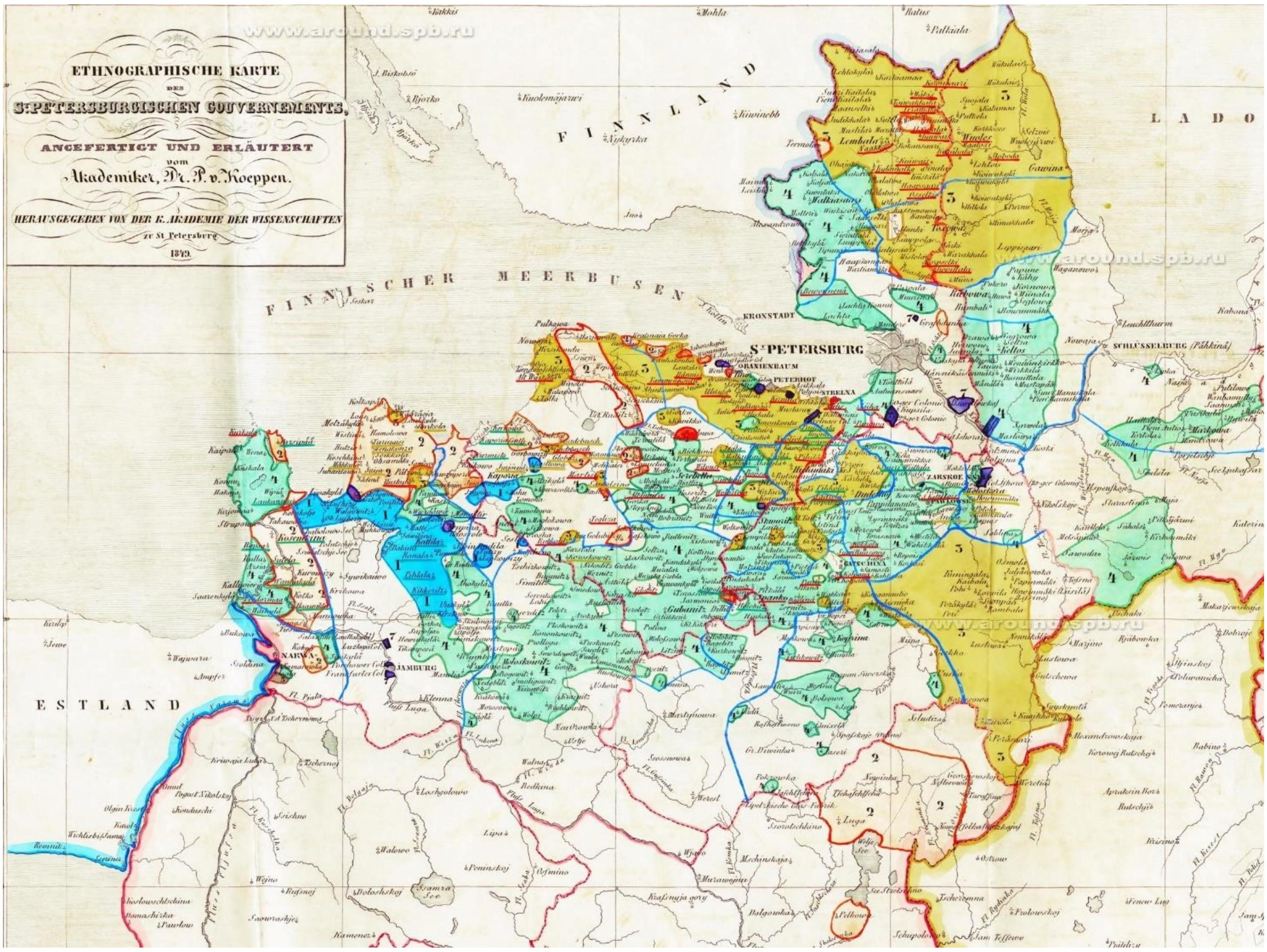

Figure 1.2: Historical ethnic groups in Ingria (a part of Köppen 1849): 1 — Votes, 2 — Ingrians, 3 — Äyrämöiset (a half of Ingrian Finns), 4 — Savakot (a half of Ingrian Finns), 5 — Estonians, (6 — Karelians; not represented in Ingria), 7 — Germans.

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of more or less fluent speakers. These Estonians were born in Western and Central Ingria, in the pre-war parishes of Kattila, Novasolkka, Moloskovitsa, Gubanitsa, Serepetta and Kobrina. Also, mixed Estonian and Ingrian Finnish speakers were found in the villages of Tikanpesä (Tikopis') and Brömbeli (Br'umbel') near Jaama.

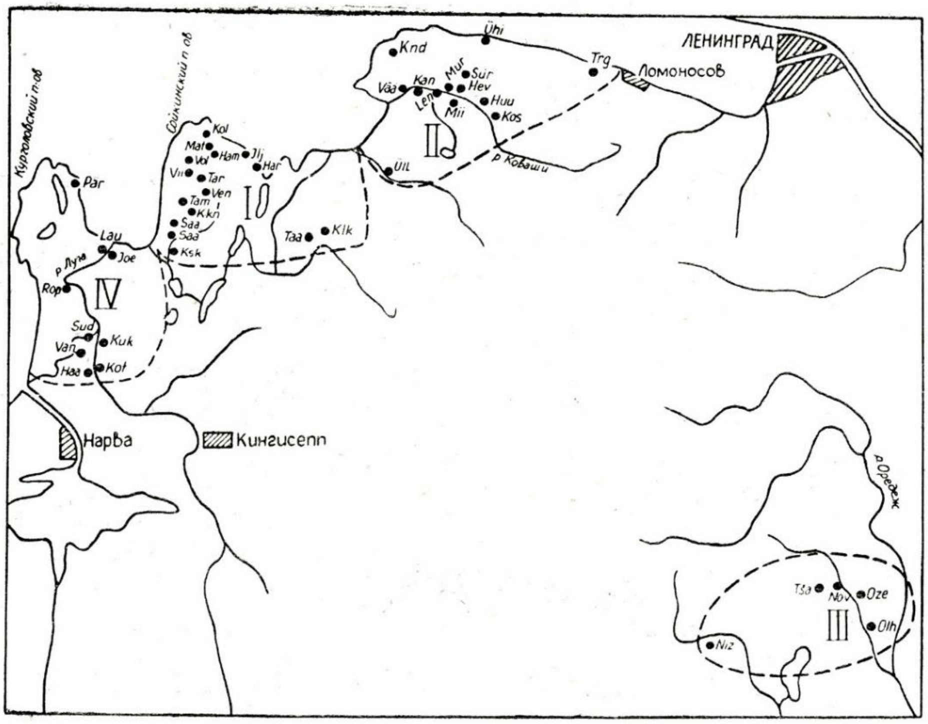
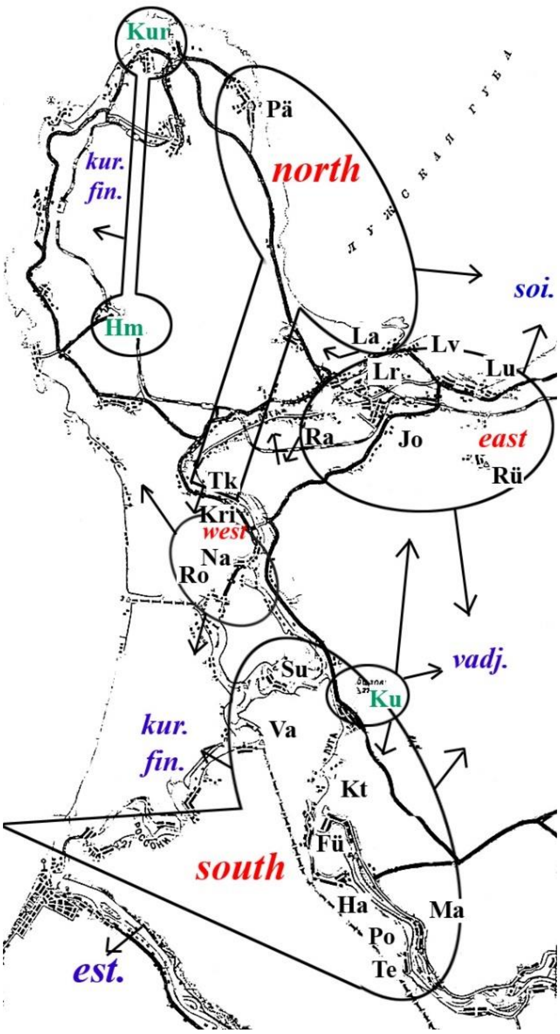


Figure 1.3: Ingrian dialects (Laanest 1966a: 4): I — Soikkola II — Hevaha, III — Oredež, IV — Lower Luga.



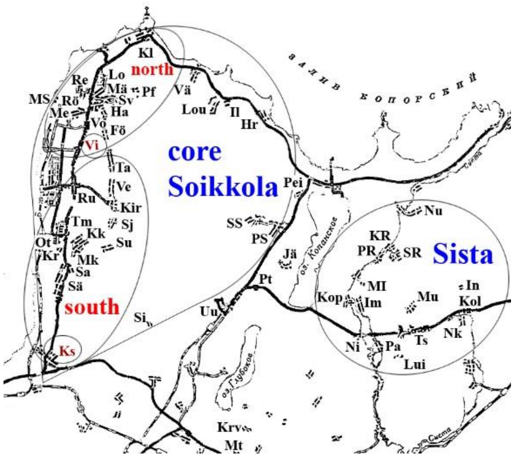


Figure 1.4: Dialectal subgroups within the Lower Luga (left) and the Soikkola (right) dialects (after N. V. Kuznecova & Sidorkevič 2012: 566-67)

Lower Luga: Northern, Eastern, Western, Southern groups, united into bigger North-Eastern and South-Western areas. Arrows indicate contact influences to Lower Luga Ingrian from the neighboring varieties: the Soikkola dialect (*soi.*), Kurkola Ingrian Finnish (*kur. fin.*), Votic (*vadj.*), Estonian (*est.*). Mixed varieties of Kukkusi (*Ku*; Ingrian/Votic), Hamala and Kurkola (*Hm* and *Kur*, both Ingrian/Ingrian Finnish) are placed in individual circles and marked light green.

Soikkola: two bigger areas: core Soikkola and Sista Soikkola. Core Soikkola varieties are divided into the Northern and the Southern group. A transitory Northern to Southern variety of Viistinä (*Vi*) and a mixed Soikkola/Lower Luga Ingrian variety of Koskisenkülä (*Ks*) are placed in individual circles and marked dark red.

1.2. Dialectal structure and historical contacts

The current dialectal diversity of Finnic languages in Ingria is to a large extent the result of multiple language contacts. In this section, we give an overview of the main dialects and indicate the sources of interdialectal influence. The recent influence of Standard Finnish and Estonian on the languages discussed will be analysed in the next section.

1.2.1. Votic

Votic was traditionally divided into four dialects: Kreevin, Eastern Votic, Western Votic, and Kukkusi Votic.

Kreevin is the dialect of theVotes who were relocated to the territory of contemporary Latvia as prisoners of war under the Livonian Order in the 15th century. The last speakers of this dialect died in the middle of the 19th century (Winkler 1997: 30).

Eastern Votic was spoken in the villages of Itčäpäivä (Icipino), Mahu (Podmoš'je), Iivanaisi (Ivanovskoe), Kliimettina (Klimotino), Koslova (Gostilovo), and Kaprio (Kopor'je). The last speaker of this dialect died in 1976 (Ernits 2005: 87). Eastern Votic was influenced by the Hevaha dialect of Ingrian.

Western Votic was a traditional name for all Votic varieties other than those listed above. All Western Votic varieties are located in the Kingisepp district of the Leningrad region.

In fact, Western Votic can hardly be considered a single dialect, because central Votic varieties [spoken in the villages around Kattila (Kotly)] demonstrate many differences from the Lower Luga varieties (spoken in the villages of Joenperä (Krakol'je), Liivakylä (Peski), Luutsa (Lužicy), and Rajo (Mežniki) in the so-called Vaipooli region). We opt for splitting Western Votic into two dialects: **Central Votic** and **Lower Luga Votic**; the same opinion was expressed by Ernits (2005: 77-89). Lower Luga Votic was very much influenced by Lower Luga Ingrian (practically all Lower Luga villages used to have mixed Ingrian and Votic populations). Central Votic was influenced by the local Ingrian Finnish varieties (Muslimov 2003). At present Central Votic is extinct, but there are several speakers of Lower Luga Votic.

The **Kukkusi** dialect is spoken in a single village, Kukkusi (Kurovicy), located on the eastern bank of the Luga river in proximity to several Ingrian villages (see Figure 1.4). It is a mixed language, with Ingrian vocabulary and phonetics and substrate Votic grammatical markers (Suhonen 1985; Muslimov 2005, 2020; E. Markus & Rozhanskiy 2012). Thus, it is difficult to qualify it as a Votic or an Ingrian dialect. We mention it among other Votic dialects following

Ariste (1948) and some other works.[4] Several scholars starting already from Adler (1966) declared the Kukkusi dialect extinct, but at least one speaker of it was still alive in 2019.

1.2.2. Ingrian

Ingrian has traditionally been divided into four dialects: Oredež, Hevaha, Soikkola, and Lower Luga (Porkka 1885; Laanest 1966a), cf. Figure 1.3.

The **Oredež** dialect was located to the west from the Ortesjoki (Oredež) river in the Hatsina district of the Leningrad region. It is nowadays extinct.[5] It was not influenced by Ingrian Finnish dialects and exibited a number of features, not attested in other Ingrian varieties (Laanest 1960).

The **Hevaha** The Hevaha dialect encompassed the villages along the Hevaha (Kovaši) river and along the Gulf of Finland from Uustia (Sosnovyj Bor) to Kaarosta (Oranienbaum). Several dozen Hevaha Ingrian speakers are mentioned in Laanest (1993: 62) and Kr'učkova (2003: 167). However, in 2002, Muslimov failed to find any competent speakers of this dialect.[6]

The **Soikkola** dialect is spoken on the Soikkola (Sojkinskij) peninsula and along the Sista river in the Kingisepp district of the Leningrad region (Figure 1.4). The Soikkola varieties are still alive, while Sista varieties are almost extinct. Soikkola Ingrian is slightly influenced by Soikkola Ingrian Finnish on the north and by Votic and Lower Luga Ingrian on the south (N. V. Kuznecova 2009a).

The **Lower Luga** dialect is spoken in the villages along the lower course of the Luga River and is still alive. Lower Luga Ingrian shows very high level of intradialectal variation due to numerous influences from different directions: Soikkola Ingrian from the north-east, Votic from the east, Finnish from the north-west and west and Estonian from the south (Muslimov 2005; N. V. Kuznecova 2009a), cf. Figure 1.4. Due to its innovative character, as compared to other Ingrian dialects, some researchers did not recognise Lower Luga dialect as a part of the Ingrian language at all (Porkka 1885: 17-24; Sovijärvi 1944: 185).

Additionally, a mixed Finnish/Ingrian variety is spoken on the Kurkola (Kurgolovskij) peninsula. Its speakers were born in the villages of Hamala (Hamolovo) and Kurkula (Kurgolovo), cf. Figure 1.4.

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[4] At the same time in Laanest (1966a) the Kukkusi variety is treated as a dialect of Ingrian. The verb 'to speak' has a stem *läkkā̆-* in Kukkusi. Being a true mixed language, Kukkusi is put under the Votic dialects conditionally.
[5] This has been recently checked by Mehmet Z. Muslimov and Daria V. Sidorkevič, who visited the villages of Oseresna (Ozerešno), Olhovitsa (Ol'hovets) and Novinka. The Oredež dialect was already moribund in the 1960s (Laanest 1993: 62).
[6] Muslimov discovered about nine semi-speakers of the Hevaha dialect, and the language of the only fluent speaker was strongly influenced by Standard Finnish.

1.2.3. Ingrian Finnish

Ingrian Finnish has considerably more speakers than Votic and Ingrian, but it is less studied, and its dialectal structure is not yet precisely established. Two main ethnic groups of Ingrian Finns, *äyrämöiset* and *savakot*, have been distinguished since early scholarship (Sjögren 1833; Köppen 1849), cf. Figure 1.2. However, this distinction was made mainly on the basis of ethnographic features and was criticised by many scholars (Leppik 1975: 6; Zinaida Mihajlovna Dubrovina 1962: 117-20). On the basis of linguistic isoglosses, Porkka (1885) further distinguished the Kurkola dialect (in the Narvusi parish). Since 2001, Mehmet Muslimov has been conducting a thorough dialectal study of Ingrian Finnish, and here we follow the dialectal classification presented in Muslimov (2009).

Ingrian Finnish is traditionally divided into four big areas. Three of them (in Northern, Eastern, and Central Ingria) did not have contacts with other local Finnic languages. They form continuous homogeneous areas of Finnish varieties, and the dialectal diversity is not very high there. The dialectal division for these three areas will be mentioned briefly, and the fourth area (Western Ingria) will be described in greater detail.

In **Northern Ingria**, the following dialects can be distinguished: (1) Keltto (Keltto and Rääpyvä parishes); (2) Haapakangas (Haapakangas parish); (3) Toksova (Lempaala, Toksova, Vuole); (4) Miikkulainen (Miikkulainen parish); and (5) Valkeasaari (Valkeasaari and Lahti parishes).

In **Eastern Ingria**, there is only a single dialect, the Järvisaari dialect (Järvisaari and Markkova parishes).

In **Central Ingria**, the following dialects are distinguished: (1) Siverskaja (the Siiverska (Siverskaja) village with some adjacent villages in the southern part of Koprina parish); (2) western Hatsina (Spankkova, Skuoritsa, Kolppana, the major part of Kupanitsa parish, the north-western part of the Koprina parish); (3) Hietamäki (Hietamäki parish); and (4) eastern Hatsina (Tuutari, Inkere, Liissilä, and Venjoki parishes the northern part of the Koprina parish). The territory of the Ropsu parish hosts varieties that are transitional between the dialects of Central and Western Ingria.

Western Ingria does not form a homogeneous area. The Finnish population here is not very numerous and lives in small enclaves surrounded by Votes, Ingrians and Estonians. Ingrian Finnish in Western Ingria underwent strong contact-driven influences from these languages and varies greatly among enclaves. Votic substrate vocabulary is found in all of the local Finnish varieties, apart from the parishes of Kaprio and Tyrö. The following dialects are distinguished on the territory of Western Ingria.

1. The Lower Luga dialect (Narvusi parish) had intensive contacts with Lower Luga Ingrian, especially in the southern part of the area (along the Luga and Rosona rivers). Estonian also influenced the southern part of the Lower Luga dialect, especially the subdialect specific to the village of Suokylä (Muslimov 2002). In the northern part (the Kurkola peninsula), Finnish occupies a compact area, and its positions are stronger than those of Ingrian.

2. The Kattila dialect (Kattila parish) was much influenced by Votic and to some extent by Estonian and the Soikkola Ingrian of the Sista river area.

3. The Novasolkka dialect (Kikkeritsa (Kikericy) and Killi villages in Novasolkka parish) was influenced by Votic from the neighboring village of Kerstova (Kerstovo) and local Estonian.

4. The Moloskovitsa dialect (Moloskovitsa parish and north-west of the Kupanitsa parish) is least influenced by other Finnic languages. It forms the eastern border of the area where Votic substrate vocabulary is spread (see also Muslimov 2014).

5. The Soikkola dialect (Vääräoja (Krivoruč'je) village in the north of the Soikkola parish) had highly intensive contacts with the surrounding Soikkola Ingrian, see Nirvi (1971, 1978).

6. The Kaprio dialect (Kaprio parish) was very much affected by Hevaha Ingrian; there were mixed Finnish/Ingrian villages in that area (Laanest 1966a).

7. Varieties of the Tyrö parish are very diverse due to close contacts with Hevaha Ingrian from the west and central Ingrian Finnish influence from the east. The more one goes to the west, the more Ingrian traits are found in the subdialects. Preliminarily, eastern Tyrö and western Tyrö can be distinguished, with the border between them in Kaarosta.

The neighboring Serepetta parish hosts heterogeneous varieties and forms a transitional zone between Central and Western Ingria areas.

It should be mentioned that all of the languages discussed here had long-lasting contacts with Russian. Votic and Ingrian have been in contact with Russian since at least the 11th century (Ränk 1960; Zinaida Mihajlovna Dubrovina 1962; Kettunen 1915: 1-5; Laanest 1966a: 9-10). Ingrian Finnish has had contacts with Russian since the 17th century (Leppik 1975; Teinonen & Virtanen 1999: 27, 35-42). Russian influence is mainly reflected in lexical borrowings and syntactic patterns, but it has not affected the dialectal structure of the languages.

1.3. Present situation

All the languages discussed are on the verge of extinction. Most of the speakers our group has worked with were born in 1910-1930s. At the moment, there are no more fluent Votic speakers any more (although there are still some semi-speakers), there are about 10-20 Ingrian speakers and probably around 100-200 Ingrian Finnish speakers (more precise data for 2006 are given in Kuznetsova, Markus & Muslimov 2015). Remaining speakers generally do not interact any more in their language, or do it very limitedly (with close relatives and neighbors, if there are any speakers among those). Additionally, Ingrian Finnish can be spoken in the church. While Votes and Ingrians are Orthodox, like the majority Russian population, Ingrian Finns are Lutherans and have a number of their own churches.[7] Church services are conducted in Standard Finnish and Russian, but elder people coming to the church often speak Ingrian Finnish among each other.

After World War II, the ethnic identity of the Finnic groups in Ingria has been shifting radically to the Russian one, and Russian influence on the structure of the corresponding languages also rose drastically. Under such circumstances, the number of speakers cited in Kuznetsova et al. (2015) for 2006 could be estimated only conventionally. First, the number of semi-speakers is gradually approaching the number of fully competent speakers, and furthermore begins to prevail. Second, the ethnic population figures differ greatly from the number of speakers. Third, a growing number of speakers remain beyond the reach of researchers, who do their fieldwork within the traditional habitat of an ethnic group, because of progressive emigration (elderly people move to their relatives, younger people move to bigger cities or, in case of Ingria, to Estonia and Finland). Fourth, one cannot rely on speakers' evaluation of their neighbors' language competence, as they do not communicate in their native language regularly. One can often hear estimates like "She was born in our village, so she should speak the language" (in fact, the person has forgotten almost everything), or "She speaks our language, I talk to her" (in fact, the person is able to understand and respond in simple phrases). On the other hand, there are people who live in the outskirts and do not communicate with other inhabitants of their village, but nonetheless remember the language well. We also faced situations when a person actively spoke his or her language as long as (s)he communicated with a neighbor or a relative in it, but stopped speaking it after the death of the communication partner. Consequently, in three to five years a competent speaker turned into a semi-speaker.[8] The opposite situation is also possible: working as a language consultants people can revive their knowledge of a language which they have not used for a long time.

[7] There are 16 Lutheran churches in Ingria and home divine services in Konnu (Konnovo), Viipiä (Vyb'je), Sääskelä (S'as'kelevo), Hynnisen Siiverska (Novosiverskaja).
[8] The same phenomenon was described e.g. in Ariste (1957) (the period between Ariste's visits was 14 years) and also mentioned in Heinsoo (1991: 450).

1.3.1. Votic

1.3.1.1. Votic: language attitudes

Until very recently, Votic has had the lowest status among Finnic languages in Ingria. "If a Russian comes — everyone starts speaking Russian, if an Ingrian comes — everyone starts speaking Ingrian, if a Vote comes — everyone goes silent" (Vote, male, born 1921). Even before the total shift to the Russian, Votes from the Vaipooli region used to shift to Ingrian, while Votes from the Kattila region shifted to Finnish (see below).

Contemporary Votes from the Vaipooli region have preserved the name *vad'd'a* (Votic) and *vad'd'alaizõd* (Votes) in their native language, but in Russian they often call themselves *ižory* (Ingrians) and their language *ižorskij* (Ingrian).[9] We have even met native Votes, who claimed that "we have heard about the *vad'd'a*, but we have never met them". Votes were always registered as Russians in their Soviet passports.

Only in the last couple of decades Votic identity has risen noticeably, mostly due to permanent interest and attention from linguists[10] and the work of local activists. T. E. Efimova made two attempts to establish a Votic museum, and since 2000 she used to organise annual Votic festivities on the anniversary of the founding of the village of Luutsa (*Lužickaja skladčina*).[11] A similar festival took place in the 1980s and 1990s in the Kukkusi village. The Luutsa festival has become especially popular among the local people and has had a positive effect on Votic national and linguistic identity. The local school founded the children's folk band *Linnud* which sings in Votic. There are also professional bands and singers performing in Votic (e.g. a band *Bestiarium* in St. Petersburg or a composer Veljo Tormis in Estonia).

Due to this recent identity rise, Votic has become more popular than Ingrian in the *Vaipooli* region. Some of the mixed speakers even started to shift back from Ingrian into Votic. A Joenperä Ingrian semi-speaker (female, b. 1934) said about her bilingual neighbor: "Before she *läkäz* ('spoke Ingrian') more, but now she *pajatõb* ('speaks Votic') more and more".

Our observations showed that Votes nowadays do not have any extreme opinions about their language. They neither consider it unique or special, nor treat it as bad or useless, or wrong.

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[9] The ethnic Votes from the Kattila region who we interviewed used the name *čud'* in speaking about their ancestors (as opposed to *čuhna* when speaking about the local Ingrian Finns).

[10] Heinike Heinsoo mentions that due to the systematic work that Estonian linguists have carried out with Votes since 1947 and efforts to raise the prestige of Votic language and identity, some of her consulatants have started to call themselves Votes in Russian (Heinsoo 1991: 450, 1995: 177).

[11] Both times it burned down. Recently, the third museum has been built by the authorities. Efimova, in turn, left the village altogether several years ago, but *Lužickaja sklad˘cina* is still organised every year.

1.3.1.2. Votic: mobility and language contacts

The last Votic speakers we have worked with lived mostly in their native places. Therefore, their geographical distribution more or less corresponded to the historical dialectal structure.

Most Votes had communicated with Finns (mostly in their childhood when they were deported to Finland, see below), and with Estonians. However, the influence of those languages on the language of Votes was tiny. Estonian influence was presumably stronger in the Kattila region (Ariste 1998). Communication with Ingrians (in Vaipooli) and Ingrian Finns (in the Kattila region) was remarkably more intensive. Votes from the Vaipooli region attended schools in Ingrian in the 1930s (see below).[12] However, Votic speakers used to switch to Ingrian or Finnish completely rather than to adjust their Votic to it. Therefore, the last Votic speakers came only from purely Votic families, who consistently spoke their language among each other and to their children, and the influence of Ingrian on the structure of their language was quite small.[13] For the same reasons, there were very few systematic changes in Votic that were caused by the Russian influence.

1.3.2. Ingrian

1.3.2.1. Ingrian: language attitudes

Among Ingrians, attitudes towards their language were rather diverse. Approximately half of the Soikkola speakers who answered the question "Would you like your children to speak Ingrian?" were positive about it and regretted that they had not taught Ingrian to their children. The other half had the opposite opinion, which varied from a very negative attitude (some claimed that Ingrian was really a burden) to indifference ("Nobody needs this language, what's the point of learning it?"). As the main reason for a negative attitude, speakers usually mentioned the bad treatment which Ingrians received after the war.

Ideas about revitalising the language often met distrust and rejection. Many people said, "We have preserved our language in spite of all the difficulties, so why should we teach those who did not want it before?" As in the case of many other minority languages, the most enthusiastic people who wanted to revive Ingrian were usually those who did not know the language but wanted "to go back to their roots", or even those who were not Ingrians at all.[14] Fluent speakers often felt rather skeptical about such "hobbyists", saying "If she had wanted,

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[12] Ethnic Votes in the Kattila region attended schools in Russian.

[13] At the same time there still existed mixed Votic/Ingrian and Votic/Finnish idiolects, as well as Votic/Ingrian code-switching (for more details, see Ariste 1981; M. Turunen 1997; Heinsoo 1991; Muslimov 2003, 2005). The result of historical contacts with Ingrian in the Kukkusi dialect was mentioned above.

[14] For example, librarians living in the villages of Mättähä (Gorki) and Suuri Narvusi, history teachers in Loka (Logi) and Suuri Narvusi, and the former head of the Ingrian museum in Viistina.

she would have learnt the language long ago. Why is she so keen on it now?". The attitude of Ingrians towards the Ingrian Community (*Ižorskaja obš'ina*)[15] organisation founded in 2005 provides a good illustration in this respect. Among the members of the Ingrian Community there were people of different nationalities, but the number of fluent Ingrian speakers was very small. Many speakers of Ingrian did not wish to join this community, and one reason given was that "there are almost no real Ingrians there".[16]

There are no cultural events connected directly to the Ingrian language. Local children's (*Rybačka*) and professional (*Šoikulan Laulut*) folk bands perform some songs in Ingrian during the annual Fisher's Day and Lähe celebrations. In the village of Viistina (Vistino), there is also an Ingrian museum.

Among the 39 Ingrian speakers who answered the question about their mother tongue, 23 people claimed Ingrian, six claimed Russian, and ten claimed both languages. All the speakers interviewed were registered as Russians in their former Soviet passports.

1.3.2.2. Ingrian: mobility and language contacts

The Soikkola and Lower Luga areas did not greatly differ in this respect — the majority of people were living in their native villages or neighboring ones. The main motivations for moving to a neighboring or a distant village within the same dialectal area were marriage (for women) or the destruction of a native village. Migrations between the Soikkola and the Lower Luga areas used to be very marginal. At the same time, a certain amount of Soikkola Ingrians who were not allowed to return home after the post-war deportations remained in the Kattila parish. Therefore, the percentage of Soikkola Ingrians who moved to other dialectal areas in Ingria was considerably higher than that of Lower Luga Ingrians. Lower Luga Ingrians from the Vaipooli region had multiple contacts with Votes. However, as the Votic identity used to be very weak, sometimes Ingrians cannot confirm these contacts — they do not know or understand the name *vad'd'a* ("I have heard this name, but I do not know who they are"). There were quite a few examples when one of the parents of an Ingrian speaker was a Vote ("My mother was from Joenperä and spoke with the sound *č*"[17]), but the speaker claimed that (s)he was a pure Ingrian.

[15] The Community deals with social rather than with language issues, and the revitalisation of the Ingrian language remains beyond its main goals.
[16] Among 28 Soikkola Ingrians interviewed, only ten persons were members of the Ingrian Community in 2006. Lower Luga Ingrians have not even heard about the Ingrian Community at all.
[17] The shift **k>č* before the front vowels is one of the most prominent features of Votic, as compared to Ingrian (apart from the Kreevin and the Kukkusi dialects where it did not take place).

Most Ingrian speakers had contacts with the Finnish language at the time of the deportation to Finland during World War II. Some of them learned Finnish there, and the majority of Ingrian school-age children attended school in Finland. Many people also communicated with Finns after the war. However, a noticeable influence of Finnish on Ingrian is only observed in the mixed Ingrian/Finnish villages of the Lower Luga area.

The majority of Ingrians had had contacts with the Estonian language. Banned from returning to their villages after the war, many Ingrians (especially from the Lower Luga area) moved temporarily or permanently to Estonia, and an Estonian influence could be observed in the language of some speakers. The villages along the Rosona (Rosson') river [including Vanakylä (Vanak'ul'a), Kallivere, Väikylä (Venek'ul'a), and Saarkylä (Sark'ul'a)] were part of Estonia in 1920–1940. Ingrians who lived there as children attended schools in Estonian or/and in Russian and were often fluent in Estonian.

Ingrians from the Soikkola peninsula and the Lower Luga area who attended primary school in Ingrian in the 1930s could read and sometimes even write in Ingrian. People who studied a foreign language at school (in most cases this was German) were able at least to read Ingrian texts written in the Roman alphabet.

1.3.3. Ingrian Finnish

1.3.3.1. Ingrian Finnish: language attitudes

A clearly positive attitude towards Ingrian Finnish was typical for speakers — Ingrian Finns differed from Ingrians and Votes in this respect. They often called Finnish the best and the most beautiful language (though they might have meant both the dialect and Standard Finnish). Being prestigious for Ingrian Finns, Standard Finnish also raised the prestige of their own dialects. Unlike Ingrians or Votes, Ingrian Finns usually identified themselves as Finns rather than Russians in recent censuses and were often registered as Finns in their Soviet passports. Three main types of language attitudes were typical of Ingrian Finns.

1. The first variant was mainly spread in the northern parts of Ingria — on the Kurkola peninsula, in Tyrö, Soikkola, Valkeasaari, Lahti parishes, where a strong influence from Standard Finnish was observed. Ingrian Finns were generally loyal to their dialect, but Standard Finnish was often more prestigious. Sometimes speakers called the local dialect an "impure language" and tried to speak as closely to the standard variant as possible (cf. also Teinonen & Virtanen 1999: 43).

2. The second variant was more widespread in southern parts of Ingria, where Standard Finnish is not so well-known, particularly in the vicinity of Hatsina. Usually Ingrian Finns were more loyal to their dialect than to Standard Finnish.

3. The third variant was typical for areas where Finnish was mixed with Ingrian or Votic, namely in the southern Lower Luga area along the Rosona river and in the Kattila parish. The speakers were quite loyal to their local varieties, but their Finnish identity was not so distinct here. For example, Finns in the Rosona region called their own language not only *ingermanlandskij*[18] (‘of Ingria’) in Russian, but also *ižorskij* (‘Ingrian’).

Juhannus (Midsummer Day) has been celebrated annually starting from 1989[19] in various Finnish villages of Ingria and plays a significant role in modern Ingrian Finnish culture. There are also smaller festivities like *Laskiainen* (Mardi Gras) in Toksova (Toksovo) village or the commemoration of victims of Stalin’s terror at the cemetery between the villages of Hakaja (Gakkovo) and Kirjamo (Kirjamo; second-to-last Saturday of July). There are many amateur and professional folk bands performing in Ingrian Finnish, such as *Pietarin Kuoro, Korpi, Talomerkit,* and *Röntyskä*.

1.3.3.2. Ingrian Finnish: mobility and language contacts

Only the general trends for the population mobility are given here. Three main types of areas could be distinguished:

1. Areas with a low level of migration, both in and out (zero to five speakers relocated): the Narvusi, Keltto, Kattila, Novasolkka, Moloskovitsa, Valkeasaari, Lahti, Kaprio, Järvisaari, and Tyrö parishes.

2. Areas with frequent migration between neighboring parishes: Hatsina vicinity — Hietamäki region and the Toksova — Lempaala — Vuole — Haapakangas region.

3. Areas with frequent emigration to relatively distant areas: the Inkere, Liissilä, Markkova parishes (villages were totally or partially destroyed during thewar) and the Miikkulainen parish [no speakers from this parish were found on the territory of Ingria at all; the closest informant was discovered in Kiviniemi (Losevo)].

Besides, in some parishes there were nursing homes organised by the Finnish government specifically for elderly Ingrian Finns, where speakers from different areas could be found.

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[18] This appellation for their language is typical for Ingrian Finns.

[19] Juhannus had been also celebrated before the revolution, but this tradition was stopped in 1928 (Musajev 2004: 358).

In general, “many Ingrian Finns who have returned to Ingria from deportations and prison camps have settled down to live as close to their original home as possible” (Teinonen & Virtanen 1999: 44). Therefore, just as in case of Votic and Ingrian, in spite of all the historical turmoil of the 20th century, the old dialectal structure of Ingrian Finnish is still roughly preserved in the villages of Ingria. The most blurred picture is found on the border with Finland in Northern Ingria (forced deportations were the most intensive and long-lasting in that area) and in the south-eastern part of Ingria (where many villages were destroyed).

The influence of Standard Finnish on the Ingrian Finnish dialects had significantly increased probably already by the end of the 19th century, and before 1937 the majority of Ingrian Finnish children received a school education in Standard Finnish and had access to Finnish cultural life (see below). As a result, “the oldest generation of Ingrian Finns includes many speakers whose normal everyday way of speaking is quite close to Standard Finnish” (Teinonen & Virtanen 1999: 41-42). Such speakers are especially widespread in Northern Ingria. Since 1937, the “contacts between Ingrian Finnish and Standard Finnish were terminated almost completely for decades. Therefore, the speech of the Finnish speakers born in the 1930s and the 1940s may at times show more signs of dialectal variation than that of the oldest generation” (Teinonen & Virtanen 1999: 43; cf. also Lehto 1996: 129, 182). In this sense, ironically, the politics of the Soviet Union was not only destructive for the Ingrian Finnish dialects, but also prolonged their life for several decades by isolating them from the influence of Standard Finnish.

During the deportation to Finland (see below), Ingrian Finns again came in contact with Standard Finnish, and their children attended Finnish schools there. Since the 1990s, Standard Finnish in spoken and written forms has made its way back to Ingria, and nowadays it again affects many Ingrian Finnish idiolects, especially of speakers born in the 1950s and 1960s (see also Teinonen & Virtanen 1999: 43-44).

Modern Ingrian Finns from the Lower Luga area had intensive contacts with Standard Estonian, especially in the villages of the Rosona river basin that belonged to Estonia in 1920–1940. However, unlike local Ingrians, Ingrian Finnish children were educated in Standard Finnish. There were intensive migrations of Ingrian Finns to Estonia after the war.

Nowadays, the strongest influence of Standard Finnish and Estonian is reflected in the native dialects of those Ingrian Finns who spend considerable time in the respective countries during the winter or have moved there permanently (see e.g. Lehto 1996: 180; Teinonen & Virtanen 1999: 33-34).

Many Ingrian Finns had contacts with Karelians after the war (see below), but we do not know cases when Karelian would have influenced Ingrian Finnish.

Contemporary Ingrian Finnish speakers from the Kattila and Novasolkka parishes experienced direct contacts with the Votic language. By now Votic has completely disappeared from that region, but mixed Finnish/Votic idiolects can still be found there as a result of mixed marriages (Muslimov 2003), and local Finns can usually indicate where *čud'* (Votes) had lived. On the western bank of the Luga river in the southern part of the Lower Luga area, contacts with Ingrian were particularly strong. Mixed marriages among Ingrians and Finns were widespread there already in the 1920s and 1930s, and nowadays mixed Finnish/Ingrian idiolects form a continuum in the Rosona river basin, in the villages of Vanakylä, Vyötermaa (F'odorovka), Suuri Narvusi, and the adjacent ones.

1.4. Historical background of the present language situation in Ingria

The situation has changed radically since the middle of the 19th century, when the discussed languages were still vital enough. In this section, the historical background of the present situation will be considered in several successive historical periods.

The time period up to the 1920s can be called non-forced Russification. When Ingria became a Russian territory again (in 1708), an influx of Russian speakers began. This was partly encouraged by the state, although the state policy was not very consistent[20]. The influence of Russian on local languages constantly increased during this time.

However, the three ethnic groups had different destinies. The Russification of the Votic and Ingrian people was facilitated by the fact that both groups were Orthodox and could easily marry Russians. The Finnish population, however, were Lutherans; they greatly outnumbered the Votic and Ingrian populations and had strong support from Finland in all cultural and religious spheres. Under the influence of Finland and Estonia, an Ingrian national movement for independence emerged at the end of the 19th century (see Nevalainen 1996 for details). However, the support it gained from Finland, Estonia and the Russian White Guard was not strong and consistent enough, and there was virtually no possibility that Russia would abandon St. Petersburg, placed in the middle of Ingria. The movement, therefore, made no tangible achievements.[21]

[20]Musajev (2004: 23-24, 55-56) notes that Peter the Great actively encouraged the Russian population to settle in Ingria. Also, at the turn of the 19th century, the Russian government aimed at the Russification of national minorities, especially through the medium of education.

[21] In 1919–1920, however, there existed an Ingrian “mini-state” on the territory around Kirjasalo in Northern Ingria (Musajev 2004: 172).

In general, the Civil War in Russia (1918–1922) led to a decrease in the Finnish population in Ingria, as some of the population emigrated and some were killed in the war. At the same time, new migrants were coming to Ingria from Finland, so the Finnish population suffered no significant decrease in the first quarter of the 20th century and even slightly increased.

Obviously, the Votic and Ingrian populations could not increase by migration. Since the middle of the 19th century, the Votic population was constantly decreasing, while the Ingrian population remained more or less stable until the 1930s. As already mentioned, Votic ethnic identity was not strong enough. The shift to the Russian language and a Russian identity went faster with Votes than with other ethnic groups.

As the Votic linguist Dimitri Tsvetkov wrote in 1922:

> Already now most people have lost their mother tongue and switched to a powerful and beautiful Russian language, so for the young generation *vad'd'õlaisijõ tšeeli* is almost like Chinese. The language is on a fast and steady way to extinction" (Dmitri Tsvetkov 2008: 4 [1922]).

In 1927, the ethnographer and anthropologist Dmitrij Zolotarëv published similar observations about Votes:

> It was quite difficult to find any data on Votes, who had lost not only their peculiar characteristics, but even the name of the ethnic group. Sporadically the name *vadja* is still preserved (Zolotarëv 1927).

In addition to Russification, the Votic population in the Lower Luga area has been gradually shifting their language and identity to Ingrian since at least the beginning of the 20th century (Kettunen 1915: 4; Dimitri Tsvetkov 1925: 43; Heinsoo 1995: 176-77; M. Turunen 1997). Votes had the same religion as Ingrians and did not have any significant cultural differences from them. In the same article Zolotarev noted: "The difference between Votic and Ingrian people is preserved only in their language" (Zolotarëv 1927; cf. also Heinsoo 1991: 449, 1995: 177). Tsvetkov pointed out in 1925 that after the revolution Votes were putting "Ingrian" as the answer to the question about their ethnicity in Soviet questionnaires and "Russian" to the question about their nationality (Dimitri Tsvetkov 1925: 43-44). Probably due to this identity shift, Votic was not included in the population censuses from 1926 until 2002. It did not become a written language and was not taught at schools.

Some informants claim that Votic was more difficult for Ingrians than vice versa: "Soikkola people cannot twist their tongue this way. We can speak like them but they cannot [speak like us]" (Vote, male, born 1921). The same idea was expressed, for example, in Agranat and Šošitajšvili (1997: 64), but criticised by Muslimov (2005: 357-58). In this case it would remain unclear why Ingrians were able to learn Estonian and Finnish (as sometimes happened), but they could not learn Votic. Besides, a similar disparity in the learning of the neighboring language was attested in the area of Votic and Finnish contacts in Kattila parish.[22] As a Finnish woman from Korovaisi (Karavaevo) village (born 1911) noted: "*čuhnat* spoke less to *čud'* [in Votic], it's rather *čud'* who were more capable of speaking a non-native language [Finnish]". Therefore, the language prestige still seems to be a more important reason for such disparities than purely linguistic grounds.

Marriages between Votes and Ingrians were quite typical. A Votic husband spoke Ingrian with his Ingrian wife, and gradually the elder generation of the family started speaking Ingrian as well (Dimitri Tsvetkov 1925: 43). We know several people who had one Votic and one either Ingrian or Finnish parent, and almost all of them spoke Ingrian or Finnish. As a result, for example, the village of Rajo in the Lower Luga area, which was originally Votic, became completely Ingrian in the last generation of speakers. In the vicinity of Kattila, only Finnish-speaking people were found in the former Votic villages.

The underlying reasons for the assimilation of Votes are still not clear. It was probably facilitated by the fact that already in the middle of the 19th century, the Ingrians outnumbered Votes by three times, and Ingrian Finns by more than ten times. Unlike Ingrians and Finns, Votes did not inhabit naturally isolated pieces of land (like the Soikkola or Kurkola peninsulas). By the beginning of the 20th century, all Votic settlements were in contact with surrounding Ingrians, Finns, or Estonians (Lensu 1930: 201-2; Heinsoo 1995: 177).

The period of the 1920s and 1930s was controversial for the Finnic people in Ingria, as it was for all minorities in the Soviet Union. In the general framework of the *korenisacija* policy, a cultural autonomy was granted to the ethnic groups of Ingria according to the Tartu peace treaty in 1920 (Musajev 2004: 161-62). Schools teaching in Standard Finnish quickly spread in Ingria from the beginning of the 20th century, and after 1920 many new schools were opened,[23] so the majority of Ingrian Finnish children were getting education in Finnish[24]. Besides, there were possibilities to get a higher education, to read newspapers and books, to listen to the radio, and to attend church services in Finnish (Musajev 2004: 183-97).

Ingrian and Votic people were in a less favorable position. The Orthodox religion was persecuted already in the 1920s, and many churches were destroyed. Ingrians and Votes had the same cultural and educational rights as Finns, but they had no written standard languages, so no school teaching could be started immediately in 1920. At first, it was decided that

[22] In Ariste (1960: 206) , a shift from Votic not only to Ingrian, but also to Finnish is also mentioned.

[23] For the 1927/1928 school year, Musajev (2004: 182) indicates 261 Finnish and 75 Estonian primary and secondary schools in the Leningrad region.

[24] According to our data, Ingrian Finns attending school at that time studied from one to seven years in Finnish.

Finnish would be taught in Ingrian schools,[25] but later a group under the leadership of V. I. Junus initiated the development of standard Ingrian and published several textbooks (Selickaja 1965: 302). A number of schools in Western Ingria (attended both by Ingrians and Votes) taught Ingrian in 1930s,[26] and Ingrian language teachers were trained at the Estonian-Finnish-Ingrian pedagogical college (V. I. Mirenkov 2000). Teaching Ingrian at school further increased the social status of Ingrian, as compared to Votic.

Ingria experienced all of the Soviet repressions of the 1930s. The first wave came with collectivisation. Although formally there were very few *kulaks* in the Leningrad region, [27] there was a massive *dekulakisation*, especially in the villages of the Ingrian Finns: 8,604 *kulak* families were deported in 1930–1931 from the Leningrad region, and many of them were part of the native Finnic population (Musajev 2004: 220).

A new wave of repressions began in 1932 with mop-up operations in the border areas with Finland and Estonia. The repressions applied first of all to the Finnish population in Northern Ingria, but also to the Estonian and Ingrian population in the Lower Luga area (Patanen 1997). Altogether about 20,000 people were deported in 1932. In 1935–1936, 26,000–27,000 Ingrian Finns and about 20,000 Estonians were deported to Central Asia and Siberia, and also to the Vologda, Tikhvin, Arkhangel'sk regions (Musajev 2004: 256-60) and the Hatsina district of the Leningrad region.

The wave of repression of 1937–1938 eliminated whatever remained of cultural autonomy. Ethnic educational institutions and periodicals, as well as Lutheran churches were closed. Pastors and national elites were subjected to repressions. The repressions caused a decrease in the Finnic population and destroyed the language environment. However, the most crucial changes began with World War II.

When the war started, the Soviet government decided to deport the Finnic and German populations (potentially disloyal, in their eyes) away from Ingria. However, Western, Central, and Eastern Ingria were quickly occupied by the Germans, and Leningrad came under siege. The government managed to deport about 50,000 Ingrian Finns from the non-occupied Northern Ingria, Leningrad, and the so-called "Oranienbaum bridgehead" (parts of Kaprio and Tyrö parishes) to Siberia, the Urals, the European North of Russia and Central Asia, see

[25] As said, Votic people were treated by the Russians as a part of the Ingrian population.

[26] The majority of Soikkola and Lower Luga Ingrians who attended primary school in the period between 1931 and 1937 studied in Ingrian from several months up to four years. For the 1935 school year, Musajev (2004: 248) indicates 18 primary and five secondary Ingrian schools in the Leningrad region. Soikkola Ingrians in the Sista river region, as well as Hevaha Ingrians were educated in Russian, as young people in those regions no longer spoke the language (Selickaja 1965: 302).

[27] Musajev (2004: 221) indicates no more than one to two percent *kulak* farms for the mid 1920s.

the illustration in Nevalainen and Sihvo (1991: 311). People were given 24 hours for packing up their possessions, the transportation and the conditions in the new living places were very poor, and many died on the way, though at the same time some lives were saved from the besieged Leningrad (see Musajev 2004: 285-91 for more details).

People who remained on the occupied territory had hard times as well. Finland suffered a great lack of manpower after the mobilisation, and the Finnish government made an agreement with Germany to deport the Finnic population from Ingria to Finland. These Finnic people were supposed to assimilate in Finland more easily than Russians and were less likely to become a "fifth column".[28] The German government originally planned to colonise this territory with German settlers and wanted the pre-existing civilian population off Ingria. Later the situation on the Eastern front grew worse, and Germany no longer favored deportation. The local population was needed to provide supplies for the German army, and a deportation could disturb military operations.[29] Paavo Nevalainen, who has thoroughly studied the deportation of the inhabitants of Ingria to Finland, notes that "both parties [Finland and Germany] treated the affair in the negotiations on the governmental level bluntly as a question of a working force. In public — when the affair was discussed at all — Finland was naturally reported as acting only on humanitarian grounds, saving Ingrian inhabitants from the maelstrom of war and bringing them to their old motherland" (Nevalainen & Sihvo 1991: 271; see also Nevalainen 1990).

Nevertheless, in 1943, most Finns, Ingrians and Votes were deported to Finland via the Estonian Klooga concentration camp and Paldiski port, while Estonians were sent to Estonia. Kattila Votes and Hevaha Ingrians, who had by that time strongly assimilated to Russians, were obviously no longer considered Finnic-speaking and were not subject to the terms of the agreement between Finland and Germany. Ethnic Votes and Ingrians from those areas, as well as local Russians, stated in interviews that they were sent to Latvia (they mentioned at least Sece, Jaunjelgava, Koknese, Jēkabpils regions) or Lithuania. Some people were not subject

[28] A protocol signed in Revel (Tallinn) on November 4, 1943 (Schlussprotokoll über die Beendigung der Umsiedlung der Ingermanländer aus dem Generalbezirk Estland und dem Bereich der Heeresgruppe Nord) stated: "A special unit of the Finnish State Police has checked the political loyalty of people from Ingria". The original records of the relocation to Finland were made accessible to Fedor Rožanskij by National Archives of Finland, Helsinki and Auswärtiges Amt Politisches Archiv, Berlin.

[29] A secret letter from the supreme command of the northern group of troops, June 14, 1943 (made accessible to Fedor Rožanskij), states: "Still I ask to refrain from extending the resettlement of people from Ingria by another 10,000, or even a total resettlement, which was discussed by the Finnish Resettlement Commission with the General Commissioner in Tallinn, if there is no urgent foreign policy need to make concessions to the Finnish government" (signed by von Küchler).

to deportation, as there was a need to service local roads. Besides, before, after or instead of these deportations some people from Ingria were sent to work in Germany.[30]

Officially, the relocation was voluntary: "The relocation of the people of Ingria is conducted on the basis of voluntary reports of those wiling to relocate".[31] Nonetheless, any researcher working with the Ingrian population would nearly always[32] hear that "we were given 24 hours" to pack (cf. also Teinonen & Virtanen 1999: 38, 51). The inhabitants of some villages went into the forest to hide and managed to escape deportation.[33] Recollections of the Klooga camp are generally very negative. Memories of the stay in Finland vary: in the worst case, the relocated were treated like slaves; in the best case, good relations between Finnish hosts and their workers lasted for many years (Teinonen & Virtanen 1999: 52; Musajev 2004: 306-9).

In 1944, most inhabitants of Ingria were returned to the Soviet Union, apart from about 8,000 of those who decided to stay in Finland or moved to Sweden (Nevalainen & Sihvo 1991: 289-92; Musajev 2004: 315-18). However, these people were not allowed to return to their native villages and instead were deported to Central Russia (Kalininskaya, Jaroslavskaya, Pskovskaya, Novgorodskaya, Velikolukskaya regions). Similar to Ingrian Finns deported from the nonoccupied parts, they were distributed among the local population speaking other languages and did not have compact areas of settlement. After the war, both deported groups (from the occupied and the non-occupied territories) tried to return home, but generally only the families of those who took part in military actions got official permits to stay. Others were sent away again in 1946–1947. At the same time, their original houses were sold to Russian, Belorussian, and Ukrainian newcomers, who were in many cases relocated here by the government[34] (Krjukov 1987: 129).

As a result, Finnic people arriving home at that time usually found themselves a marginalised minority on illegal grounds, stigmatised as "enemies of the people", and met in a hostile way by the Russian-speaking majority. "People were saying, here dwell Ingrians, a mean nation" (Ingrian, male, born 1937). The inhabitants of Ingria had to conceal their nationality: "We had to become Russians, otherwise we could not return home" (Ingrian, female, born

[30] In 1943, there were about 3000 people from Ingria in Germany (Musajev 2004: 301).

[31] Agreement on Relocation of population from Ingria to Finland, which is annexed to the letter addressed to the supreme command of the northern group of troops, June 6, 1943 (made accessible to Fedor Rožanskij).

[32] Though the cases were also attested, when Finns from the villages at the front line were indeed asked and agreed to relocate, as active military actions were going on in their villages, all the houses were burnt, and the living conditions were very poor. Speakers also indicated that relocation was also voluntary in those Rosona river Ingrian and Finnish villages that belonged to Estonia in 1920–1940.

[33] Among Ingrians, for example, the inhabitants of Kukkusi, Kotko (Orly), Vanakylä, Haavikko (Kejkino) in the Lower Luga area, and also individual Soikkola families.

[34] For example, the government moved more than 8,000 Russians from the Vladimirskaja, R'azanskaja, Kalininskaja, Gor'kovskaja and Jaroslavskaja regions to Ingria in 1948–1949 (Musajev 2004: 332-33).

1931). Russian newcomers treated Finnic people as intruders rather than natives in Ingria: "My son asked a teacher: 'Is it true that people live better in America?' The teacher answered that his parents should be sent back to where they came from" (Ingrian, female, born 1920).

Attempts to speak native languages were often suppressed by Russians, who called Finnic people by derogatory names like *talapany*. "An old woman who could speak only Ingrian asked me to buy some bread for her, and I answered her in Ingrian. A neighbor heard us and said: 'Here come the *talapany*!'" (Ingrian, female, born 1928). Speaking Finnic languages was also persecuted by the police (cf. Teinonen & Virtanen 1999: 101). As a result, the overall majority of parents spoke only Russian to their children even if they spoke Ingrian to each other. Children were prohibited to speak their native language also at school: "Ingrian was not allowed at school, teachers got angry. When my younger son was going to school, the teachers told me that he must be taught in Russian, not in Ingrian" (Ingrian, female, born 1920).

Many Finnic people, again barred from their homes, went either to Estonia or Karelia. Our field research showed that people from Western Ingria went to Estonia and very rarely to Karelia. From Central and Eastern Ingria, they went either to Estonia or to Karelia, or to Estonia and (usually later) to Karelia. From Northern Ingria, they went almost without exception to Karelia (cf. also Teinonen & Virtanen 1999: 163). In Karelia, a program was initiated in 1949 by G. N. Kuprijanov to increase the percentage of the "ethnic" population there by hiring people from Ingria (mainly for forest works). About 20,000 people managed to arrive before 1950, when the program was stopped and Kuprijanov was arrested (Musajev 2004: 335-39).

Only after the death of Stalin, since 1954, the inhabitants of Ingria had a legal possibility to return home. Tolerance from the Russian-speaking majority towards them also rose. At the same time, the situation still did not favor the preservation of the Finnic languages and ethnic identity. The people of Ingria were scattered over different parts of Russia and other countries (primarily Finland, Estonia, and Sweden). It was not easy to come back home when many villages had been destroyed and houses occupied by other people. The percentage of the urban population among the Finnic ethnic groups of Ingria rose drastically (the census of 1959 indicates that over 50 % of the Finns of the USSR lived in urban areas). Even those who returned to Ingria were now scattered within the Russian majority and tried not to demonstrate any differences from them. Mixed marriages with Orthodox Russian-speaking people became a norm even among Ingrian Finns, who remained Lutherans. The generation born between the 1910s and the 1930s, exiled and marginalised, completely stopped passing their languages and identities on to their children, who now "construct their identity on completely different grounds" (Teinonen & Virtanen 1999: 120).

At the end of the 1980s, the existence of a Finnic population in Ingria again rose in prominence. However, by that time a language and identity shift had already happened in the middle and younger generations. The state also gave no active support to minor ethnic groups. At present, the traditional habitat and occupations of the Ingrians, Votes, and Finns of Western Ingria are also threatened by the construction of a huge cargo port in Ust'-Luga.

1.5. Language maintenance

From the 1930s up to the end of the Soviet era, there were no attempts to maintain the minority languages of Ingria. At the beginning of the 1990s, minor ethnic groups and the idea of language maintenance gained some attention. However, this maintenance activity has been mostly aimed at ethnographic aspects (museums, handicraft, folklore bands) rather than at supporting the language. Language maintenance efforts include courses taught either at local schools and cultural centers or in St. Petersburg by linguists and/or local activists, the development of manuals and other teaching materials, text publications in local newspapers, speeches in local languages during local festivities. The situation of Ingrian Finnish differs from that of Votic and Ingrian, because it has never been actively supported. On the contrary, as said, the learning of Standard Finnish to Ingrian Finns has always been promoted.

1.6. Summary and conclusions

Like many other minority languages, Ingrian, Votic, and Ingrian Finnish did not have many chances to survive under the pressure of the social and industrial changes that started in the end of the 19th century. The global industrial revolution, which started in Russia in the 1870s and 1880s, put an end to traditional, closed-off rural societies. Such societies were the main prerequisites for safe preservation of the minority languages. When they came to an end, only those languages which could adapt to a new societal structure (depict new realities, quickly spread through education and mass media and thus give access to various political and economic resources), had a chance to be learned by younger generations and survive. Younger generations in turn were becoming less dependent on collective values, more individualistic and free in their life choices. The postindustrial information society that emerged after World War II, with its rapid processes of globalisation, posed even greater challenges for minority languages and further sped up their extinction (cf. Zam'atin, Pasanen & Saarikivi 2012).

All other negative factors that were exerting pressure on minority languages (in the case of Ingria, these included forced migrations, political repressions, marginalising and stigmatising of the minorities, deliberate dissolving of language communities, lack or deprivation of a standard language and education in it) just intensified and accelerated existing processes of extinction. However, these factors cannot be considered the main underlying force of the vanishing of the languages of Ingria, as well as of many other minority languages. There is a high degree of variation among particular sociolinguistic situations for minorities around the world, but mass language shifts were happening in the 20th century all over the globe approximately at the same time. Still, intensive state repressions executed on the minorities and their languages in the Soviet Union (and the Finnic population of Ingria among them) drove many of these languages to "radical death". Otherwise these languages would have rather experienced "gradual death", in the terminology of Campbell and Muntzel (1989). The term "linguicide" (Orlin 2015) can thus be fully applied to state policies towards minority languages in the Soviet Union.

Obviously, any particular case of language shift also has features specific to it. For the Finnic languages of Ingria, the main characteristics are summed up below.

1.6.1. Ingria as a whole

Factors:

1. The rise of a nationalist movement and a short period of mainly symbolic independence, supported by Finland and Estonia.
2. A tight network of contacts in Ingria between speakers of closely related languages.
3. Especially strong and long-lasting repressions compared to the "average" situations of Soviet minorities (Musajev 2004: 363), as the Finnic peoples of Ingria were seen as directly connected to hostile foreign states, and many people resided in the border areas.
4. Forced deportation during World War II and a policy that turned these communities into a newly returned minority that was met on their own ethnic territory in a hostile way by the Russian-speaking majority, recently formed in the area.

The first factor played its role in the beginning of the 20th century but is irrelevant for the identity of contemporary language speakers. All other factors are relevant for the last generation of speakers. The second factor triggered a high level of variation in both Finnic languages and Finnic identities in Ingria, blurring and merging their borders. Two last factors caused strong negative emotions towards Finnic languages and identities among many speakers.

1.6.2. Votic

Factors:

1. The language had a lower status than all other Finnic languages of Ingria.

2. There has been a rising interest towards Votic among scholars and the general public since the middle of the 20th century.

Due to the first factor, a language and identity shift into Ingrian and partly Finnish was going on in the Votic community since at least the beginning of the 20th century. As a result, the number of Votic speakers fell several times faster than speakers of other Finnic languages of Ingria. Probably for this reason, Votic never got a written variety. The second factor stipulated a positive attitude among the contemporary Votic speakers towards their native language. Votic even became more prestigious than Ingrian in the Lower Luga area. It is also remarkable that a full six grammatical descriptions of Votic have been published (Ahlqvist 1856; Dmitri Tsvetkov 2008; Ariste 1948; Barbera 2012 [1995]; Agranat 2007; E. B. Markus & Rožanskij 2011). At the same time, Ingrian Finnish dialects have never been objects of systematic linguistic research, and only two grammatical descriptions of Ingrian have been published (Porkka 1885; Junus 1936).

1.6.3. Ingrian

Factors:

1. There are no strong factors that would support the prestige of the language today.
2. Compared to Votic and Ingrian Finnish, Ingrian was under the least pressure from the closely related languages.

Across the background of other minority languages in Soviet Union, Ingrian has the least specific features among the languages of Ingria. Due to the first factor, the attitude of the speakers towards Ingrian is more negative than in the case of Votic and Ingrian Finnish. At the same time, due to the second factor, Ingrians show the least unambiguous ethnic identity among the Finnic ethnic groups in Ingria. They consider themselves as a separate ethnic group speaking its own language, and are also perceived in this way from the outside. Probably for the same reason, the youngest fluent speaker (now in her 30s) in the whole area is Ingrian.

1.6.4. Ingrian Finnish

Factors:

1. Unlike Votes and Ingrians, Ingrian Finns have always been Lutherans;
2. Wherever possible, Ingrian Finns had strong support from Finland in various aspects of their lives;
3. Standard Finnish became a standard written variety for Ingrian Finnish dialects.

All these three factors resulted in that nowadays Ingrian Finnish speakers and a portion of semi- and non-speakers have a Finnish rather than Russian identity (unlike Ingrians and Votes). The second factor also played its role in that Ingrian Finns used to be more educated than Votes and Ingrians and managed to produce a national elite that was the core of the national movement. Due to the third factor, Ingrian Finnish is often seen as a variant of Standard Finnish. Standard Finnish has high prestige among the Ingrian Finnish speakers, and therefore the Ingrian Finnish dialects, cognate to it, usually evoke positive emotions in the community as well. On the other hand, a shift into Standard Finnish started among Ingrian Finns already in the beginning of the 20th century. It was then partly reverted in Soviet times when all contacts with Finland were terminated. Unlike Votic or Ingrian, there have never been any attempts to teach, maintain, and revitalise Ingrian Finnish dialects. Until very recently, there have been no serious attempts to establish the number of Ingrian Finnish dialects or to create any standard version of the "Ingrian Finnish language" (as e.g. in case of Kven in Norway). It is hard to estimate precisely, but it seems that nowadays the percentage of those speaking Ingrian Finnish among those who claim an Ingrian Finnish ethnic identity is much lower than in the case of Ingrian and Votic.

Chapter 2: Two phonological rarities in the dialects of the Ingrian language

2.1. Introduction

2.1.1. On the phonological and morphonological typology of Finnic and Saami languages

Finnic and Saami complex morphonological systems of grade alternation are well-known in linguistic typology. They have developed from mainly phonetic quantitative phenomena, but synchronically these systems of quantitative contrasts and quantity-based alternations are extremely diverse.

On one extreme of this continuum, there are systems like in Veps, where the original grade alternation was lost completely. Quantitative oppositions of vowels and consonants are marginal in Veps (long phonemes are very rare). Moreover, Veps lacks morphonological stem alternations of long and short consonants (Zaiceva 1981: 17, 35).

On the other extreme, there are systems like in Livonian. This language has one of the most complicated systems of stem alternations among Finnic languages, where quantitative oppositions, including the ternary ones, are accompanied by glottalisation contrasts (Viitso 1975). Saami languages, genetically close to Finnic, have similar or even more intricate systems. For example, ternary quantity contrasts accompanied by glottalisation and pharyngealisation oppositions constitute the base for stem alternations in North Saami dialects (Sammallahti 1998: 39-60; McRobbie-Utasi 2007: 179-80; Bals Baal, Odden & Rice 2012).

For the description of languages on this side of the continuum, a prosodic unit such as the foot is extremely relevant. Hereafter, a foot is defined as a sequence of one to three syllables, which are not only linked together into one common stress group, but are also the domain of other prosodic features. The further any Finnic or Saami variety is removed from the extreme of phonologically and morphonologically complex systems, the lesser is the relevance of the foot for its phonetics and phonology.

2.1.2. Ingrian phonology and morphonology against the background of Finnic and Saami languages

Ingrian is situated towards the side of this continuum which has more complex systems, i.e. it is closer to Livonian and Saami than to Veps. At the same time, the level of phonological and morphonological complexity varies considerably within Ingrian dialects. It is precisely the differences in the structure of phonological quantitative contrasts and morphonological quantitative alternations that are the key source for this diversity. In the Lower Luga dialect, quantitative oppositions and alternations exhibit the least complex structure. This dialect differs the most from the other three dialects of Ingrian, as it has undergone heavy contact influence from the neighboring related languages of the Lower Luga area: Votic, Ingrian Finnish and, to some extent, Estonian (Laanest 1966a: 146, 150-51; Muslimov 2005: 1, 5; see Figure 1.4 in Chapter 1). In this sense, the Lower Luga dialect could serve as a good example for a typological hypothesis regarding the direct correlation between the level of intensity and duration of contact and the level of structural simplicity in the contacting languages. The longer and more actively a language participates in areal contacts, the simpler its structure becomes (Trudgill 2001; Gil, Trudgill & Sampson 2009). The phonological system of the Lower Luga dialect is, in general, also the most innovative of all the Ingrian dialects.

The quantitative contrasts and alternations have the most complex structure in the Soikkola and the extinct Hevaha dialect. The system of the currently extinct Oredež dialect was between the Lower Luga and the Soikkola/Hevaha ones.

2.1.3. Two typological rarities in Ingrian dialects

This chapter considers general features of two typologically rare phonological phenomena in Ingrian related to the development of sound lengthening and reduction. The first is attested in the Soikkola dialect, and involves a phonological ternary quantity contrast of consonants. The second exists in Southern Lower Luga varieties (see map on Figure 1.4 in Chapter 1), and involves a phonological opposition of full modal and reduced voiceless vowels.

In 2.2 and 2.3, brief phonetic, phonological and typological profiles of these phenomena are given. In 2.4, there is an analysis of their probable further evolution, which is supported by examples from genetically related and unrelated languages. Section 2.5 is devoted to the question of stability and maintenance forces of these contrasts, and 2.6 deals with their significance in light of the general prosodic development of the Soikkola and Lower Luga dialects. More phonetic and other details on the Soikkola Ingrian ternary quantity contrast are provided in Chapter 5, and on the Lower Luga Ingrian reduced voicelss vowels in Chapter 4.

2.2. The Soikkola dialect: ternary quantity contrast

2.2.1. Ternary quantity contrast in the Soikkola dialect

The Soikkola dialect manifests a rare phenomenon called a ternary (or three-way) quantity contrast of consonants. This phenomenon is further illustrated in the intervocalic position before a lengthened/long vowel: [ˈka**n**ā][35] ‘hen’ vs. [ˈka**n̆n**à] ‘hen:PRT/ILL’ vs. [ˈli**nn**à ~ ˈli**ǹn**à]

[35] See Appendix III for the signs used in the phonetic and phonological transcription of the dissertation.

‘town:PRT/ILL’. Figures 2.1–2.3 provide examples of spectrograms for each word (pronounced by AJF, a female born in 1933 in the *Hamׅ̆maala* village). Pronunciations most easily comparable by their overall length and phrasal position were chosen.

Table 2.1 shows mean durations of segments in the foot nucleus (a sequence ranging from the start of the first vowel to the end of the second one; cf. also Chapter 5) of each structural type in AJF’s speech. For these measurements, tokens with an intervocalic sonorant (*n*, *l* or *m*) and a second closed syllable were taken from her spontaneous speech.[36] For comparative purposes, a structure like [ˈlinnăn] ‘town:GEN’ containing the longest consonant allophone before a short/reduced vowel was also added to Table 2.1. Other two durational types of consonants never occur before a short vowel in a disyllabic foot. There is also a phonological transcription for each structural type, in which all non-initial vowels are considered as phonologically short and a system of foot quantity accents, light /´/ and heavy /`/, is used (see Chapter 5). Such a conception serves two purposes: it keeps the phonological and morphonological descriptions consistent, and it highlights the correlation between the reductions and lengthenings of segments within a foot and their existing link to the morphologised stress.

The existence of the ternary quantity contrast in the Soikkola dialect was first attested by Sovijärvi in his experimental research from the 1930s (1944: 12,14). Kuznecova (2009a, 2012) and Markus (2010, 2011) confirmed Sovijärvi's findings for disyllables on the basis on phonetic measurements of speech samples from contemporary Soikkola speakers. A detailed phonetic analysis of trisyllables is given in Chapter 5.

Table 2.1. Ternary quantity contrast in AJF’s spontaneous speech (disyllables)

structural type	**V_1**[37], ms	σ, ms	**C/C·/C:**, ms	σ, ms	**V_2**, ms	σ, ms	**number of tokens**
k´anan [ˈkanàn] ‘hen:GEN’	**82**	18	**74**	12	**109**	23	56
s`iňnin [ˈšiňnìn] ‘blue’	**116**	30	**120**	24	**91**	16	50
l`innas [ˈlinnàš] ‘town:IN’	**117**	22	**185**	26	**88**	16	51
l´innan [ˈlinnăn] ‘town:GEN’	**115**	24	**161**	27	**64**	10	49

[36] Note that the duration of V_2 in a closed syllable is about 20–30 ms shorter than in an open one. Furthermore, in AJF’s speech, a lengthened vs. short vowel contrast after the long first syllable has in fact been replaced with a short vs. reduced vowel contrast; cf. more data from her in Markus (2010: 46, see Speaker 5), Kuznetsova (2012: 49), and Chapter 5.

[37] A list of abbreviations appears in Appendices I-II.

Figure 2.1. [ˈkanā]

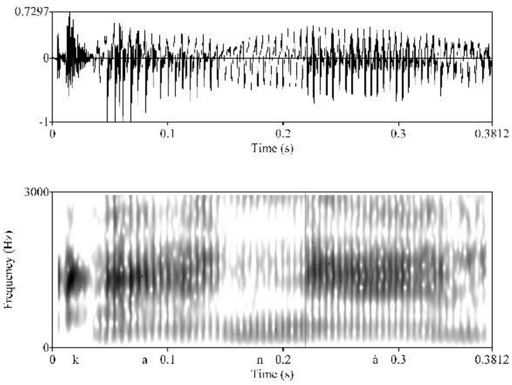


Figure 2.2. [ˈkan̆nà]

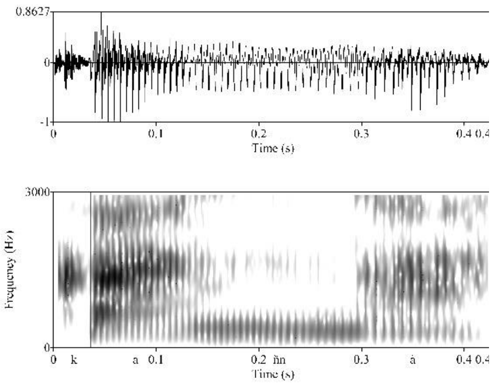
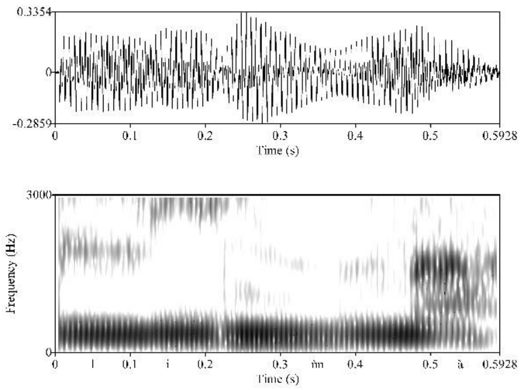


Figure 2.3. [ˈliǹnà]



2.2.2. Positions of the ternary contrast

For the stops *p*, *t*, *k* and the fricative *s*, the ternary contrast at the boundary between the first and the second syllable nowadays exists in **four positions (1)–(4)**, listed below. For other consonants, it exists only in positions (1) and (3) (see also Chapter 5).

(1) In the V_V₂ context in a disyllabic foot:

[ˈtabā ~ ˈtaBā] ‘kill:IMP’ vs. [ˈtap̆pà] ‘catch:3SG’ vs. [ˈtappà] ‘kill:INF’;

(2) In the VR_V₂, VV_V₂ contexts in a disyllabic foot:

[ˈkar̀Dàš] ‘card:IN’ vs. [ˈkartà ~ ˈkar̀tà ~ ˈkart̆tà] ‘tin:PRT/ILL’ vs. [ˈkarttà ~ ˈkart̆tà] ‘card:PRT/ILL’,

[ˈmā̀Dà] ‘sleep:IPS’ vs. [ˈłūtà ~ ˈłūt̀à ~ ˈłūt̆tà] ‘broom:PRT/ILL’ vs. [ˈłūttà] ‘rely:INF’;

(3) In the V_V₂ context in a trisyllabic foot:

[ˈkaDājà] ‘juniper:PRT/ILL’ vs. [ˈkatàjă ~ ˈkat̀àjă ~ ˈkat̆tàjă] ‘juniper’ vs. [ˈkattojă ~ ˈkat̆tòjă] ‘roof:PL:PRT’,

[ˈmaGià] ‘sweet:PRT/ILL’ vs. [ˈšuk̆kìa ~ ˈšuk̆kia] ‘1) comb:PL:PRT; 2) comb:INF’ vs. [ˈšukkia] ‘sock:PL:PRT’;

(4) In the VR_V_2, VV_V_2 contexts in a trisyllabic foot:

[ˈkarDă̆łłĕ] ‘card:ALL’ vs. [ˈkartojă ~ ˈkart̀ŏjă ~ ˈkart̆tŏjă] ‘tin:PL:PRT’ / [ˈkertàmă ~ ˈkert̀àmă ~ ˈkertamă] ‘spin:1PL (wool)’ vs. [ˈkart̆tŏjă ~ ˈkarttŏjă] ‘card:PL:PRT’ / [ˈšorttùmă ~ ˈšort̆tùmă ~ ˈšorttumă] ‘sort:1PL’,

[ˈšū̆Dă̆mă̆] ‘feed:1PL’ vs. [ˈrītĕlĕ ~ ˈrīt̀ĕlĕ ~ ˈrīt̆tĕlĕ] ‘quarrel:1PL’ / [ˈłātìmă ~ ˈłāt̀ìmă ~ ˈłātimă] ‘be_going:1PL (to do smth.)’ vs. [ˈūt̆tĕlĕ ~ ˈūttĕlĕ] ‘wait:IMP’ / [ˈšū̆t̆tìmă̆ ~ ˈšū̆ttìmă̆ ~ ˈšū̆ttimă̆] ‘feed_oneself:1PL’.

The duration of vowels and consonants varies across structures due to a phonetic tendency towards foot isochrony (N. V. Kuznecova 2009a: 63, 2009b: 34; E. Markus 2010: 48, 50; see more in Chapter 5). In this case, the tendency manifests itself such that the more segments a foot contains, the shorter their absolute duration becomes. Under the influence of isochrony, a partly different phonetic feature now distinguishes the two “long” classes in positions (2)–(4), as compared to (1). In (1), the consonant is always realised as long both in cases like [ˈtap̆pà] and [ˈtappà]. In (2)–(4), the consonants of the third quantitative class are generally pronounced as long, while the realisation of the second class consonants varies between long and short (Laanest 1987: 290-91; N. V. Kuznecova 2009a: 67).

2.2.3. Existing terms for the quantitative consonantal classes

The three quantitative classes of Soikkola consonants can be referred to in a variety of ways in the literature, depending on whether the authors are Finno-Ugrists or general linguists, and whether they aim to emphasise the phonetic realisation of the consonants, or the nature of their phonological opposition, or their origin. To facilitate greater clarity of the following discussion, the main terms for these consonants are summarised in Table 2.2 (cf. also Chapter 5).

Table 2.2 Terms for the consonant classes within the Soikkola ternary contrast

Class of consonants	Etymological terms	Phonetic terms
class 1	short /singletons	1) *all consonants*: short/singleton; 2) *stops and* s *additionally:* (half-) voiced [D/d]
class 2	secondary geminates	1) *all consonants*: geminates/double/long; — *particular types of allophones*: short geminates [t̆t] ~ half-long/lengthened singletons [t̀]; 2) *stops and* s *additionally*: voiceless (can also be realised as voiceless singletons [t])
class 3	primary geminates	1) *all consonants*: geminates/double/long; — *particular types of allophones*: long geminates [tt] ~ overlong geminates [t̀t]; 2) *stops and* s *additionally*: voiceless

In Table 2.2 above, “Class of consonants” can be taken to mean conventional numbers referring to the quantitative classes of consonants (“first”, “second”, and “third degree of length or quantity”, respectively, are also frequent). “Etymological terms” refer to the origin of the consonants in accordance with the standard norms common to Finnic studies. “Primary” are the geminates that presumably existed already in Proto-Finnic, while “secondary” geminates emerged from Proto-Finnic short consonants in certain Finnic varieties later. “Phonetic terms” mean the often-distinguished allophonic classes of absolute duration in different structures and positions for each consonantal type.

2.2.4. Typological data on the ternary quantity contrast

Typological works mention only a handful of languages where the ternary contrast is the most incontrovertibly attested. Three contrastive degrees of consonantal length are indicated only for languages closely related to Ingrian. The most typologically well-known are Estonian and some Saami languages (Ladefoged & Maddieson 1996: 93; Blevins 2004: 201); a similar phenomenon is also found in Livonian (Viitso 1997: 231). Among languages with three vocalic lengths, the literature typically mentions first and foremost Estonian, as well as Dinka (Kir-Abbaian family; Southern Sudan), Coatlán Mixe and San José Paraíso Mixe (dialects of Lowland Mixe; Mixe-Zoque family; Mexico), and Yavapai (Yuman-Cochimí family; USA) (Ladefoged & Maddieson 1996: 320; Blevins 2004: 201; McRobbie-Utasi 2007: 185-93).

A typological claim that only two contrastive segmental lengths can exist in a language was first expressed by N. S. Trubetzkoy and was then reiterated by a number of authors. His idea can be summarised as follows: if there seems to exist a segmental three-way (or more complex) length contrast, the latter is always accompanied by additional phonetic distinctions by other features of the same segments, or by prosodic features (Trubeckoj 2000: 206-11 [1939]). A ternary length contrast cannot, therefore, be considered the only contrastive phonemic feature and consequently cannot be totally assigned to the segmental level.

Experimental phonetic research on Estonian, Livonian and Saami languages has since completely confirmed this hypothesis. The aforementioned foot concept is crucial for the phonetics and phonology of all these languages.

In Estonian, the three-way contrast in a disyllabic foot manifests itself in different ratios between the elements of the foot nucleus. Three main quantitative types of a first syllable are in inverse relation with three quantitative types of a second syllable vowel. Three combinations are possible: overlong – short, long – short/lengthened, short – lengthened/long. Moreover, there are four types of ratios between the first syllable vowels and the following consonants: long – short, short – long, half-long – half-long, short – short (cf. detailed measurements in Eek & Meister 2003, 2004). Additionally, if the first syllable contains long vowels or diphthongs, there is a difference in pitch movement within such a foot.

These main trends were experimentally substantiated in the early 1960s (Lehiste 1960; Liiv 1961) and further elaborated in numerous experimental works by, most notably, I. Lehiste, A. Eek and E. Meister, D. Krull, E. L. Asu(-Garcia), and P. Lippus. Later research showed, among other things, the role of intensity and vowel quality as secondary features for length distinctions (Eek 1973; Lippus 2011). There also exists a secondary voicing opposition for the stops and the voiceless alveolar sibilant /s/: class 1 consonant allophones are voiced or half-voiced, as opposed to voiceless class 2 and 3 allophones.

Similar to this are Livonian and the Saami languages. In Livonian, short and half-long consonantal allophones occur only before a lengthened vowel of the second syllable, and long consonantal allophones only before a short vowel. Further, glottalisation in dissyllables combines only with a long consonantal allophone (Viitso 1997: 231; Lehiste et al. 2008).

Phonetic research on Saami languages also clearly manifests interdependencies between either the first syllable elements or the whole foot nucleus elements. For example, in Skolt Saami (Eastern Saami group) there are three types of ratios between the first syllable vowels and the following consonants/consonantal clusters: long – short, short – long, half-long – half-long. The duration of the second syllable vowels does not affect these ratios (McRobbie-Utasi 1996: 29). Research on the North Saami (Western Saami group) dialect of Kautokeino shows similar results. Four types of ratios between the first syllable vowels and the following consonants are the same as in Estonian (Bals Baal, Odden & Rice 2012; the duration of the second syllable vowels was not measured). Detailed experimental research on Inari Saami (Eastern Saami group) also established similar kinds of nucleus V_1/C and C/V_2 ratios. For example, for structures with a short first syllable vowel and an open second syllable the following C/V_2 ratios were found: long – short, half-long – long, short – long. In other structures, partly different ratios were discovered, but in all cases, correlations of this kind were established (Bye, Sagulin & Toivonen 2009).

Therefore, at least in the case of all languages with a presumed ternary contrast of consonants, the three-way opposition exists at the level of either the syllable or the foot. It is, therefore, not segmental; cf. similar statements in McRobbie-Utasi (2007: 194-96). In this sense, Trubetzkoy's claim still holds. Apparently, such systems of a complex "three-way quantity contrast" (in terms of McRobbie-Utasi, who opposes it to a segmental "three-way length contrast") are phonologically most adequately described with the help of suprasegmental (either syllable or foot) accents, with only a binary or even a lack of quantitative phonological contrasts on the segmental level.

Among languages with a presumed three-way contrast of vowels, the example of Estonian has been already discussed. As for Mixe, Yavapai, and Dinka, there are more reasons to believe that vowel length alone can be a distinctive feature. However, to my knowledge, detailed phonetic research proving the claim has been conducted only on Dinka (Remijsen & Gilley 2008). The authors showed that vowel length does not significantly correlate with either the length of the coda (a final consonant in monosyllables), or with the tonal contour on a word, or with vowel quality and intensity. Some parallels in the structure and evolution of the ternary contrast in Dinka and Ingrian are discussed in 2.4.1.2 and 2.5.2.2; cf. also Chapter 5.

2.2.5. The Soikkola ternary contrast against the typological background

In the previously discussed languages with a presumed three-way consonant contrast, quantitative consonantal classes are insufficient in themselves to distinguish between words, due to coexisting phonetic contrasts. The Soikkola dialect does not provide a completely pure case of a three-way length contrast either. There are other oppositions that come into play and reinforce the length contrast.

First, as in Estonian, the shortest allophone of the stops and /s/ is voiced or half-voiced, e.g. [ˈta**b**ā ~ ˈta**ʙ**ā] ‘kill:IMP’. The ternary contrast for this group of consonants is, therefore, not purely quantitative, as the voicing feature also participates in distinguishing between the three consonantal classes. However, for the other members of the consonant inventory, this voicing opposition is irrelevant. The length contrast is based only of consonantal duration.

Furthermore, in the VCV nucleus, as in [ˈtaʙ**ā**], a second syllable vowel undergoes salient prosodic lengthening, which is automatic (contrary to all other non-initial vowel lengthenings). It is always present in this position. Ingrian does not differ in this respect from Estonian, Votic, Finnish (at least some of its dialects), or Livonian. The duration of this vowel is considerably longer than the one of lengthened vowels after the long first syllable (in [ˈtap̆pà], [ˈtappà] and other foot nucleus types). In many idiolects, it roughly corresponds to the length of an initial long vowel. In this sense, the contrast of a structure with a class 1 consonant vs. with either class 2 or class 3 consonants does not only rely on consonantal length. The duration of the following vowel (and possibly also the preceding one, cf. data in Table 1) also plays an important role.

However, one feature of the Soikkola ternary contrast makes it unique in comparison to the aforementioned languages. In Soikkola, **the contrast of “long” classes 2 and 3 can alone produce minimal pairs**, for example:

[ˈtap̆pà] ‘catch:3SG’ vs. [ˈtappà] ‘kill:INF’;

[ˈlep̆pä̀] ‘rest:IMP’ vs. [ˈleppä̀] ‘alder:PRT/ILL’;

[ˈłak̆kà] ‘sweep:IMP’ vs. [ˈłakkà] ‘hayloft:PRT/ILL’;
[ˈšuk̆kà] ‘1) comb:PRT/ILL; 2) (not) at all’ vs. [ˈšukkà] ‘sock:PRT/ILL’.

Phonetic research carried out by Kuznecova (2009a: 64, checked in 2012: 48) and Markus (2010, 2011) has shown that at least words with a disyllabic foot nucleus of a structure [VC̆CV̀ / VČCV̀] can be opposed only by two “long” consonantal classes. The durations of nucleus V_1 and V_2 do not show statistically significant differences (cf. Table 2.1 and measurement results in the works mentioned above, and also Chapter 5).

Soikkola Ingrian could thus be said to have a pure ternary length contrast in positions (1) and (3), were it not for the fact that V_2 in the VCV nucleus is phonetically longer than the lengthened second syllable vowels in other nucleus types. Soikkola Ingrian could also be said to have this contrast in positions (2) and (4), where the second syllable vowels have a comparable duration after all the three quantitative consonantal classes. However, only stops and /s/ participate in a ternary contrast in these positions, and their class 1 allophones are always additionally (half-)voiced.

Still, Soikkola Ingrian is closer to a pure three-way consonantal length contrast case than Estonian, Livonian or Saami. It also shows that the duration of the “long” consonantal classes 2 and 3 can in principle serve as the only distinctive feature. This seems an important typological finding which partly overrides Trubetzkoy’s assumption.

Phonetically, a ternary vocalic contrast also exists in Soikkola, both in initial and non-initial syllables. There are in total three quantitative vowel types in the non-initial syllables: short/reduced, lengthened, and long: [ˈlepp**ä̆**] ‘alder’ vs. [ˈlepp**ä̀**] ‘alder:PRT/ILL’ vs. [ˈtaʙ**ā**] ‘kill:IMP’. However, the long allophone is present only in the VCV nucleus, where no other allophonic types are possible. It does not make a phonological opposition with a short and a lengthened type. In the initial syllables, there are also three types of vowel allophones: short, long, and overlong (E. Markus 2011: 111). However, the situation here is similar to the one in Saami or Estonian. There are four types of ratios between these vowels and the following consonants (ibid.). These ratios are essentially the same as the ones given previously for Estonian: long – long ([ˈvōttă] ‘year:PRT’), short – overlong ([ˈkuk̀kă] ‘flower’), overlong – short ([ˈsā̀da] ‘get:INF’), short – short ([ˈtaʙā] ‘kill:IMP’).

Therefore, the Soikkola three-way contrast of vowels, unlike the consonantal contrast, entirely follows a common Finno-Saami pattern and is a phonetic phenomenon. The phonological contrast of vowels is binary both in initial and in non-initial syllables, and the occurrence of the third class is one of the phonetic effects of foot isochrony.[38]

2.3. The Lower Luga dialect: reduced voiceless vowel phonemes

2.3.1. Contrast of full modal and reduced voiceless vowels in Southern Lower Luga varieties

In Lower Luga Ingrian, the reduction of non-initial vowels is the most salient of all the Ingrian dialects. The most innovative varieties in this respect are within the southern subdialect, immediately adjacent to the Estonian language area. Their system is three steps ahead of the Soikkola system (cf. Kuznetsova 2011: 192). In the first stage, originally short non-initial vowels underwent quantitative reduction and began to elide in rapid speech. Thereafter, some non-initial short vowels underwent qualitative reduction to [ə] and were no longer restored to full vowels. Lengthened non-initial vowels were often pronounced as short vowels. Finally, in the third stage, a system of reduced vowel phonemes *(ĭ, ĕ, ü̆, ö̆, ŏ, ŭ, ə)* emerged out of the short non-initial vowels in certain positions. All non-initial lengthened vowels (apart from the second vowel in VCV nucleus) were shortened completely (cf. Chapter 3).

As a result, synchronically, there exists a phonological short vs. long vowel contrast in the initial syllables of stem morphemes and a short vs. reduced vowel contrast in the non-initial syllables: ***tuli*** 'fire' vs. ***tūlĭ*** 'wind' vs. ***sūt'i*** 'judge:3SG'. Non-initial short vowels are realised as lengthened in the VCV nucleus ([ˈtul**ì**]) and as short in other positions ([ˈsūt'**i**] etc). In no context, the three phonetic durational classes of vowels make a ternary opposition, which is similar to the Soikkola situation presented in the previous section.

Reduced vowels of Southern Lower Luga Ingrian are a typological rarity, as they are often realised as **voiceless** ([ˈtūl**ĭ̥**]). At the same time, they render independent phonemes opposed to short non-initial modal vowels (*i*, *e, ü, ö, o, u, a*, *ä*). For example, the Soikkola contrast [ˈkukk**ŏ**] 'rooster' vs. [ˈkuk̀k**ò**] 'rooster.ILL' is realised in Southern Lower Luga as [ˈkukk**ŏ̥**] (~ kuk̄)] vs. [ˈkukk**o**], where the second syllable vowels are the sole carriers of a distinctive function. The pronunciation of these words in the speech of NDP (a male, born in 1924 in Vanakülä) is illustrated in the spectograms in Figures 2.4 and 2.5 (see also Chapter 4).

[38] Actually, each of the "long" classes of consonants (short and long geminates) under the tendency towards foot isochrony has a bit different duration before the short vs. before the long vowels. Therefore, consonants, at least in position (1), could be said to have the total of five durational classes (illustrated in E. Markus 2011: 112), similar to the three durational classes of vowels. Even more durational classes could be established, if a finer gradation of structures is employed, see Chapter 5.

Figure 2.4. *kukkŏ* [ˈkukkŏ̥]

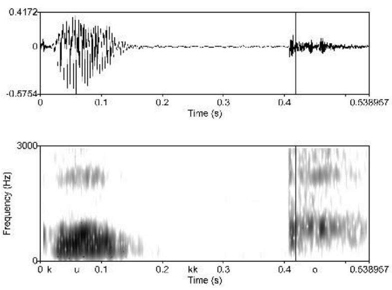
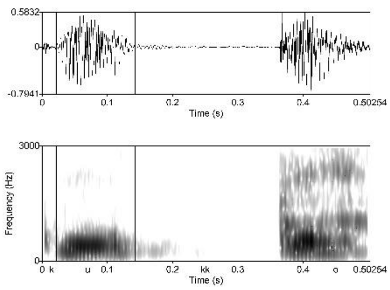


Figure 2.5. *kukko* [ˈkukko]



From an articulatory perspective, the configuration of the vocal tract is the same as during voiced phonation, but instead of the periodical vocal-fold vibration there is either a silent smooth laminar or a turbulent airflow through the (relatively) widely abducted glottis. Depending on a degree of constriction on a scale of decreasing width of glottal opening, voiceless pronunciation can be either “breathy” or “whisper” (Laver 1994: 189-91). Acoustically, voiceless vowels do not have F_0. Their other formants are at the same frequencies as for modal vowels, with an input that is irregular and noisy rather than pulsed. Notably, the Lower Luga reduced vowels are not always pronounced as completely voiceless, especially in slow speech. There can be a short period of modal phonation at the beginning of a vowel.

Lower Luga reduced voiceless vowels were first described in Mägiste (1925: 3:82, 85), and are also mentioned in Ariste (1965, 1969: 173).

2.3.2. Typological data on voiceless vowels

To date, there are no known languages in which the phonological contrast of voiced and voiceless vowels could be incontrovertibly established. Such contrast might exist in the Kewa (Santo Domingo) and Tamaiya (Santa Ana) dialects of Eastern Keresan (Keresan family; USA) and in Malto (Paharia; Dravidian family; India). Moreover, this contrast has been reconstructed for Proto-Keresan. Additionally, Ik (Kuliak family; Easter Uganda), Nishi (Dafla; Sino-Tibetan family; India) and, with lesser certainty, Ute (Southern Paiute) and Comanche (Uto-Aztecan family; USA) are often mentioned as possibly having such a contrast (Mahapatra 1979: 203-5; Jakobson & Waught 1987: 138-39 with a reference to J. Greenberg; Ladefoged & Maddieson 1996: 315; Gordon 1998; Blevins 2004: 199-201) Voiceless vowels with zero phonation could probably exist in Shiwiar (Jivaroan, Equador). According to Kohlberger (2014; p.c), they are realised only through an articulatory gesture corresponding to each type of vowel, but without any phonation at all. Phonation starts only at a transitory stage towards the following vowel (however, a proper experimental investigation is still to be conducted here).

2.3.3. Lower Luga voiceless vowels against the typological background

Blevins (2004: 199) describes two common sources of vowel devoicing. Very short vowels are either devoiced when adjacent to voiceless consonants (obstruents, especially *h*) or independently; in the latter case, usually word- or phrase-finally.

In some North Germanic and Saami languages, vowels can undergo complete or partial devoicing resulting from the preaspiration of the following stops. Skolt Saami, Icelandic, Faroese, and certain Norwegian and Swedish dialects, which manifest this phenomenon, have even been analysed by some scholars as having phonologically voiceless vowels (c.f. Liberman 1982: 90-117; McRobbie-Utasi 1991).

Lower Luga voiceless vowels have nothing to do with this case as they emerged according to the second scenario, through reduction. Lower Luga, as the other Ingrian dialects, has a foot structure, but the prosodic unity of the foot is not so salient any longer. Voiceless reduced vowels usually occur in the end of a final or a non-final foot: [ˈtüttö̥̆] ‘girl’, [ˈavàhtŭ̥] ‘be_opened:PST:3SG’, [ˈsukkŭ̥ˌr'iš] ‘sugar:IN’, [ˈlisȁh'ü̥̆ˌminè] ‘be_added:NMLZ’.

An interesting trait of Lower Luga against the typological background is that such vowels also occur in the **non-final** second syllable of a trisyllabic foot (cf., however, initial-only voiceless vowels in Malto mentioned in Mahapatra 1979: 205). For example: [ˈihmĭ̥sed] ‘man:pl’, [ˈjǟhü̥̆teˌttä] ‘cool:IPS’, [ˈkiskŏ̥huˌminè] ‘be_torn_off:NMLZ’ (cf. a detailed chart of positions possible for voiceless vowels in Kuznetsova 2011: 189; N. V. Kuznecova 2012: 59-60).

The main problem in postulating voiceless vowel phonemes when they have developed independently of consonantal environments is that they are typically also very short. This is also the case in Lower Luga Ingrian. Such vowels can be treated either as phonologically voiceless or reduced, and for Lower Luga Ingrian the latter variant seems preferable. The phoneme /ə/, a mid-central vowel, also occurs in those positions where it cannot elide due to phonotactic and speech production restrictions, e.g. [ˈłamməz] ‘sheep’. In such cases, /ə/ is usually pronounced as a reduced but still voiced vowel. Therefore, Lower Luga does not provide a completely pure case of voiceless vowel phonemes either.

2.4. Evolution of rare phonological contrasts

2.4.1. Evolution of the ternary contrast

A cross-linguistic analysis reveals two typical paths for the further evolution of ternary contrasts. These are either the restoring of a binary contrast or the shift of a phonological contrast from the segmental to the suprasegmental level. In the following, the Soikkola material is further considered in respect of both variants.

2.4.1.1. Binarity restoring

Remijsen and Gilley (2008: 340-41) made the following claim regarding the fate of the ternary contrast:

> Languages can develop a three-way vowel length distinction, but the only way forward, in a diachronic sense, is the way back: once a three-way vowel length contrast has developed, it can be maintained in the face of the pressures of reorganisation, but any further increase in quantity contrasts is unlikely, because the phonetic distance between categories may be too small.

Blevins (2004: 202) formulated a more concrete typological hypothesis: the merger of the long and extra-long categories as a single "long" category is predicted as a common type of sound change. A brief overview on the ternary contrast evolution in Ingrian dialects is given below in light of this assumption.

A ternary quantity contrast currently exists only in Soikkola, and not even in all of its varieties. The contrast is claimed to be absent from the transitory Soikkola to Lower Luga variety of Koskisenkylä, and in the eastern corner of the Soikkola dialectal area, i.e. the Sista area (Laanest 1978: 123)[39] . Phonetic measurements indicate that it has nearly or totally disappeared at least from the southernmost Soikkola varieties adjacent to Koskisenkylä, among others from the Saarove (Gordon 2009: 96) and Venakontsa villages (E. Markus 2010: 42-44, Speaker 4). Furthermore, in places where the contrast exists in shorter structures, it has started to vanish from the longer ones. For example, in two-foot words like [ˈka**t̀**ăˌmà] 'cover:SUP' ("primary" geminate) vs. [ˈma**k̀**àˌmà:] 'sleep:SUP' ("secondary" geminate), the durational difference between the geminates became neutralised in some speakers even in position (1) (E. Markus 2010: 48-49). Sovijärvi (1944: 12, 14) reported the ternary contrast also after the second and third syllable, which is no longer attested in my data (see Chapter 5).

A three-way contrast is definitely absent from the Lower Luga dialect. According to Laanest (1987: 288-91), it has also disappeared from the Hevaha and Oredež dialects. The Soikkola dialect, which still maintains the opposition, seems to be the most conservative in this respect. The original development of a ternary contrast in Ingrian was linked to the

[39] This manuscript (a doctoral dissertation) was later published in Estonian as (Laanest 1986).

emergence of secondary geminates, which yielded durational class 2 in modern Soikkola Ingrian (see Table 2.2 and Chapter 5). Initially, it was a phonetic phenomenon (Laanest 1978: 123). Secondary geminates have presumably emerged no later than in Proto-Ingrian; in position (1) possibly even earlier (cf. Laanest 1966a: 23-29, 1978: 136, 320-23; Sovijärvi 1944: 84-90). The latter assumption might seem plausible given the fact that among Finnic languages secondary geminates in positions (2)–(4) exist only in Ingrian, but see Chapter 5.

If the contrast dates back to Proto-Ingrian, it was then maintained and phonologised in the Soikkola, Hevaha, and partly Oredež dialects (Laanest 1978: 124). Classes 2 and 3 later merged into one /long/ category in Hevaha, Oredež and, to some extent, Soikkola.

The situation is different in the Lower Luga dialect. Secondary geminates have consistently developed and later merged with primary geminates only in position (1). Compare, for example, a Lower Luga contrast [ˈta**p**ā] 'kill:IMP' vs. [ˈta**pp**à] '1. catch:3SG; 2. kill:INF' with the Soikkola one [ˈtabā ~ ˈtaBā] 'kill:IMP' vs. [ˈtap̆pà] 'catch:3SG' vs. [ˈtappà] 'kill:INF', which was given in 2.2.2.

In positions (2)–(4), in place of the Soikkola secondary geminates, there are nearly always short consonants in Lower Luga. Cf. Lower Luga pairs (from the northern varieties):

[ˈmā**t**à] 'sleep:IPS' — [ˈłō**t**à] 'broom:PRT/ILL';

[ˈka**t**àjà] 'juniper:PRT/ILL' — [ˈka**t**àjă] 'juniper';

[ˈper**t**ʾīllĕ] 'room:ALL' — [ker**t**ŏjă] 'time:PL:PRT'.

In Soikkola, the first word of each pair would contain a short consonant (class 1) and the second word a secondary geminate (class 2), see 2.2.2. It appears that in the Lower Luga dialect Proto-Ingrian "secondary" geminates in positions (2)–(4) have become **short phonemes** again.

Few exceptional cases of secondary geminates outside position (1) have still been attested in Lower Luga Ingrian, e.g. [ˈtu**ll**iz] (<**tulisi*) 'come:CND:3SG', [ˈo**ll**isid] (<**olisit*) 'be:CND:3SG', [ˈmä**nn**isim̃] (<**mänisimmä*) 'go:CND:3SG', [ˈva**rr**apʾi] (<**varempī*) 'early:CMP'. In all such cases, variants with single consonants were also attested in other or even the same Lower Luga varieties or idiolects, e.g. [ˈo**ll**isid ~ ˈo**l**ìsid].

At the same time, secondary geminates in positions as in the two last structures (**mänisimmä*, **varempī*) are unknown in other Ingrian dialects. This shows that secondary gemination, though infrequent at present, could have once been an internal active phonetic tendency in Lower Luga. Moreover, all these examples corroborate the assumption that secondary gemination may have once been consistent in Lower Luga outside position (1) as well.

To summarise, the evolution of the ternary quantity contrast across Ingrian dialects generally supports Blevins's hypothesis. Classes 2 and 3 have nearly or totally merged into a /long/ category in the majority of cases. However, if a ternary contrast indeed existed already in Proto-Ingrian, and in the Lower Luga dialect, class 2 (short geminates) then merged with class 1 (singletons) in positions (2)–(4), Blevins's assumption would be contradicted.

This deviation could apparently be explained by "a contact influence from the Lower Luga Finnish and Votic varieties" (Laanest 1966a: 28). Secondary geminates have disappeared from Lower Luga Ingrian exactly in the positions where they are also absent from the geographically adjacent related languages. The analogical pressure from these varieties, which are extremely similar to Lower Luga Ingrian, could easily divert the default way of development in the latter (cf. Laanest 1978: 307-11).

The disappearance of geminates could have also been advanced by the fact that, at the Proto-Ingrian stage when the future Lower Luga dialect entered into contact with closely related languages, the assumed ternary contrast was still a purely phonetic phenomenon, at least in positions (2)–(4). The preservation of geminates in position (1) could be, in turn, related to the fact that this type of gemination had developed in Proto-Ingrian earlier than the other types, or was more phonetically salient (see Chapter 5). Furthermore, secondary gemination in this position exists in the neighboring Ingrian Finnish varieties, which have influenced Lower Luga Ingrian the most (Laanest 1978: 311). Moreover, it is exactly in position (1), that class 2 consonants have presumably always been realised as long, while in positions (2)–(4) their realisation might have varied from short to long (cf. 2.2.2).

2.4.1.2. A three-way length contrast to a suprasegmental contrast

McRobbie-Utasi (2007: 197) assumed an alternative direction of the ternary contrast evolution:

> Although phonological systems can function perfectly well with ternary distinction, there appears to be a counter-tendency, as soon as the system becomes ternary, to re-establish the binary system or to readjust the system to another prosodic feature distinctive.

As one possible general cause for maintenance of rare contrasts (see 2.5.2), Blevins (2004: 209-11) named "coexisting phonetic contrasts which prime or reinforce the others". As discussed in 2.2.4, N. S. Trubetzkoy even thought a ternary length contrast impossible without such correlating secondary oppositions. There are few exceptions of this rule, such as in Dinka or Soikkola Ingrian (which nearly make pure cases), but they all seem to be in a transitory stage (cf. McRobbie-Utasi 2007: 196) From a dynamic perspective, the development of secondary contrasts appears to be an inevitable alternative to the restoring of binarity.

The development of Estonian and Saami languages in this direction is discussed in detail in McRobbie-Utasi (2007); see also section 2.2.4. Similar processes are under way also in Dinka, where there exists a three-way contrast of vocalic length. The shortest vowel allophones tend to become more centralised as compared to the two longer classes. Furthermore, an inverse ratio of the vowel length to the length of the following consonant coda is emerging. All these secondary contrasts are still statistically insignificant and unstable among speakers, compared to the key vowel length contrast (Remijsen & Gilley 2008: 334-36, 338, 341). Nevertheless, the direction of development is similar to other cases where a ternary contrast is described. Similar tendencies are also observed in Soikkola Ingrian. An additional voicing contrast which reinforces the quantitative opposition of the stops and /s/ (the consonants having a three-way contrast in the maximal number or positions) was discussed in 2.2.5. Notably, the voicing opposition exists only in those positions where the ternary contrast is (or was historically) possible, i.e. intervocalically and after a sonorant. In positions where quantitative contrasts are neutralised, stops and /s/ are either always voiced (before a sonorant), or voiceless (before an obstruent), or either voiced or voiceless depending on sandhi with a following or preceding word (word-initially and -finally).

The voicing feature is an innovation, as compared to the Proto-Finnic background, and it tends to get further reinforced. It already became an independent phonological feature in the Lower Luga dialect. A contrast of lenis vs. tenuis consonants, still present in Soikkola Ingrian, was split in Lower Luga into two separate contrasts: in length and in voicing:

[ˈsa**t**à] ‘hundred’ — [ˈsa**tt**à] ‘hundred:ILL’;

[ˈsa**d**à] ‘garden’ — [ˈsa**dd**à] ‘garden:ILL’.

The same forms will look in Soikkola Ingrian as follows:

[ˈša**ᴅ**à] — [ˈša**t̆t**à];

[ˈšā**d**ŭ] — [ˈšā**t̀**ù].

In Soikkola Ingrian and other Ingrian dialects, completely voiced allophones have become more frequent than half-voiced (Laanest 1966a: 20-21, 1987). Voiced allophones occasionally appear as opposed to voiceless in the word-initial position in Soikkola onomatopoetic words and Russian borrowings (N. V. Kuznecova 2009a: 188-89). In positions (2)–(4), the functional load of distinguishing between consonantal classes 1 and 2 (of stops and /s/) tends to shift to the voicing contrast, as class 2 allophones can be realised as short (see 2.2.2).

The durational difference between the second syllable lengthened vowels in the VCV nucleus vs. other nucleus types reinforces the opposition of the short intervocalic consonant to the two “long” classes, see 2.2.5. The difference is presumably a young phenomenon. It is linked to a general contemporary Soikkola tendency to reduce non-initial vowels (N. V. Kuznecova 2009b: 33-34; E. Markus 2011: 117). Lengthened vowels after a long first syllable have reduced faster than after a short first syllable. Additionally, in Markus (2010: 45-46), the lengthened vowels of the second syllable were noticeably longer after the class 2 consonants than after the class 3 ones in the speech of 2 out of 6 speakers. This difference is yet statistically insignificant and unstable in the language in general. However, if further developed, the Soikkola ternary contrast of consonants in disyllables might enter into a strict inverse ratio with the ternary opposition of second syllable vowels, similar to Estonian (as already happened in Soikkola trisyllabic feet, cf. Chapter 5).

In summary, Ingrian follows the two natural ways of the ternary contrast evolution. There is both the tendency to restore binarity and the tendency to develop secondary contrasts reinforcing the length opposition. In the latter case, the contrast increasingly shifts to the suprasegmental levels of syllable, foot, and word.

2.4.2. Evolution of voiceless vowels

2.4.2.1. Evolution of Southern Lower Luga voiceless vowels against the typological background

As one of the most likely causes why the vocalic voicing contrasts are rare (although frequent as a phonetic phenomenon), Blevins (2004: 199) named the ultimate loss of reduced voiceless vowels. In Lower Luga Ingrian, these vowels often elide in rapid speech. Speakers are frequently not aware of the presence of /ə/ and, in some cases, other reduced vowels in a word (N. V. Kuznecova 2012: 63-64; Kuznetsova 2012), see also Chapter 4.

Consequently, if the Lower Luga dialect were to survive, there would be a high probability for it to lose the reduced voiceless vowels. At present, when elided, reduced /ĭ/ frequently leaves the preceding consonant palatalised, /ӧ̆, ŏ, ŭ/ labialised, /ü̆/ labialised and palatalised. There is a tendency towards a system of reduced vowels with two binary contrasts, in backness and labialisation. Such a system can be also described through the consonantal features of palatalisation and labialisation (see Chapter 3). Synchronically, the height contrast of labialised reduced vowels is yet generally maintained across the idiolects. The direction of development of reduced voiceless vowels is illustrated in Table 2.3.

In neighboring Estonian with even more innovative phonology, the original short non-initial vowels were lost exactly in the positions where Ingrian has eliding reduced voiceless vowels (see Chapter 3 for more details). Estonian may have also gone through the stage of voiceless vowels before their ultimate loss. In many cases, Estonian front vowels left behind the palatalisation of a preceding consonant, e.g. *kott* [kot̄'] 'bag' vs. *kott* [kot̄] ‘worn_out_shoe’. Cf. genitive forms where original stem vowels are preserved: *koti* [ˈkoť̆ti] vs. *kota* [ˈkoť̆ta] respectively. In Estonian, no traces of consonantal labialisation before the original labialised vowels were left.

Table 2.3. Development of Lower Luga voiceless reduced vowels

height \ backness	front: labialised	front: non-labialised	middle	back
high	ü̆ [ü̥̆]	ĭ [ĭ̥]		ŭ [ŭ̥]
non-high	ö̆ [ö̥̆]	ĕ [ĕ̥]	ə [ə̥̆] (<*[ă/ä̆/ĕ])	ŏ [ŏ̥]

backness \ labialisation	non-labialised	labialised
front	ĭ [ĭ̥]	ü̆ [ü̥̆]
non-front	ə [ə̥̆] (<*[ă/ä̆/ĕ])	ɵ [ɵ̥̆] (<*[ŭ̥/ŏ̥/ö̥̆])

palatalisation \ labialisation	non-labialised	labialised
palatalised	[t'ĭ̥] > t'	[t'ü̥̆] > [t'°] > ?t'
non-palatalised	[tə̥̆] > t	[tɵ̥̆] > [t°] > ?t

2.4.2.2. Voiceless vowels in the Siberian Ingrian/Finnish variety

An interesting case shows that reduced voiceless vowels can nevertheless be maintained in a language for a sufficient period of time. In 1804, a group of peasants was sent to Siberia from the area where the Southern Lower Luga Ingrian varieties are spoken together with local Ingrian Finnish varieties. Their descendants have preserved their own language (a mixed Ingrian-Finnish variety) until the present. Sidorkevič (2011: 577), who studied the idiom in the field, has found reduced voiceless vowels in the same positions as in Lower Luga Ingrian. These vowels are also in contrast with short and (in VCV nucleus) lengthened allophones. However, the reduction here is one step more advanced than in Lower Luga Ingrian. For reduced vowels, there no longer exists a difference between original Proto-Finnic /*o/, /*ö/ and /*u/, as well as between /*a/, /*ä/ and /*e/. This essentially is already a four-member system depicted at the second stage in Table 3 (see Chapters 3 and 4 for more details).

For the present discussion, it is interesting that this variety became completely isolated from related languages as early as in the beginning of the 19th century. Synchronically, its vowel system is still very close to the one of the southern Lower Luga Ingrian varieties. This might indicate that reduced voiceless vowels were present in the latter already at the point where the Siberian variety split with them. On the other hand, these vowels might have developed in two idioms independently, following common innate developmental tendencies (“drift”, in Sapir’s sense). However, if the first hypothesis is plausible, this means that reduced voiceless vowels have already existed both in Southern Lower Luga Ingrian and in a Siberian variety for more than two centuries. This might prove that such vowels do not necessarily disappear from the language immediately after their emergence and can be maintained over long periods. The causes for maintenance of rare contrasts are discussed in section 2.5.

2.5. Instability and maintenance of rare phonological contrasts

2.5.1. Instability of rare phonological contrasts

2.5.1.1. Instability of the ternary contrast

Within the framework of evolutionary phonology, Blevins explained the rarity of certain phonological contrasts as “the uncommon occurrence of sound changes giving rise to them, or the common occurrence of neutralising sound changes resulting in their elimination, or both” (2004: 204). Such a conception implies a typical instability of rare phonological contrasts.

The developmental history of the ternary quantity contrast in Ingrian dialects, as discussed in 2.4.1, clearly indicates its instability (cf. also McRobbie-Utasi 2007). Out of the four dialects, it has been maintained only in Soikkola, but not even in all of its varieties and types of structures.

The cause for this instability is obviously a “crowding” within the perceptual space (Blevins 2004: 202), that is, the phonetic distance between categories is too small. So far, no perceptual studies have been conducted on the Soikkola Ingrian ternary contrast. However, some data from elicitation interviews indicate that speakers are not generally aware of the difference between durational classes 2 and 3. When one of the two “long” allophones of stops and /s/ occurs in positions (3), (2) and (4), especially the two latter, speakers often say there is a single voiceless consonant (“one *t*” etc) for both class 2 and class 3 allophones. For example, EMV (a female, born in 1927 in Viistinä) syllabicated a word [ˈpīrk̆kă] ‘pie’ (with a “primary” geminate) as [ˈpi-ˈir-ˈka]. As an example of an opposite interpretation, see dialog (1) with the aforementioned speaker AJF (the geminate is secondary, i.e. short; its duration in ms is indicated in parentheses):

(1) How would you say ‘sheep(:PL)’? (int.) — [ˈłampāt] (120). — [łam...]? (int.) — [ˈłamp̀āt] (190). — [ˈłamppāt]? (int.) — Two ‘p’s’. [ˈłamppāt] (205).

At the same time, when asked if there is a difference in the pronunciation of words [ˈkart̀ŏjă] ‘tin:PL:PRT’ (with a secondary/short geminate) and [ˈkart̆tŏjă] ‘card:PL:PRT’ (with a primary/long geminate), AJF yet said: “Well, here one letter should be changed a little”. Such data are still too unsystematic to draw any certain conclusions.

2.5.1.2. Instability of voiceless vowels

As stated in 2.4.2.1, one cause for the rarity of vocalic voicing contrasts is that voiceless vowels are usually very short and tend to disappear. In the case on Lower Luga Ingrian, there is a durational contrast which coexists with a voicing opposition. However, the former favors the disappearance of the latter rather than reinforces it.

No perceptual experiments have been conducted on Lower Luga Ingrian reduced voiceless vowels either. Some data on how speakers write in their idiolects (Kuznetsova 2012), as well as addressing their introspection during the elicitation interviews, showed that modern speakers interpret reduced vowels as vowels rather than as consonantal features of palatalisation and labialisation (see Chapter 4 for an experimental study). Speakers also sometimes spontaneously mentioned the reduced character of these vowels. Cf. a dialogue (2) with the aforementioned speaker NDP on the nature of final *ĭ* in ‘shotglass’:

(2) [ˈP'ikàrĭ̥], a ‘shotglass’ is [ˈp'ikàrĭ̥]. — [ˈP'ikàri], right? (int.) — [ˈp'ikàr']. ‘I’, weak ‘i’ in the end.

At the same time, when asked whether the pronunciation of the words [ˈkukkŏ̥] ‘rooster’ and [ˈkukko] ‘rooster.PRT/ILL’ differs, NDP confirmed the difference but was unable to clearly formulate it: “There is no big difference, but something, kind of, I don’t know how to say, a stress”. NDP invented the Cyrillic-based orthography for his native idiolect. He depicts the phoneme /ə/ as similar to the Russian high central vowel /ɨ/ («ы», in Cyrillic orthography), but writes all other reduced vowels the same way as modal ones (cf. also Chapter 4).

In this sense, the opposition of reduced voiceless and full modal vowels, like a ternary contrast, seems to be unstable also on perceptual grounds.

2.5.2. The causes for maintenance of rare contrasts

Blevins (2004: 204-5) posed a question about the forces that could inhibit neutralising instances of sound change and allow rare contrasts to survive. One such force is the development of coexisting phonetic contrasts reinforcing the rare ones. This aspect has already been discussed for the Ingrian data.

Another important force is a phonological and especially morphological load of the contrast. The phonological load includes, among other things, “the number of minimal pairs that depend on the distinction", "the number" and "the discriminability of the phonetic features on which the opposition depends", "the limitations in the range of movements that would avoid merger" (Blevins 2004: 204-5, with a reference to W. Labov). Heavy morphological load implies that "the contrast in question directly instantiates a morphological feature within a morphological paradigm". If the contrast "is limited to defining non-paradigmatic oppositions, its load is much lighter" (Blevins 2004: 204). Enough has already been said regarding the different constituents of the phonological load of the rare contrasts analysed. Their morphological load is briefly surveyed below.

2.5.2.1. Morphological load of the ternary quantity contrast

In Soikkola paradigms, the alternations of class 1 with either class 2 or class 3 consonants are regular, e.g. [ˈka**n**ā] 'hen' — [ˈka**n̆n**à] 'hen:PRT/ILL', [ˈle**pp**ă̄] 'alder' — [ˈle**b**ā̆n] 'alder:GEN'. Minimal pairs opposed by the class 2 vs. class 3 consonants are, in turn, extremely rare (see examples in 2.2.5 above), and in nearly all cases they contain different lexemes[40]. The opposition of the two "long" classes thus bears an extremely light functional load, unlike in Estonian.

Moreover, the morphological factor favors the merger of classes 2 and 3 into one "long" category. Minimal pairs like [ˈkanà] vs. [ˈkan̆nà] are common in Ingrian, and the intention of speakers to make the phonetic distance between such words even more salient would come as no surprise. Here, the key distinction lies in the consonantal length. Consequently, the greater the phonetic distance between consonantal classes is, the more distinct the opposition of forms becomes. Based on the material of the Hevaha dialect, Arvo Laanest made a remark that during the history of Ingrian dialects, the paradigmatic load has been re-distributed from the non-initial vowels to the foot nucleus consonants (Laanest 1966b: 21). This re-distribution towards the state of the Hevaha dialect documented by Laanest happened in rouhgly the following stages: [*ˈpat**a**] 'pot' vs. [*ˈpat**ā**] 'pot:PRT/ILL' > [*ˈpa**ᴅ**à] vs. [*ˈpa**t̆t**ā] > [ˈpa**d**à] vs. [ˈpa**tt**à]. The morphological factor could thus have served an important premise for the merger of the "long" classes, which came to be in the majority of Ingrian varieties.

2.5.2.2. Morphological load of the vocalic voicing contrast

The full voiced vs. reduced voiceless vowel contrast in Southern Lower Luga Ingrian, on the contrary, bears a heavy functional load. It distinguishes between forms in numerous nominal and verbal paradigms, cf. [ˈkukk**ŏ**] NOM vs. [ˈkuk̀k**ò**] ILL of 'rooster' in 2.3.1.

[40] I do not know any full minimal pairs of this kind, though there are at least several quasi-minimal pairs, e.g. [ˈtułłèt] 'come:PC:PST:ACT:PL' vs. [ˈtuł̆łòt] 'come:3PL', [ˈmännèt] 'go:PC:PST:ACT:PL' vs. [ˈmän̆nȍt] 'go:3PL'.

However, even if reduced voiceless vowels disappeared, the forms would not become homonymic. The paradigmatic functional load would shift to the contrast of the final vowel presence vs. absence. Such a situation is observed in more innovative Estonian, cf. *kott* [kot̄ʹ] NOM vs. *koti* [ˈkot̆ʹti] GEN of 'bag' in 2.4.2.1.

Lower Luga Ingrian is thus different in this respect from Estonian and Dinka, as discussed by Blevins, where numerous pairs of grammatical forms would become homonymic given the ternary contrast disappearance. In Ingrian, a heavy morphological load of the vocalic voicing contrast should not necessarily become an inhibiting factor of sound change.

2.6. Ingrian phonological rarities in light of general prosodic development of the respective dialects

The Lower Luga dialect, forming a Sprachbund with closely related languages, has the most innovative phonology among the Ingrian dialects. The most advanced of these is Southern Lower Luga Ingrian, adjacent to the area where even more innovative Estonian is spoken. Reduction of non-initial vowels is especially salient in this subdialect and, compared to other Lower Luga Ingrian subdialects, reaches a new developmental stage. In this stage, a contrast of non-initial short and long vowels transforms into an opposition of reduced and short vowels.

The Soikkola dialect, in turn, has more conservative phonology with respect to reduction. On the other hand, Soikkola (together with the extinct Hevaha and Oredež dialects) has developed some phonological innovations which are unknown to the Lower Luga dialect. These innovations are linked to the more intensive development of vocalic and consonantal lengthening in certain positions.

In this sense, the vectors of phonological development in the Soikkola and Lower Luga dialects used to be partly counter-directional. The vector of Soikkola dialectal development was more "aimed" at developing lengthening, while the one of Lower Luga Ingrian was directed towards developing reduction.

The analysed rarities in their phonology can serve as a vivid illustration of this. The Soikkola phonological system reaches the utmost point of the development of length. More than three degrees of length are usually considered impossible for human languages. The Lower Luga phonological system manifests the zenith of the vowel reduction development: extra-short eliding voiceless vowels.

Chapter 3: Vowel reduction in the Finnic varieties of Ingria and adjacent languages: full evolutionary cycle

3.1. Introduction

Vowel reduction in the non-initial syllables is a widespread phenomenon in Finnic languages. The degree of reduction varies considerably across varieties. One can observe a complete cycle of phonological sound change of the vocalic non-initial durational contrast in these languages. This cycle starts from a long vs. short vowel contrast and ends in a short vs. no vowel contrast. The chapter describes this transformation in detail, elaborating how it transpires at each stage, on the basis of existing published sources and the field data of the author.

Finnic reduced vowels have emerged out of the non-initial short vowels in certain positions. The exact list of these positions slightly varies across the languages in question, but the main trends are similar. The most widespread is apocope, followed by syncope. For example, in Lower Luga Ingrian reduced vowels typically occur foot-finally (examples are from InSLL; see also Chapter 2): [ˈtüttö̥̆] ‘girl’, [ˈavàhtŭ̥] ‘be_opened:PST:3SG’, [ˈsukkŭ̥ˌr'iī̄s] ‘sugar:IN’, [ˈlisȁh'ü̥̆ˌminè] ‘be_added:NMLZ’. Reduction is also possible not foot-finally, in the second syllable of a trisyllabic foot: [ˈihmĭ̥sed] ‘man:pl’, [ˈjā̈hü̥̆teˌttä] ‘cool:IPS’, [ˈkiskŏ̥huˌminè] ‘be_torn_off:NMLZ’.

In the Finnic languages of Ingria, vowel reduction is a pronounced widespread process represented at many stages. All varieties of Ingria are subject to this reduction to some extent. Different varieties show how the original short vowels go through quantitative and qualitative reduction, grammatically and phonetically conditioned elision, and devoicing. Being further reduced, these segments subsequently turn into the consonantal features of palatalisation and labialisation, and are finally lost, while the original long non-initial vowels completely shorten.

The stages of reduction will be considered in the following varieties of Ingria: Ingrian Finnish (FiI; a part of South-Eastern Finnish dialects, see Kettunen 1930), the Soikkola (InS) and the Lower Luga (InLL) dialects of the Ingrian language, the Luutsa variety of the Western Votic dialect (VoL), and the mixed Siberian Ingrian/Finnish variety of the Ryžkovo village (FiRyž). Northern, Central (=East and West, cf. Figure 1.3) and Southern subdialects of Lower Luga Ingrian will be referred to as InNLL, InCLL, InSLL respectively. Comparative data on adjacent South-Eastern Finnish dialects of Karelia (FiSK), as well as on Standard Finnish (Fi) and Estonian (Es) will also be cited. Among all these varieties, special attention will be paid to those two which contain the complete phonological subsystems of reduced voiceless vowels, a typological rarity (Gordon 1998; Blevins 2004: 199-201; see Chapter 2): Southern Lower Luga

Ingrian and Siberian Ingrian/Finnish. These varieties illustrate two successive stages of the evolution of reduced voiceless vowels (see sections 3.8-3.10).

As discussed in Chapter 1, all Finnic varieties of Ingria are severely endangered. In 2006, there were several hundred Ingrian Finnish speakers scattered across Russia, Finland, Estonia and Sweden, 50-70 fluent Lower Luga Ingrian speakers and the same amount of Soikkola speakers, and less then 10 Western (Luutsa-Liivčülä and Jõgõperä) Votic speakers (Kuznetsova, Markus & Muslimov 2015); since then the number has decreased even more. As for the Siberian variety, there were some 30 fluent speakers in 2009-2012 (Sidorkevič 2013b: 11).

3.2. The starting point of reduction: Standard Finnish

The development of reduction from the point when there was a distinct contrast of short and long vowels in the non-initial syllables will be traced below. There is a general consensus in Finno-Ugric studies that this contrast does not go back to the Proto-Finnic stage, as there were no long non-initial vowels in Proto-Finnic. These vowels emerged in the process of the contraction of short vowels, while the consonants between the latter were lost (viz. e.g. Lehtonen 1970: 136). Among all the Finnic languages, the situation in Standard Finnish is the closest to that point. In Standard Finnish, there is a robust opposition of short and long non-initial vowels. This contrast is foot-structure-insensitive and structurally unrestricted, it can occur in any syllable (see examples in Lehtonen 1970: 29-30; Leskinen & Lehtonen 1985: 49; Suomi, Toivanen & Ylitalo 2008: 41). Two central types of contexts for this contrast include:

(1) position after a short/light syllable (open, containing a short vowel): *kan**a*** 'hen' vs. *kan**ā*** 'hen:PRT';

(2) position after a long/heavy syllable (all other syllable types): *linn**a*** 'fortress' vs. *linn**ā*** 'fortress:PRT'.

The phonetic distance between long and short non-initial vowels is very distinct (far over 2 : 1), and is even greater than the distance between long and short initial vowels (cf. the $\bar{V}_1/\breve{V}_1$ and $\bar{V}_2/\breve{V}_2$ ratios for Standard Finnish given in Table 3.1).

Foot isochrony, i.e. "interstress intervals ...of approximately equal size" (Lehiste 1977), is observed in Standard Finnish in its embryonic phase. One of the important effects of foot isochrony in Finnic languages is that "a given sound is significantly shorter in a longer word than a corresponding sound in a shorter word" (Lehtonen 1970: 143), and vice versa. This effect was not confirmed for Standard Finnish as a general rule valid for each prosodic position (ibid.). The only robust effect was the realisation of a short vowel in a syllable following the first short syllable as phonetically half-long: [ˈkan**à**] 'hen' (the $\grave{V}_2/\breve{V}_1$ ratio in disyllables was 1.6 in Lehtonen's experiment, see Table 1). The duration of $\grave{V}_2$ in this shortest disyllabic foot structure (with the short first syllable) is thus phonetically prolonged to the maximum. This brings the overall foot duration closer to the duration of other foot types, which contain more segments. Absolute duration of this half-long vowel decreases in an inverse relation with increasing the number of syllables in a word (Lehtonen 1970: 141-44). However, half-long vowel is not observed in all speakers of Standard Finnish: it depends on their dialectal background. Wiik and Lehiste, who have studied the matter, conclude on this isogloss (Wiik & Lehiste 1968: 573-74):

> In the type of Finnish that does not use a half-long vowel, quantity appears to function primarily on a segmental level. In dialects with the half-long vowel, quantity seems to have an additional higher-level function. In addition to manifesting the phonemic quantity of each vocalic segment, the duration of the vowels also contributes toward establishing the suprasegmental patterns characteristic of words.

There are solid grounds to reconstruct the phonetic tendency to foot isochrony (and the half-long vowel as one of its manifestations) already for Proto-Finnic. Foot isochrony was later disrupted in the process of vowel contraction, when phonemic long non-initial vowels emerged. However, this tendency was later restored in many Finnic varieties. In Standard Finnish, however, it was not restored: on the contrary, even the half-long vowel disappeared from some of its varieties (Lehtonen 1970: 136-38; Prince 1980: 545-46; Wiik 1991; Eek & Meister 2004: 342-51). The area in which half-long vowels does not occur (see maps in Wiik 1975) highly overlaps with the area of Swedish historical settlements in Finland, and this might not be a coincidence.

In any case, we can consider the reduction stage observed in Standard Finnish as the most conservative in a sense that it is the closest to that particular proto-stage with disrupted foot isochrony and the robust contrast of non-initial short and long vowels. All the subsequent phases of the foot integrity restoration and the vowel reduction will be further traced starting from this point. Standard Finnish length contrast of the non-initial vowels is schematised below. Open disyllabic feet with initial short (1)-(2) and long (3)-(4) syllables are taken as examples:

(1) [ˈkan**à** ~ ˈkan**a**] — (2) [ˈkan**ā**] ('hen' in NOM vs. PRT);

(3) [ˈlinn**a**] — (4) [ˈlinn**ā**] ('fortress' in NOM vs. PRT; in the varieties of Ingria means 'city').

All the varieties analysed below manifest more innovative developments of this contrast. They will be considered according to their degree of innovation, in an order from the least to the most advanced. Varieties presented at a given stage include all the innovations from the previous stages.

3.3. Restoration of the foot integrity in more innovative varieties

Compared to Standard Finnish, all Finnic varieties of Ingria indicate more developed foot structure and stronger tendency towards foot isochrony (N. V. Kuznecova 2009b: 34; Kuznetsova 2013; E. Markus 2010: 48, 50 on Soikkola Ingrian; cf. also Chapter 2). While Standard Finnish, in a sense, remained in that stage where foot integrity was disrupted by the emergence of long non-initial vowels, these latter varieties have overcome this disruption and have developed in the direction of restoring the foot integrity.

To demonstrate this, Table 3.1 summarises available experimental data on the average ratios of long or lengthened vs. short initial and non-initial vowels across disyllabic structures[41] in the following Finnic varieties:

(1) Standard Finnish spoken by the speakers with various dialectal backgrounds;

(2) the South-Eastern Finnish dialects of South Karelia (the Karelian Isthmus and the southern coastal area of the Ladoga lake) and Ingria (Koprina, Skuoritsa, and Tyrö parishes);

(3) Soikkola Ingrian;

(4) the Luutsa variety of Western Votic (more precisely, the Luu(di)tsa-Liivčülä variety);

(5) Standard Estonian.

The varieties are organised in Table from the least to the most innovative in terms of vowel reduction and the degree of development of the foot. Four types of ratios are represented:

(a) $\grave{V}_2/\breve{V}_1$: second lengthened to first short vowel in disyllabic feet with a VCV nucleus;

(b) $\bar{V}_2/\grave{V}_2$: phonemically long 2^nd^ syllable vowel after a long syllable (containing long vowel or diphthong and/or closed) to the lengthened second vowel in a VCV foot nucleus;

(c) $\bar{V}_2/\breve{V}_2$: non-initial long to short vowels of the 2^nd^ syllable in other than VCV foot nuclei;

(d) $\bar{V}_1/\breve{V}_1$: long to short vowels of the initial syllables in all foot nucleus types (first short vowel in the VCV nucleus included).

The ratios are cited or calculated from various sources. The phrasal position of the words and the number of disyllabic structures, the presence or absence of a phrasal accent, as well as the size of samples, the number of speakers and the diversity of their geographic origin widely vary across experiments[42] (and are not provided in Table 3.1). The ratios, averaged across structures, phrasal positions, local subvarieties and the speakers of the respective experiments, vary much less and manifest several robust trends, listed below.

[41] The durations of the long and short vowels in trisyllables are highly comparable with the data on disyllables. Not all the experiments cited in Table 1 provide data on trisyllables, therefore, for the reasons of consistency, we took only the disyllabic structures.

[42] I did not however include data on slow and fast speech tempos from Eek and Meister (2003, 2004) (only on the moderate tempo), as well as the data on contrastively accented words from Suomi et al. (2013) (only on unaccented and accented words).

(1) Even in the Standard Finnish varieties without the half-long vowel, the second short vowel is slightly longer than the first one in the VCV nucleus (e.g. *k**a**n**a***; the average $\grave{V}_2/\breve{V}_1$ ratio in a disyllabic foot was 1.1 in Wiik and Lehiste's experiment). In those Standard Finnish varieties that have the half-long vowel, the $\grave{V}_2/\breve{V}_1$ ratio was 1.4-1.6. In more innovative Finnic varieties, placed in the table to the right of Standard Finnish, this ratio was also around 1.6.

(2) On the other hand, the ratios between phonologically long and short vowels (both initial and non-initial, e.g. *linn**a*** : *linn**ā***, *k**a**rta* 'tin' : *k**ā**rto* 'rainbow'[43]) in longer structural foot types dramatically shrink in other varieties, as compared to Standard Finnish. While in Standard Finnish these ratios ($\bar{V}_1/\breve{V}_1$, $\bar{V}_2/\breve{V}_2$) are greater than 2 : 1, in all other varieties given in the table they are substantially smaller, especially for the non-initial vowels (both $\bar{V}_1/\breve{V}_1$, and $\bar{V}_2/\breve{V}_2$ ratios were mostly under 2 : 1, and $\bar{V}_2/\breve{V}_2$ ratios in all the experiments were under 1.7 : 1)[44].

Therefore, we can observe the following dynamic tendency. The shortest foot nucleus structure (C)VCV(C) phonetically extends the duration of a second etymologically short vowel. At the same time, longer foot nucleus structures shorten etymologically long vowels both in initial and non-initial syllables, bringing their duration closer to the duration of short vowels. These two processes lead to the strengthening of an overall foot isochrony.

(3) Longer $\grave{V}_2$ in VCV foot nucleus (*kan**à***) and shorter $\bar{V}_2$ in other foot types (*linn**ā*** etc.) result in a drastic change of their mutual ratios in all the varieties placed to the right of Standard Finnish, as compared to the latter. In Standard Finnish, half-long vowel in the VCV foot nucleus (*kan**à***) can indeed be called "half-long". It is relatively longer by its absolute duration than other short vowels (*linn**a***), but relatively shorter than phonologically long non-initial vowels (*linn**ā***): $\breve{V}_2$ (*linn**a***) < $\grave{V}_2$ (*kan**à***) < $\bar{V}_2$ (*linn**ā***). The average durations of these types of vowels in disyllables, counted across the experiments on Standard Finnish given in Table 3.1, were 59 ms, 107 ms and 130 ms, respectively.

In more innovative varieties, the order of $\grave{V}_2$ and $\bar{V}_2$ reverses. It is now the $\grave{V}_2$ in the VCV foot nucleus that becomes the longest non-initial vocalic type by its absolute duration: $*\breve{V}_2$ (*linn**a***) < $*\bar{V}_2$ (*linn**ā***) < $*\grave{V}_2$ (*kan**à***). The average durations of these vowels, counted across the

[43] The last two examples are taken from InS.

[44] The exception is the ratio of the Estonian first syllable long vowels in the third degree of quantity (Q3) to the initial short vowels. Estonian has a very innovative prosody compared to the Finnic languages of Ingria: it has developed a new suprasegmental foot-level opposition of three degrees of quantity (see e.g. Tauli 1954; Lehiste 1960, and subsequent extensive research). During this process, a phonological split in ratios has happened in the feet with the first long syllable, so a 2.4 : 1 ratio in Q3 is partly a secondary newly-acquired feature. Table 1 shows that the ratio in Q2 stays close to the Ingria-type ratios, while the ratio in Q3 resembles the Standard Finnish type. Proximity of Estonian Q3 ratios to the Finnish phonetic distance between long and short vowels has been mentioned in Eek and Meister (2004: 349), Meister and Meister (2013: 241). In a psycholinguistic experiment by Suomi et al. (2013: 12), Finnish speakers confused words in their language rather with Estonian Q3 than with Q2.

experiments on all the varieties placed to the right of Standard Finnish in Table 1, were 77 ms, 114 ms, and 139 ms, respectively. Therefore, it is no more correct to call $\grave{V}_2$ “half-long” (or “lengthened”) and $\bar{V}_2$ “long” for all these languages. Researchers studying the respective varieties have already expressed this concern, and those who aim at building synchronic structural descriptions prefer other phonetic and phonological labels (Lehtonen & Leskinen 1973: 320; Leskinen & Lehtonen 1985: 58, 66; Leskinen 1978: 130; N. V. Kuznecova 2009a: 118; E. Markus 2011: 109; Rozhanskiy 2015).

(4) In Finnish (both standard and dialectal), the ratios between long and short non-initial vowels (*linn**a*** : *linn**ā***) are equal or greater than the ratios between initial long and short vowels (*k**a**rta* : *k**ā**rto*): $\bar{V}_2/\breve{V}_2 > \bar{V}_1/\breve{V}_1$. In more prosodically innovative languages (Ingrian, Votic, Estonian), the ratios between long and short non-initial vowels became smaller than between the respective initial vowels: $\bar{V}_2/\breve{V}_2 < \bar{V}_1/\breve{V}_1$. In Estonian, the most innovative of all the varieties in this respect, the difference between those ratios is especially big.[45]

This change in ratios provides an explicit manifestation of how exactly the vowel reduction works in Finnic varieties. The phonetic distance between long and short vowels in the non-initial syllables has shrunk much faster than in the initial syllables. This process contributes to making the initial syllables much more prosodically prominent than the non-initial ones; it thus strengthens the metrical pattern typical of stress languages. It also creates premises for the ultimate disappearance of the length contrast in the non-initial syllables, where short vowels either merge with long ones in some positions or completely disappear in other positions (these two processes are considered in detail in 3.8-3.9).

Based on the data from Table 3.1, the schematic representation of the overall change in ratios between long, lengthened (“half-long”), and short initial and non-initial vowels is given in Figure 3.1 and Table 3.2. Standard Finnish is taken as the first, more conservative stage. The situation in more innovative varieties, Finnish of South Karelia and Ingria, Soikkola Ingrian, Luutsa Votic and Standard Estonian, represents the second, more innovative stage. In Figure 3.1, the relative phonetic distance between particular vowel types is symbolically depicted as their relative proximity to each other on the vertical scale. Between each pair of vocalic types, their average ratio is given (averaged across all the data from Table 3.1 on respective varieties).

For example, as $\grave{V}_2/\breve{V}_1$ ratio in Standard Finnish is much smaller than both $\bar{V}_2/\breve{V}_2$ and $\bar{V}_1/\breve{V}_1$ ratios, the vertical distance between $\grave{V}_2$ and $\breve{V}_1$ is much shorter than between $\bar{V}_2$ and $\breve{V}_2$,

[45] For Estonian, $\bar{V}_2/\breve{V}_2$ is the ratio between the lengthened second vowel in Q2 words and the short second vowel in Q3 words. This ratio is much smaller than the $\bar{V}_1/\breve{V}_1$ ratios both in Q2 and in Q3 words (see Table 3.1).

and between $\bar{V}_1$ and $\breve{V}_1$. On the central picture of Figure 1, the dynamic process of change in phonetic distances is depicted. The $\bar{V}_1/\breve{V}_1$ and $\bar{V}_2/\breve{V}_2$ ratios are getting much smaller (the arrows are pointing inwards), while the $\grave{V}_2/\breve{V}_1$ ratio is getting slightly bigger (the arrows are pointing outwards). As a result, in more innovative varieties at Stage 2, all the three types of ratios get very close to each other.

Table 3.1: Average ratios of long or lengthened (half-long) to short initial and non-initial vowels in several Finnic varieties

Types of ratios	Fi			FiSK			FiI	InS			VoL		Es	
	L 1970	S et al. 2013	W&L 1968	L 1978	L&L 1973	L&L 1985	K&F 2011	L 1978	K 2009	M 2011	K&F 2013	R 2015	E&M 2003	S et al. 2013
(a) $\grave{V}_2/\breve{V}_1$	1.6	1.6	1.4[1] *1.1*[2]	1.6	1.6	1.5	— [6]	1.5	1.5	1.8	—	1.6	1.6	1,4
(b) $\bar{V}_2/\grave{V}_2$	1.3	—	1.4[1] *1.8*[2]	0.8	0.9	0.9	— [6]	0.8	0.7	0.8	—	0.8	0.7	0,7
(c) $\bar{V}_2/\breve{V}_2$	2.8	—	2.3	1.7	1.7	1.7	1.5	1.5	1.6	1.3	1.3	1.6	1.4[3]	1.2[3]
(d) $\bar{V}_1/\breve{V}_1$	2.1	2.1	2.3	1.6	1.7	1.6	1.3	1.8	1.6	1.9	1.5	2	1.9[4] (Q2) *2.4*[5] (Q3)	2[4] (Q2) *2.4*[5] (Q3)

Abbreviations: '(a) $\grave{V}_2/\breve{V}_1$' — 2nd to 1st vowel ratio in a (C)VCV(C) foot; '(b) $\bar{V}_2/\grave{V}_2$' — non-initial long vowels in feet with the first long syllable to the 2nd "half-long" vowel in a (C)VCV(C) foot; '(c) $\bar{V}_2/\breve{V}_2$' — non-initial long to short vowels in the feet with the first long syllable; '(d) $\bar{V}_1/\breve{V}_1$' — long to short vowels of the first syllable in all disyllabic foot types.

Notes: [1]in varieties with the "half-long" vowel; [2]in varieties with no "half-long" vowel; [3]the ratio between the lengthened second vowel in Q2 words and the short second vowel in Q3 words; [4]$\bar{V}_1$ from Q2 words; [5]$\bar{V}_1$ from Q3 words; [6]see, however, Leskinen and Lehtonen (1985: 69), who note the existence of the "half-long" second vowel in the VCV foot nucleus also in Ingrian Finnish (which corresponds to my own auditory experience on these dialects), and claim that this type of lengthening in general is likely to originate from the South-Eastern corner of the Finnish language area.

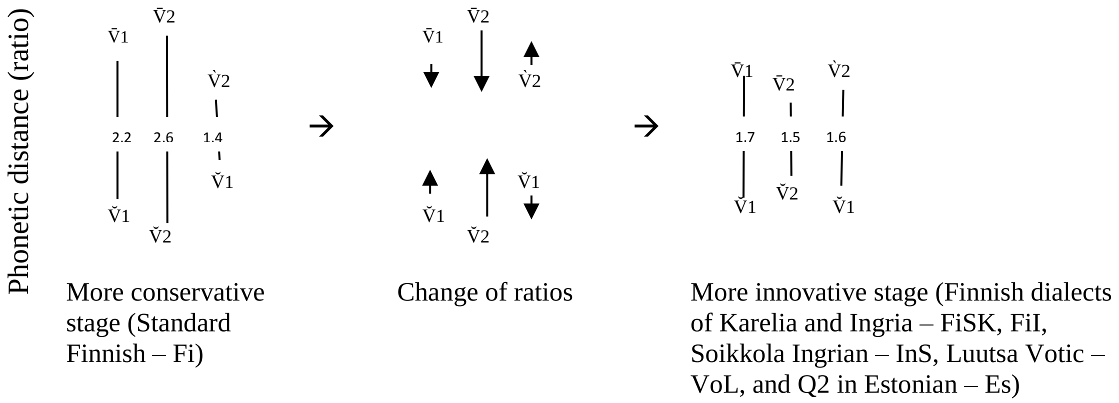
Sources: L 1970 — (Lehtonen 1970: 127-29), Standard Finnish of Jyväskylä; S et al. 2013 — (Suomi et al. 2013: 5), Standard Finnish of Oulu, Standard Estonian of Tallinn; W&L 1965 — (Wiik & Lehiste 1968: 571), Standard Finnish against various dialectal backgrounds; K&F 2011 — yet unpublished experiment conducted by Maxim Fedotov and myself in 2011–2012 on Finnish of Central and Western Ingria (see some results in Kuznetsova 2013); L&L 1973 — (Lehtonen & Leskinen 1973: 320-24); L 1978 — (Leskinen 1978: 123-24, 127-28); L&L 1985 — (Leskinen & Lehtonen 1985: 53-55, 65, 68), all the three last ones are on Finnish of South Karelia; L 1978 — (Leskinen 1978: 126, 129), Soikkola Ingrian of Saarove; K 2009 — (N. V. Kuznecova 2009a: 31, 35); M 2011 — (E. Markus 2011: 107-9, 114), both are on Soikkola Ingrian of different villages; K&F 2013 — yet unpublished experiment conducted by Maxim Fedotov and myself in 2013 on Luutsa and

Jõgõperä Votic (see some results in Kuznetsova & Fedotov 2013); R 2015 — (Rozhanskiy 2015: 105-16; see also, 2013), Luutsa Votic; E&M 2003 — (Eek & Meister 2003: 905, 2004: 267, 269-70), Standard Estonian.

Table 3.2: Change in ratios between long, half-long and short initial and non-initial vowels across Finnic varieties of Ingria, as compared to Standard Finnish

Stage 1 (Fi)		Stage 2 (FiSK, FiI, InS, VoL, Es)
$\bar{V}_2/\grave{V}_2 > 1:1$		$\bar{V}_2/\grave{V}_2 < 1:1$
$\bar{V}_2/\breve{V}_2 > 2:1$	→	$\bar{V}_2/\breve{V}_2 < 2:1$
$\bar{V}_1/\breve{V}_1 > 2:1$		$\bar{V}_1/\breve{V}_1 \leq 2:1$

Figure 3.1: Schematic representation of the evolution of ratios between long, half-long and short vowels



3.4. Positional restriction of the non-initial vowel length contrast in more innovative varieties

In the non-initial syllables, in addition to the drastic shrinking of ratios between long and short vowels, a restructurisation of the vocalic length contrast has occurred in all the varieties placed in Table 3.1 to the right of Standard Finnish. This led to the restriction of prosodic positions generally possible for this contrast in the language. The restructurisation happened in two ways, but they both led to the same result for the vocalic systems: the disappearance of the vocalic length contrast in the second syllable of the VCV foot nucleus.

The first, more archaic, path is observed in all the varieties of Ingria (apart for some Eastern Votic subdialects), as well as in a big part of Finnish dialects (basically the same that have the "half-long" second vowel in VCV foot nucleus, cf. Wiik 1975: 420), also in South Estonian and Livonian (Palander 1987: 10). The process is usually referred to as “general (or common) secondary gemination” (*yleisgeminaatio*, in Finnish; cf. also Chapter 5). The general rule is that during this process geminate consonants have emerged out of intervocalic singletons before the syllables that contained long vowels and certain types of diphthongs, e.g. **kanā* ‘hen:PRT’ > [ˈkannà] (FiI, InLL, partly VoL) / [ˈkanňà] (InS). As a result, the phonological contrast of long and short vowels in the second syllable of a VCV nucleus, as in Standard Finnish *kan**a*** 'hen' vs. *kan**ā*** 'hen:PRT', ceased to exist in these varieties.

The second, more innovative, path of disappearance of this contrast is observed in some of those varieties, where the general secondary gemination did not take place. Such gemination does not exist at all in Estonian and in Kattila Votic, and is irregularly present in those Votic varieties that have contacted with the Ingrian language (Viitso 1964) . In Estonian and partly in Luutsa Votic (in the cases of absence of general secondary gemination, viz. Rozhanskiy 2015), original long second vowels in VCV foot nucleus merged with etymologically short (phonetically "half-long") vowels. Therefore, in place of the Standard Finnish contrast *kan**a*** vs. *kan**ā*** ('hen' in NOM vs. PRT) only one variant is possible, be it phonetically [ˈkanà] or [ˈkanā].

Positional restriction of the non-initial length contrast, as compared to the stage represented in Standard Finnish, is schematised as following (innovations from the previous stage are marked in bold):

(1) [ˈkanà] > [ˈkan**à** ~ ˈkan**ā**] 'hen';

(2) [ˈkanā] > (a) [ˈka**n̆nà**, ˈka**nnà**] (FiSK, FiI, InS, InLL, some Votic varieties), or (b) [ˈkan**à** ~ ˈkan**ā**] 'hen:PRT' (Es, some Votic varieties);

(3) [ˈlinna] = [ˈlinna] 'city';

(4) [ˈlinnā] = [ˈlinnā] 'city:PRT'.

3.5. Beginning of qualitative vowel reduction and elision: Ingrian Finnish, Soikkola Ingrian

Among living Finnic varieties of Ingria, Ingrian Finnish and Soikkola Ingrian manifest the first stages of vowel reduction, as compared to Standard Finnish.[46] They differ from the Standard Finnish stage only by the features discussed in 3.3 and 3.4. Other features characteristic of more advanced stages of reduction exist here at the initial level.

First, short non-initial vowels *a*, *ä* and sometimes *e* tend to undergo qualitative reduction to schwa[47] especially in fast speech (for Soikkola Ingrian, viz. N. V. Kuznecova 2009a: 33-34; E. Markus 2011: 117). In these varieties, such reduction can be still considered a phonetic phenomenon, as schwas are generally restored to the corresponding full vowels in well-articulated speech. However, there are already cases when, from the etymological point of

[46] In this paper, I do not consider those Ingrian Finnish and Eastern Votic varieties where non-initial long vowels were innovatively diphthongised (Ariste 1968: 2-3; Muslimov 2009: 191-94). Only reduction processes are analysed.

[47] The term 'schwa' is used here for "neutral" central mid vowel [ə] (as in Iivonen, Sovijärvi & Aulanko 1990: 36); see e.g. its formant structure in Votic in Rozhanskiy (2015: 120, Table 23). In the languages discussed in this chapter, schwa is not always an overshort vowel; especially reduced schwas will be separately marked as [ə̆].

view, a schwa is sometimes restored to a full vowel incorrectly, e.g. [ˈajjət] to *ajjet*, not to *ajjat* ‘fence:PL’ (N. V. Kuznecova 2009a: 33-34). In the transitional Soikkola to Lower Luga variety of Koskisenkülä, speakers sometimes pertain schwa instead of a full vowel even in well-articulated speech, cf. the syllabification of a word *pikkarain* ‘small’ by a speaker as [ˈpik-ˈk**ə**-ˈrai̯n] (N. V. Kuznecova 2012: 101). Such varieties manifest the first stage of the formation of phonemic schwa.

Second, certain short non-initial vowels (especially *a, ä,* more rarely *e, i, u, ü*) undergo elision in certain contexts. For the varieties at this stage, the conditions are mostly grammatical. Regular vowel loss have occurred in certain morphemes: some case suffixes (e.g. **-ssa/ssä* > *-s* IN, **-lla/-llä* > *-l* AD, **-ksi* > *-ks* TRL), verbal declension suffixes (e.g. **-nut/-nüt* > *-nt* PC:PST:ACT), as well as some derivational suffixes, e.g. in the adjectival suffix (**-nen* >) **-ne* > *-n: *naine* > [nai̯n] ‘woman’. In some cases, this grammatically conditioned process is still ongoing, as in plural partitive forms with the *-oi-* diphthong before a partitive suffix in the southern Soikkola varieties: **astioja* > [ˈaštioja ~ ˈaštioi̯] ‘dish:PL:PRT’.

Only extremely rarely a phonetically conditioned phrasal elision occurs, where any vowel type can elide in the unstressed final position of any word in a sandhi with the following word, e.g. [pai̯st] for *paisti* ‘be_seen:PST:3SG’ in *ettǟlt* ***paist*** *ja* ‘[It] could be seen from far away and...’ (viz. also for other examples Laanest 1984: 72). I observed such elision also in the phrase-final position, e.g. [vet̄] for *vettä* ‘water:PRT’ in *uhlulois on pal'ju* ***vet̄*** ‘In the buckets, there is a lot of water’.

Vowel elision in the South-Eastern Finnish dialects (which include also Ingrian Finnish) and in Soikkola Ingrian are considered in detail with numerous examples in Leskinen (1973) and Laanest (Laanest 1980, 1984). Obviously, grammatically conditioned vowel elision emerged earlier than purely phonetically conditioned elision (Laanest 1980: 73-74), and it happened first of all in the most frequently used morphemes (Leskinen 1973: 218). This is in line with the cross-linguistic studies showing that high-frequency grammatical elements tend to undergo sound change earlier and faster than low-frequency elements (Bybee 2001: 11-12).

The innovations in Ingrian Finnish and Soikkola Ingrian, as compared to the Standard Finnish stage, are schematically represented below (innovations are in bold):

(1) [ˈkanà] > [ˈkan**à** ~ ˈkan**ā**] ‘hen’;

(2) [ˈkanā] > [ˈka**ňnà** InS, ˈka**nnà** FiI] ‘hen:PRT’;

(3) [ˈlinna] > [ˈlinn**a** ~ ˈlinn**ə**] ‘city’, but vowel loss under certain grammatical conditions (examples from InS): (1) regular loss: **naine* > [nai̯n**Ø**][48] ‘woman’ or (2) irregular loss: **astioja* > [ˈaštioj**a** ~ ˈaštioi̯**Ø**] ‘dishes:PL:PRT’;

(4) [ˈlinnā] > [ˈlinn**à**] ‘city:PRT’.

3.6. Regular phonetically conditioned vowel elision: Northern Lower Luga Ingrian

The Lower Luga dialect differs the most from the other three Ingrian dialects, Soikkola, Hevaha† and Oredež† (cf. Chapter 1). It has undergone heavy contact influence from the neighboring related languages of the Lower Luga area: Votic, Ingrian Finnish and, to some extent, Estonian (Laanest 1966a: 146, 150-51; Muslimov 2005: 5, 13). The reduction of non-initial vowels in Lower Luga Ingrian is the most salient of all the Ingrian dialects. Within this dialect, the degree of vowel reduction grows from the north to the south of the area (N. V. Kuznecova 2012). The Lower Luga subdialects range from the least to the most susceptible to reduction in the following way: Northern > Central (comprising Eastern and Western) > Southern. For example, compare the variants of the word ‘neighbor’ in all these varieties (the names of the villages where a variant was registered in Ingrian speech are given in parentheses; the most frequent variants for each group are in bold; for more examples see N. V. Kuznecova 2012: 510-21):

(a) Northern: [ˈ**nāpuri**] (Pärspää, Laukaansuu, Takaväljä) ~ [ˈnāpər'ĭ] (Takaväljä);

(b) Eastern: [ˈ**nāpuri**] (Luutsa, Joenperä, Rüsümäki, Kukkusi) ~ [ˈnāpăr'ĭ] (Joenperä) ~ [ˈ**nāpər'Ø**] (Joenperä; Kukkusi);

(c) Western: [ˈ**nāpŭr'ĭ**] (Narvusi) ~ [ˈ**nāpər'ĭ**] (Sutela) ~ [ˈnāpər'ĭ̥] (Ropsu) ~ [ˈnāpŭr'Ø] (Narvusi) ~ [ˈnāpər'Ø] (Ropsu);

(d) Southern: [ˈnāpŭr'ĭ] (Haavikko) ~ [ˈ**nāpər'ĭ**] (Haavikko, Sutela) ~ [ˈ**nāpər'ĭ̥**] (Vanakülä, Kotko) ~ [ˈnāpŭr'] (Teensuu) ~ [ˈ**nāpər'Ø**] (Vanakülä, Kotko, Dal'njaja Pol'ana) ~ [ˈnāpᵊr'Ø] (Vanakülä, Teensuu).

The level of reduction in Northern Lower Luga Ingrian is not much higher than in Ingrian Finnish or in Soikkola Ingrian. All qualitative reduction of *a, ä, e* to schwa can be also considered phonetic here.

However, phrasal vowel elision in speech is not grammatically conditioned in this variety any longer. It is a very widespread and regular phenomenon conditioned only by phonetic

[48] The sign ‘Ø’ marks the loss of vowel, see also Appendix III.

rules. Elision happens both word-finally (apocope) and word-internally (syncope). Here are some examples from a speaker born in Pärspää:

(1) apocope:

(a) [miä **hänt** näen] ‘I see him’, [siä näit ˈ**händä**] ‘Have you seen him?’ (= *häntä* ‘he:PRT’);

(b) [ˈ**pū̆h**ˈ mā] ‘Sweep the floor’ (= *pū̆hi* ‘sweep:IMP’);

(c) (while discussing the words for ‘beautiful’ in their language) [ˈ**Mukàvə**, vḕl ˈ**mukàv** ono, ˈ**mukàv** mei̯n ˈvīsi ˈonò. ˈLust'i i ˈ**mukàva**, ˈ**mukàva**] (‘*Mukava*, also there is *mukava*, our way is *mukava. Lusti* and *mukava, mukava*’) (= *mukava* ‘beautiful, nice’);

(d) (while discussing the words for ‘small’ in their language) [I pḕn, i ˈ**pikka**ˌ**rai̯ne**. ˈ**Pikka**ˌ**rai̯n** laps...] ‘Both *pēn* and *pikkaraine.* ‘Little child’...’ (= *pikkaraine* ‘small, little’);

(2) syncope: [ˈPā̆sännä ˈ**ihmset** ˈkävvät ˈkirìkko] ‘On Easter, people go to church’ (= **ihmiset* ‘human:PL’).

Here, one can already speak about the structural positions of reduction, not about certain morphemes, as at the previous stage (cf. a detailed chart of these positions in N. Kuznetsova 2011: 189; N. V. Kuznetsova 2012a: 59-60). Note that in Lower Luga Ingrian, reduction in frequently used grammatical morphemes is sometimes observed at more advanced stages than elsewhere (N. V. Kuznecova 2012: 72-74). The most likely reason is, as said in the previous section, that it has started in these elements earlier.

The advance of vowel reduction in Northern Lower Luga Ingrian, as compared to the previous stage of Ingrian Finnish and Soikkola Ingrian, is schematically summed up below (innovations are in bold):

(1) [ˈkanà ~ ˈkanā] = [ˈkanà ~ ˈkanā] ‘hen’;

(2) [ˈkannà] = [ˈkannà] ‘hen:PRT’;

(3) [ˈlinna ~ ˈlinnə] ‘city’, but grammatically conditioned elision in certain cases [ˈnai̯ne ~ nai̯n] ‘woman’ > only structurally conditioned and unified rules of elision [ˈlinn**a** ~ ˈlinn**ə** ~ liñ**Ø**, ˈnai̯n**e** ~ nai̯n**Ø**];

(4) [ˈlinnà] = [ˈlinnà] ‘city:PRT’.

3.7. Development of the schwa phoneme and sporadic vowel devoicing: Central Lower Luga Ingrian, Luutsa Votic

Central Lower Luga Ingrian represents the next stage of reduction. The same stage is manifest in the only still living variety of the Votic language, Luu(di)tsa Votic. These varieties are not far from the previous stage. The only important difference is that, in certain contexts, short non-initial *a*, *ä* and in some cases *e* have completely reduced here into the phonemic schwa:

linna* > [ˈlinnə**] ‘city’, **päivä* > [ˈpäi̯v'**ə**] ‘day’, **tütölle* > [ˈtütöl'l'**ə**] ‘girl:ALL’ (Viitso 1961; N. V. Kuznecova 2012; Rozhanskiy 2013, 2015). Measurements on Luutsa Votic show that the mean duration of schwa is shorter than of other reduced non-initial vowels in the same positions (Rozhanskiy 2015). Moreover, the speakers of Central Lower Luga Ingrian and of Luutsa Votic are generally not aware of the presence of schwa in a word, though they often pronounce it, especially in the closed syllables, e.g. **lammaz* > [łamm**ə**z] ‘sheep’ (see also Chapter 4). The cases of speakers’ non-perception of schwa for Kukkusi Votic (which was at the same stage of vowel reduction as Luutsa Votic) are given in Posti (1980: XXI), for Lower Luga Ingrian, in Kuznecova (2009b: 164, 2012). For example, Posti’s informants were writing some words in their respective native varieties as *пайкз* <paikz> [ˈpai̯kk**ə**z] < **paikkasi* ‘repair:PST:3SG’, *мютль* <m’utl’> [ˈmǖt**əl̄'**] < **mǖtel̄* ‘along’, my informants as *турвз* <turvz> or *турваз* <turvaz> [ˈturv**ə**z] < **turvas* ‘dung’, *лехм* <lehm> [ˈleh'm'**ə̆**] < **lehmä* ‘cow’, *ахвн* <ahvn> [ˈahv'**ĕ**n**ĕ** ~ ˈahv'**ĕ**n**ə̆** ~ ˈahv'**ə̆**n**ə̆**] < **ahvene* ‘perch’.

In Central Lower Luga Ingrian and Luutsa Votic, occasional phonetic devoicing of reduced vowels in certain positions is also attested; however, it is still very sporadic (Viitso 1961: 149, 151, 2008: 201; N. V. Kuznecova 2012: 84, 510-21). For example, [ˈnai̯zikk**o̥**] (VoL) ‘woman’ (Viitso 1961: 146) [ˈnāpər'**ĭ̥** ~ ˈnāpər'] ‘neighbor’ (InCLL).

In addition, a considerable shortening of original long non-initial vowels is observed in both varieties. These vowels are often realised as short, i.e. there is a regular synchronic variation like [ˈlinn**à** ~ ˈlinn**a**] ‘city:PRT/ILL’ in speech. The length contrast in the non-initial syllables is thus being blurred (viz. Viitso 1961, 1981; N. V. Kuznecova 2012: 41-48; Kuznetsova & Fedotov 2013; Rozhanskiy 2015).

This stage of reduction is compared to the previous one in the following scheme (innovations are in bold):

(1) [ˈkanà ~ ˈkanā] = [ˈkanà ~ ˈkanā] ‘hen’;

(2) [ˈkannà] > [ˈkannà ~ ˈkann**a**] ‘hen:PRT’ (in Luutsa Votic, it can also be **kanā* > [ˈkan**à** ~ ˈkan**ā**]);

(3) [ˈlinna ~ ˈlinnə̆ ~ liñØ] > [ˈlinn**ə̆** ~ liñ**Ø**] ‘city’;

(4) [ˈlinnà] > [ˈlinnà ~ ˈlinn**a**] ‘city:PRT’.

3.8. Well-formed phonological subsystem of reduced voiceless vowels: Southern Lower Luga Ingrian

The southern subdialect of Lower Luga Ingrian is the most innovative of all the Finnic varieties currently situated in Ingria in respect of vowel reduction (on Siberian

Ingrian/Finnish, which is not geographically placed in Ingria, see 3.9). It is immediately adjacent to the area of the even more innovative Estonian language. The devoicing and elision of the non-initial reduced vowels and some diphthongs in rapid speech are extremely frequent here, e.g. [ˈtaht**o**văd ~ ˈtaht**ŏ̥**vəd ~ ˈtaht**Ø**vəd] < **tahtoivad* ‘want:PST:3PL’ (see also examples in N. V. Kuznetsova 2012a: 516-21).

Original long non-initial vowels have completely shortened here, so the only lengthened non-initial vocalic type is the second “half-long” vowel in a foot with the VCV nucleus. This “half-long” vowel is considered an allophone of a short non-initial vowel, as it does not form a phonological contrast with the latter (see also Chapter 5).

In the non-initial syllables, the subsystem of reduced voiceless vowels is thus phonologically contrasted to the short modal vowels, e.g. /ĭ/ in [ˈtūl**ĭ̥**] ‘wind’ (<**tūli*) vs. /i/ in [ˈtul**i**] ‘fire’ (<**tuli*) and [ˈsūtʹ**i**] ‘judge:3SG’ (< **sūtī*). This subsystem has preserved all the original qualitative contrasts of the system it had emerged from, with the exception of the height contrast for middle vowels: [*ü, *ö, *u, *o, *i, *e, *a, *ä] > [ü̥̆, ö̥̆, ŭ̥, ŏ̥, ĭ̥, ĕ̥, ə̥̆ (<**a*, **ä*, partly **e*)]. More data on Southern Lower Luga Ingrian reduced voiceless vowels can be found in Mägiste (1925), Ariste (1965), Kuznecova (2012), Kuznetsova (2015).

However, a tendency towards the merger of etymological high and non-high vowels is already observed here: *ŭ* with *ŏ; ü̆* with *ö̆; ĕ* both with *ə (<ä)* and *ĭ*. For example, speakers transcribe [ˈau̯kkŏ̥] ‘hole’ as *aukko* or *aukku* (cf. N. V. Kuznecova 2012: 65; Kuznetsova 2012). Also, Mägiste mentions the “darkening” of voiceless *o*, *e*, *ö* in his early research: “Sometimes it is hard to distinguish these darkened sounds from the close *u*, *i*, *ü*” (1925: 80).

As argued in Chapter 2, reduced voiceless vowels are to be treated as phonologically reduced rather than voiceless, i.e. /ü̆, ö̆, ŭ, ŏ, ĭ, ĕ, ə/. The reduced schwa phoneme also occurs in the positions where it cannot elide due to phonotactic and speech production restrictions, e.g. [ˈłamm**ə̆**z] ‘sheep’. In such cases, schwa is pronounced as a reduced but voiced vowel.

Additionally, the devoiced allophones are just one type of realisations, along many others, even not the most frequent one (cf. Chapter 4). Therefore, the reduced character of vowels should be considered as the primary phonetic feature, which can trigger devoicing in some, but not all, contexts. In this sense, the case of Ingrian reduced voiceless vowels does not stand out of other cross-linguistically known similar cases. It seems that voicelessness is in no language a primary underlying feature that would be completely independent of other vocalic features and/or of immediate phonetic context (cf. Chapter 2).

The schematic representation of this stage of reduction, as compared to the previous one, is given below (innovations are in bold):

(1) [ˈkanà ~ ˈkanā] = [ˈkanà ~ ˈkanā] ‘hen’;

(2) [ˈkannà ~ ˈkanna] > [ˈkann**a**] ‘hen:PRT’;

(3) [ˈlinnə ~ lin̄Ø] > [ˈlinnə̥̆ ~ lin̄Ø] ‘city’;

(4) [ˈlinnà ~ ˈlinna] > [ˈlinn**a**] ‘city:PRT’.

3.9. The consonantal features of palatalisation and labialisation: Siberian Ingrian/Finnish

Siberian Ingrian/Finnish is a mixed variety of Southern Lower Luga Ingrian and the Ingrian Finnish variety of the Lower Luga area. Since the works by Zlobina (1971, 1972) and Nirvi (1972), this ethnic group has been known by the name *korlaki*. However, a sociolinguistic research conducted by Sidorkevič has found that this nomination is thought pejorative by the speakers and is rather to be avoided (Sidorkevič 2013b).

This dialect also originates from Ingria. It is spoken by an ethnic group whose ancestors were expelled to the Omsk region of Western Siberia in 1803–1804 after an upspring against Baron von Ungern-Sternberg. They settled down in the village of Ryžkovo and the surrounding ones. The speakers originated from the Rosona river basin, where Southern Lower Luga Ingrian has been traditionally spoken along with the local Ingrian Finnish dialects. The Siberian variety has existed in complete isolation from its “mother” languages for more than two centuries. It has however been in some contact with local Siberian Estonian (Sidorkevič 2012).

Apart from the early works mentioned above, the Siberian variety remained completely unstudied until very recently. This partly happened because this group has changed their ethnic identity into Estonian, and was thus sociologically indistinguishable from Siberian Estonians residing in the same area (ibid.). Recently, a comprehensive field study on the Siberian variety has been conducted by Sidorkevič (2013b). Among other things, she has also discovered the traces of reduced voiceless vowels in this dialect (viz. Sidorkevič 2011: 577, 2013a).

In Siberian Ingrian/Finnish, reduced vowels have completely lost the original height contrast. The system now contains two binary oppositions, in backness and labialisation: [ŭ̥, ĭ̥, ə̥̆ (<**a*, **ä*, **e*), ɵ̥̆ [49] (<**u*, **o*, **ö*)]. This system can be already described through the consonantal features of palatalisation and labialisation (C stands for any consonant): [C'ŭ̥, C'ĭ̥, Cə̥̆, Cɵ̥̆] = /C'°, C', C, C°/[50]. Such an interpretation is even preferable for this variety, at least according to the phonetic realisation and the speakers’ introspection (see Chapter 4).

Interpretation of voiceless vowels through the consonantal features leaves the Siberian variety with an ample transitory system of consonants. The majority of consonants come to

[49] Labialised central midvowel (see Iivonen, Sovijärvi & Aulanko 1990: 36).

[50] Consonantal labialisation is marked with the symbol [°] after the consonant, see Appendix III.

have four variants: plain, palatalised, labialised, and labiopalatalised. For example, /pü**t̄**'°/ (< **püttü*) ‘barrel’ vs. /hun**t̄**'/ (< **huntti* ‘wolf’) vs. /kä**t̄**/ (< **kättä* ‘hand:PRT’) vs. /tü**t̄**°/ (< **tüttö* ‘girl’).[51] Many of these consonants are marginal and have a vague phonological status. Their positions of occurrence are extremely restricted, and palatalisation and especially labialisation are not stable in realisation for the majority of the consonantal groups.

The development of reduction in this variety, as compared to the previous stage, is summed up in the scheme below (a word *püttŭ̈* ‘barrel’ containing a front labial final vowel was added for more representativeness; innovations are in bold):

(1) [ˈkanà ~ ˈkanā] = [ˈkanà ~ ˈkanā] ‘hen’;

(2) [ˈkanna] = [ˈkanna] ‘hen:PRT’;

(3) [ˈlinnə̥̆ ~ lin̄Ø], [ˈpüt't'ŭ̥̈ ~ püt̄'°Ø] > [lin̄ᵊ̥ ~ lin̄**Ø**] ‘city’, [ˈpüt't'ᵘ̥̈ ~ püt̄'°**Ø** ~ püt̄'**Ø**] ‘barrel’;

(4) [ˈlinna] = [ˈlinna] ‘city:PRT’.

3.10. The utmost loss of reduced voiceless vowels: Standard Estonian

As previously mentioned, Siberian Ingrian Finnish has an ample consontantal inventory, with a very large marginal periphery. Sidorkevič mentions that the stability of realisation of labialisation and palatalisation varies a lot among different consonantal types, frequent vs. infrequent words and the particular vocalic types that gave rise to these features. She suggests that such instability indicates the tendency towards the simplification of the system (Sidorkevič 2013a: 676, 679-80).

This hypothesis is corroborated by the subsequent stage of evolution observed in Estonian. In Standard Estonian, the original short vowels were completely lost in roughly the same positions where InSLL and FiRyž have reduced voiceless vowels or their remnants. Estonian has obviously also passed through the stage of voiceless vowels before their ultimate loss (see data on the Estonian dialects still maintaining reduced voiceless vowels in Tauli 1956: 66-84).

In Estonian, no traces of consonantal labialisation remained, e.g. *pütt* [püt̄'] ‘tub’ (< **püttü*). Palatalisation was preserved but only for some dental consonants. Palatalisation is not marked in Estonian orthography, and there has been no normalisation in the use of palatalised phonemes, which varies a lot across Estonian speakers with different dialectal backgrounds (Laugaste 1956: 81). The majority of regional varieties contain four types of palatalised consonants: *t*, *n*, *s*, *l*. Palatalisation of *r* sounds old-fashioned in contemporary Standard Estonian

[51] Cf. also chapter 4 on a discussion about a distinction between the plain and the aspirated consonants.

(Ariste 1953: 80; Hint 1998: 154), although it was wide-spread in the Central North Estonian dialect which had laid a basis for the standard language (Must & Univere 2002: 100). Only very seldom can also *k* and *ŋ* be palatalised in this dialect (Laugaste 1956: 74,76; Must & Univere 2002: 98). Table 3.3 summarises the consonantal inventory of Standard Estonian. In addition, the palatalised consonants that are not present in the contemporary standard variety but can occur in the Central North Estonian dialect were added.

Table 3.3. Consonantal inventory of Standard Estonian with some data from the Central North Estonian dialect

Labial	Dental	Palatal	Velar
p p̄	t t̄ **t' t̄'**		k k̄ (**k' k̄'** EsCN)
m m̄	n n̄ **n' n̄'**		(ŋ) (**ŋ'** EsCN)
f f̄	s s̄ **s' s̄'**		h h̄
v v̄	š š̄		
	l l̄ **l' l̄'**		
	r r̄ (**r' r̄'** EsCN)		
(w w̄)		j j̄	

Palatalisation, therefore, proves to be a more stable feature than labialisation. However, there is a dynamic tendency in Estonian towards the disappearance of particular palatalised consonants from the system in general (as it happened with *r'*) and from certain phonetic contexts and structural types of words (Teras & Pajusalu 2014). Estonian palatalisation is in fact prepalalisation, and its degree of prominence varies a lot as a function of a consonantal type, its geminate or singleton nature, the surrounding phonetic context, the degree of quantity in a foot, particular segmental structure of a word, and the age of speakers (Laugaste 1956; Eek 1971, 1973; Hint 1998; Must & Univere 2002; Teras & Pajusalu 2014). Operstein (2010) observes that prepalatalisation is often a part of the process of consonantal depalatalisation.

The final stage of evolution of the non-initial vocalic length contrast, as indicated from Standard Estonian, is summarised below (innovations in comparison with the previous stage are in bold):

(1) [ˈkanà ~ ˈkanā] = *kana* [ˈkanà ~ ˈkanā] ‘hen’;

(2) *[ˈkanna] for ‘hen:PRT’ is not present in Standard Estonian, there is *kana* [ˈkanà ~ kanā] without gemination instead, cf. section 3.4;

(3) [lin̄ᵊ̥ ~ lin̄], [püt't'ᵘ̥̈̆ ~ püt̄'° ~ püt̄'] > *linn* [lin̄̀**Ø**] ‘hen’, *pütt* [püt̄̀'**Ø**] ‘tub’;[52]

(4) [ˈlinna] > *linna* [ˈliǹna] ‘city:PRT’ (the development of prosodic Q3 in PRT/ILL was an innovation, but no principal innovations happened in terms of final vowels).

3.11. Conclusion: a model for the evolutionary chain of the Finnic non-initial vocalic length contrast

Three types of sound change processes in the Finnic varieties of Ingria and the adjacent ones were traced in Chapter 3:

(1) Evolution of the short second vowel in the (C)VCV(C) foot (*kan**a***): “half-long”, opposed to long in the same position → (b) “half-long” only, and the second-long durational type in the non-initial syllables ($\bar{V}_2 > \mathbf{\grave{V}_2} > \breve{V}_2$) → (c) the longest durational type in the non-initial syllables ($*\mathbf{\grave{V}_2} > *\bar{V}_2 > *\breve{V}_2$).

(2) Evolution of the long second vowel in the (C)VCV(C) foot (*kan**ā***): (a) long opposed to “half-long” in the same position ($\mathbf{\bar{V}_2} > \grave{V}_2$) > (b) disappearance of the contrast in this position in course of either a merger with “half-long” ($\mathbf{\bar{V}_2} = \grave{V}_2$) or a restructurisation of the whole structure (*kan**ā*** > *kann**ā***).

(3) Evolution of the non-initial long vowels in other positions (*linn**ā***): (a) the longest type in the non-initial syllables ($\mathbf{\bar{V}_2} > \grave{V}_2 > \breve{V}_2$) → (b) second long type in the non-initial syllables ($*\grave{V}_2 > \mathbf{*\bar{V}_2} > *\breve{V}_2$) → (c) short vowel ($\grave{V}_2 > \mathbf{*\bar{V}_2} = \breve{V}_2$).

(4) Evolution of the non-initial short vowels (*linn**a***) is summed up in Table 3.4. In the left column, the stages of reduction are briefly described. In the right column, the synchronic phonological system of non-initial short vowels at each stage (or a series of stages) is given. The vocalic system at the first stage is the one which is usually reconstructed for Proto-Finnic. Finally, Table 3.5 presents the evolutionary path of the non-initial vocalic length contrast in general, summing up all the particular stages that were given separately in the end of each section.

[52] All monosyllabic words have Q3 in Estonian.

Table 3.4. Evolutionary stages of the non-initial short vowels, as indicated from the Finnic varieties discussed in Chapter 3

Stages of reduction of etymological short non-initial vowels	Phonological system of non-initial short vowels at each stage
(1) Short non-initial vowels in a robust length contrast with long vowels (ratio 1 : 2.3-2.8); the phonetic distance is even greater than for the initial vowels: $\bar{V}_2/\breve{V}_2 > \bar{V}_1/\breve{V}_1$;	ü i u ö e o ä a
(2) Shrinking of the phonetic distance between short and long non-initial vowels (ratio 1 : 1.2-1.7); the distance between them becomes smaller than between short and long initial vowels: $\bar{V}_2/\breve{V}_2 < \bar{V}_1/\breve{V}_1$;	
(3) Occasional phonetic reduction of *a*, *ä*, *e* to schwa; regular grammatically conditioned elision of vowels in certain morphemes; rare phonetically conditioned elision of word-final vowels;	
(4) Regular phonetically conditioned elision of all types of vowels in certain final and non-final positions in a foot;	
(5) The formation of the phonemic schwa out of *a*, *ä*, in some cases *e*; occasional phonetic devoicing of reduced vowels;	ü i u ö e ə (<[ă/ä̆/ĕ]) o
(6) Frequent devoicing of reduced vowels; a tendency to merge high and non-high reduced vowels; reduced vowels form a subsystem contrasted to the non-initial short vowels;	ü̆ [ü̥̆] ĭ [ĭ̥] ŭ [ŭ̥] ö̆ [ö̥̆] ĕ [ĕ̥] ə [ə̥̆] ŏ [ŏ̥] (<[ă/ä̆/ĕ])
(7) Drastic increase in vowel elision; reduced vowels lose the height contrast and are phonologically transformed into the consonantal features of palatalisation and labialisation;	[t'ü̥̆] = t'˚ [t'ĭ̥] = t' [tɵ̥̆] (<ŭ/ŏ/o) [tə̥̆] (<[ă/ä̆/ĕ/ĭ]) = t˚ = t
(8) Loss of labialisation; tendency to lose palatalisation.	t' (<t', t'˚) t (<t, t˚)

Table 3.5. General evolutionary scheme of the non-initial vocalic length contrast, as indicated from the Finnic varieties discussed in Chapter 3

**kana* 'hen'	**kanā* 'hen:PRT'		**linnā* 'city/fortress:PRT'	**linna* 'city/fortress'
kana ~ *kanà* Fi	*kanā* Fi		*linnā* Fi	*linna* Fi
	↓	↘	↓	↓
↓	*kanà* ~ *kanā* VoL (partly), Es	*kan̆nà* InS	*linnà* InS	*linna* ~ *linnə* (but loss in certain morphemes, e.g. **naine* > *nai̯n* 'woman') FiSK, FiI, InS
	↙	↘	↓	↓
kanà ~ *kanā* FiSK, InS, InLL, VoL, FiRyž, Es			*kannà* = *linnà* FiSK, FiI, InNLL, InCLL, VoL (partly)	*linna* ~ *linnə* ~ *lin̄* InNLL
			↓	↓
			kanna = *linna* InSLL, FiRyž	*linnə* ~ *lin̄* InCLL, VoL
				↓
				linnə̥̆ ~ *lin̄* (also e.g. *püt't'ü̥* ~ *püt̄'°* ~ *püt̄'* 'barrel') InSLL, FiRyž
				↓
				lin̄ (also e.g. *püt̄'*) Es

Chapter 4: Vowel reduction in the Finnic varieties of Ingria: phonetics and categorisation

4.1. Introduction

4.1.1. Synchronic variation and sound change

Systematic individual variation in speech perception and production produces a pool of variation which becomes the source of language change (Kruszewski 1883; Baudouin de Courtenay 1895; Ohala 1989; Labov 1994; Baker, Archangeli & Mielke 2011; Yu 2013; M. Stevens & Harrington 2014; Bybee 2015). Language change is propagated through the repeated exposure of several generations of speakers to a gradually changing variable pool of realisations. Learning theories, placed on a continuum between rational Bayesian approaches and associationist models inspired by biological discoveries, are now at the core of psychophysical sound change models.

Associative learning in phonology implies constant bidirectional updating of the connection weights in mappings between acoustic cues and phonological/subphonemic categories. Learning is distributional in that the learner acquires knowledge of the frequency distribution of various phonetic stimuli and builds a mental phonological model of the language on this. Frequency distribution is even suggested to be a more important factor in the formation of phonemic categories than minimal pairs (Maye & Gerken 2000; Olejarczuk, Kapatsinski & Baayen 2018; Vallabha et al. 2007; Wanrooij, Escudero & Raijmakers 2013). This approach also explains the puzzling cases of near-mergers, when speakers already categorise items in the same phonemic class when there is still a phonetic difference in the realisation of two former classes (Labov, Karen & Miller 1991; Barnes 2006; Roettger et al. 2014). The exact structure of such mental constructions is still, however, under debate between prototype, exemplar, etc. models (Mompeán-González 2004; Gureckis & Goldstone 2008; Johnson 2015; Davis & Poldrack 2014; Kapatsinski 2018).

Sound change, as any language change, follows the S-curve path, where a weighting jumps to a different value at some point during the change (Hyman 1976; Kirby 2010: 148; Blythe & Croft 2012: 293). Its actuation is discussed (Baker, Archangeli & Mielke 2011; M. Stevens & Harrington 2014; Priva 2017), as well as the exact mechanism of the jump between values. The latter might be linked to properties of the articulatory/acoustic relation, when the manipulation of an articulator can result in a non-monotonic varialibity of an acoustic parameter (K. N. Stevens 2004). The usage-based approaches have also hypothesised that lexical frequency prompts sound change. The latter starts from frequent words and morphemes due to a higher level of automatisation in their production and can later spread throughout the entire phonological system (Bergem 1995; Bybee 2001: 11-12; Bybee, File-Muriel & de Souza 2016; Hay & Foulkes 2016; Kapatsinski 2018; Hall et al. 2018).

Sound change implies two connected processes: the change in the structure of the pool of phonetic realisations and the categorical reanalysis in the mind of the speakers/listeners. The temporal and causal correlation between these two processes is still unclear (Bybee 2001: 55). Modern phonology still has to reconcile the data on the continuous and variable nature of the phonetic signal and on the behavior of symbolic processes in a consistent fashion (Barnes 2006: 222; Kirby 2010: 149). In associative learning framework, the same question concerns the relations between typicality distributions in perception and frequency distributions in production (Kapatsinski 2018: 275). The concept of attractor landscape used in non-linear dynamic systems might be of use in modelling this link between continious and categorical variation. A dynamic system is continuous, but there are specific stable states (attractors) it moves to (Roessig, Mücke & Grice 2019). A change in the weighting of attractors can model the change in the frequency distributions of different realisations throughout the sound change.

This chapter explores the correlation between production and mental representation in a case study on vowel reduction and loss in several minor Finnic varieties.

4.1.2. Vowel reduction: general and particular mechanisms

Vowel reduction and loss is observed in many languages of the world,[53] but there is much still to be understood about the circumstances under which it occurs, the manner in which it develops, and its interaction with the rest of the language system. Works taking a typological or general theoretical approach to vowel reduction and loss are relatively scarce, and in many language descriptions vowel reduction is stated simply as a fact, with little further interrogation of its causes, phonetic mechanisms, or consequences. Meanwhile, ongoing reduction poses challenges for synchronic phonological descriptions and for the elaboration of practical orthographies in the case of non-standardised varieties without a literary tradition. Vowel reduction and loss can also trigger major typological shift in the phonological system of a language, provoking dramatic morphonological and morphological restructuring.

For some major language groups, there is a long and active tradition of phonetic and phonological research on reduced vowels, within which their phonotactic properties, acoustic features, and relation to stress and full vowels have been studied. This holds, for example, for

[53] For example, in the typological database of 630 language varieties, P-base 3 (Brohan & Mielke 2018: 210), vowel shortening accounted for 185 cases (4.04% of all sound changes in the database), while vowel lengthening for only 102 (2.24%).

the Romance languages: Italian (i.a. Baroni 1996; Bertinetto & Loporcaro 2005; Loporcaro 2015; Bucci et al. 2019), Spanish (see the overview in Ronquest 2013), Portuguese (e.g. Barbosa 2006; Undolo 2016), French (see e.g. Andreassen & Pustka 2016), the Slavic languages (i.a. an overview on Russian in Jaworski 2010), the Germanic group (e.g. on English, Burzio 2007; Flemming & Johnson 2007; on German, Kohler 1990; on Dutch, Bergem 1993; on Danish, Basbøll 2005), the Finno-Ugric group (e.g. McRobbie-Utasi 2001 on Skolt Saami; Kuznetsova 2016 on Finnic varieties), Greek (Arvaniti 2007; Trudgill 2009; Lengeris 2012); cf. also a special issue on reduction of the *Journal of Phonetics* (Ernestus & Warner 2011).

As for general accounts of vowel reduction and loss, there is still more to be learned about the exact changes in the structure of a phonetic pool of variation during ongoing reduction (Padgett & Tabain 2005), as well as the correlation between production and perception or categorisation of reduced vowels (see Bergem 1995). There are few comparative phonetic studies in this field (but see Delattre 1969; Loporcaro 2015). Much work also remains to be done on the typology of the consequences for phonology and morphonology of vowel reduction and loss (but cf. Easterday 2019). It is yet to be understood what types of vocalic and consonantal systems can emerge in languages which have undergone strong reduction and/or widespread loss of vowels, for example, what effects might this have in terms of the development of secondary localisation (although see C. Anderson 2016 for some examples) or changes in laryngeal features. The typology of phonotactic patterns and morphonological alternations which emerge as a result of vowel loss also requires further research. Some already established typological trends, as well as phonetic mechanisms of vowel reduction and loss are outlined below.

Existing typological phonological surveys (Crosswhite 2001, 2004; Barnes 2006) mostly tackle qualitative, but not quantitative reduction. The reason for this is likely that "for phonologists, vowel reduction corresponds to the loss of a number of phonological contrasts within the vocalic system of a given language" (Bucci et al. 2019: 288). Vowel reduction, therefore, is typically defined in phonological works as the positional neutralisation of a vowel contrast in unstressed positions. However, reduction does not necessarily result in neutralisation. For example, a contrast of long and short vowels can be transformed into a contrast of short and reduced vowels.[54]

Phonetic accounts of vowel reduction and loss phenomena rely on general articulatory, acoustic and cognitive mechanisms, and, therefore, are essentially functionalist and usage-

[54] Shortening of long vowels and devoicing of short ones were the two general patterns which occurred in all types of languages in the cross-linguistic data presented by Easterday (2019: 241), grouped by the complexity of consonantal clusters.

based. Lindblom (1963) suggested that vowel reduction occurs through the mechanism of formant undershoot, which is a function of decrease in vowel duration. This view was supported by Delattre (1969), Flemming (2004, 1995), Kirchner (1998), Barnes (2006), although the causal relation between undershoot and duration was reversed by Crosswhite (2004).

The matter of reduction is discussed in a number of functionalist works, where the language system is represented as a trade-off between the needs of the speaker to economise effort and the listener to be able to decipher the message. Lindblom (1990) later proposed a H&H framework, where a message varies in articulatory clarity being a compromise between hypospeech minimising articulatory effort and hyperspeech maximising discriminability. This laid the groundwork for a currently widespread functionalist/usage-based view on vowel reduction as "part of planned speech behaviour rather than an accidental by-product of vocal organ inertia" (Harris 2005: 132; cf. also Trudgill 2009; Priva 2017; Kapatsinski 2018; Hall et al. 2018). Specifically, reduction is connected to the low informativity of certain chunks of speech. The motor control theory also linked reduction to increased coarticulation: slower movements of articulators reduce the speaker's effort, but this results in massive overlapping of these movements (Nelson 1983; Matthies et al. 2001; Perkell et al. 2002). Reduction is also seen as a consequence of language learning: low informativity chunks are usually those which are the most frequent in speech. More frequent elements are better mastered by speakers and, therefore, need shorter time for realisation than less frequent ones (Gahl & Baayen 2019; Kapatsinski, Easterday & Bybee 2020).

Reduction does not affect all vowel qualities or positions in word or phrase equally, nor does it work always in the same direction. For example, word-final and especially phrase-final position manifests both vowel strengthening (lengthening and strengthening of articulation) and vowel weakening (devoicing, laryngealisation, nasalisation, loss). Barnes (2006) explains the weakening effects by the perceptual weakness of final vowels, in spite of their possible articulatory strength. Vowel reduction could also have different underlying mechanisms. Kapatsinski (2018: 286) opposes phonetically gradual reduction produced by automatisation of execution in production to phonetically abrupt loss of low-salience parts left meaningless by overshadowing in perception.

Two general paths of vowel reduction are distinguished: centripetal (centralisation towards schwa) and centrifugal (dispersion towards the three corner vowels *a, i, u*). However, this distinction between the two reduction patterns still raises certain conceptual issues. First, it is not yet clear whether they can co-exist in the same language system (Crosswhite 2004; Harris 2005). Second, Kapatsinski et al. (2020) suggest on usage-based grounds that patterns which seem centrifugal on the surface (and which are not numerous cross-linguistically), actually do not result from reductive sound change. At the same time, Tomaschek et al. (2018a, b) found that vowels in high frequency words were shorter but at the same time more peripheral than those of low frequency words. Additionally, Tomaschek et al. (2020) observed that acoustic variability decreased with increased frequency. Advanced reduction and reduced variability in more frequent words is predicted by the usage-based framework. The production of more frequent words is more automatised than that of the less frequent ones and, therefore, more prone to spatio-temporal optimisation (Bergem 1995; Bybee 2001: 11-12; Bybee, File-Muriel & de Souza 2016; Hay & Foulkes 2016; Kapatsinski 2018; Hall et al. 2018).

However, F1/F2 position could be a parameter at least partially independent from duration. Gahl and Baayen (2019) show that the position of vowels in F1/F2 space tends to shift towards the periphery with the increasing age of speakers, while duration manifested much less variation. They link this F1/F2 centrifugal effect to automatisation and the mastering of more efficient and precise articulation (p. 42-43), i.e. to the same kinds of usage-based factors which prompt Kapatsinski et al. (2020) to deny the centrifugal reduction altogether.

In P-base 3 (Brohan & Mielke 2018: 203-9), the most frequent vowel height changes concerned those between high and mid vowels, in both directions. The only frequent change concerning low vowels (both as input and as an output of sound change) was their centralisation. In general, the centralisation of all vowels to schwa was the most typical vowel height change (1.27%). Similarly, Easterday (2019: 228) reported that the most vowel reduction processes in her data concerned all vowels in a language, but the second most frequently affected category were high vowels. These data indicate that a centrifugal pattern might indeed not result for a unified phonetic reduction process but could be, for example, a combined result of the raising of mid vowels and the preservation of low vowels.

Third, the corner vowels are known to be special in various respects: the most stable and focalised, perceptually salient, the easiest for neural processing because of the maximal distinction etc. (Crosswhite 2004; Polka & Bohn 2003, 2011; Harris 2005; Johnson 2015; Manca & Grimaldi 2016). However, the data on acoustic, perceptual and other differences within the corner vowels themselves are scarce. The typological studies on vowel reduction show that vowel height is affected before frontness/backness, rounding, or ATR contrasts (Barnes 2002, 2006; Flemming 2004). Reduced speech is characterised by the compression of the acoustic space between F1 and F2 through F1 raising, an effect of less jaw opening (Lindblom 1963; Uchanski 2005). The bottom-up direction of the compression suggests that high unstressed vowels would be less marked than non-high ones (Walker 2011: 29). The latter require more jaw opening and longer time to be realised. At the same time, phonological reduction-based sonority scales presume that the vowel *a* is less marked, but that schwa is more marked than *i* and *u* (Crosswhite 2004: 209; Lacy 2006: 286).

The existence of differences between *i* and *u* is not much discussed in the surveys on vowel reduction. Some argue on the role of F2-based harmony in blocking the reduction of front vowels (Pearce 2008; Szeredi 2010). Evidence for the disparity between *i* and *u* comes also from research on vowel perception and neuroimaging, where place of articulation and tongue height are seen as relatively simple features. They directly correspond to F1 and F2 values, which, in turn, find their straight correlates in regions and types of brain activity. The rounding feature appears more complex, as it requires higher level information processing, is acoustically less reliable, and perceived with significant help from the visual channel (Traunmüller & Öhrström 2007; Eulitz & Obleser 2007; Vatakis et al. 2012; Manca & Grimaldi 2016). Consequently, one might suggest that *u* is less perceptually robust and salient than *i* and, therefore, more prompt for reduction, especially in languages with fronting vowel harmony.

Finally, vowel reduction and loss should be considered within a broader prosodic profile of a language rather than as an isolated process. For example, relatively robust correlations between the degree of vowel reduction, the presence of metrical stress in the language, and the level of complexity of consonantal clusters were established in a cross-linguistic study by Easterday (2019, see especially Chapters 5 and 6). Interaction between reduction and isochrony resulted in specific non-initial vowel length patterns observed in Finnic languages, where the second syllable vowel is reduced after the heavy syllable but phonetically lengthened after the light one (see Chapter 3). 'Ballistic', uneven patterns of articulatory energy distribution within a prosodic domain, such as those in Danish or Estonian (Grønnum & Basbøll 2007: 199-200; Eek & Meister 1997: 77; Kuznetsova 2018a: 129-30), can result in an extreme prosodic enhancement of the stressed syllable correlated with an extreme reduction of unstressed ones.

This study offers further experimental data to explore the general mechanisms of reduction and loss, as well as vowel markedness hierarchies at different subsequent stages of reduction.

4.2. Aims and methods of the study

4.2.1. Aims, data and background of the study

Correlations between the frequencies of various realisations of the three corner vowels in production and mental categorisation are explored in a comparative phonetic field study (2014-2016) on final vowel reduction and loss. We look at three Finnic languages of the Lower Luga area in the west of historical Ingria: Ingrian, Votic and Finnish (Figures 4.0a-b). They have been in a close contact for centuries and formed a Lower Luga Sprachbund (Muslimov 2005). Besides, a group of Ingrian and Finnish speakers was expelled from this region (more precisely, from the Rosona area, nr. 4 on Figure 4.0b) to Western Siberia in 1803-1804 after a strike against Baron von Ungern-Sternberg (Figure 4.0c). A contact Siberian Ingrian/Finnish language developed there in isolation from its sister varieties (Nirvi 1972; Sidorkevič 2013b).

The process of reduction advances through several stages, still observed in the living varieties of these languages (see Chapter 3 for the full evolutionary cycle). The following varieties were chosen for this study: (1) the Kurkola Ingrian Finnish dialect (**IF**), (2) the Luutsa dialect of Votic (**V**), (3) the Central (**CI**) and (4) the Sourthern (**SI1**, **SI2**) variety of the Lower Luga dialect of Ingrian, and (5) Siberian Ingrian/Finnish (**S**) (Figure 4.0b). The data were obtained from one speaker per variety, with the exception of Southern Lower Luga Ingrian, for which two speakers were recorded (Table 4.1).

This is a limitation of this study, stipulated by little availability of fluent speakers able to participate in such an experiment, as individual speakers even of the same language may display different reduction behavior (Hanique, Ernestus & Boves 2015). General reduction patterns in Lower Luga and adjacent areas were, however, established prior to this experiment (N. V. Kuznecova 2009b, 2012; Kuznetsova 2016; cf. Chapter 3) on the basis of existing published sources, as well as field audiodata on several dozens of speakers. It was observed that the degree of reduction increases from the north to the south of the Lower Luga area towards the most innovative in this respect Estonian language, which completely lost reduced vowels.

In particular, the areas listed in Figure 4.0b range from the least to the most susceptible to reduction in the following way: North (nr 1: Kurkola Ingrian Finnish and Northern Lower Luga Ingrian) > Center (nr 2, 5, 6: Votic, Central (=Eastern and Western) Lower Luga Ingrian, and a mixed Kukkusi Votic/Ingrian variety) > South (nr 3, 4, 7: Southern Lower Luga Ingrian, Rosona and Suonkülä Ingrian Finnish), see Kuznetsova (2012a). The varieties experimentally studied in this chapter range in this respect as follows: Kurkola Ingrian Finnish (IF) > Votic and Central Lower Luga Ingrian (V, CI) > Southern Lower Luga Ingrian (SI1, SI2) > Siberian Ingrian/Finnish (S).

Observed processes include qualitative and quantitative reduction, devoicing, and speech elision, e.g.: *püssü* [ˈpüsːü] > [ˈpüsːü̆] > [ˈpüsːü̥̆] > [püs'°ː] > [püs'ː] > [püsː] ‘rifle’. While vowels still preserve their segmental status in the Lower Luga area, they turned into the consonantal features of labialisation and palatalisation in Siberian Ingrian/Finnish (Sidorkevič 2013b).

Figure 4.0a. Historical Ingria and the Lower Luga area (modified from Kuznetsova 2015: 128)

Table 4.1. Sociolinguistic data on the speakers

Variety code	Language	Dialect	Subdialect	Sex	Birth year	Birth place	Recording place
IF	Finnish	South-Western	Kurkola Ingrian Finnish	F	1933	Hakaja (Hk)	Sutela (Su)
V	Votic	Western	Luutsa	F	1928	Liivčülä (Lv)	Liivčülä (Lv)
CI	Ingrian	Lower Luga	Central	F	1927	Ropsu (Ro)	Ropsu (Ro)
SI1			Southern	M	1924	Vanakülä (Va)	Vanakülä (Va)
SI2				F	1932	Dal'n'aja Pol'ana (Po)	D. Pol'ana (Po) / Narva
S	Ingrian/ Finnish (mixed)	Siberian variety: Southern Lower Luga Ingrian / Rosona Ingrian Finnish		F	1950	Ryžkovo (Omsk region)	Tallinn

Sociolinguistic Lower Luga areas on Figure 4.1b: 1 — Kurkola (IF); 2 — Narvusi (CI), 3 — Haavikko (SI2); 4 — Rosona (SI1); 5 — Vaipooli (V); 6 — Kukkusi; 7 — Suonkülä.

Figure 4.0b. Sociolinguistic areas in Lower Luga (after N. V. Kuznecova & Sidorkevič 2012: 565)

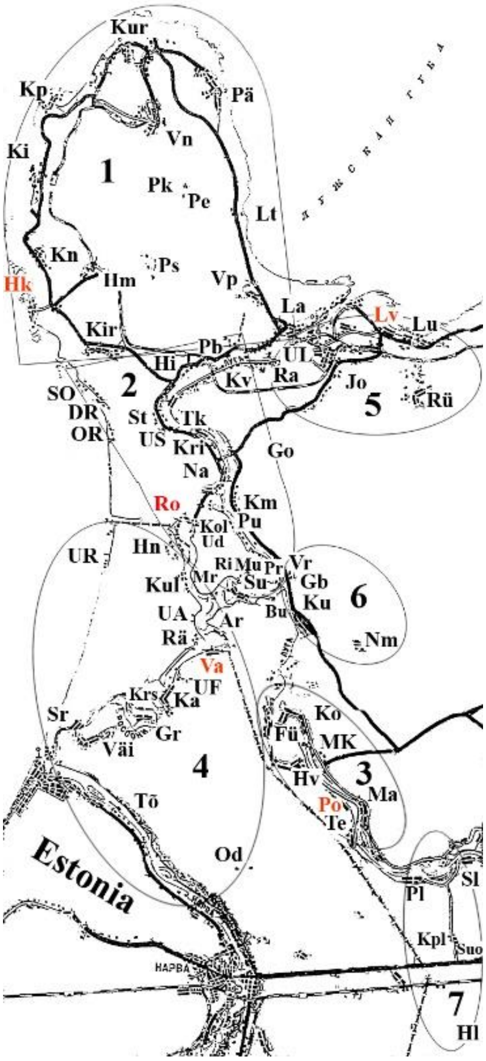


Figure 4.0c. Historical exile of Siberian Ingrian/Finnish speakers to the Omsk region in Siberia (Russia)

The role of the lexical and grammatical factor at the initial stages of reduction, predicted by the usage-based approaches (see 4.1.1), has been also noticed previously in the Finnic languages of Ingria and South-Western Finnish dialects. Grammatically conditioned vowel elision is claimed to have emerged earlier than purely phonetically conditioned elision (Laanest 1984: 73-74), and it occurred first of all in the most frequently used morphemes (Leskinen 1973: 218). Specifically, lexically and grammatically conditioned vowel reduction has been attested in phonologically more archaic Ingrian Finnish and Soikkola Ingrian, while in more innovative Lower Luga Ingrian the conditioning is generalised to purely phonetic (Kuznetsova 2016: 9-11; cf. Chapter 3).

The present experimental study was designed following the patterns established in the abovementioned works and was aimed at further clarifying the results previously obtained mainly from non-systematic auditory impressions. All these languages share the same type and drift of reduction and differ just by its degree. Therefore, in this case it is possible to transpose this geographic variability along the north-south axis into the reduction progress along the time axis. All four languages are severely endangered: the number of speakers ranges from less than ten to a couple of hundred (Kuznetsova, Markus & Muslimov 2015; Sidorkevič 2013b; cf. Chapter 1). Therefore, the observed differences in production and categorisation of reduced vowels can hardly be attributed to the very fact of their endangerment.

The vowel inventories of these varieties contain low, mid, and high vowels; front and back vowels; labialised and non-labialised vowels. The systems in their most archaic variant in terms of non-initial vowel reduction, which can serve as a reference point for the processes described in the study, can be summarised as follows: *i : ī, ü : ǖ, u : ū, e : ē/ie, ö : ȫ/üö, õ : ȭ, o: ō/uo, ä : ǟ, a : ā.* Unrounded back vowels *õ : ȭ* are present only in Votic. The languages are characterised by significant prosodic differences between initial (stressed) and non-initial (unstressed) syllables. In certain varieties, long initial mid vowels were raised into diphthongs *ie, üö, uo*. Stems in all varieties are characterised by the fronting vowel harmony within the domain of the root plus the following derivative and inflectional suffixes, like in Standard Finnish: *a, o, u* can occur in back-vowel stems, *ä, ö, ü* in the front-vowel ones, “neutral” vowels *i* and *e* in both (for irregularities in Votic see e.g. Hulst 2018: 176-78).

In general, short vowels can undergo reduction and loss in the end of a final or a non-final foot and in the second syllable of a trisyllabic foot (see Chapters 2, 3). Reduction in non-initial long vowels, discussed among other processes in Chapter 3, is outside the scope of this study.

4.2.2. Methods of data collection and analysis

In the phonetic experiment, open disyllables ending in the three corner types of vowels, *a, i,* *u* (or *o*) after both voiced (*n, l, r, m, v*) and voiceless (*t, k, p, s, h*) singleton consonants were studied in the phrase-initial and the phrase-final position (3 vowels *2 consonants *13 words *4 iterations *2 positions = 624 tokens per sample). Most types of word-final combinations of these vowels with consonants were covered. Based on existing phonological descriptions of these languages (Leppik 1975; N. V. Kuznecova 2009a; E. B. Markus & Rožanskij 2011), one can argue that at least consonantal palatalisation might be stronger in front-vowel stems, and that geminates could be affected by it less than singletons. We, therefore, limited ourselves to singleton consonants and to stems with back and neutral vowels. Chosen stems were mostly morphonologically back (the few front-vowel stems, which contained only neutral vowels *i* and *e*, are underlined in Appendix 4.1).

Questionnaires were nearly identical (~5% of variability) for all varieties, which share a substantial part of the lexicon. Words ending in *o* were taken instead of those with *u* in about 1/3 of cases. First, rounded vowels are much rarer in non-initial syllables than unrounded ones. Due to the endangered state of the varieties, it proved in some cases impossible to find words ending in the required combinations of *u* and a consonant that would be familiar to the speakers. Second, in the process of vowel reduction and loss in these varieties, the mid vowels *o, ö, e* are raised to *u, ü, i* (Mägiste 1925: 3:80; N. V. Kuznecova 2012; Kuznetsova 2012, 2016), see e.g. *maito/maitu* 'milk', *pudro/pudru* 'porridge', *viero/vieru* 'wheel' in Appendix 4.1 and Chapter 3. Third, the loss of both *o* and *u* results in consonantal labialisation, so from this point of view they are functionally similar.

The two phrasal positions were thought to be prosodically different enough to attest a wide range of phonetic variability in vowel realisations. Words in the phrase-initial position were pronounced in the context before the consonant *s*. The most typical position for complete vowel loss in these varieties is in sandhi before a following vowel. A position before a consonant was chosen because it allowed for subtler differences in the process of loss of different vowel qualities to be better identified. In the prevocalic context, where all vowels are nearly invariably lost in fast speech, these differences are neutralised. The data were recorded with a Zoom H4n digital recorder in the field, segmented and classified in Praat, and analysed in SPSS 11.5.0. Speakers had to translate the Finnic sentences with a carrier word from a phrase asked in Russian and repeat them four times. We subsequently counted the ratios of various types of vowel reflexes within each pool of realisations along several scales. The most general *binary scale* included two main types: (1) "vowel" and (2) "loss". The latter were further divided into *six subtypes* in the following way:

— "**vowel**" (= "vocalic" realisations): (1) modal, (2) partially and (3) fully devoiced vowels;

— “**loss**” (= “consonantal” realisations): (4) heavy segmental aspiration (>30-35 ms) after the consonant, (5) palatalised or labialised consonant, and (6) complete vowel loss without any traces.

For the first three speakers (IF, V, CI), a more detailed scale of variability in production was also used. These speakers showed low ratios of vowel loss, but still significant reduction in vowel quality. Their “vocalic” types were additionally assessed according to the *three independent scales*:

— presence of strong laryngealisation: (1) yes, (2) no;

— vowel quality: (1) full, (2) partially or (3) completely reduced (to schwa);

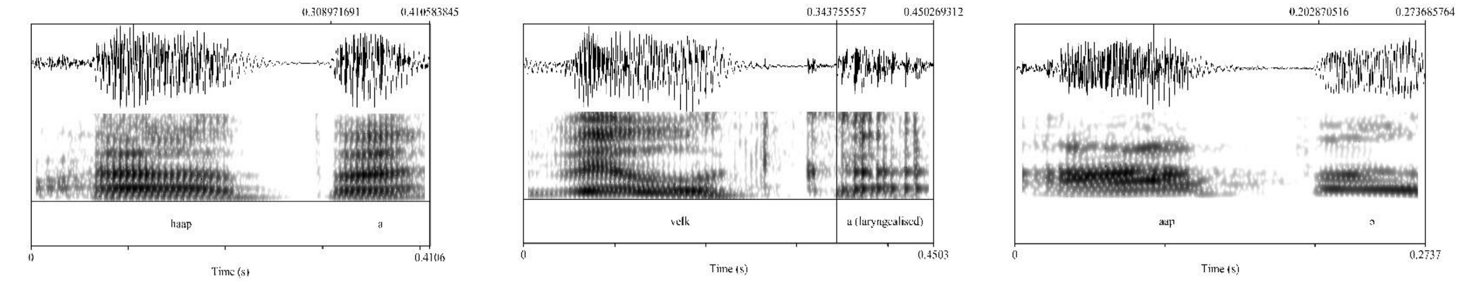
— devoicing: (1) modal, (2) slightly aspirated vowels, and vowels with (3) 10-30%, (4) 30-50%, (5) 50-70%, (6) 70-90% of devoicing, or (7) full devoicing.

The devoicing scale is a more detailed variant of the six-type scale: the type (1) of the latter includes the devoicing types (1)-(3), type (2) — the devoicing types (4)-(5), and type (3) — the devoicing types (6)-(7).

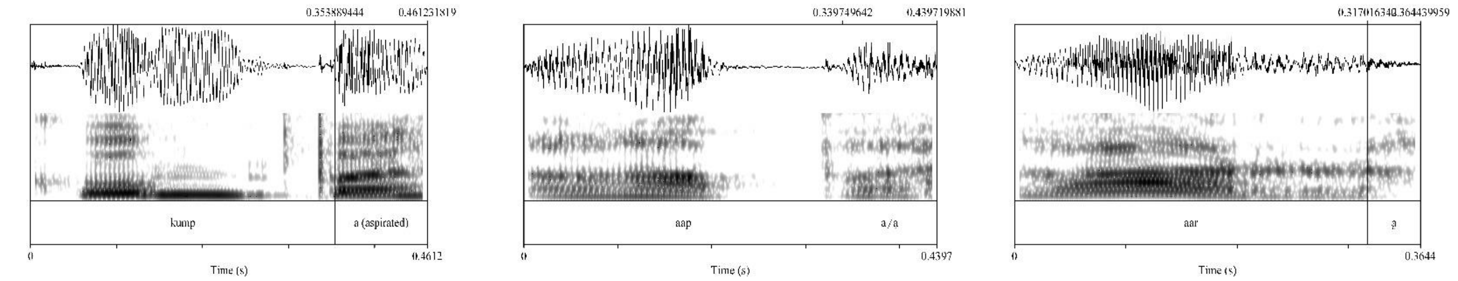
Vowel reflexes were classified manually on the basis of spectrographic data. Examples of main types of realisations are given in Figure 4.1 and 4.14-4.16. “Vocalic” types still preserved F1 and F2. If just one formant was present, the case was considered as “heavy segmental aspiration”. Being shorter than 30-35 ms, such aspiration was seen as a consonantal feature of palatalisation or labialisation (see Chapter 5 on reasons for such a threshold).

Figure 4.1. Examples of reduction in vocalic quality

a. Full modal V (***hāpa* [haːpa] ‘aspen’) MO   b. Laryngealised V (***velka* [vełka̰] ‘debt’) MO   c. Schwa (***āpa* [aːpə] ‘aspen’) PK



d. Slightly aspirated V (***kumpa* [kumpa^{h}] ‘which of the two’) MO   e. Partially devoiced V (***āpa* [aːpḁ] ‘aspen’) PK   f. Devoiced V (***āra* [aːrḁ] ‘branch’) PK



In a separate session from the phonetic experiment, we ran a parallel psycholinguistic test on how speakers categorise the reduced vowel reflexes. They were asked to write down in any preferred orthography the carrier words from the phonetic questionnaire the way they perceived them (~78 words). The task was formulated in Russian as "Please write down a word for 'bird' in your language whatever way you prefer". If speakers noted that they do not know how to write in their languages, the researcher emphasised her interest in the way how a person "feels" the word, not in the right orthography.

Three speakers used the Cyrillic and three others (IF, SI1, S) the Latin letters. Speakers SI1 and S, though, also sporadically used Cyrillic letters. For example, **lintu* 'bird' could be typically written as *линту/lintu* or *линт/lint*. We did not give a multiple-choice task to the speakers so as to not attract their attention to the final vowels. However, if speakers spontaneously noted that a word could be pronounced both with a vowel and without it, we counted these cases as two separate tokens. We counted the ratios of final vowel presence vs. loss for each speaker (sizes of the samples: IF=78, V=81, CI=76, SI1=78, SI2=81, S=85).

Neither variety has a literary standard, so such a test provided a unique possibility to observe more or less directly speakers' intuitions about the presence/absence of a vowel word-finally. At the same time, a classical perception test was not possible in those field conditions, given the advanced age and fragile health conditions of the subjects. The Russian language and the Finnic varieties belong to different language families (Indo-European vs. Altaic), so the Russian tokens for carrier words were not expected to significantly influence the outcome of the test. Moreover, both Cyrillic and Latin mediating orthographies rely on the phonemic principle of encoding and so they automatically prompted subjects to reflect in writing whether there was any vowel word-finally or not.

In some cases, a more detailed scale was used for this categorisation test:

— "**vowel**": (1) full vowels, (2) reduced vowels;

— "**loss**": (3) retention of consonantal palatalisation or labialisation, (4) zero.

Palatalisation was coded by speakers with the use of the Russian "soft sign" '*ь*'. The results on the categorisation of palalisation and labialialisation should be considered tentative, as the Russian orthography does not have a corresponding sign for labialisation. Labialisation was depicted only by the Siberian speaker as *(o)* or *(u)* in parentheses after the consonant, while she explicitly claimed the absence of final vowels. The observed asymmetry in the depiction of the two features might be partially influenced by this orthographic disparity. Reduced vowels were rendered by some with the means of Russian '*ы*' (high unrounded mid vowel).

4.3. Results and discussion

The results showed a robust correlation between production and categorisation. The general structure of the category prototypes (Rosch 1978) was the same in phonetic realisation and phonemic representation at each of the observed three stages of vowel loss (see Figure 4.1a and a more detailed Figure 41b; hereafter, "pr" – production, "ct" – categorisation; cf. also Figure 4.11). At Stage 1, (IF, V, CI), the "vocalic" realisations comprised more than 90% of the sample, which correlated to their only one robust mental prototype [+SEGMENT]. At Stage 2 (SI1, SI2), there was a roughly 50/50 split both between the "vocalic" and "consonantal" realisations, on the one hand, and the [+SEGMENT] and [–SEGMENT] categorisations, on the other hand. At Stage 3 (S), with vowel loss in >70% of cases, only one [-SEGMENT] category prototype prevailed. These results clarify Kuznetsova (2016), given in Chapter 3, where less phonetic reduction was expected for Kurkola Ingrian Finnish and more for Central Lower Luga Ingrian, respectively.

Figure 4.1a. General results of the study

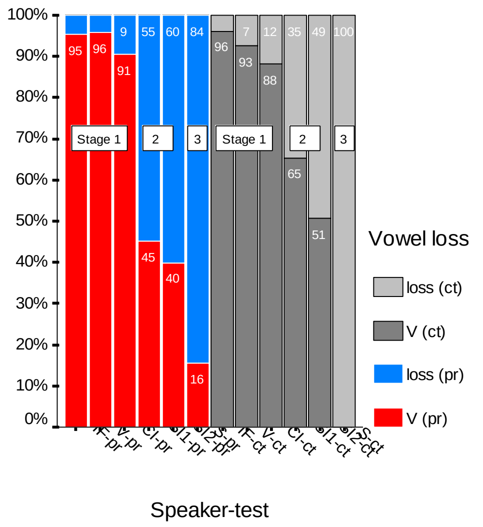


Figure 4.1b. Detailed general results of the study

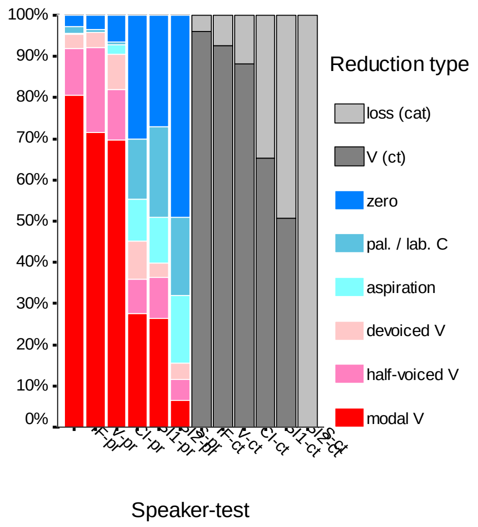
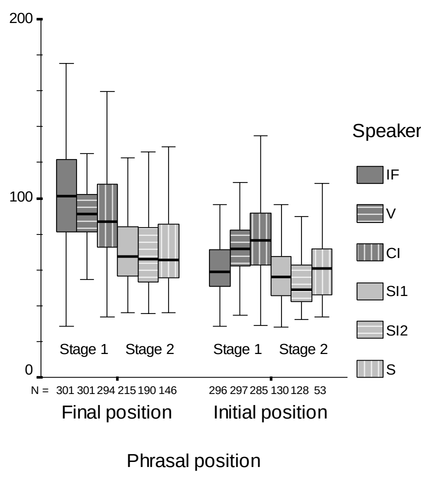


Figure 4.1c. Final vowel duration in phrasal-final and -initial position at Stages 1–2 (in ms; n of tokens is under the boxes)



Below we address individual features of production and categorisation and summarise the tendencies at each stage. In a general discussion, we outline main trends in the loss of vowel quality and main differences between the six speakers and the three vowel types. Phonetic differences across positions, consonantal types, and individual words, as well as the nuances concerning vowel duration largely remain outside the scope of this study. The differences across phrasal positions and after voiced vs. voiceless consonants were indeed noticeable in terms of the percentage of vowel loss, duration, and quality. Vowels expectedly manifested much more devoicing after voiceless consonants. Initial phrasal position was, in turn, primarily characterised by strong qualitative reduction (apparently triggered by extremely reduced duration), while final position exhibited more devoicing.

Vowel duration divided speakers into two groups (Figure 4.1c):

(1) Stage 1: short vowels (90-100 ms) phrase-finally and reduced vowels (<80 ms) phrase-initially;

(2) Stage 2 and 3: reduced vowels (<80 ms) in both phrasal positions.

4.3.1. Stage 1: Ingrian Finnish, Votic, Central Lower Luga Ingrian

Samples at Stage 1 of reduction belong to three different languages: Finnish, Votic, and Ingrian. Even if similar in the general structures of distributions, they exhibit slightly different configurations of vowel loss in realisation and categorisation (see the percetages of loss in Figures 4.5-4.7). Ingrian Finnish represents the most conservative variety, and Central Lower Luga Ingrian the most innovative one, with Votic in the middle. In all the three samples, the vowel **u*[55] reveals exactly the same pattern, being the most conservative of all the vowels: full preservation in mental categorisation and just 1-2% of loss in production. What differs across the varieties in question, is the configuration of vowels **a* and **i*. In Ingrian Finnish, **i* is the most innovative in terms of both production and categorisation, while in Central Lower Luga Ingrian, it is the vowel **a*. In Votic, the production pattern corresponds to the one found in IF (**i* is the most innovative and **a* is as conservative as **u*), while the categorisation rather resembles that of CI, where **a* is more innovative than other vowels.

A more detailed look at vowel devoicing (Figures 4.2-4.4) and the reduction of quality (Figures 4.5-4.7), as well as lexical considerations (Table 4.4), clarify possible reasons for these differences. Vocalic segments are still largely present at Stage 1, but their quality is reduced along three dimensions: aspiration, centralisation and laryngealisation (cf. Klatt & Klatt 1990;

[55] Hereafter, the original etymological vowel qualities, whose reflexes are studied in the experiments, are marked with an asterisk.

Laver 1994: 189-91; 2006: 114-50). Completely non-aspirated variants, in fact, accounted for just about half of those realisations which were considered modal according to the six-type scale (see Figures 4.2-4.4). In total, partially or fully aspirated and devoiced allophones overwhelmingly prevailed over the “clear” modal ones even at Stage 1. The percentage of non-aspirated modal allophones is in negative correlation with the percentage of complete loss in production in nearly all the cases (apart from **a* in Votic). The prototypical realisations (6: ‘zero’) of the new category [-SEGMENT] are therefore gaining strength in production first of all at the cost of the prototypical realisations (1: ‘modal non-aspirated vowel’) of the old category [+SEGMENT]. The belt of intermediate types preserves roughly the same structure for all the three vowels within each speaker and just slides down the scale.

Figure 4.2. IF: vowel devoicing

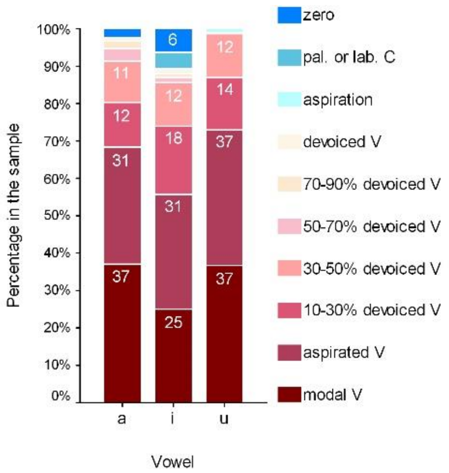


Figure 4.3. V: vowel devoicing

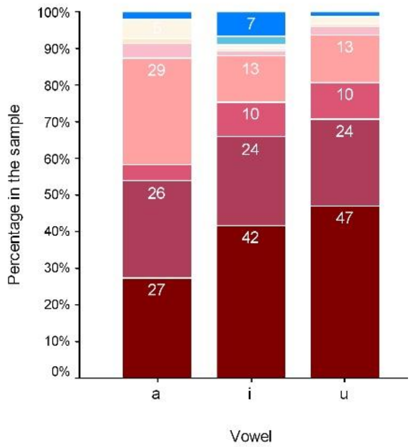
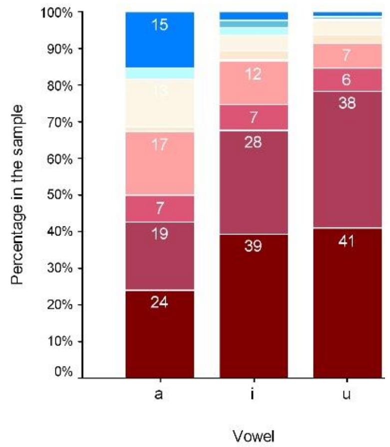


Figure 4.4. CI: vowel devoicing



Qualitative vowel reduction reveals quite a different picture (Figures 4.5-4.7). Noticeable differences in the structure of phonetic variability appear between vowel types but not across speakers. Phonetic reasons for these differences are, therefore, to be sought in the articulatory and perceptual properties of vowel qualities rather than in other factors. In all three samples, *a* has undergone an extremely strong reduction to schwa (around 65% of complete schwa realisations and less than 30% of full vowels), and at the later stages on reduction it is realised as schwa almost invariably. On the contrary, **i* was the most liable to retain its quality (around 80% of non-reduced allophones). The vowel **u* occupied an intermediate position, with about half of its realisations being non-reduced. In quality assessment, a more detailed scale for categorisation was used (see 4.2.2). The category of a reduced vowel rendered via Russian ‘ы’ occurred only in the vowel **a* of the Votic speaker.

Figure 4.5. IF: qualitative reduction

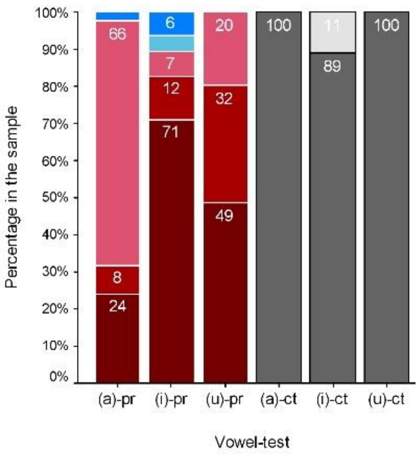


Figure 4.6. V: qualitative reduction

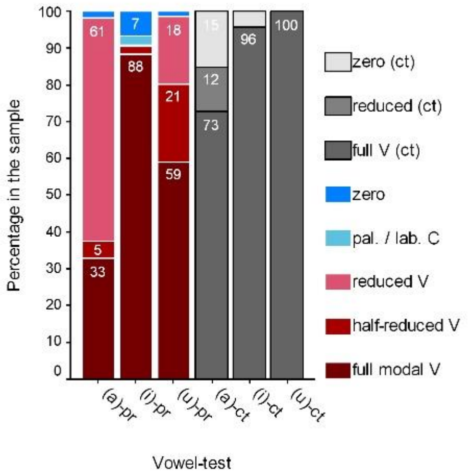
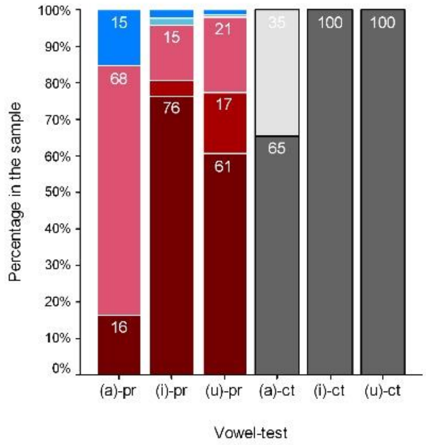


Figure 4.7. CI: qualitative reduction



Qualitative reduction and devoicing manifest very differently, sometimes opposing distributional patterns. We explored which of the two correlates best to the percentages of vowel loss in production and categorisation.

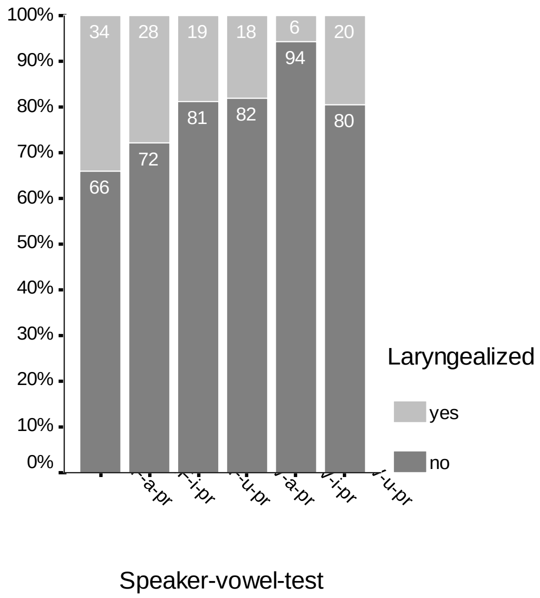
In Ingrian Finnish, the devoicing structure is the same for all vowel types, so it cannot be a factor conditioning the differences in their loss. Qualitative reduction, in turn, correlates negatively with loss in production and categorisation. The only obvious phonetic factor correlating with the level of loss is, therefore, the type of vowel in itself, as the level of loss in **i* is higher than in other vowel types (for non-phonetic factors see 4.3.4).

In Central Lower Luga Ingrian, on the contrary, loss in production and categorisation positively correlates with the level of devoicing in all cases and, in **a*, also with qualitative reduction. One could say that in **a*, devoicing and centralisation reinforce each other as phonetic drivers for reduction resulting in a relatively high percentage of loss in production (19%) and even more so in categorisation (35%). We will see later that in Lower Luga Ingrian, it is indeed vowel devoicing, reinforced by qualitative reduction, that is the primary driving force of loss, especially of the drastic loss of **a* from speakers' awareness and production. Devoicing with quality preservation leads to the rise of phonemic consonantal palatalisation as a trace of **i*.

The Votic speaker presents a mixed strategy between these two. As in IF, loss in the production and categorisation of **i* does not correlate with devoicing and negatively correlates with centralisation. At the same time, the configuration for **a* resembles that found in CI, although the equation is not perfect. The level of loss in categorisation positively correlates with those of qualitative reduction and devoicing. At the same time, the level of loss in production correlates with all three negatively. In other words, even if the speaker centralises and devoices **a*, this does not lead to an increased drop of this often-voiceless schwa from her production. In fact, Votic **a* is the only vowel in the Stage 1 speakers which shows a clear negative correlation between the levels of loss in production and categorisation. The loss of reduced **a* has already started in the mental categorisation but not yet in the production of the Votic speaker, so she manifests also a more conservative production pattern for **a* than the CI speaker. She is the only one who was aware of the qualitative reduction of **a* among the Stage 1 speakers. This awareness might be related to the presence of an unrounded mid back vowel *õ* in Votic, uniquely among these varieties (see 4.2.1). The Votic speaker might identify the schwa with this *õ*.

In IF and V, final vowels also undergo laryngealisation (27% of tokens in IF and 15% in V; Figure 4.7a). This process was not attested in the CI speaker. Summary laryngealisation patterns (IF+V) across the vowel types broadly correlate with the patterns for qualitative reduction. Vowel **i* tends to be the most conservative (17% of laryngealisation), and **a* the most innovative (26%), with **u* in the middle (19%), although these are not strong tendencies.

Figure 4.7a. Laryngealisation of vowels in IF and V



4.3.2. Stage 2: Southern Lower Luga Ingrian, and Stage 3: Siberian Ingrian/Finnish

Speakers at Stages 2 and 3 of reduction (Figures 4.8-4.10) manifest the continuation of the same tendencies, especially those observed in CI. Speakers at Stage 2 belong to the same variety (Southern Lower Luga Ingrian), but the male speaker SI1 is not a typical one. He used to be a community manager and a local cultural leader and has a notably higher level of linguistic awareness compared to others. In his notebooks, one can find texts and words in his own variety in an orthography created by himself, reasonings for choices of orthography, texts in other Finnic languages copied from published sources, and etymological comparisons between cognate Finnic words (published as N. V. Kuznecova 2020).

The main reasons for the differences observed between SI1 and SI2 could be attributed to these specific characteristics of SI1. He has a more innovative production pattern for **a* and more conservative ones for **i* and **u*, compared to SI2. Categorisation suggests a clue to the origins of this difference. In SI1, categorisation is the most consistent of all six speakers (apart for the Siberian one, where the sound change process has already reached the terminal stage). He categorised the final **a>ə* always as zero. Actually, he is not as consistent regarding schwas in non-final positions, where he often uses '*ы*' (Kuznetsova 2012), much as the Votic speaker does. Seemingly '*ы*' is the closest perceptual Russian correlate for schwa for the speakers of local languages. Final **i* and **u*, on the contrary, are always perceived by him as vowels, though he is aware of their reduced character and calls them "half-vowels". He seemed to target these mental categorisations in his pronunciation consciously, and so his percentage of loss is correspondingly higher for **a* and lower for **i* and **u* than in the otherwise linguistically very close SI2. He was obviously not able to attain full control over his production, though, and his pattern of loss for the three vowels still has a scalar shape similar to other Ingrian speakers (CI and SI2).

Figure 4.8. SI1: vowel devoicing

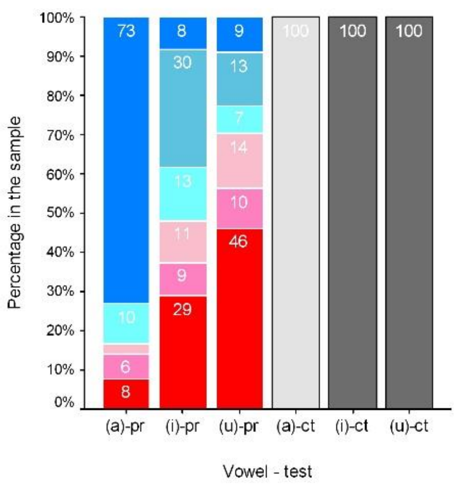


Figure 4.9. SI2: vowel devoicing

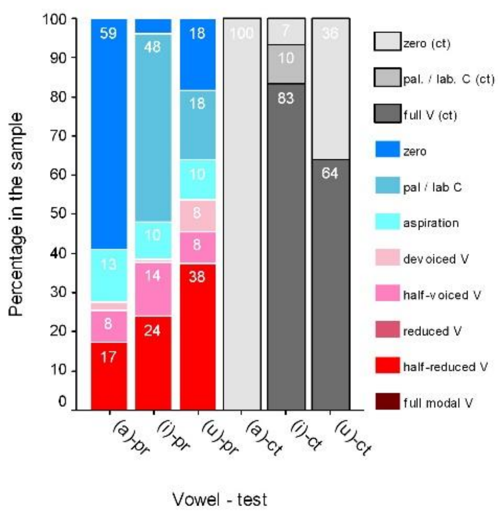
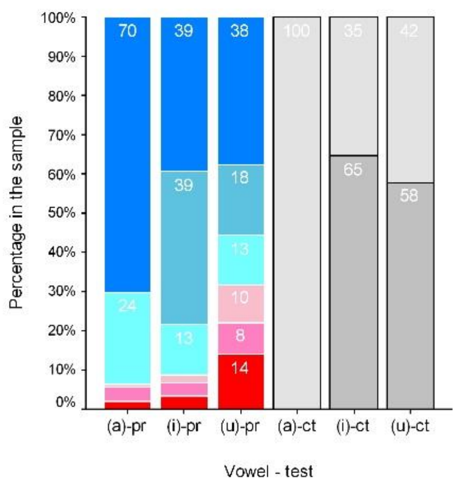


Figure 4.10. S: vowel devoicing



In SI2, the phonemic categorisation (as zero) is consistent only for the vowel **a*, which has reached the critical threshold for complete loss. Interestingly, **i* and **u* show reverse patterns of loss in her production vs. categorisation, which is apparently rooted in the acoustic and perception properties of these two vowels. In general, at Stages 2 and 3, one observes a robust cluster of palatalisation for **i* in all speakers (~40% of phonetic production). Vowel **u* also manifests a visible cluster of labialisation, completely absent at Stage 1, but it accounts for only 15% of the phonetic production of *u*. If one adds the clusters of strong aspiration and palatalisation / labialisation to the “vocalic” realisations of vowels, the distributional patterns in production of the **i* and **u* of both SI speakers match those of categorisation much closer. It seems that an intermediary Stage 2, the “consonantal” reflexes of the vowels **i* and **u*, which give colour to consonants, still correspond rather to [+SEGMENT] in mental categorisation. Especially in the case of **i*, one could argue that both SI1 and SI2 still perceive and target, more or less conciously, the full vowel. This might be linked to a robust salience of **i*-reflexes both in perception and articulation (see 4.4.2). Speakers succeed in reaching a vowel in only about half of cases, though, ending up with a more or less aspirated palatalised final consonant in the other half instead. Less perceptual salience of **u* can be seen in its relatively innovative categorisation by SI2, which is in general not as systematic as that by SI1. In an even less perceptually salient **a*, however, a relatively robust cluster of consonantal aspiration does not prevent a complete loss from categorisation, as **a* does not colour consonants.

In the Siberian speaker at Stage 3, we see the next step of the same processes. Here, all the vowels have already reached the critical threshold for loss in production in order to be lost from mental categorisation. Judging by all the three samples at Stages 2 and 3, one could estimate this threshold at about 70%. Categorisation became innovative for vowels which have reached it, while their production still lags behind. In the Siberian speaker, the structure of phonetic loss for **i* already closely follows the one of **a*, i.e. the middle step of the “ladder-like” pattern flattened. We still see a more conservative production for **u* with respect to other vowels, though. The phonetically conservative nature of **u*, observed in all the speakers at Stages 2 and 3, cannot be explained by its categorisation properties and should apparently be attributed to general physiological factors (acoustics, articulation, perception, storage in the memory, see 4.1.2, 4.4.2). At the same time, while in the Siberian speaker the palatalisation cluster is yet as big as the cluster of complete loss, the labialisation cluster is already twice as small as the latter. One might hypothesise that while palatalisation could still have a chance to be preserved as a phonemic feature in these languages, labialisation has already lost the historical sound change battle, even though the Siberian speaker still perceives its presence. The aspiration cluster as a reflex of **a* is especially robust in the Siberian speaker, but as at Stage 2, this does not affect any more its perceived complete loss.

4.3.3. Statistical tests on the main findings

The main results of the study are corroborated by statistics. We compared the means of "vowel" (=0) vs. "loss" (=1) in the overall production and categorisation, across the vowels, the speakers, the vowels in speakers, and the stages of reduction. *One-way ANOVA* and *Levene's F* showed a highly significant difference ($p<0.001$) in all cases apart for the first comparison. The overall production ($N=3744$, $M=0.36$, $SD=0.481$, $SE=0.008$) and categorisation ($N=479$, $M=0.35$, $SD=0.479$, $SE=0.022$) did not differ: $F(1, 4221)=0.12$, $p=0.729$, *Levene's* $F=0.501$, $p=0.479$, which supports the general correlation in production and perception of vowel loss (the SE difference can be explained by the unequal size of the groups). For other cases, we ran two post-hoc tests for pairwise within-group comparisons in big samples of unequal size and variance: *Tamhane's T2* (more conservative) and *Games-Howell* (more liberal) at the 95% confidence interval. Few differences between them are reported below as *T / GH*.

There was a significant effect of the stage on the level of loss: $F(5, 4217)=654.27$, $p<0.001$. Both post-hoc tests showed no difference between production and categorisation at Stage 1 ($MD=-0.02$, $SE=0.018$, $p=1$), a difference at Stage 2 ($MD=0.15$, $SE=0.042$, $p=0.004$), and a highly significant difference at Stage 3 ($MD=-0.16$, $SE=0.015$, $p<0.001$). In other words, both production and categorisation are still conservative at the first stage, then production becomes significantly more innovative, which leads to the shift in a categorial analysis: categorisation becomes significantly more innovative and drives the loss at the terminal stage.

Overall results on the three vowels showed a highly significant difference ($F(2, 4220)=77.49$, $p<0.001$), as each vowel has its unique congiruration of loss in production and categorisation (Table 4.2, Figure 4.12). Post-hoc tests on these two aspects analysed separately showed that both the production and categorisation of **u* as well as the categorisation of **i* did not differ and were conservative. At the same time, the more innovative production of **i* manifested a relatively significant difference from these three, being closer to the even more innovative production of **a*. The latter was insignificantly more conservative than the production of **a*. In sum, **u* was conservative and **a* innovative in both aspects, while **i* was conservative in categorisation and intermediate in production.

Table 4.2. Differences between the overall means of production and categorisation in vowels

Vowel (test)	i (pr)	u (pr)	a (ct)	i(ct)	u(ct)
a (pr)	0.07** (p=0.006)	0.21***	-0.11 (p=0.086 T / 0.065 GH)	0.21***	0.22***
i (pr)		0.14***	-0.18***	0.14** (p=0.002)	0.15** (p=0.002 T / 0.001 GH)
u (pr)			-0.32***	0.0	0.01
a (ct)				0.32***	0.33***
i (ct)			***p<0.001, **p<0.01		0.01

Overall results on the six speakers lacked of any difference in IF and V (*MD*<0.01, *p*=1), but CI differed from both (CI–IF: *MD*=0.05, *p*=0.003 *T* / 0.002 *GH*; CI–V: *MD*=0.05, *p*=0.002). CI manifests a little more advanced substage of reduction inside Stage 1, where **a* takes over **i* as the leader of loss. At Stage 2, SI1 did not significantly differ from SI2 (*MD*=-0.06, *p*=0.262). All other differences between speakers were highly significant (*p*<0.001). Reduction and categorisation are further analysed across speakers in Table 4.3 (see also Figures 4.11, 4.13). At Stage 1, both the production and the categorisation by IF and V, as well as the categorisation by CI did not differ and were conservative. The production by CI was slightly more innovative: it showed moderate-to-weak difference from the production by IF and V (but not from the categorisation by CI). The production and categorisation by S highly differed from everything else and from each other (her production is significantly more conservative than production due to the categorial shift at Stage 3). At the intermediate Stage 2, the production and categorisation by SI1 and the production by SI2 did not show significant differences. However, the categorisation by SI1 stands out of all effects in Table 4.3. The peculiarity of SI1 categorisation is likely linked to his unusual linguistic awareness and full systematicity in transcription (**a* as zero, **i* and **u* as vowels, see 4.3.2).

Table 4.3. Mean differences between production and categorisation of each speaker

Sp	V(pr)	CI(pr)	SI1(pr)	SI2(pr)	S(pr)	IF(ct)	V(ct)	CI(ct)	SI1(ct)	SI2(ct)	S(ct)
IF(pr)	0.0	-0.05(*) (p=0.058 T / 0.042 GH)	0.5***	0.55***	0.8***	0.01	0.03	0.07	0.3***	0.45***	0.95***
V(pr)		-0.05* (p=0.013 T / 0.011 GH)	0.51***	0.56***	0.8***	0.0	0.03	0.08	0.3***	0.45***	0.96***
CI(pr)			0.46***	0.4***	0.75***	0.06	0.02	0.02	-0.25** (p=0.001)	0.4***	0.91***
SI1(pr)				0.05	0.29***	0.51***	0.48***	0.43***	*0.2 (p=0.042 T / 0.03 GH)	0.06	0.45***
SI2(pr)					0.24***	0.56***	0.53***	0.48***	**0.25 (p=0.002 T / 0.001 GH)	0.11	-0.4***
S(pr)						0.81***	0.77***	0.73***	0.5***	0.35***	-0.16***
IF(ct)							-0.04	-0.08	-0.31***	-0.46***	-0.96***
V(ct)								-0.04	**(*)0.27 (p=0.001 T / <0.001 GH)	-0.42***	-0.93***
CI(ct)									*0.23 (p=0.047 T / 0.034 GH)	-0.38***	-0.88***
SI1(ct)										-0.15	-0.65***
SI2(ct)	***p<0.001, **p<0.01, *p<0.05										-0.51***

4.3.4. Lexical factor in reduction at Stage 1

Lexical factor effect at the initial stage of reduction (see 4.1.1, 4.2.1) was observed also in the present data, with nuances concerning vowel type, speaker, and correlation between production and categorisation. Table 4 gives data on lexical distribution of the cases of loss at Stage 1. In Column 1, the total number of lexical words in each sample is given. Column 2 provides a number of lexemes in which at least one token of the “loss” in production is attested, their percentage in the sample for each speaker, and their distribution across **a*, **i*, and **u/o* types. The vowel types are arranged in parentheses from those with the highest number of words exhibiting loss to those with the lowest number. Column 3 cites only those words in which more than half the tokens show loss (i.e. *n>4*; the exact number of such tokens is given in parentheses for each word). Column 4 summarises the number of words from Column 3 and their percentage in each sample. Finally, in Column 5, the ratio between the numbers of words in columns 4 and 2 is calculated, providing an idea of the lexical compactness of the distribution of vowel loss.

Table 4.4. Lexical specification of vowel loss at Stage 1

Sp (N)	N of lexemes exhibiting phonetic loss	Lexemes with phonetic loss *n>4* (>50%)	N of lexemes with phonetic loss >50%	Lexical compactnes s of loss	Lexemes which exhibited loss in categorisation (by glosses)
1	2	3	4	5	6
IF (78)	**12** (15,3%) (*i, a*)	*ūs**i*** 'new' (8), *pien**i*** 'small' (6)	**2** (2,6%)	**0,17**	**i**: small, child (*i/Ø*), elk
V (81)	**10** (12,3%) (*i, a, u/o*)	*sūr**i*** 'big' (6), *pēn**i*** 'small' (6)	**2** (2,5%)	**0,2**	**i**: big (*i/Ø*); **a:** dog, change:IMP, barley, nail, bath broom
CI (76)	**21** (27,6%) (*a, i, u/o*)	*nāgl**a*** 'nail' (6)	**1** (1,3%)	**0,05**	**a:** nail, leg, which (of the two), black (*a/Ø*), change:IMP, debit, twig, bath broom, floor broom, class, skinny

In IF and V, the level of the lexical compactness of loss is four times higher than in CI. The vowel loss in these speakers is concentrated in very few frequent basic words, while in CI the lexical dispersion of loss is much higher. It is remarkable that in IF and V, the loss in frequent words concerns only the vowel **i*. In Soikkola Ingrian, the other still existing Ingrian dialect which is about as archaic as IF from the point of view of reduction (Kuznetsova 2016; see also Chapter 2), the same type of **i*-loss in frequent words became lexicalised. For example, the following words in our questionnaire (Appendix 4.1) do not have the final **i* in Soikkola Ingrian: *pēn/pīn* 'small', *ūs* 'new', *sūr* 'big', *laps* 'child', *nōr/nūr* 'young'. Grammatical morphemes (even more frequent elements of the language) of Ingrian Finnish, Votic and Soikkola Ingrian manifest such grammaticalised loss for both **i* and **a*. In CI, a more innovative variety where reduction is already conditioned phonetically, **a* becomes the reduction leader.

These differences in production find a parallel in categorisation (see Column 6; words encoded with V/Ø were cited by the respective speakers as having both a variant with a vowel and without it). In Ingrian Finnish, the loss was perceived only in **i*-words, in Votic, both in **i*- and in **a*-words, and in CI, only in **a*-words. The number of lexical items with perceived loss also increases from IF to CI. It is worth noting that the match between production and categorisation is close in a statistical sense but not in the lexical one. Examples in Table 4.4 show that in each speaker's production and perception the trends for reduction and loss correlate better across the vowel types than across the concrete lexical items. This might provide support for the distributional learning of phonological categories, which happens relatively independently of individual lexemes and minimal pairs (see 4.1.1).

4.4. General discussion

4.4.1. General course of vowel reduction and loss

Our study was restricted to two phrasal contexts (in the production part) and three types of vowels, and only one speaker was taken for each variety apart one. Even if limited by these and other methodological restrictions, the results revealed a stable correlation of frequency distributions in production and perception across all six speakers. The latter represented three main stages of vowel reduction and loss in the Finnic languages of Ingria. This correlation of the internal structure of categorical representation to the structure of production is probably best explained by the adaptive hybrid models of mental storage which suggest the internal clusterisation of exemplars within the category (Gureckis & Goldstone 2008; Kirby 2010: 34-37).

The main vectors summarising the general course of vowel reduction and loss in the Finnic languages of Ingria and the differences across speakers and vowel types are represented in Figures 4.11-4.13 (mean values of each test on the scale between 0 = “vowel” and 1 = “loss” and the SE bars are given; red stands for production and grey for categorisation). The dotted horizontal lines are drawn at 70% of loss and at 70% of preservation of segments, which appeared to be important thresholds for the stages of reduction and loss and changes in categorisation.

Indeed, one can observe the three stages of reduction, described in the chapter, divided by these thresholds on Figure 4.11. At Stage 1, production and categorisation are closely matched. As discussed in 4.3.4, vowel reduction and especially loss at this initial stage (speakers IF, V) is linked to a large extent to certain frequent elements (frequent lexemes, grammatical markers). At the same time, the correlation between production and perception in each vowel of each speaker is in general closer in a statistical sense than across concrete lexemes. The learned phonological category looks more like a sum of the distributional properties of phonetic variants in production, abstracted from particular lexical words, in line with the distributive learning hypotheses (see 4.1.1).

By the middle phase of loss, the novel stimuli have been accumulated and spread through the phonetic system, so reduction and loss are conditioned phonetically rather than lexically or grammatically. Categorisation remains more conservative at the first two stages, i.e. more of the new category is produced than perceived. Speakers at Stage 2 still often seem to target the old category in pronunciation, especially in the vowels which give colour to consonants, but achieve it only partially. The mechanism of reduction with a more conservative categorisation than realisation is linked to the automatisation of execution in production, is phonetically gradual, and can likely take a considerable amount of time. If the old category ([+SEGMENT] in our case) still keeps 70% or more of realisation, the formation of the new category [-SEGMENT] is not yet perceived by speakers (Stage 1). If both categories are pronounced in about 50% of cases, the categorisation is also split about 50/50 between the perceived presence and absence of vowel (Stage 2). When the new category arrives at more than 70% of realisations (Stage 3 and some vowels at Stage 2), the crucial jump in categorisation happens. The pattern drastically reverses: the old value is no longer perceived, while it is still partially maintained in production. Reduction and loss at the stage of a more innovative categorisation imply a drop of low-salience meaningless parts, which is sometimes distinguished from the automatisation-based mechanism (see 4.1.2). At the same time, it might still mean automatisation in production, now of the new category rather than of the old one.

Major differences in production and categorisation observed between the three corner vowels are summarised in Figure 4.12. Each of the three vowels manifested its own combination of production and categorisation values. The vowel **u* turned out to be conservative both in production and categorisation, and in total the most conservative among the corner vowels. The vowel **i* had an intermediate position, with an overall categorisation as conservative, as in **u*, but production nearly as innovative as **a*. This innovativeness in loss is actually accompanied by the formation of a robust cluster of consonantal palatalisation (see 4.4.2). The vowel **a* is the most advanced in terms of loss, and here, in turn, categorisation is more innovative than realisation. This is obviously linked to the fact of its extremely strong qualitative reduction and that it does not leave any colour to the consonants. In general, the more the vowels were reduced to schwa, the less their presense was perceived.

Our results actually showed that the two main patterns of vowel reduction (centrifugal and centripetal) do not exclude each other, in line with Harris (2005) and unlike a sharp distinction made in Crosswhite (2004). In the course of vowel reduction and loss in the Finnic languages of Ingria, the elements of both patterns are observed. Mid vowels *o, ö, e* are raised to high vowels *u, ü, i*, which can be seen in variants *maito/maitu* 'milk', *pudro/pudru* 'porridge', *viero/vieru* 'wheel' (cf. Appendix 4.1), occurring even in the same speaker. At the same time, all vowels can lose their quality completely at later stages and centralise to schwa.

Figure 4.13 gives a chart of the loss across the vowels of individual speakers. Both the speakers and the vowels are placed starting from the most conservative to the most innovative ones, which gives an idea of an S-curve of the sound change. The chart shows that the reverse in a ratio between production and categorisation happens in **a* at a much earlier point than in **i* and **u*. Only in the most conservative speaker IF, the pattern of **a* matches those of the other vowels. The vowel **a* basically jumps over the transitory middle zone with a 50/50 split in production between the old and new values, sped forward by its innovative categorisation. Processes of loss in **i* and **u* run more smoothly. In these two consonant-colouring vowels, in turn, it is mostly an innovative realisation that drives forward the process of change.

Figure 11. Summary: speakers

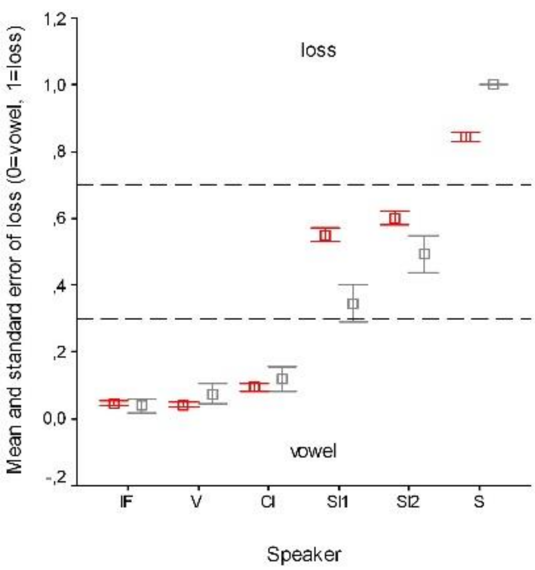


Figure 12. Summary: vowels

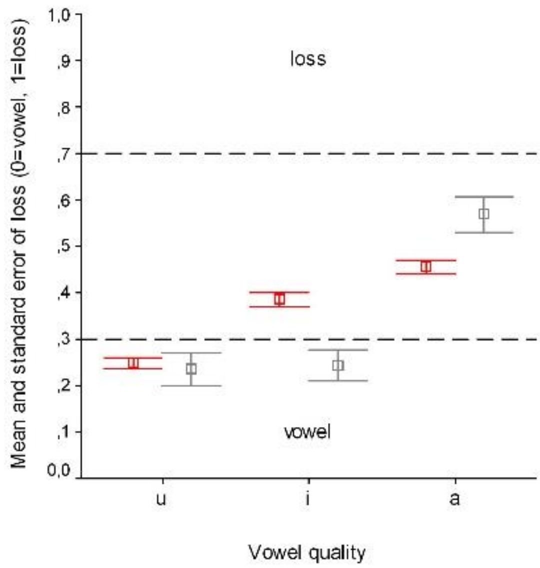
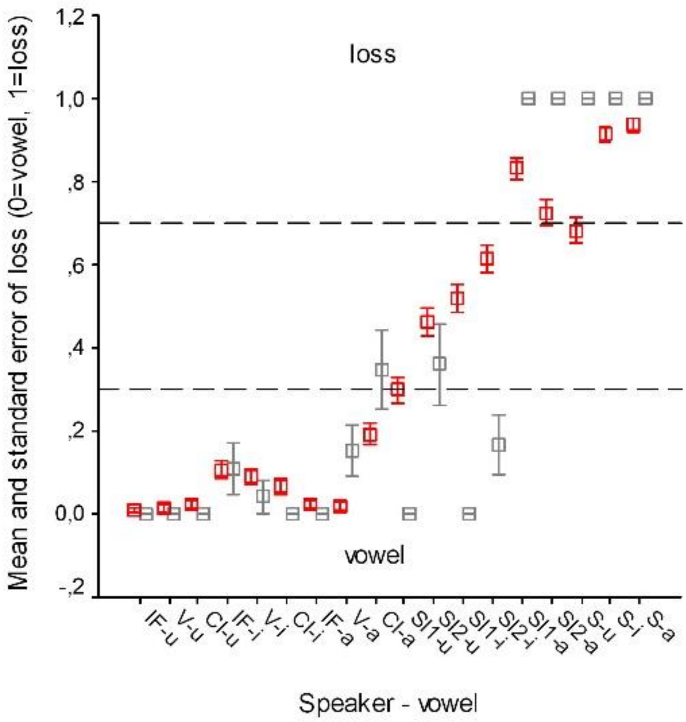


Figure 13. Summary: speakers and vowels



4.4.2. Formation and loss of consonantal palatalisation, labialisation, and aspiration

Already at Stage 1, vowel qualities revealed significant differences in their patterns of reduction and loss both in production and perception. It seems that vowel loss starts from **i* and is yet lexically and grammatically stipulated to a large extend (see 4.3.4). Later on, as loss is generalised throughout the entire phonetic system, **a* takes over as a leader, because its reduction and loss proceed faster (it can be seen in speakers starting from CI). This is presumably linked to the strongest qualitative reduction and devoicing of the latter, and also to the fact that **a* does not give any colour (i.e. secondary localisation) to the consonants, unlike **i* and **u*. In **i*, on the contrary, the qualitative reduction is the weakest. For the vowel **u*, no reduction or loss is yet perceived at Stage 1, even if qualitative reduction is already very frequent.

An overall trend observed across all vowels and speakers is that during vowel loss the prototypical variants (zero vowel reflexes) of the new category [-SEGMENT] are gaining percentage first of all at the cost of the prototypical variants (full clear modal vowels) of the old category [+SEGMENT]. Intermediate variants form a belt which in total accounts for about 20-30% of each sample and slides down the scale. The only major exception from this is a significant cluster of consonantal palatalisation, which replaces a substantial part of the full non-reduced modal vowel **i* between Stages 1 and 2. The vowel **i* is the first vowel type to exhibit loss and is nearly as fast in phonetic loss as schwa (<**a*). However, even the Stage 2 speakers typically did not yet categorise the reflexes of **i* and **u* as consonantal features. SI1 was consistent in perceiving both as vowels, while SI2 perceived palatalisation also rather as vowel but labialisation already rather as loss. This is likely linked to a higher acoustic, articulatory, and therefore perceptual salience of **i* and palatisation over **u* and labalisation. Matthies et al. (2001) report the same tendency for quality preservation in *i* even in fast speech. Phonological consonantal palatalisation is apparently formed earlier than labialisation, at least in the history of the varieties in question, but lost from the language slower. The possible impact of the front vowel harmony characteristic of the Finnic languages of Ingria in this asymmetry is yet to be investigated.

The high level of susceptibility of **u* to qualitative reduction and concomitant loss of rounding might be one of the factors impeding the formation of the phonemic consonantal labialisation over the loss of the segmental vowel at the later stages of reduction. The vowel **u* is the most conservative among the three vowels in terms of vowel loss, as it retains the largest "vocalic" cluster of realisations in all speakers, but it manifests gradual transitions between the stages in all aspects: qualitative reduction, devoicing, and loss. No robust cluster of consonantal labialisation as the trace of **u* is formed, the segmental vowel is rather directly lost. Evidence from vowel perception and neuroimaging (see 4.1.2) also suggests that *u* is a more complex unit than *i* for brain processing, and acoustically and perceptually less salient.

A difference in the size of consonantal palatalisation and labialisation clusters at Stages 2 and 3 could also be attributed to the articulatory properties of these two features. In the Finnic languages of Ingria, consonants do not typically undergo a coarticulatory labialisation along their whole length: only the very last portion of the segment is regressively affected. Labialised consonants are often aspirated consonants where just the aspiration portion is labialised rather than the consonant itself (cf. labialised vs. plain aspiration on Figures 4.14 and 4.15). The labialised aspiration is then "eaten" away by reduction, and the consonant remains plain.

Consonantal palatalisation (Figure 4.16) has a much more powerful impact on the articulation of consonants in these languages. Especially for dentals (and specifically for *l* and *t*), it is a full rather than secondary palatalisation, with a shift of the primary articulation towards the palatal region of the vowel tract (cf. surveys in Kochetov 2011; Krämer & Urek 2016). Our preliminary observations show that the number of palatalised consonants and the degree of their palatalisation manifest a positive correlation with the degree of vowel reduction in the Finnic languages of Ingria. The more advanced the vowel reduction and loss are, the bigger number of palatalised consonantal phonemes could be distinguished for any particular variety and the stronger the palatalisation is from the phonetic point of view. Ingrian Finnish and Soikkola Ingrian have dental palatalised phonemes, but in Votic their inventory is significantly larger. At the same time, in Ingrian Finnish, Soikkola Ingrian, Votic, and partially Central Lower Luga Ingrian the consonant *t* is just secondarily palatalised and can be easily realised also as a plain one. In most other Lower Luga Ingrian varieties (Northern, Southern, and partially Central) and in the Siberian Ingrian Finnish, in turn, this consonant is always fully palatalised in the context before the high front vowels *i* and *ü*. This palatalisation is so strong that sometimes a palatal stop in pronounced (viz. Leppik 1975: 116-17; N. V. Kuznecova 2009a: 195-235; E. B. Markus & Rožanskij 2011: 17-18).

These observations are to be further verified, but one could hypothesise this trend to be a result of re-phonologisation. Front high vowel quality, which originally stipulated palatalisation, ceases to do so, as vowels are progressively reduced and lost. Palatalisation starts to be perceived as a distinct property of consonants and becomes phonetically reinforced. Subsequently, even if the aspiration after consonants disappears, the palatalised articulation in those consonants where it has emerged as a stable property is preserved. Indeed, in the Siberian speaker, consonantal palatalisation was unevenly distributed across consonants. The consonants *l* and *t* were palatalised as a trace of **i* in all cases, and here we can speak about a well-formed consonantal palatalisation. Consonants *p, k, n* manifested palatalisation in 30-60% of cases, and consonants *s, h, r, n, m, v* only sporadically. In these two groups, especially in the last one, the tendency towards complete depalatalisation was observed.

Figure 14. Aspirated labialised C (**lastu* [łast$^{\circ h}$] 'chip') PS

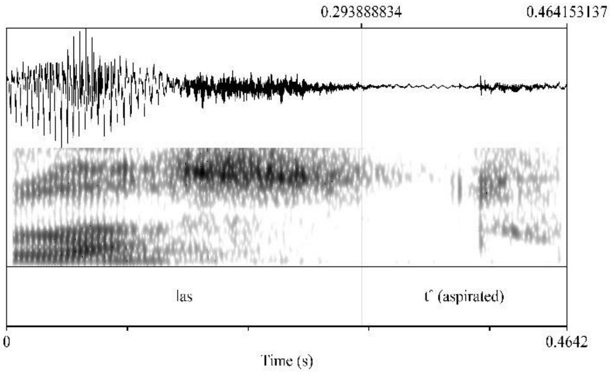


Figure 15. Aspirated C (**lasta* [łast^{h}] 'child:PRT') PS

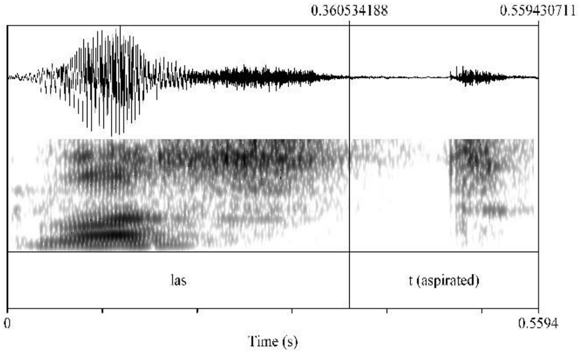
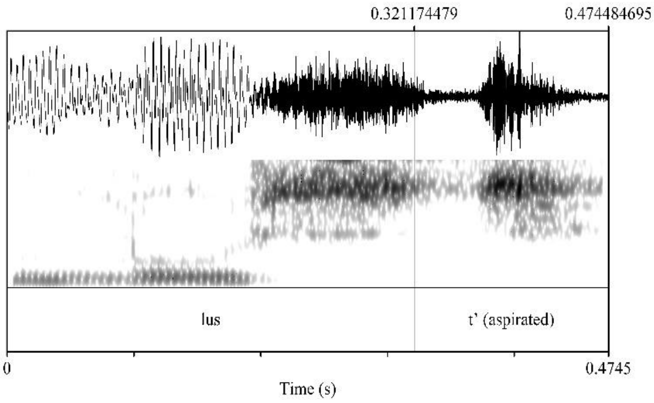


Figure 16. Aspirated palatalised C (**lusti* [łust^{jh}] 'beautiful') AU



Palatalisation might still, therefore, survive as a phonemic feature, at least for some consonantal types. Labialisation is likely to be lost without any reflexes. Indeed, in neighboring Estonian, which represents an even more advanced state of the same type of reduction and has passed through the stage of devoiced vowels, consonantal palatalisation as a trace of **i* still exists (only for dental consonants and with a trend towards further loss), but no traces of consonantal labialisation were preserved (Teras & Pajusalu 2014; Kuznetsova 2016).

A similar disparity in the trajectories of loss of **i* and **u* is observed in the history of other languages, such as Russian (Šahmatov 1915: 1:15-16; Kiparsky 1963) or Irish (Greene 1973; C. Anderson 2016). Labialised consonants are much rarer cross-linguistically than palatalised ones. Blevins (2004: 204) explains the rarity of certain phonological contrasts through the uncommon occurrence of sound changes giving rise to them. Consonantal palatalisation accounted for 145 (3.18%) cases in the PBase (Mielke 2008; Brohan & Mielke 2018: 218-19), being one of the most frequent types of sound change, while labialisation included just 38 entries.

We do not know of cases of the emergence of phonemic consonantal aspiration as a result of the loss of the following plain schwa, a reflex of **a* (nor the P-base gives such examples). This is just an additional indication of a very low perceptual saliency of this schwa, especially in the final prosodic positions. In our case study, this leads to its fast disappearance both from the mind and the production of speakers. One might still wonder if, at Stages 2 and 3, it is still possible to distinguish a separate phonemic series of aspirated consonants, as opposed to the non-aspirated ones, at the synchronic level, e.g. *vīn* 'bring_away:1SG' vs. *vīn*^{h} (<**vīna*) 'vodka'. At Stage 3, this series would be an addition to the plain, palatalised, labialised, and labiopalatalised series (Sidorkevič 2013b; Kuznetsova 2015, 2016; see Chapter 3). However, all the speakers at Stages 2 and 3 still perceive reflexes of **i* and **u*, but none perceives plain aspiration as a reflex of **a*. If the difference between aspirated and plain consonants were still consistently maintained in production, this case would represent an example of a near-merger, the next-to-last step of phonologisation (Barnes 2006: 223-38, see also 4.1.1).

4.5. Conclusion

The novelty of our approach to the problem of correspondence in production and perception at different stages of sound change was that real varieties were studied and speakers assessed words in their own languages. Similar studies usually involve miniature artificial languages or cross-linguistic assessments, with their own methodological restrictions. The most typical question asked is which of the vowels is perceived, while our request was rather whether any vowel is perceived at all. If a variety has no literary standard, the latter question is much easier to answer by means of the categorisation test proposed in this study (only if the intermediary orthography has a segmental principle of encoding).

At the initial stage, vowel reduction and loss are linked to the automatisation of execution in production of the old category. Categorisation remains more conservative than production and the phonetic loss is likely to be concentrated in a few frequent words and grammatical morphemes. At later stages, loss spreads throughout the system and its conditioning becomes purely phonetic. When speakers pronounced a vowel in more than 70% of cases, they typically perceived its presence. A decisive qualitative shift seemed to happen in categorisation after the new realisational types have gained more than 70%. Speakers stopped perceiving any segment and categorisation became innovative, while production still showed a certain percentage of vowel preservation and was lagging behind. Reduction is based on a loss of now meaningless parts, and this last stage can contain near-mergers. Automatisation of execution is likely still be at work here, only now the production of the new category is being automatised. The comparison of several stages of vowel reduction and loss revealed no irreconcilable contradiction between the two main patterns of reduction, centrifugal and centripetal. Both were observed in our data: the rise of mid to high vowels and eventual centralisation of all vowels to schwa.

We studied the three basic corner vowels, which are known to share a specific set of properties with regard to reduction and loss, and observed asymmetry in their production and perception. The results suggested two types of the markedness hierarchies of these vowels. As regards the process of reduction and loss itself, the hierarchy of vowels (from the most to the least innovative) is *a* > *i* > *u*. The phonological saliency of secondary consonantal localisations emerging in the process of loss of these vowels, in turn, would suggest the hierarchy *a* > *u* > *i* (from the least to the most salient secondary localisations). Some possible physiological features stipulating both hierarchies were outlined in the chapter.

Appendix 4.1. *List of the most typical carrier words*

In the list below, morphonologically front-vowel stems are underlined.

T	**A**	**I**	**U/O**	**R**	**A**	**I**	**U/O**
t	*musta* 'black'	*lusti* 'beautiful'	*lastu* 'chip'	**l**	*suola* 'salt'	*stuoli* 'chair'	*škoulu* 'school'
t	*vihta* 'bath broom'	<u>*risti*</u> '(a) cross'	*lintu* 'bird'	**l**	*naula/nāgla* 'nail'	<u>*hīli*</u> 'coal'	*laulu* 'song'
t	*lūta* 'broom'	*puoti* 'shop'	*maito/maitu* 'milk'	**l**	*muila* 'soap'	<u>*kieli*</u> 'tongue'	*joulu* 'Christmas'
p	*hāpa* 'aspen'	<u>*sīpi*</u> 'wing'	*rūpo* 'rubbish'; *(ei) korpu* '(does not) dry out:3SG'	**r**	*koira* 'dog'	*sūri* 'big'	*pudru/pudro* 'porridge'
p	*kumpa* 'which of the two'	*krāpi* 'comb (wool):IMP'	*urpo* 'willow'	**r**	*nuora* 'rope'	*nuori* 'young'	*vieru/viero* 'wheel'
k	*jalka* 'leg, foot'	*panki* 'bucket'	*hanko* 'snowbank'	**r**	*hāra* 'branch'	<u>*hīri*</u> 'mouse'	*viiru* 'stripe'
k	*nahka* 'skin'	*poski* 'cheek'	*pehko* 'bush'	**n**	*vīna* 'vodka'	<u>*pieni*</u> 'small'	*hieno* 'fine'
k	*poika* 'boy'	*hauki* 'pike'	*riuku* 'pole'	**n**	*sauna* 'sauna'	*sāni* 'sleigh'; <u>*sieni*</u> 'mushroom'	*kehno* 'worn out'
k	*velka* 'debt'	*olki* 'straw'	*halko* 'billet'	**m**	*ilma* 'air'	*tormi* 'storm'	*silmu* 'lamprey'
s	*oksa* 'twig'	*lapsi* 'child'	*paksu* 'thick'	**m**	*surma* 'death'	*sormi* 'finger'	*formu* '(a) form'
s	*klāsa* 'class'; *vatsa* 'stomach'	*ūsi* 'new'	*haisu* '(a) smell'	**m**	*māma* 'mother'	*Suomi* 'Finland'	*solmu* 'knot'
h	*vaiha* 'change:IMP'	<u>*rīhi*</u> 'drying barn'; *jouhi* 'horsehair'	*jauho* 'wheat'	**v**	*hīva* 'yeast'	*talvi* 'winter'	*kaivo* '(a) well'
h	*laiha* 'lean, thin'; *turha* 'vain'	*tuohi* 'birchbark'	*karhu* '(a) bear'; *kaiho* 'damage'	**v**	*līva* 'sand'	<u>*hirvi*</u> 'elk'; *sarvi* 'horn'	*koivu* 'birch'

Chapter 5: Isochrony and gemination in Soikkola Ingrian

5.1. Introduction

The Soikkola dialect of Ingrian manifests a rare ternary quantity contrast of consonants, attested only in closely related Estonian, Livonian, and Saami. The Ingrian ternary contrast relies less on secondary durational cues in other foot segments than in these languages, at least in the disyllabic foot (E. Markus 2011; Kuznetsova 2015; see Chapter 2). The trisyllabic foot, little studied before, shows prosodic differences from both the disyllabic foot and the combination of a disyllabic and a monosyllabic foot. Most notably, it manifests two prosodic phenomena, already considered to be interrelated by Sovijärvi (1944: 182-84): specific types of prosodically motivated gemination and ongoing shortening of long vowels in the second syllable.

This chapter aims at a comprehensive analysis of an interaction of phonological length and foot structure observed in segmental durations within main quantitative patterns of trisyllabic feet, in comparison with selected disyllables. We look both at synchronic timing patterns and at their precursors in earlier language history. We claim that both can be explained through the influence of two main phonetic tendencies on length: isochrony (temporal compensation observed at different levels of prosodic constituency) and "anti-isochrony" (lengthening of segments before longer sounds). One of the most evident manifestations of isochrony is an ongoing simplification of a phonological length contrast in the second syllable vowel of trisyllables, as compared to disyllables, which still maintain the original contrast. In turn, "anti-isochrony" is best represented by a historical process of prosodically-motivated gemination of singleton consonants before long vowels. These two phonological phenomena are in the focus of our study. Additionally, we study subtler living phonetic manifestations of both isochrony and "anti-isochrony" in other foot positions and compare their effect sizes through the prosodic positions in the foot. Our findings present some challenges for current phonological models, both physiologically-motivated and formal ones.

5.2. Basic facts on synchronic and diachronic phonology of Soikkola Ingrian quantity

Soikkola Ingrian, along with the Lower Luga and extinct Hevaha and Oredež dialects, is one of the four dialects of Ingrian (cf. Chapter 1), considered to be an independent language rather than a group of Finnish dialects since Ariste (1956). Soikkola Ingrian has a front vowel harmony of the Finnish type; the phonemic system is given in Table 5.1 (revised from N. V. Kuznecova 2009a). The ternary quantity contrast of consonants exists in an intervocalic position for all consonants, and after a sonorant before a vowel for the consonants *k p t t' s s'* (cf. Chapter 2).

Singletons of these latter consonants and *h* are phonetically (half-)voiced, but only fricatives *v : f* manifest an emerging true voicing contrast.

Soikkola Ingrian middle length class, unlike in Estonian and Livonian, has emerged through a historical process of so-called secondary gemination of singletons rather than through the shortening of long geminates (in Saami both processes were attested, cf. Sammallahti 1998). Many Finnic languages manifest two historical types of geminates: **primary** (original) geminates, dating back to Proto-Finnic (Setälä 1891), and **secondary** (late) geminates, which emerged later out of singleton consonants in certain prosodic positions (Kettunen 1909). Phonetic and phonological manifestations of secondary gemination vary a lot across Finnic varieties. In Soikkola Ingrian, Eastern Votic, and the Finnish dialects of North Karelia and Häme, primary geminates are realised as **long** geminates, and secondary geminates as **short** geminates (Kettunen 1913; Sovijärvi 1944; Nirvi 1950; Paunonen 1973; Nahkola 1987).

The overall system of secondary gemination in Soikkola (and Hevaha) Ingrian is the most complex in the Finnic space (see 5.6.2). Table 5.2 presents main quantity patterns in di- and trisyllabic feet, which result from the gemination and existing exceptions to it, as well as shows the corresponding monosyllabic foot quantity patterns. These patterns were attested in sources covering a period from the second half of the 19th c. to the first half of the 20th c. (Porkka 1885; Sovijärvi 1944; Nirvi 1971) and were taken as a starting point for our study. Attested combinations of the phonological length classes in the second syllable vowel (V_2) and the consonant at the 1st/2nd syllable boundary (C_2) after an original light (C)V-, heavy (C)VV- / (C)VR-, and extraheavy (C)VVR- syllable are summarised in Table 5.3.

Secondary gemination emerged both in di- and trisyllables before original long vowels and certain diphthongs, e.g. **kanā* > *ka**n̆n**ā* ‘hen:PRT’, *kerkīm(m̆)ā̄* > *ker**k̆k**īm(m̆)ā̄* ‘be_in_time:SUP’. However, it also happened in the trisyllabic foot before a sequence of two light syllables *-CVCV(C), e.g. **murkina* > *mur**k̆k**ina* ‘breakfast’, hence the possibility of a C˙$_2$ + V_2 sequence in tri-, but not in disyllables. A development in trisyllables after (C)V-, like in **omena* [ˈomeˑna] > *o**m̆m**ēna* ‘apple’, is addressed in 5.5.2.3.

Both di- and trisyllables present a number of synchronic exceptions to the gemination rules, a result of various processes of syllabic structure restructurisation. Most notably, when phonological gemination was under formation, certain structures did not fulfill the required conditions, cf. **makat̆tak* >> *mā**t**ā* ‘sleep:INF’, **lak̆kat̆tak* >> *la**k**ata* ‘sweep.INF’ without gemination. Therefore, the sequence C_2 + Vː$_2$ is synchronically possible in disyllables (see footnotes *a-b* to Table 5.2 for other exceptions) and the sequence C_2 + V_2 is synchronically possible in trisyllables before two light syllables (cf. structures 32-35 in Table 5.2).

In our study, the foot is defined as a 1-3-syllabic domain of the foot stress (foot stress can be lexicalised or rhythmic, cf. a description for Soikkola Ingrian and Estonian in N. V. Kuznecova 2009b; Kuznetsova 2018a). This is similar, e.g., to a cross-word foot in Articulatory Phonology (viz. Turk & Shattuck-Hufnagel 2020: 16). A sequence from the first syllable vowel throughout the second syllable vowel, where the main length contrasts and their alternations are concentrated, is referred to as a "foot nucleus", by analogy to the syllabic nucleus. The trisyllabic foot presents numerous challenges for formal phonological accounts on feet and is often represented as the so-called recursive (two-layered) foot, where the "minimal foot" roughly corresponds to the foot nucleus of the present study and the "maximal foot" to our trisyllabic foot (e.g. Martínez-Paricio & Kager 2015). However, as we discuss in 5.6.4.1, Soikkola Ingrian also provides specific phonological evidence for an independent prosodic status of the trisyllabic foot.

Table 5.1. Soikkola Ingrian phonemes

(a) Vowels

	front		non-front
	unrounded	rounded	
high	i iː	ü üː	(ɨ)[a] u uː
mid	e eː/iː[b]	ö öː/üː	o oː/uː
low	ä äː		a aː

(b) Consonants

		labial	dental	palatal(ised)	velar
stops		p pˑ pː	t tˑ tː	(t' t'ˑ t'ː)	k kˑ kː
fricatives		(f fˑ fː)[a]	s sˑ sː	(s' s'ˑ s'ː)	h hˑ hː
sono-rants	nasals	m mˑ mː	n nˑ nː	(n' n'ˑ)	
	laterals		l lˑ lː	(l' l'ˑ)	
	thrills		r rˑ rː	(r' r'ˑ)	
affricates				(č čː)	
glides		v vˑ vː		j jˑ jː	

Footnotes: [a]Phonemes in parentheses occur only in expressive lexemes and Russian loans. [b]Long mid vowels in the stressed root syllables are realised in a range from mid to high depending on a village and a speaker.

Table 5.2. Quantity patterns in the nuclei of the 1-3-syllabic foot, attested in existing sources of the 19-20[th] cc.

Foot type	Type of C_2+V_2	Type of a sequence in the first syllable				
		(C)V-	(C)Vː-	(C)V_1V_2-	(C)VR-	(C)VːR-
Monosyllabic	—	no[1]	mā[2]	sai[3]	ken[4]	sūr[5]
	only C	nüt[6]	māt[7]	sait[8]	hänt[9]	sūrt[10]
Disyllabic	C + V	tapa[11]	lōta[12]	aita[13]	karta[14]	kārto[15]
	C + Vː		mātā[16]	aitās[17,a]	kartās[18,a]	*raentā*[b]
	(Cˑ + V)					
	Cˑ + Vː	tap̆pā[19]	lōt̆tā[20]	ait̆tā[21]	kart̆tā[22]	kārt̆tō[23]
	Cː + V	natta[24]	vōtta[25]	aitta[26]	kartta[27]	
	Cː + Vː	tappā[28]	nōttā[29]	aittā[30]	karttā[31]	
Trisyllabic	C + V	lakata[32]	vīkate[33]	leikata[34]	harkata[35]	*kērsim(m)ä*[c]
	(C + Vː)					
	Cˑ + V		vōt̆tava[36]	voit̆teli[37]	murk̆kina[38]	vā̆nt̆teli[39]
	Cˑ + Vː	mat̆tāla[40]	sūt̆tīm(m)a[41]	hoit̆tīm(m)a[42]	kerk̆kīm(m)ä[43]	vā̆nt̆tīm(m)ä[44]
	Cː + V	kattila[45]	ōttele[46]	voitteli[47]	markkoja[48]	
	Cː + Vː	kattīm(m)a[49]	mūttīm(m)a[50]	toittīm(m)a[51]	harkkām(m)a[52]	

Footnotes: [a]Only structures with late compensatory lengthening in the 2nd closed syllable were attested, e.g. **aitassa* > *aitās*. [b]Only examples with a "contracted" diphthong in the 1st syllable, previously divided by a syllabic boundary, were attested: *raentā* 'milk_pail:PRT' (varies in our data with *raenˇtā*), *tüärtǟ* 'daughter:PRT:3POS' (Sovijärvi 1944: 40), *näöltǟ* 'face:PRT:3POS' (Laanest 1986: 16), cf. Proto-Finnic **näköltäsen* 'face:PRT:3POS' > trisyllable *nä.öl.tǟ* > disyllable *näöl.tǟ*. [c]In the present phonetic study, bifoot words with a long 3rd syllable vowel (*vǟntelȫ* 'twist:3SG') were used instead of this structure, but later we became aware also of true trisyllabic feet like *kērsim(m)ä* 'circle:PST:1PL' (Nirvi 1971: 163) with *s* instead of a stop as C_2.

Glosses: [1]'but', [2]'land', [3]'get:PST:3SG', [4]'who', [5]'big', [6]'now', [7]'land:PL', [8]'get:PST:2SG', [9]'he:PRT', [10]'big:PRT', [11]'kill:IMP', [12]'broom', [13]'fence', [14]'baking_sheet', [15]'rainbow', [16]'sleep:INF', [17]'barn:IN', [18]'map:IN', [19]'catch:3SG', [20]'broom:PRT', [21]'fence:PRT', [22]'baking_sheet:PRT', [23]'rainbow:ILL', [24]'slime', [25]'year:PRT', [26]'barn', [27]'map', [28]'kill:3SG', [29]'seine', [30]'barn:PRT', [31]'map:PRT', [32] 'sweep_floor:INF', [33]'scythe', [34]'cut:INF', [35]'step:INF', [36]'leak:PC.PRS.ACT', [37]'smear:PST:3SG', [38]'breakfast', [39]'twist:PST:3SG', [40]'low', [41]'judge:1PL', [42]'beware:1PL', [43]'be_in_time:1PL', [44]'turn:1PL', [45]'cauldron', [46]'wait:IMP', [47]'struggle:PST:3SG', [48]'postage_stamp:PL:PRT', [49]'cover:1PL', [50]'change_oneself:1PL', [51]'feed_oneself:1PL', [52]'step:1PL'.

Table 5.3. Attested combinations of C_2 and V_2 length after (C)V-, (C)VV- / (C)VR-, and (C)VVR- in the first syllable

Foot type	$C_2 + V_2$	$C_2 + V{:}_2$	$C{\cdot}_2 + V_2$	$C{\cdot}_2 + V{:}_2$	$C{:}_2 + V_2$	$C{:}_2 + V{:}_2$
Disyllabic	✓	✓ but not after (C)V-	×	✓	✓ but not after (C)VVR-	✓ but not after (C)VVR-
Trisyllabic	✓	×	✓ but not after (C)V-	✓	✓ but not after (C)VVR-	✓ but not after (C)VVR-

5.3. Background and research questions of the study

5.3.1. Acoustics of phonetic and phonological timing in Finnic and Saami languages

Finnic and Saami languages show tight durational interrelations between foot elements, as well as the importance of ratios between them for speech production and perception. The ratios are much more stable than absolute segmental durations, although they differ to a certain extent both between varieties and between foot structures (see e.g. Eek 1990; Lehiste 1997a; Eek & Meister 2003, 2004; Lippus et al. 2013 on Estonian; Lehtonen 1970; Suomi, Toivanen & Ylitalo 2008 on Finnish; Lehiste et al. 2008; Tuisk 2015 on Livonian; N. V. Kuznecova 2009b; Kuznetsova 2016; E. Markus 2010, 2011 on Ingrian and adjacent languages; Türk et al. 2019; Hiovain, Vainio & Šimko 2020 on Saami). Among other things, the ternary quantity contrast of consonants in Estonian, Livonian, and Saami is reinforced by statistically significant modifications in the durations of the first and, in the Finnic languages, especially the second syllable vowel.

Most reported structural effects are compensatory (isochronic), where an increase in length in some positions provokes durational shortening in other positions, and vice versa. Structural influences on duration are not equally strong for all length classes. Finnic longer length classes of both vowels and consonants show more durational variability, including the structural effects, than the shorter ones (Sadeniemi 1949: 104; Lehtonen 1970: 35; Nahkola 1987: 15-16 for Finnish). This is in line with a general observation on both speech and non-speech movements that variability grows linearly with an interval duration (viz. Turk & Shattuck-Hufnagel 2020: 90-95). Finnic diphthongs in stressed syllables are comparable in their duration and overall prosodic properties to long monophthongs (Lehtonen 1970: 69; Eek & Meister 2004).

The strength of the structural impact on duration also depends on prosodic context. Cross-linguistically, different prosodic positions at micro- (e.g. intrasyllabic) and macro- (e.g. phrasal, text) levels can stipulate stronger or weaker compression or lengthening effects (White 2014; Rathcke & Smith 2015). However, languages like Finnish, with complex quantity contrasts, strongly regulate such effects in order to preserve their quantity system from distortion (Lehtonen 1970: 35; Nakai et al. 2009, 2012). At the micro-level, the strongest isochronic shortening effects were observed in Finnic languages (1) in long vowels and consonants of the initial stressed syllable, (2) in non-initial unstressed vowels after a stressed heavy syllable (any other than (C)V). At the same time, consonants in the word-initial position were reported as not affected by foot structure at all (Eek & Meister 2004; Suomi et al. 2013).

One of the manifestations of isochronic shortening, described for many languages, is poly-subconstituent shortening at different prosodic levels, when the duration of segments and syllables decreases by adding more segments and syllables to a prosodic domain (cf. Lehiste 1972 on English; Turk & Shattuck-Hufnagel 2020: 135-43 for a general overview). Finnic data are controversial in this respect. Polysyllabic shortening was not confirmed for Finnish as a general tendency concerning all segments (Lehtonen 1970: 143; Suomi 2009: 415). In Estonian, Livonian, and Saami, durations of second syllable vowels and long geminates were shorter in trisyllabic than in disyllabic structures (Lehiste 1968, 1997b; Lehtonen 1970; Tuisk 2015; Türk et al. 2020). For Soikkola Ingrian, Sovijärvi (1944: 182-84) mentions ongoing reduction of second syllable long vowels observed only in the trisyllabic feet with the first heavy syllable.

The most prominent Finnic isochronic lengthening effect, when more duration in one position is connected to less length in the other, appears after the light (short) stressed syllable (C)V. This effect is manifested in a phonetic prolongation of the phonologically short second syllable vowel, called a “half-long vowel” since Hakulinen (1922), cf. Soikkola Ingrian *tapa* [ˈtab̥**a**ˑ] ‘kill:IMP’, *lakata* [ˈłag̊**a**ˑd̥a] ‘sweep.INF’.

Along with isochrony, Finnic languages also manifest anti-compensatory (“anti-isochronic”) effects, which are much less known and experimentally studied. The most prominent of them is consonantal lengthening before long vowels and diphthongs, which had also triggered the emergence of phonological secondary gemination in an earlier historical period. At initial stages, however, it is a local phonetic process between two adjacent sounds. It is apparently physiologically motivated and starts from more frequent words (cf. Nahkola 1987 on Finnish dialects). Such local lengthening is attested not only in the prosodic positions of secondary gemination, but also in original (primary) geminates, which become phonetically overlong, and in word-initial consonants before long vowels (Laurosela 1922; Nirvi 1950; A. Turunen 1959; Lehtonen 1970; Räisänen 1972; Paunonen 1973; Nahkola 1987; Palander 1987; Suomi, Toivanen & Ylitalo 2008; Kuznetsova 2013). A functional correlation between secondary gemination and phonetic lengthening of any coda type is outlined by Holman (1976).

When this lengthening becomes phonologised as secondary gemination, its prosodic properties change. Its impact on neighboring sounds expands, e.g. it can spread or shift to those sounds of the first syllable which are no more adjacent to the second syllable vowel (Kuznetsova 2013). At late phonological stages of development, secondary gemination can be conditioned by very general rhythmic factors rather than just by the length of the following vowel, in particular, by stress placement rules and a degree of lexical and phrasal stress (Sovijärvi 1944: 24-25; Nahkola 1987: 184-87, 238-39 on Finnish dialects), or by two following light syllables, as in the Soikkola and Hevaha Ingrian trisyllabic feet. Phonological secondary geminates can eventually reach the length of the primary (original) geminates. This happened e.g. in Lower Luga Ingrian, Western Votic, and peripheral Soikkola Ingrian varieties (Kuznetsova 2015).

Such lengthening can be seen as contrary to isochrony, as it adds more duration in connection with more length (its “anticompensatory” nature was pointed out by Leskinen 1961: 148; Nahkola 1987: 24, 32; O’Dell 2003: 15). It keeps the ratio between adjacent segments constant, while isochrony tends to preserve general duration of a prosodic domain (Kuznetsova 2013). When dialectal Finnish speakers de-geminated secondary geminates, trying to get rid of a distinct dialectal feature, the following long vowel also shortened (Palander 1987: 230), and so the ratio between the two was maintained. This process is sociolinguistically motivated and starts with the least frequent words and in formal speech (Nahkola 1987).

Isochrony functions as a more general prosodic tendency governing the effects of secondary gemination as well. For example, the longer the duration secondary geminates obtained, the stronger the reduction of the following and preceding vowels was, especially of the long ones, in non-initial syllables, and in long words (Sovijärvi 1944: 27; Lehtonen 1970: 126-29; Palander 1987: 222-29; Nahkola 1987: 257-60). Secondary geminates in structurally more complex feet were phonetically shorter than in the less complex ones (Sovijärvi 1944; Gordon 2009).

To sum up, known structural influences on Finnic and Saami sound durations result from a complex interaction of compensatory and “anti-compensatory” effects. A varying degree of prominence of these influences has been reported to depend on: (1) particular variety, (2) prosodic position of a segment in syllable, foot, and word, (3) structure of each of the latter, (4) segmental length class. In order to draw apart length and other factors, it is essential to place contrasting sounds in maximally comparable structural and prosodic contexts (Lehiste 1968; Nahkola 1987: 240-42).

5.3.2. Possibilities for articulatory accounts of Finnic timing patterns

Compensatory effects (vowel reduction or lengthening in the second syllable depending of the weight of the first syllable) and “anti-compensatory” gemination manifest a correlation across Finnic varieties both in a degree of prominence and in geographical distribution. The areas of “half-long” vowel and “common” secondary gemination (Type 1 in Table 5.10) coincide in Finnish dialects (Wiik 1975, 1982). Both the allegedly oldest type of Finnish secondary gemination (Type 2 from Table 5.10) and the strongest vowel reduction are attested in South-Western Finnish dialects (Penttilä 1926: 13, 44-45). Secondary gemination, “half-long” vowel, and vowel reduction are phonetically and phonologically prominent in Ingrian, Votic, and the Finnish dialects of Karelia (Kuznetsova 2016; Kuznetsova & Verkhodanova 2019; cf. Chapters 3 and 4).

This correlation might be accounted for by common articulatory mechanisms of both compensatory and “anti-compensatory” effects. The tenseness of articulation has been long perceived as drastically decreasing throughout the Finnic word (Penttilä 1926: 41-42). Arvo Eek, who conducted numerous articulatory (palatographic and cineradiographic), acoustic, and perception studies on Estonian, linked isochrony and vowel reduction in non-initial syllables, among other things, to a possible shift in motor control between the two parts of the foot (Eek & Help 1987; Eek 1990). The first part, tense and pronounced with a greater muscular effort, is well-controlled (it shows higher velocity of articulators, less articulatory target undershoot, and less coarticulation), but this control is released at a certain point after or within the first syllable in the second, relaxation, phase. Also in other Finnic studies, both “half-long” vowel and secondary gemination have been linked to the tense articulation of the whole light stressed syllable: an “articulatory overexertion” of the consonant in anticipation of the following long vowel and the “close contact” (*luja liittymä*) between the two (Porkka 1885; Hakulinen 1922; Vilkuna 1928; Ariste 1939; Rapola 1947; Tauli 1956; A. Turunen 1959; Leskinen 1961; Lehtonen 1970; Nahkola 1987).

In formulating his hypothesis, Eek drew upon models of speech articulation and motor control system contemporary of 1960-1980s, making inferences from acoustic and articulatory data to muscular activity. At present, the most elaborate model of this kind is Articulatory Phonology / Task Dynamics (AP/TD), which represents speech activity as a sequence of coordinated (coupled) articulatory gestures, modelled as critically damped mass-springs oscillating towards gestural targets. Eek's model, however, conceptually differs from AP/TD on two important points. First, AP/TD presumes phonological representations to be spatiotemporal, i.e. timing-intrinsic, while Eek was following those variants of articulatory phonology which presumed timing-extrinsic, symbolic phonological representations (e.g. Fujimura 1987 et seq.). Second, Eek saw the foot as one of the central units of timing regulation according to isochrony, but where "the temporal compression ...need not be the same for every constituent part of the frame" (1990: 253).

Non-local, prosodic patterns are in general not yet well-integrated into AP/TD, which triggers further adjustments of this framework (cf. Tilsen 2019; Turk & Shattuck-Hufnagel 2020; Krivokapić 2020). Some patterns are modelled in AP/TD through π-gestures (prosodic gestures, Byrd & Saltzman 2003), which account for lengthening at initial and final prosodic boundaries at different levels of prosodic hierarchy, and μ-gestures (modulation gestures, Saltzman et al. 2008) accounting for lexical stress related lengthening. These gestures are gradually activated and deactivated at prosodic boundaries over a timespan of several single articulatory gestures. The most recent versions of AP/TD also introduced coupling oscillators for prosodic levels over syllables, i.e. for the foot and the phrase, to account for poly-subconstituent shortening (O'Dell & Nieminen 1999; Saltzman et al. 2008).

The prosodic components of AP/TD predict, among other things, that prosodic boundary gestures would not skip segments and would affect long and short phonemes in an equal manner, and that poly-subconstituent shortening would either be equally manifested in all subconstituents or affect only stressed syllables (Saltzman et al. 2008; Krivokapić 2020). However, a growing body of data, much of which comes from quantity languages, is not in line with these predictions, showing higher variability of longer phonemes, uneven distribution of poly-subconstituent shortening through given prosodic domains (hence also Eek's views on an unequal compression within the foot), and restrictions on boundary lengthening from the phonological length of segments. Such evidence stimulated a proposal to re-introduce "an approach to speech-motor control based on general-purpose, phonology-extrinsic timing mechanisms, and symbolic phonological representations" (Turk & Shattuck-Hufnagel 2020: 313). A relevance of phonemes and other symbolic representations is promoted also in recent psycholinguistic studies employing EEG brain research (e.g. Kazanina, Bowers & Idsardi

2018; Scharinger 2020). We also adhere to the phonology-extrinsic view on timing, which allows us to study influences of segmental phonological length on sound durations. In 5.6.3, we discuss how our results further challenge AP/TD's assumptions and predictions.

5.3.3. Research questions of the study

The present study attempts to disentangle the most important structural effects on sound durations in 22 trisyllabic and four disyllabic types of Soikkola Ingrian and to compare the relative strength of these effects between predictors in one position and across positions. The following main questions are addressed:

(1) how the foot nucleus structure affects the length and duration of each of its elements in trisyllables;

(2) how the number of syllables in the foot (2 vs. 3) affects the duration and length of segments in the four shortest foot nucleus types;

(3) whether and how the relative strength of compensatory and "anti-compensatory" effects changes throughout the nuclei of the studied foot types;

(4) how the observed effects and processes could be accounted for both by articulatory phonology and by formal phonological models.

We were especially interested in:

— ongoing phonological shortening of long second syllable vowels in trisyllabic feet;

— durational properties of a typologically rare ternary quantity contrast of consonants;

— phonetic isochronic effects thoughout the foot nucleus;

— phonetic "anti-isochronic" effects thoughout the foot nucleus.

5.4. Data and methods

The matrix of trisyllabic structures in Table 5.2 enabled us to disentangle the individual factors of phonological length and foot nucleus structure which influence segmental durations in each position of the trisyllabic foot nucleus, as well as to look at their interactions. In particular, on the basis of earlier research, the following specific predictions could be tested for Soikkola Ingrian:

— no foot structure impacts in the word-initial consonant,

— no significant durational differences between long monophthongs and diphthongs;

— robust ternary quantity contrast of consonants in di- and trisyllables;

— isochronic shortening in at least first and second syllable vowels and the consonant between them as a function of longer segmental length classes, more elements, and more syllables in the structure;

— stronger isochronic shortening in second syllable vowels than in first syllable elements;

— stronger isochronic shortening in longer length classes of vowels and consonants;

— isochronic lengthening of a second syllable short vowel after a light stressed syllable (C)V;

— anti-isochronic lengthening in consonants preceding long vowels in any position.

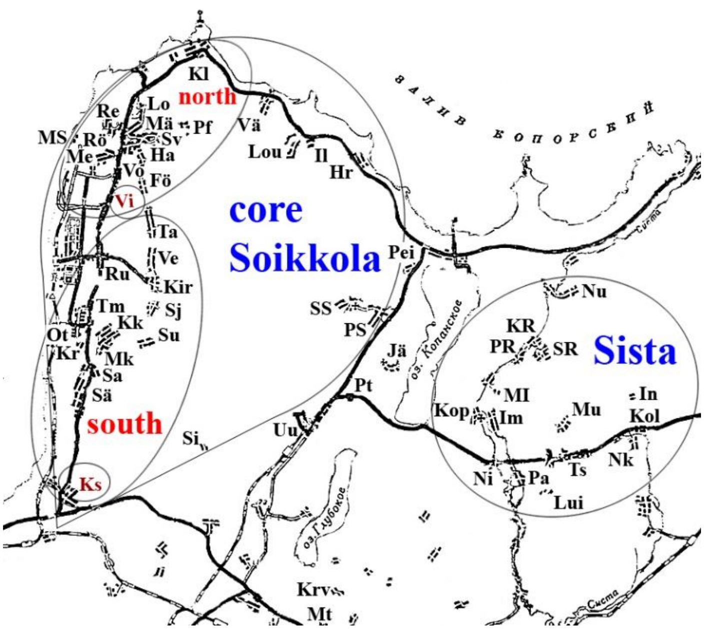
Study 1 on trisyllabic feet showed differences from those previously reported on disyllabic feet as regards the second syllable vowel and the ternary quantity contrast of consonants. Therefore, we ran an additional minor **Study 2** to compare the durations of length classes in these two positions, recorded from the same speakers in similar phrasal conditions, in the four shortest foot nuclei types of trisyllabic vs. disyllabic feet. In this second study, the hypothesis on polysyllabic shortening as a function of the number of syllables in the foot could be explored.

Study 1 included two questionnaires with trisyllables (22 structural types; 3812 tokens): Questionnaire 1 with structures nr 36-52 from Table 5.2, and Questionnaire 2 with structures nr 32-35 and a structure *vā̆ntelō̆* 'twist:3SG' with a final long vowel, to cover the foot nucleus V:RCV (see Ft. *f* to Table 5.2). A consonant in the beginning of the third syllable (C_3) was either a singleton or an original long geminate, which is often shortened up to a singleton in contemporary realisations (rendered in Table 5.2 as in *sūt̆tīm(m)a*). Each structure in Questionnaires 1-2 included five phrases with different carrier words. Each phrase was pronounced from 4 to 7 times by each of the five speakers (Questionnaire 2 contained less data than Questionnaire 1). Study 2 (Questionnaire 3) compared trisyllabic structures nr 32, 40, 45, 49 from Table 5.2 (383 tokens) with disyllabic structures nr 11, 19, 24, 28 (429 tokens) in three out of five speakers. Each of the four disyllabic structures included 7-12 tokens pronounced by speakers from 2 to 12 times.

Data were collected in the Kingisepp district (Russia) in 2014-2016, in the residence places of the speakers — five females, who learned a Northern subdialect of Soikkola Ingrian (or a similar transitory variety of *Vīstinä*) in their childhood (cf. Table 5.4, Figure 1.4). The Northern subdialect is phonologically slightly more archaic than the Southern one: it exhibits fewer effects of reduction, of mid vowel raising, and of singleton consonant voicing (N. V. Kuznecova 2009a). Older speakers ST, LM and EI still spoke Ingrian with their family members and friends at the time of the interview and considered it as their only mother tongue. Younger speakers AL and AG were less fluent and considered both Ingrian and Russian as their mother tongues. Speakers were either presented a phrase in Russian and asked to translate it into Ingrian and repeat it three or four times, or were presented directly with an Ingrian phrase and asked to repeat it several times.

Table 5.4. Sociolinguistic data on the speakers and the amount of collected data in Questionnaires 1-3 (labelled as “q1-q3”). Village names are given in Soikkola Ingrian, together with their abbreviations on the map of Soikkola varieties below (reproduction of Figure 1.4, right part, from Chapter 2) and their official Russian names in parentheses. Numbers of tokens placed in parentheses refer to the subset of Study 1 data used for Study 2. Token counts for each wordform in each speaker are given in Appendix 5.6.

Speaker code	Sub-dialect	Birth year	Birth place	Mother born	Father born	Recording place	Study 1 (n of tokens)			Study 2 (n of tokens)	
							long and short geminates (q1)		singletons (q2)	3-syllables (q1-2 subset)	2-syllables (q3)
AL	north	1933	Haǹmāla (Ha; Gamolovo)	Haǹmāla (Gamolovo) (died early)	Ukraine	Voloitsa (Vo; Val’anicy)	267	342	210	(114)	165
AG	north	1936	Reǹpōla (Re; Repino)	NA	NA (died in 1937)	Voloitsa (Vo; Val’anicy)	278	349	73	(103)	161
ST	north	1924	Mättüisī (Mä; Gorki)	Mättüizī (Mä; Gorki)	Mättüisī (Mä; Gorki)	Savimäki (Sv; Glinki)	298	239	52	(166)	103
LM	north	1930	Reǹpōla (Re, Repino)	Tarinaišsī (Ta; Andreevš’ina)	Reǹpōla (Re; Repino)	Mättüisī (Mä; Gorki)	331	356	90		
EI	transitory	1929	Vīstinä (Vi; Vistino)	Mättüisī (Mä; Gorki)	Vīstinä (Vi; Vistino)	Rūtsia (Ru; Ruč’ji)	317	395	215		
Tokens across Study 1 and 2 (q1-3): 4241						**Total:**	**1491**	**1681**	**640**	**(383)**	**429**



Reproduction of Figure 1.4 (right part): Dialectal subgroups within the Soikkola dialect

Two bigger areas: core Soikkola and Sista Soikkola. Core Soikkola varieties are divided into the Northern and the Southern group. A transitory Northern to Southern variety of Viistinä (*Vi*) and a mixed Soikkola/Lower Luga Ingrian variety of Koskisenkülä (*Ks*) are placed in individual circles and marked dark red.

Data were semi-automatically segmented in Praat (Boersma & Weenink 2013) and manually corrected, durations extracted with the help of Python and Praat scripts and statistically analysed in R (v. 4.0.0, R Core Team 2020) with a use of *car*, *lme4*, *lmerTest*, *emmeans*, *MuMIn*, *effects*, *ggplot* packages (by methods presented by Gries 2019). Various linear regression mixed effects models (see e.g. Boisgontier & Cheval 2016) were fitted in order to study relationships between the structural parameters of the foot nucleus and the durations of its segments. Main fixed effects were the length classes of all segments in a foot nucleus and the presence of a sonorant (*l*, *m*, *n*, *r*) in the 1st syllable coda. It was also checked whether the presence or absence of the word-initial consonant affects the duration of the following vowel, and how the length of this vowel, in turn, affects C_1 duration. Additionally, a distinction between the long monophthong and the diphthong in the 1st syllable was included in some models. These effects were checked, where relevant, in binary interaction with segmental length in each studied position. A ternary interaction was studied only for the V_2 position, where a prediction for it was available. Random effects included by-speaker and by-wordform random intercepts (Baayen, Davidson & Bates 2008), as well as phonemic qualities in a given position (cf. Lehiste 1960; Liiv 1961; Eek 1974; Lehtonen 1970: 60-75; Suomi, Toivanen & Ylitalo 2008 on intrinsic segmental durations) and in the two adjacent ones (Liiv 1961; Lehtonen 1970: 76-81). Random slopes were not included due to the model convergence issues, but interspeaker differences are addressed in connection with ongoing shortening of V_2. A list of all dependent variables, fixed and random effects is given in Appendix 5.1, and the list of reported models in Appendix 5.2.

Backwards stepwise regression based on AIC and the *p*-value of each predictor, returned by *drop1* and *lmerTest::step*, was applied first to random and then to fixed effects. Insignificant interactions (marked as "interaction n.s." in figure captions) were not dropped if pairwise comparisons between least squares means showed significant differences in at least one length category. Effect sizes were estimated by likelihood ratio tests and compared across positions and foot types in 5.5.5.

Effects usually returned significant *p*-values (<0.05) at *t*-values ≥ |2|. However, a statistically significant *p*-value does not necessarily mean that an effect is phonological. Robust length contrasts usually had a *t*-value >|5| across our tests, and smaller statistically significant values generally indicated compensatory or "anti-compensatory" phonetic effects. Results were also placed against the minimal perceptibility threshold for phonetic durational differences (based on Weber's law, a non-linear measure which depends on the absolute duration of compared units). For English foot durations between 300-500 ms, it has been assessed as 30-100 ms in optimal (experimental) hearing conditions and even higher in the normal ones (Lehiste 1977: 258).

Modern neuroimaging also shows that a brain response to the categorical phonemic contrasts starts at about 50-100 ms (e.g. Obleser & Eisner 2009). Robust phonemic length contrasts, therefore, are supposed to have at least 30-40 ms of mean difference.

Durational variability of sounds is also affected by speech tempo (Eek & Meister 2003), not accounted for in our study, and by phrasal effects. The chosen phrase-final position is known to cause utterance-final lengthening (Lehiste 1972; White 2002), and this can be seen as a limitation of the study. Stressed vowels in words under phrase-final broad focus might be especially susceptible to sentence-final lengthening (White 2014) and polysyllabic shortening (White & Turk 2010). However, as said in 5.3.1, quantity languages put tight restrictions on such effects. Suomi et al. (2013; 2003) also observed little durational differences between unaccented and moderately accented words, while lengthening effects in strongly accented words. Our study lacked narrowly-focused phrases with strong phrasal accents. On the other hand, length contrasts are articulated phrase-finally very clearly, which allowed us to avoid a risk of occasional vowel contrast reduction or merger caused just by an unaccented phrasal position.

The study was not specifically designed to study length in the third syllable. For the third syllable initial consonant (C_3), only a binary length contrast has been attested in cognate languages. In Estonian, the long C_3 class was closer in duration to short C_2 geminates, while in Inari Saami to long C_2 geminates (Lehiste 1997b; Türk et al. 2020). In Soikkola Ingrian, the ternary length contrast was reported also for the C_3 position (Sovijärvi 1944), but now all geminates in this position are prone to shortening (N. V. Kuznecova 2009a: 240-41). Soikkola Ingrian trisyllabic words with a long third syllable vowel (V_3) make a sequence of a disyllabic and a monosyllabic foot and were not studied, apart for the structure *vǟntelȫ* (see also 5.6.4.1). Given that some (very skewed) data on long V_3 and original long geminates C_3 were available in our study, we report their mean differences from corresponding short phonemes.

5.5. Results of Study 1 and 2

5.5.1. Synthesis: structural influences on sound durations in the studied trisyllabic and disyllabic feet

This section provides a synthetic overview of main results, explicated in details in 5.5.2-5.5.5. Aggregated raw mean durations of segments (apart C_1) across both studies are given in Appendix 5.3.

Our results were in line with previous findings and drew a comprehensive picture of an interaction between phonological length and trisyllabic foot structure in Soikkola Ingrian, with an additional comparison to the shortest disyllabic feet. The duration of sounds varied greatly and, as in earlier works, the scope of variability increased in higher length classes of segments. In general, observed compensatory (isochronic) structural influences on segmental durations outnumbered the anti-compensatory ("anti-isochronic") ones. Expected isochronic shortening was the most evident in long V_1, both geminate types of C_2, sonorant R, and long V_2 after a heavy syllable, while expected isochronic lengthening was prominently manifest in the lengthened short V_2 after the first light syllable (C)V.

A comparison of relative effect sizes across the foot nucleus positions confirmed that the strength of isochony progressively grows from the beginning toward the end of the nucleus and overcomes the phonological length contrast in the V_2 of trisyllables. In particular, reduction, one of the main isochronic effects influencing length contrasts, grows throughout the whole foot. The binary length contrast is well-preserved in V_1, blurred in V_2, and absent from the V_3 of true trisyllabic feet. The ternary length contrast of consonants is preserved in C_2 and has likely transformed into the binary one in C_3. Isochrony resulted as a global phenomenon showing its effects at several levels of prosodic hierarchy. Its impact at the syllabic level is seen in the influence of the V_1 and C_2 length and the presence of R on durations of all the three. Its effect at the foot nucleus level is observed in a strong isochronic influence of the whole first syllable structure (light vs. heavy) on V_2 duration and length. An isochronic effect at the whole foot level is manifest in the influence of the number of syllables in the foot (two vs. three) on the duration and length of foot nucleus elements, especially V_2 and, to some extent, C_2 (in Study 2). "Anti-isochronic" effects were more local, subordinate to isochrony, and as expected, the most evident in lengthening of consonants before long vowels. They showed a weak trend to be slightly more numerous in the initial part of the foot nucleus (one effect in C_1 and in V_1, two in C_2, and no effects in V_2).

Etymological length contrasts are well-maintained in V_1 and C_2. In trisyllables, an overall ratio between the short and long vowels was 1 : 2, and between the consonantal length types 1 : 2 : 2.5. The ratios slightly varied depending on the structure (cf. the ratios in the four shortest trisyllables vs. disyllables in Table 5.7). Mean durations of short vowels and singletons and of long vowels and short geminates were close to each other, while long geminates can be called "phonetically overlong".

Our main finding was a significant difference between tri- and disyllables as regards the reinforcement of the ternary length contrast of C_2 by an inverse duration of V_2. Disyllables are still phonetically distinguished mostly by the duration of C_2 and not by that of V_2, a feature which differentiated Soikkola Ingrian from other known languages with the ternary length contrasts of consonants also in earlier studies. There is a slight isochronic trend towards the inverse ratio of the V_2 duration to the C_2 length, but still as an emerging and in general insignificant effect (cf. similar results on a larger set of disyllables in E. Markus 2011).

Trisyllables represent a more innovative phonological stage, where two important changes happened. First, the inverse ratio of the V_2 duration to the C_2 length became statistically highly significant. Second, most etymologically long V_2 phonologically shortened in trisyllables. Durationally long types of V_2 were preserved only in the two shortest types of foot nuclei, VCV and VC·V:, where historically there was no V_2 length contrast (see Tables 5.2-5.3). Therefore, long and short V_2 are no more phonologically contrasted in any type of the foot nucleus of trisyllables, while in disyllables they are still contrasted after long (primary) geminates. After short (secondary) geminates, this contrast is gone from the language altogether, as it never existed in disyllables and was lost from trisyllables. At the same time, Soikkola Ingrian trisyllables maintained the contrast of short and long geminates before short vowels, a unique feature in the Finnic space (see 5.6.1 for a comparison of our results on Soikkola Ingrian with other similar languages). A summary on the synchronic phonological outcome of the structural change in V_2 length, as compared to the situation reflected in Tables 5.2-5.3, is given in Table 5.5.

Table 5.5. Synchronic phonological outcome of Study 1 and 2, as compared to the original situation reflected in Tables 5.2-5.3

(a) New quantity patterns in the nuclei of studied di- and trisyllabic feet. Durationally long V_2 are in bold, "CV" refers to one of the $C_2 + V_2$ length class combinations in the next three columns. [a]A structure *vā̃ntelō̃* was included in the study instead.

Syllable number	Foot nucleus	Singleton $C_2 + V_2$ C + V	Secondary geminate $C_2 + V_2$ C· + *V C: + *V	Primary geminate $C_2 + V_2$ C: + *V: C· + *V:
2 syllables	VCV	tap**a** [**a**:]	tap̆p**ā**	natta ≠ tapp**ā**
3 syllables	VCV	lakata [**a**:]	mat̆t**ā**la	kattila = *kattīma
	V:CV	vīkate	vūt̆tava = *sūt̆tīma	ūttele = *mūttīma
	V_1V_2CV	leikata	voit̆teli = *hoit̆tīma	voitteli = *toittīma
	VRCV	harkata	munk̆kina = *kerk̆kīmä	markkoja = *harkkāma
	V:RCV	kērsimä[a]	vā̃nt̆teli = *vā̃nt̆tīmä	

(b) New synchronic combinations of the C_2 and V_2 length after (C)V-, (C)VV- / (C)VR-, and (C)VVR- in the first syllable

Foot type	$C_2 + V_2$	$C_2 + V{:}_2$	$C^{\cdot}{}_2 + V_2$	$C^{\cdot}{}_2 + V{:}_2$	$C{:}_2 + V_2$	$C{:}_2 + V{:}_2$
Disyllabic	✓	✓ but not after (C)V-	×	✓	✓ but not after (C)VVR-	✓ but not after (C)VVR-
Trisyllabic	✓	×	✓ but not after (C)V-	✓ only after (C)V-	✓ but not after (C)VVR-	✓ but not after (C)VVR-

5.5.2. Positions of length contrasts in trisyllables

5.5.2.1. Restructurisation of the V_2 length contrast

Vowels in the V_2 position after a heavy syllable undergo strong reduction, which changes original phonological contrasts. Four durational vocalic types can be distinguished in synchrony (Figure 5.1a):

Type 1: original short V_2 after a heavy syllable — remained short;

Type 2: original long V_2 after a heavy syllable, apart for the VC·V: nucleus — nearly shortened;

Type 3: phonologically long V_2 in the VC·V: nucleus, the shortest type of nuclei with a phonologically long V_2 after a heavy syllable — remained long;

Type 4: phonologically short V_2 in VCV, after a light stressed syllable — phonetically lengthened (the so-called "half-long" vowel).

The type of a structure before the expected "half-long" vowel (Type 4) and the other durationally long type (Type 3) is described by a three-way interaction of the three main predictors in the first syllable (V_1 and C_2 length, and the presence of R). This interaction was included in the model on V_2 duration together with original phonological length of V_2 presented in Table 5.2 (cf. also 5.5.2.3; the matrix is incomplete as a combination V:RC: does not exist) to study post-hoc pairwise differences between combinations of these predictors. Interaction resulted significant for V_2 duration (p=0.005719**[56]), as well as the etymological length of V_2 (with just 9 ms*** of difference between original phonologically short and long vowels, cf. 5.5.2.3). Duration of V_2 after VC and VC· (cf. Types 3 and 4) in this model differed by 23 ms***[57] and showed differences from V_2 duration in foot nuclei with all other combinations of the three predictors: in VCV, by 60-66 ms*** and in VC·V:, by 37-43 ms***. Duration of V_2 in all the latter groups (i.e. within Types 1 and 2) did not show any significant mutual differences.

The restructurisation of the length contrast is still in progress, observed as such also by Sovijärvi (1944: 182-84), with an increased interspeaker variability typical of ongoing changes and aggravated by the lack of real communication between speakers in case of a moribund language. By-speaker versions of Figure 5.1a, included in Appendix 5.4, show that in three out of five speakers (LM, ST, AL), there was indeed no difference at all between Types 1 and 2 (in

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[56]Detailed statistics on reported effects is given in Tables 5.6–5.8 and Appendix 5.5. In the text, we indicate only the *p*-value significance codes: p<0.001***, p<0.01**, p<0.05*, and the exact p-values in case of significance less than ***.

[57]In this pair, the difference between estimated least squares means was considerably larger than between observed raw means between the VCV and VC·V: nuclei (11 ms in Figure 1a) due to the presence of V_2 phonological length in the model. The difference still remains significant if V_2 length is excluded from the model (13 ms**, p=0.006799) or if a model estimates V_2 duration as a function of the whole foot nucleus structure, where the predictor levels exactly correspond to the individual boxes in Figure 1a (14 ms**, p=0.0012828).

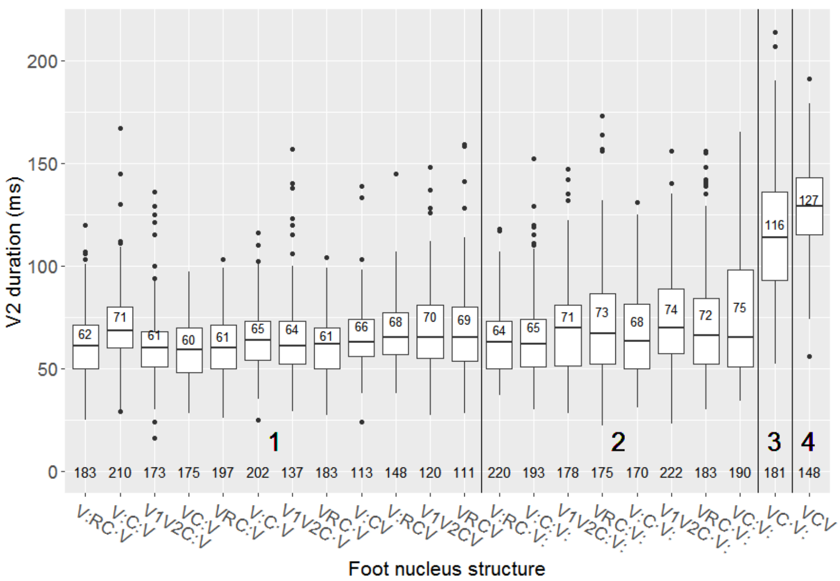
LM and ST, the shortened long vowels were even slightly shorter than the original short vowels). In AG and EI, a clear unfinished isochronic shortening trend could be observed: the longer and more complex the first syllable structure was, the stronger long V_2 was shortened. The speakers also considerably varied in the degree of a discrepancy between durationally long V_2 in the VCV–VC·V: pair (Type 3 vs. 4), from no difference in LM to a very big one in AL.

5.5.2.2. Length contrast maintenance in V_1 and C_2

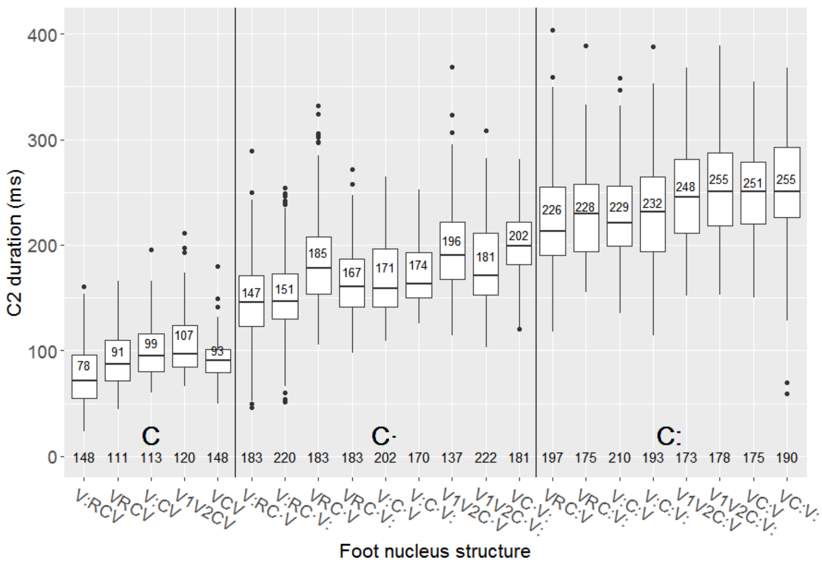
Figures 5.1b-c present data on raw mean durations of C_2 and V_1 in different foot nucleus types. In line with prediction, higher length classes of both resulted in progressively higher durational variability, including higher sensitivity to the structural influences. In certain cases, shorter members of the length categories of both V_1 and C_2 showed no statistical differences in phonetic effects, while longer members did. Phonetic effects in combination with the complex ternary length contrast make C_2 duration look like a continuum especially in case of short and long geminates (cf. Gordon 2009). In comparable contexts, which differed only in C_2 length, all the three length classes were always clearly distinguished, though. A phonological ternary length contrast of C_2 was, therefore, confirmed in synchrony for trisyllabic feet. An overview of all synchronic phonological length contrasts in trisyllables is given in 5.5.2.3, while 5.5.3 and 5.5.4 discuss phonetic isochronic and "anti-isochronic" influences, and a summary of effect sizes is given in 5.5.5.

Figure 5.1. Duration and length of V_2, V_1, and C_2, grouped by the 22 trisyllabic structures of Study 1. Boxes are coded by the foot nucleus types reported in Table 5.2. Raw means are reported within boxes; number of tokens is given below each box at the bottom. *(a)* Numbers from 1 to 4 code four synchronic durational vocalic types (see 5.5.1.2). *(b-c)* Structures are grouped by the phonological length of C_2 and V_1 respectively.

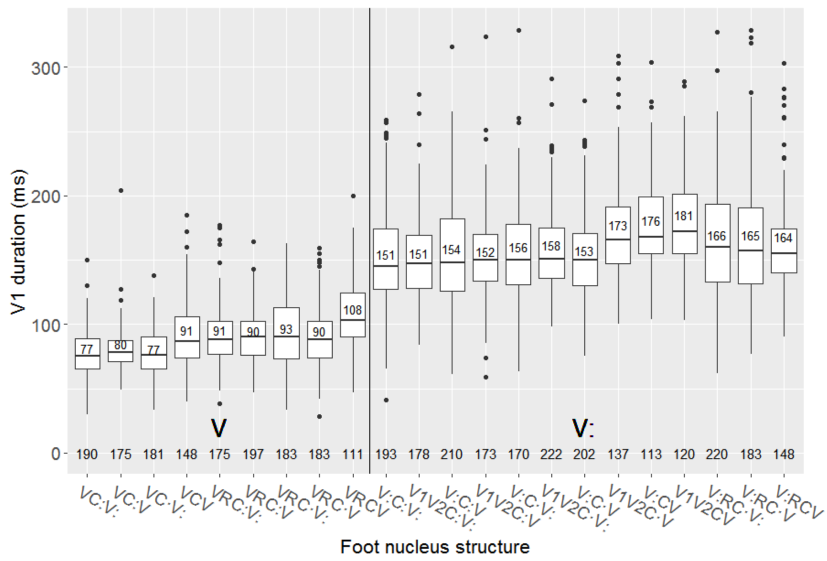
(a) V_2



(b) C_2



(c) V_1



5.5.2.3. Summary on phonological length contrasts and their evolution in trisyllables

Table 5.6 summarises our results on length contrasts in trisyllables (see used final models in Appendix 5.2). Both V_1 and C_2 manifested robust length contrasts: the binary of vowels (94 vs. 181 ms***) and the ternary of consonants (94 vs. 177 vs. 234 ms***), with ratios 1 : 2 and 1 : 2 : 2.5, respectively. A phonological length contrast of V_2, in turn, is nearly lost. Original phonological length (opposing Types 1 & 4 vs. 2 & 3 from Figure 5.1a) resulted significant across the whole dataset, but the difference between the length classes was just 9 ms*** (72 vs. 81 ms), which is far below the audibility threshold (see 5.4).

If vocalic Types 1 & 2 from Figure 5.1a are combined into the short V_2 class and Types 3 & 4 (with VCV and VCˑVː nuclei) into the long one, two clear durational classes of V_2 are distinguished in synchrony: 66 vs. 119 ms***, with the same 1 : 2 ratio as in V_1. However, this is a newly formed and non-phonological distinction. “Half-long” vowel (Type 4) is hardly ever considered in Finnic studies as phonologically long. First, it can still be contrasted to a true long vowel in some varieties, cf. Finnish *tap**a*** ‘habit’ vs. *tap**ā*** ‘meet.3SG’. Second, this lengthening is extremely variable in duration and can decrease up to zero with an increase in the number of syllables and segments in the foot and word, as well as in non-initial feet (Lehtonen 1970, 1974; Lehtonen & Leskinen 1973; Pajusalu et al. 2005). Third, the exact places of such lengthenings in multifoot words depend on whether a trochaic, a dactylic, or a mixed stress pattern is used, e.g. Estonian *k´avalamalegi* [ˈkav**a**ˑˌłam**a**ˑˌleg̊**i**ˑ ~ ˈkav**a**ˑłaˌmal**e**ˑg̊**i**] ‘to more cunning’ (viz. Sepp 1980; Eek & Meister 2004: 344; Lippus, Pajusalu & Teras 2006). In prosodically innovative Finnic varieties, which include also Soikkola Ingrian, “half-long” vowel became durationally the longest of all non-initial vowels, which has created concerns for their synchronic phonological description (Kuznetsova 2016), cf. Chapter 3.

Long V_2 in trisyllables with VCˑVː nucleus (Type 3) had actually also been a “half-long” phonologically short vowel at the Proto-Finnic level: **omena* [ˈom**e**ˑna] >> *om̆m**ē**na* ‘apple’. However, after the phonologisation of secondary gemination, this vowel in a given position could not anymore be considered as phonologically short in Ingrian. Gemination changed the structure of the first syllable from light to heavy, and the vowel length contrast after a heavy syllable exists in the language system, unlike in the position after a light syllable. For this reason, although the second vowel of the VCV nucleus is now durationally the longest vocalic allophone of all V_2, we consider it as phonologically short, while the V_2 of the VCˑVː nucleus is treated in synchrony as phonologically long.

Some authors have also interpreted Finnic secondary short geminates as phonetic instances of phonological singletons appearing under certain prosodic conditions, which is suggested by their historical origins. A tradition to call secondary gemination phonetic rather than phonological in cases when secondary geminates did not reach the duration of primary geminates (as in Soikkola Ingrian) apparently goes back to Leskinen (1959; followed by Paunonen 1973; Nahkola 1987; Gordon 2009). However, due to historical processes mentioned in Section 2, Soikkola Ingrian structures with a long V_2 can be now opposed just by the presence vs. absence of secondary gemination: *lō**t̆t**ā* [ˈloː**t**ˑaː] ‘broom:PRT’ vs. *mā**t**ā* [ˈmaː**d̥**aː] ‘sleep:INF’ (see other examples in Table 5.2). Synchronic secondary geminates are not, therefore, entirely conditioned by the context any more and are seen as independent phonemes.

Table 5.6. Summary on length contrasts in all studied positions of trisyllables (Study 1). Least squares means (*Part I*) and pairwise differences between them (*Part II*) are reported. Satterthwaite's approximation of the degrees of freedom and a confidence level 95% (LCL and UCL refer to the lower and upper confidence level) were used for *t*- and *p*-statistics. See 5.5.2.3 for more information.

I. Least squares means of length classes (in ms)							**II. Pairwise differences of least squares means (in ms)**							
Position	Length	Mean	SE	df	LCL	UCL	Contrast	Estimate	SE	df	LCL	UCL	t-ratio	p-value(>|t|)
V1	V1	93.9	9.54	6.70	71.1	116.6	**V1-V1:**	-86.6	4.85	93.0	-96.3	-77.0	-17.9	<2.2e-16
	V1:	180.5	9.68	7.10	157.7	203.3								
C2	C2	94.0	13.30	5.00	59.8	128.2	**C-Cˑ**	-82.8	4.52	119.7	-91.8	-78.1	-18.3	<2.2e-16
	C2ˑ	176.8	12.94	4.49	142.4	211.3	**C-C:**	-140.2	4.58	121.5	-149.3	-134.3	-30.6	<2.2e-16
	C2:	234.2	12.94	4.49	199.8	268.7	**Cˑ-C:**	-57.4	3.43	119.1	-64.2	-51.0	-16.7	<2.2e-16
***V2** (original phonological length: Types 1&4 vs. 2&3)	*V2	72.2	5.45	5.07	58.2	86.1	***V2-*V2:**	-8.7	2.04	89.1	-12.8	-4.7	-4.3	0.00004976
	*V2:	80.9	5.60	5.57	66.9	94.9								
V2 (synchronic durational classes: Types 1&2 vs. 3&4)	[V2]	65.4	5.45	5.10	51.5	79.4	**[V2]-[V2:]**	-53.9	2.43	127.4	-58.7	-49.1	-22.2	<2.2e-16
	[V2:]	119.4	5.85	6.77	105.5	133.3								
C3 (imbalanced data)	C3	83.3	4.69	4.62	70.9	95.7	**C3-*C3:**	-23.1	1.81	137.4	-26.6	-19.5	-12.7	<2.2e-16
	*C3:	106.4	4.69	4.63	94.0	118.7								
V3 (imbalanced data)	V3	90.2	8.60	4.09	66.5	114.0	**V3-V3:**	-61.2	5.23	130.9	-71.5	-50.8	-11.7	<2.2e-16
	V3:	151.3	9.97	7.34	128.0	175.0								

Duration and length of C_3 and V_3 were not in the focus of this study. Wordforms with singleton C_3 were preferred, but in many cases verbal forms of the first plural with an original suffix **-mma/-mmä* and nominal forms in allative with a **-lle* (or **-lla/-llä*) suffix were the only options to obtain the trisyllabic foot with a required foot nucleus structure. As a result, in the dataset on C_3, the short and the long class had nearly the same number of tokens (1894 vs. 1918) but were very imbalanced in terms of consonantal types (*m*, *l*, *n*, *r*, *v*, *j*, *d* vs. **mː*, **lː*) and the structures of foot nucleus involved (only three out of 22 structures contained tokens with both short and long C_3). As for V_3, we did not explore trisyllabic words with long V_3 as they do not constitute a trisyllabic foot (see 5.6.4.1). However, one structure *vä̃ntelȭ* with a long V_3 was considered as a replacement for a foot with the VːRCV foot nucleus (cf. Ftn. *f* to Table 5.2). The data on V_3, therefore, are also extremely skewed (3664 short vs. 148 long V_3; 21 vs. 1 structure). Models on C_3 and V_3 contained just their own phonological length and by-speaker and by-word random intercepts.

In C_3, original long geminates **mː* and **lː* still slightly differ in duration from short consonants (106 vs. 83 ms***), but this difference is below the audibility threshold for robust phonemic contrasts. Their longest variants occurred after VCV, the shortest type of the foot nucleus, with mean durations of 127 ms (CI95%=113-140 ms) and 133 ms (CI95%=118-148 ms), respectively. However, even in this case the C_3 consonants did not reach the typical duration even of short geminate C_2 stops (178 ms, CI95%=142-212 ms). Therefore, the C_3 length contrast is likely to be now at most binary, not ternary, and original long geminates in this position could be considered rather as short geminates (e.g. *mˑ* and *lˑ* in our dataset).

In V_3, the long third syllable vowel of feet with the V:RCV nucleus, in turn, very significantly differed from all short V_3 after shorter foot nucleus types (151 vs. 90 ms***), so the vocalic length contrast in this position seems well-preserved. A smaller (1 : 1.7) ratio between short and long vowels, as compared to V_1, might be at least partially attributed to the fact that the examined long V_3 appeared after the longest foot nucleus type.

5.5.3. Influence of overall foot length (2 vs. 3 syllables) on length contrasts in V_2 and C_2

An influence of overall foot length (2 vs. 3 syllables) on the duration and length of V_2 and C_2 is discussed on an example of structures with four shortest foot nucleus types (Study 2). Data presented in Figure 5.2c-d and Table 5.7 are drawn from a model where V_2 and C_2 duration is assessed as a function of an interaction of entire foot nucleus structure and a number of syllables in the foot. This interaction resulted highly significant in the case of V_2 ($\chi^2(3)=26.76$***) and significant in the case of C_2 ($\chi^2(3)=14.28$**, p=0.002545). Significant interactions of individual structural parameters in each foot nucleus position with a number of syllables in the foot are given in Table 8b.

Our study showed a robust ternary quantity C_2 contrast both in di- and in trisyllables (cf. 86 vs. 205 vs. 271 ms*** and 89 vs. 187 vs. 237 ms*** in best comparable nuclei VCV – VC·V: – VC:V: with originally long durational types of V_2 in Table 5.7). Smaller ratios in trisyllables than in disyllables (1 : 2.4 : 3.2 and 1 : 2.1 : 2.7) were due to shorter durations of both types of geminates in trisyllables. These shorter durations were at least in part due to shorter durations of the following original long vowels, especially because of the phonological shortening of V_2 in trisyllables.

Figure 5.2 illustrates a clear correlation between real synchronic duration of original long vowels and the degree of "anti-isochronic" lengthening in preceding short and long geminates (see also Table 5.7). In di- vs. trisyllables with a VC·V: nucleus, the difference between long V_2 is 32 ms*** and between the preceding C_2 is 18 ms* (p=0.0425). In feet with a VC:V: nucleus, the difference between di- vs. trisyllables grows considerably for both V_2 and C_2. For originally long V_2, it is 64 ms*** (and reflects the difference between truly long and shortened long vowels), and for C_2, it is 34 ms*** (p=0.0002). Singleton C_2, however, did not differ in di- and trisyllables (4 ms, n.s.), while the following "half-long" (phonologically short) V_2 showed a weakly significant difference (16 ms, p=0.0129).

As a part of a general process discussed in 5.5.2.1, original long V_2 in trisyllables with the VC:V: nucleus shifted into the phonologically short class (the shift is marked as V: vs. V under the boxes in Figure 2a). In Study 2, they differed from original short V_2 in the VC:V nucleus by 13.5 ms (n.s.). Consequently, long geminates C_2 preceding these shortened vowels do not undergo "anti-isochronic" lengthening any more: their duration was equal to those preceding originally short vowels (2 ms, n.s.).

Disyllables, in turn, retained phonologically long vowels after primary geminates in the VCːVː nucleus, and the difference between long and short V_2 in the VCːVː – VCːV pair was 40 ms***. Consequently, there was also a very significant difference between the preceding consonants (35 ms***, p=0.0001; highlighted by circles in Figure 5.2b), as these long geminates C_2 undergo "anti-isochronic" lengthening before long vowels but not before short vowels.

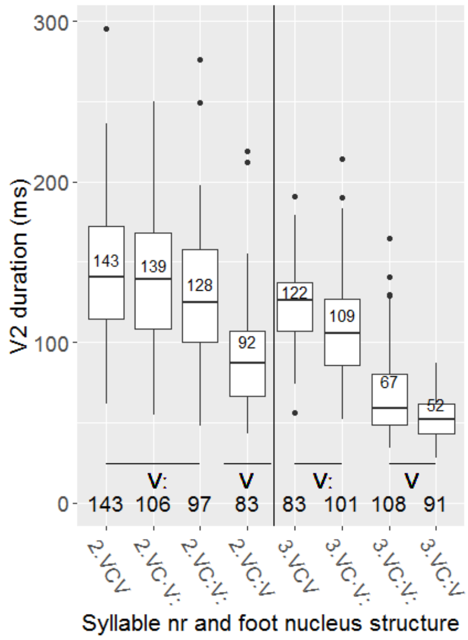
By-speaker graphs in Appendix 5.4 provide an additional illustration that "anti-isochronic" lengthening before non-shortened long vowels is still a living phonetic tendency. In speakers AL and ST, where long vowels in trisyllables completely shortened (see 5.5.2.1), no "anti-isochronic" lengthening in preceding long geminates in the VCːVː nucleus of trisyllables could be observed. However, in AG long vowels still partially retain their original duration, especially in shorter types of nuclei, and so a long geminate C_2 of the VCːVː nucleus manifested "anti-isochronic" lengthening both in di- and in trisyllables.

Di- and trisyllables also differed in the degree of development of an inverse ratio between V_2 duration and C_2 length. A triplet VCV – VCˑVː – VCːVː of disyllables in Figures 5.2a-b and in Table 5.7 manifests a slight isochronic trend of this kind. In VCV, the least squares mean duration of V_2 was 144 ms, in VCˑV: 139 ms, and in VCːV: 131 ms. The difference between V_2 duration in the first and the second, as well as between the second and the third member of this triplet was insignificant, but weakly significant between the first and the third one (p=0.0321*). In trisyllables, in turn, the least squares means of V_2 duration in the same structures were 128, 107, and 66 ms respectively, and all their mutual differences highly significant.

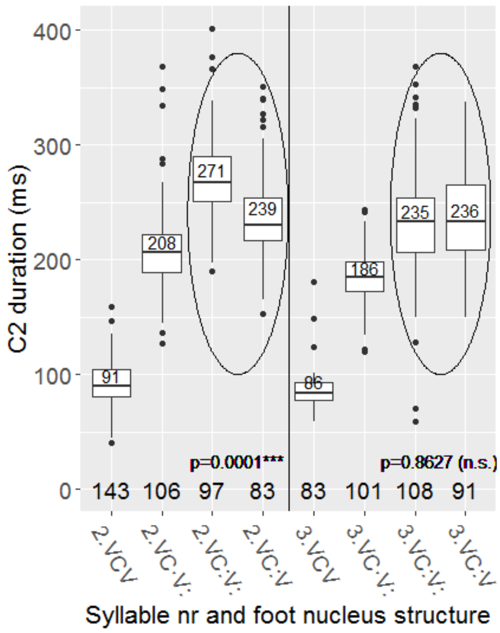
We shall comment on possible phrasal-final lengthening, which could be present in the foot nuclei of disyllables (especially in the final second syllable) and not in those of trisyllables (where the second syllable is non-final). Studies have shown greater magnitude of this effect in the rhymes of phrase-final syllables as compared to onsets (Turk & Shattuck-Hufnagel 2020: 33). In Study 2, phonologically short C_2 and V_1, as well as long geminates C_2 before short vowels, did not differ in duration between di- and trisyllables. A difference in duration of long geminates before originally long V_2 in di- vs. trisyllables is well explained by "anti-isochronic" lengthening before truly long vowels in disyllables vs. no lengthening before shortened long vowels in trisyllables. The duration of V_2 was in general a bit longer in disyllables than in trisyllables. However, this difference can be attributed to a possible phrase-final lengthening in disyllables at most partially. First, as said in 5.3.1, quantity languages strongly regulate this effect. Second, vowel duration in this position is affected by isochrony the strongest, as evident from the results of both studies and earlier research. The phonological shortening of long V_2 in trisyllables, reported already by Sovijärvi (1944: 182-84), cannot be explained just by the lack of phrase-final lengthening in the second syllable, as compared to disyllables, while it is well explained by isochrony.

Figure 5.2. Structural effects on V_2 and C_2 duration in di- vs. trisyllables with the four shortest foot nuclei. Boxes are coded by the foot nucleus types reported in Table 5.2. Raw means are reported within boxes; number of tokens is given below each box at the bottom. Coding such as 2.VCV, 3.VCV refers to the number of syllables in the foot and the structure of the foot nucleus.

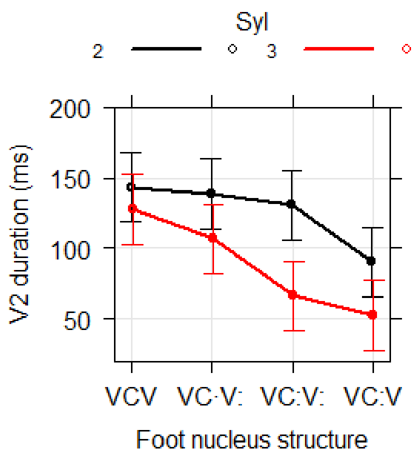
(a) Raw mean duration of V_2



(b) Raw mean duration of C_2



(c) Influence of the number of syllables in the foot (*Syl*) and the foot nucleus structure on V_2 duration



(d) Influence of the number of syllables in the foot (*Syl*) and the foot nucleus structure on C_2 duration

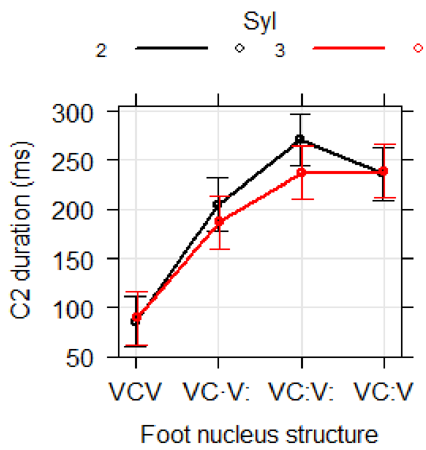


Table 5.7. Summary on interaction between the foot nucleus type and the number of syllables in the foot in Study 2. Satterthwaite's approximation of the degrees of freedom and a confidence level 95% (LCL and UCL refer to the lower and upper confidence level correspondingly) were used for *t*- and *p*-statistics. *Part I* reports the least squares means in V_2 (upper part) and C_2 (lower part) within various foot structures. Coding such as 2.VCV, 3.VCV etc refers to the number of syllables in the foot and the structure of the foot nucleus. *Part II* reports pairwise differences between the least squares means in V_2 (left part) and C_2 (right part) in various pairs of foot structures. Comparisons from top to bottom: pairs of disyllabic feet with different types of foot nucleus; same pairs of trisyllabic feet; pairs of di- vs. trisyllables with identical types of foot nucleus.

I. Least squares means of V2 and C2 (in ms)							II. Pairwise differences of least squares means (in ms)											
									V2					C2				
Position	Structure	Mean	SE	df	LCL	UCL	Structure	Contrast	Mean	SE	df	t-value	p-value (>|t|)	Estimate	SE	df	t-ratio	p-value (>|t|)
V2	2.VCV	143.6	12.3	2.37	97.9	189.2	2-syllabic	VCV-VC·V:	4.6	6.03	45.2	0.8	0.4461	-119.1	7.7	46.6	-15.47	<.0001
	2.VC·V:	138.9	12.7	2.68	95.8	182.1		VC·V:-VC:V:	8.1	6.59	46.0	1.2	0.2241	-66.0	8.4	47.7	-7.851	<.0001
	2.VC:V:	130.8	12.6	2.60	87.0	174.6		VCV-VC:V:	12.8	5.80	53.4	2.2	0.0321	-185.1	7.3	52.6	-25.4	<.0001
	2.VC:V	90.4	12.6	2.66	47.1	133.7		VCV-VC:V	53.2	5.95	53.1	8.9	<.0001	-150.2	7.5	51.3	-20.04	<.0001
	3.VCV	127.7	12.7	2.73	84.8	170.5		VC·V:-VC:V	48.6	6.73	46.3	7.2	<.0001	-31.1	8.6	47.2	-3.622	0.0007
	3.VC·V:	106.5	12.7	2.67	63.3	149.8		VC:V:-VC:V	40.4	6.53	53.0	6.2	<.0001	34.9	8.2	52.0	4.239	0.0001
	3.VC:V:	66.4	12.6	2.65	23.1	109.8	3-syllabic	VCV-VC·V:	21.2	6.89	49.1	3.1	0.0035	-97.5	8.7	51.9	-11.2	<.0001
	3.VC:V	53.0	12.7	2.75	10.2	95.7		VC·V:-VC:V:	40.1	6.72	43.8	6.0	<.0001	-50.3	8.6	47.7	-5.858	<.0001
C2	2.VCV	85.8	13.1	2.56	39.8	132.0		VCV-VC:V:	61.3	6.84	47.3	9.0	<.0001	-147.8	8.7	50.0	-17.02	<.0001
	2.VC·V:	204.9	13.7	3.10	162.0	248.0		VCV-VC:V	74.7	7.04	48.0	10.6	<.0001	-149.4	8.9	50.3	-16.73	<.0001
	2.VC:V:	270.9	13.5	2.90	227.1	315.0		VC·V:-VC:V	53.6	6.92	44.5	7.7	<.0001	-51.8	8.8	48.1	-5.867	<.0001
	2.VC:V	236.0	13.6	3.01	192.7	279.0		VC:V:-VC:V	13.5	6.86	42.7	2.0	0.0563	-1.5	8.8	46.2	-0.174	0.8627
	3.VCV	89.2	13.7	3.11	46.4	132.0	VCV	2 vs. 3 syllables in the foot	15.9	6.17	54.0	2.6	0.0129	-3.5	7.7	54.0	-0.4	0.6559
	3.VC·V:	186.8	13.7	3.05	143.7	230.0	VC·V:		32.4	6.78	43.0	4.8	<.0001	18.1	8.7	46.5	2.1	0.0425
	3.VC:V:	237.1	13.7	3.04	193.9	280.0	VC:V:		64.4	6.54	47.1	9.8	<.0001	33.8	8.3	49.3	4.1	0.0002
	3.VC:V	238.6	13.8	3.18	196.0	281.0	VC:V		37.4	6.89	48.1	5.4	<.0001	-2.6	8.8	49.0	-0.3	0.7677

5.5.4. Effects of foot nucleus structure (number and length of phonemes) on segmental durations

In this section, we cover remaining structural influences on segmental durations in the first two syllables of both tri- and disyllables, first isochronic, then "anti-isochronic" ones (see Appendix 5.5 for detailed statistics). Section 5.5.5 summarises effects sizes across all segments of the first two syllables in both studies.

5.5.4.1. Isochronic (compensatory) effects

Isochronic effects (Figure 5.3) show an inverse relation between longer length or a presence in the structure of one segment and shorter duration of another segment, as compared to its longer duration in a shorter structure. The three key elements of the foot nucleus, V_1, C_2, and R, revealed significant mutual isochronic influences, and longer length classes of V_1 and C_2 were more affected, in line with expectations.

First, the longer was the following consonant, the shorter was V_1 duration (5.3a). Long vowels before secondary (short) geminates were 18 ms*** shorter than before singletons and 11 ms** (p=0.0015) longer than before primary (long) geminates. Short vowels before secondary geminates were 16 ms*** shorter than before singletons, and just 4 ms (n.s.) longer than before primary geminates[58].

Second, the longer was the preceding vowel, the shorter was a duration of any geminate C_2 (5.3b), while the singletons were not affected (3 ms; n.s.). Secondary geminates were 25 ms*** longer and primary geminates 21 ms*** longer before the short vowels than before the long vowels.

Third, all the three length classes of C_2 were shortened if preceded by a sonorant R (5.3c): singletons by 19 ms** (p=0.0017), secondary geminates by 29 ms***, and primary geminates by 34 ms***.

Fourth, longer lengths of both V_1 and C_2 shortened a sonorant R; this was a generally expected, but, to our knowledge, a previously unreported finding. Long V_1 shortened R by 11 ms*** (5.3d). Before a singleton C_2, it was 19 ms*** longer, and before a long geminate, 11 ms*** shorter than before a short geminate (5.3e).

Additionally, both in Study 1 and 2 there was a trivial isochronic effect of a presence vs. absence of a consonant in the beginning of the word (C_1) on the duration of the following vowel. In Study 1 (5.3f), in structures without C_1 (n=212), short V_1 were slightly (13 ms, n.s.) and long V_1 significantly (31 ms***) longer than in those with C_1 (n=3600).[59] In short V_1 of Study 2 (5.3g), this effect was weakly significant: 80 vs. 106 ms* (p=0.0153 ms).

5.5.4.2. "Anti-isochronic" effects

In Study 1, there was an expected "anti-isochronic" lengthening of C_1 (by 9 ms***, 5.4a) before long vowels, as compared to the position before short vowels. In Study 2, which contained only structures with short V_1, no structural effects in C_1 were found.

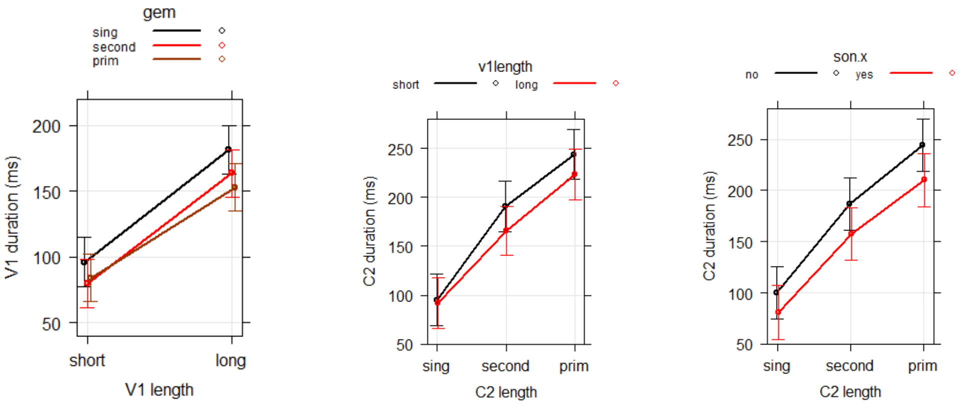
Additionally, there were two unexpected and previously unreported effects in V_1 and in C_2 showing that vowels were longer before sonorants than before stops (5.4b), while stops were longer after monophthongs than after diphthongs (5.4c). The effects were weak and significant in V_1 only for short vowels (5.4b; 10 ms**, p=0.0029), and in C_2 only for long geminates (19 ms***, 5.4c). We preliminarily classified them as "anti-isochronic", but see 5.6.3 for discussion.

[58] A slightly shorter V_1 duration before short geminates than before the long ones was likely because the former group included structures with the longest type of the first syllable, V:RC·, while the latter did not, due to their absence in Ingrian.

[59] This considerable disbalance in the number of tokens without vs. with C_1 was likely the most important factor in lower mean durations of V_1 in the raw data (Figure 5.1b) than in the least squares means estimated by the regression model.

Figure 5.3. Isochronic effects of number and length of phonemes on segmental durations in the first two syllables. Cases of statistically insignificant interactions are marked as “interaction n.s.”

(a) Influence of C_2 length (*gem*) on V_1 duration | (b) Influence of V_1 length (*v1length*) on C_2 duration | (c) Influence of R (*son.x*) on C_2 duration (interaction n.s.)



(d) Influence of the V_1 length on R duration | (e) Influence of the C_2 length on R duration | (f) Influence of C_1 presence (*C1pres*) on V_1 duration | (g) Influence of the C_1 presence on V_1 duration (Study 2)

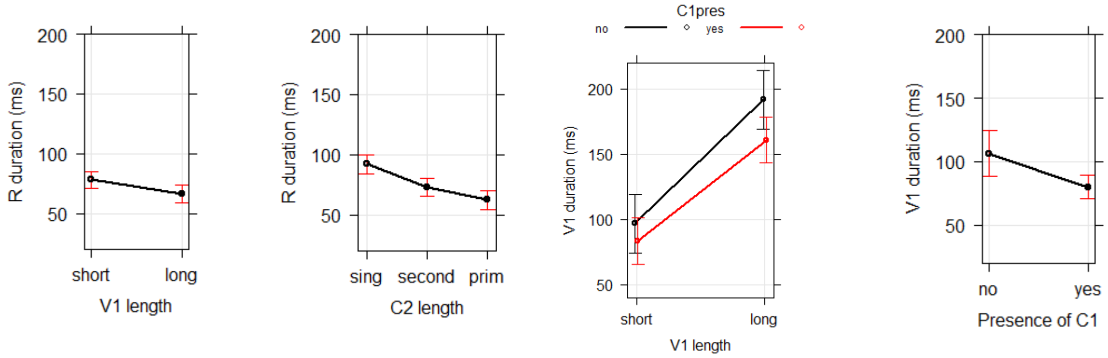
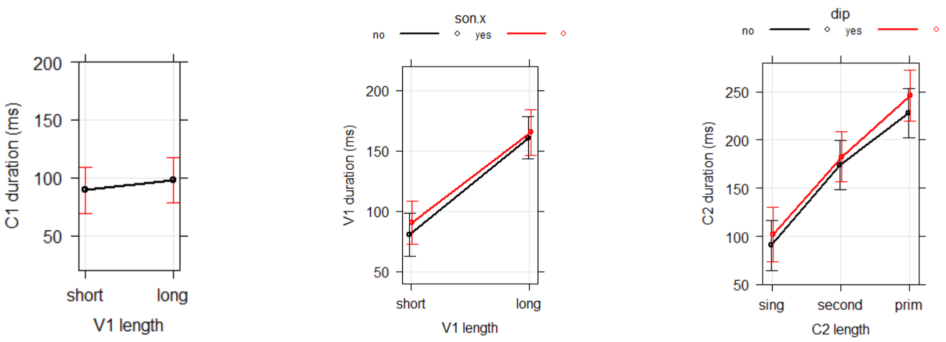


Figure 5.4. “Anti-isochronic” effects of number, length, and quality of phonemes on segmental durations in the first two syllables. Cases of statistically insignificant interactions are marked as “interaction n.s.”

(a) Influence of the V_1 length on C_1 duration | (b) Influence of R (*son.x*) on V_1 duration (interaction n.s.) | (c) Influence of long V_1 type (*dip:* diphthong (*yes*) or monophthong (*no*)) on C2 duration (interaction n.s.)



5.5.5. Dynamics of isochrony and anti-isochronony throughout the foot (effects sizes)

In this section, we report effect sizes of predictors from our final models across all segments of the first two syllables in both studies and discuss the dynamics of isochrony and "anti-isochrony" throughout these segments.

Effects sizes from regression models are based on the Akaike (AIC) information criterion of each model (not very informative in itself as it depends on the sample size) and the AIC weight of each predictor in the model (e.g. Burnham & Anderson 2004). The AIC weight of a predictor means the number of points by which the AIC of the model goes down if the predictor is taken out of the model. The more it is going down, the heavier the predictor's weight in the model is. Two kinds of tests are reported: (1) the AIC weight and its *p*-value by a Chi-square (χ^2) test of each predictor, obtained with *drop1* (Part II of Tables 5.8a-b), which basically means dropping one predictor at a time from a final model and assessing the loss in the AIC of the model; (2) the AIC weight of each single (outside interactions) predictor of a final model, if added to a null model containing only random effects of the final model (obtained by *MuMIn::dredge*, set to be based on AIC and applied to each final model; Part III of Tables 5.8a-b). Additionally, Part I of Tables 5.8a-b reports the goodness-of-fit of each final model: R^2m and R^2c, which show how much of the variance is accounted by the model's fixed effects and by the whole model, respectively (*MuMIn::r.squaredGLMM*), and the correlation between the values fitted by the model and those observed in reality *(cor)*.

Results numerically describe the growing strength of isochrony throughout the first two syllables. An increase in the number and weight of significant structural influences on segmental durations towards the end of the foot nucleus is observed in both studies. In particular, the effect size and complexity of significant interactions, indicating a higher sensitivity of a segment to the context, grows. Among positions without length contrasts, no compensatory effects were observed in C_1, while very strong ones were observed in the sonorant R. Positions of V_1 and C_2 with length contrasts manifested a comparable mutual influence on each other's duration in interaction with their own length. Still, C_2 duration is more strongly affected by V_1 length than V_1 duration by C_2 length, and much more strongly affected by the presence of a sonorant than V_1 duration. A mutual isochronic influence of a sonorant and C_2 is especially strong. In V_2, isochrony "wins" over the phonological length, which becomes the least important factor of those stipulating the segmental duration in this position. In V_1 and C_2, their own phonological length added to a null model as the only predictor of their duration had a huge effect size (V_1: AIC -240, C_2: AIC -268 and -154 in both studies). In V_2 of trisyllables (Study 1), its original phonological length did not change the AIC of the null model and turned

Table 5.8. Features of the final models for elements of the first two syllables in Study 1 and 2. *Part I*: Goodness-of-fit of final models (R^2m, R^2c, correlation between fitted and observed values). *Part II:* Effects sizes (AIC and a *p*-value from χ^2 at a confidence level 95%) in each position calculated by dropping predictors from final models with *drop1*. [1]In case of non-significant interactions of predictors with segmental length in the final models, such interactions were dropped and the effect size of these predictors outside interactions was additionally reported under the grey line (models with such dropped interactions had very similar features to the final models). *Part III*: Effect sizes (AIC) of single predictors if consequentely added with *dredge* to null models (which contained only random effects of the final models). In column "*eff*", the types of effects are marked for each position: "i" – "isochronic", "a" – "anti-isochronic", "lgt" – phonological length of a segment in a given position.

(a) Study 1: 22 trisyllables

	Prosodic position:	C1	V1	R	C2	V2
	N of tokens in sample	n=3600	n=3812	n=3812	n=3812	n=3812
I.	R2m	0.01	0.55	0.20	0.62	0.32
	R2c	0.54	0.74	0.36	0.82	0.57
	Correlation fitted/real	0.73	0.85	0.60	0.91	0.76
II.	AIC of final model	35068	36086	11977	36645	32950
	Predictor	eff AIC χ2 df p	eff AIC χ2 df p	eff AIC χ2 df p	eff AIC χ2 df p	eff AIC χ2 df p
	V1 length : R : C2 length					i -6 7.64 1 **0.0057
	V1 length : C2 length		i -10 13.37 2 **0.0012		i -6 9.86 2 **0.0072	
	V1 length : R		a 1 0.93 1 n.s.			
	R : C2 length				i 0 4.06 2 n.s.	
	V1 length : C1 presence		i -2 3.90 1 *0.0483			
	C2 length : diphthong V1				a 2 2.19 2 n.s.	
	V1 length	a -12 13.41 1 ***		i -21 23.03 1 ***		
	C2 length			i -61 64.63 2 ***		
	V2 length					lgt -16 18.30 1 ***
	R[1]		a -8 10.00 1 **0.0016		i -78 1 ***	
	diphthong V1[1]				a -12 1 ***	
III.	AIC of null model	35080	36388	12037	37015	33156
	Predictor	eff AIC	eff AIC	eff AIC	eff AIC	eff AIC
	V1 length	a -12	lgt -240	i 1	i 2	i -14
	C2 length		i -4	i -39	lgt -268	i -8
	R		a -4		i -13	i -8
	V2 length					lgt 0
	C1 presence		i 2			
	diphthong V1				a -4	

(b) Study 2: Four shortest di- and trisyllables

	Prosodic position:	C1	V1	C2	V2
	N of tokens in sample	n=745	n=812	n=812	n=812
I.	R2m	0.00	0.11	0.77	0.20
	R2c	0.49	0.40	0.87	0.36
	Correlation fitted/real	0.61	0.61	0.94	0.82
II.	AIC of final model	6851	7015	7786	7747
	Predictor		eff AIC χ2 df p	eff AIC χ2 df p	eff AIC χ2 df p
	V2 length : n of syllables			a -8 9.60 1 **0.0019	i -7 8.61 1 ***
	C2 length : n of syllables			i 2 1.8453 2 n.s.	i -13 16.44 2 ***
	C1 presence		i -5 7.38 1 **0.0066		
	C2 length[1]			lgt -156 160.01 2 ***	
III.	AIC of null model		7020	7957	7857
	Predictor		eff AIC	eff AIC	eff AIC
	V2 length			a -18	lgt 2
	C2 length			lgt -154	i -30
	Syllable nr			i 2	i -22
	C1 presence		i -5		

out to be a significant predictor only in combination with the ternary interaction of structural factors in the first syllable (V_1 and C_2 length, the presence of R). Also in the V_2 of Study 2, an interaction of C_2 length and the number of syllables in the foot had twice the effect size of the interaction of V_2 phonological length with the syllable number.

"Anti-isochronic" effects are mostly linked to C_1 and C_2. While no such effects were found in V_2, the most affected by isochrony, a weak "anti-isochronic" influence of a sonorant was observed in V_1. Anti-isochronic effects, therefore, might decrease towards the end of the foot nucleus (but see also 5.6.3).

The goodness-of-fit of models shows that the more complex (ternary vs. binary vs. no contrast) and the clearer the length contrast in a given position was, the better a model performed. The highest values characterised the C_2 models of both studies (the correlation between fitted and real values >90% and R^2c >80%), followed by V_1 in Study 1 (85% of correlation and 74% of R^2c). Explanatory power was much lower in models with no or blurred length contrasts (C_1, R, V_2, short V_1 in Study 2), with correlation 60-76%, R^2c 36-57%, and the share of fixed effects (R^2m) from zero to 32%. Apparently, the share of phonetic factors not covered in the study (e.g. speech tempo, boundary lengthening) or not included in fixed effects (e.g. intrinsic segmental durations or interspeaker differences) could become higher where phonological length and structual influences play a smaller role.

5.6. General discussion

5.6.1. Soikkola Ingrian length contrasts and their evolution in a cross-linguistic context

A comparison of Soikkola Ingrian ratios between the means of the length classes in C_2 consonants of di- and trisyllables and in C_3 consonants of trisyllables with the ratios in similar structures of Estonian and Inari Saami is reported in Table 5.9. It shows that Soikkola Ingrian short geminates are further from singletons and closer to long geminates than in the other two languages. In those Ingrian varieties where the ternary contrast was not preserved, short geminates, indeed, generally merged with long geminates (Kuznetsova 2015), cf. Chapter 2. However, in Inari Saami, cited here due to the availability of data on trisyllables, short geminates stayed the closest to singletons out of all acoustically studied Saami languages. The ratios in North and Lule Saami disyllables were more similar to those in Soikkola Ingrian (cf. Türk et al. 2019: 37). These differences might still be at least partially linked to the different origins of the middle length class, which emerged through lengthening of singletons in Ingrian, through shortening of long geminates in Estonian, and through both processes in the Saami languages.

A comparison of C_3 data (structurally very heteronegeous across studies) suggests that the two length classes represented in our Soikkola Ingrian data are much closer than in the other two languages. Notably, the long C_3 class in our data actually corresponds to original long geminates, but it does not reach the duration even of short geminates in the C_2 position. While C_3 requires further studies, these data likely indicate an ongoing loss of the length contrast in this position in Soikkola Ingrian.

A difference in the structure of the V_2 length contrast, revealed in our study for Soikkola Ingrian disyllabic and trisyllabic feet, is of typological nature. Disyllables are mainly distinguished just by the different duration of C_2 in three length classes, while an inverse ratio of V_2 duration to the duration and length of C_2 is an emerging and still insignificant trend. This typologically very rare situation is similar to that of Dinka and Shilluk, West Nilotic languages with three distinctive vowel quantities, where the duration of a coda consonant also slightly (statistically insignificantly) reinforced the duration of a preceding vowel (Remijsen & Gilley 2008; Remijsen, Ayoker & Jørgensen 2019). In such cases, phonological interpretation of the ternary contrast at the segmental level might still be plausible, although it is undesirable for general phonological theory.

Trisyllables, in turn, are typologically similar to the Finnic and Saami languages with the ternary quantity contrast of consonants. Here, the phonological length contrast in V_2 gave place to a statistically significant and strictly inverse ratio of V_2 duration to C_2 length. It is noteworthy that in Soikkola Ingrian, Estonian, and Livonian, all synchronic durationally long V_2 originate from Proto-Finnic short vowels, while original phonologically long non-initial vowels became short or even reduced. It is also remarkable that in synchrony all the three languages manifest a contrast of short and long geminates before short vowels in trisyllables, but in Soikkola Ingrian it has entirely different origins than that in Livonian and Estonian.

Table 5.9. Durational ratios between length classes in C_2 and C_3 in selected di- and trisyllabic feet of Soikkola Ingrian, Estonian, and Inary Saami. For C_2, only the position after the short V_1 before a short or long V_2 is represented (i.e. the V_V(:) context). For C_3, all existing (very heterogeneous) data are summarised. In Soikkola Ingrian, the ratios of singletons and short geminates to long geminates are counted separately for structures with long geminates before a short vs. a long vowel (given as VC:V and VC:V:). Soikkola Ingrian ratios showing the biggest differences from those in the listed cognate languages are in bold.

Foot type:		Disyllables			Trisyllables				
Contrast type:		C: - C	C· - C	C: - C·	C: - C	C· - C	C: - C·	C_3:-C_3	Source
Data:		only the V_V(:) context			only the V_V(:) context			heterogeneous data	
Soikkola Ingrian	VC:V	2.7		**1.2**	2.7		**1.3**	**1.3**	Study 2 (C_2); Study 1 (C_3)
	VC:V:	3.2	**2.4**	**1.3**	2.7	**2.1**	**1.3**		
Estonian		3.5	2.1	1.7	3.2	1.9	1.6	2.5	(Lehiste 1997b: 151, 158)
Inari Saami		2.8	1.5	1.8	2.3	1.5	1.6	2.4	(Türk et al. 2019, 2020)

5.6.2. Soikkola Ingrian secondary gemination in historical and dialectal perspective

There has been a long-standing debate on a relative and absolute chronology of different types of secondary gemination in Finnic varieties (viz. Porkka 1885; Hakulinen 1926; Kettunen 1940; Sovijärvi 1944; Laanest 1966a, 1986; Rapola 1966; Nahkola 1987; Palander 1987). This chronology was based on the wideness of spread of each type of phonologised gemination across varieties, on a relative chronology of gemination with respect to other sound changes, and on known migrations of Finnic groups. Table 5.10 provides essential data on all the five known types of Finnic secondary gemination in the primarily stressed syllable of words up to three syllables, discussed in our study: three types distinguished for Finnish dialects by Kettunen (1930) and two additional types in the trisyllabic foot. The types are ordered according to the wideness of their geographic spread across Finnic varieties, while their usually alleged relative chronology is given in the second column. It can be seen that the overall system of secondary gemination in Soikkola and Hevaha Ingrian presents the most complex combination of types.

We will not go deep into the chronological debate. Most importantly, "common" gemination (of all consonantal types after a light syllable) is usually presumed to be older than that after a heavy syllable. This presumption has even caused terminological confusion around secondary gemination. In some works (Paunonen 1973; Palander 1987; Nahkola 1987; O'Dell 2003; Gordon 2009; Spahr 2011), "common" gemination (*yleisgeminaatio*, Type 1 in Table 5.10) was rendered in English as "primary gemination", while "special" gemination (*erikoisgeminaatio*, Type 3) as "secondary gemination". These terms reflect the alleged chronology of the two types, but are confusing in a sense that actually **all** types of gemination presented in Table 5.10 are late and secondary with respect to the original Proto-Finnic geminates, which we call "primary" following the terminological tradition in Finnish, Estonian, and Russian.

Gordon (2009), who found secondary geminates in Soikkola Ingrian to be shorter after the heavy than after the light syllable, also used this alleged chronology of the two types to explain their durational difference. He presumed that geminates after a heavy syllable are shorter because they are younger in the language. However, as evident from Figures 1b and 2b, duration of C_2 constitutes a general ladder-like pattern, where the duration of each length class is in inverse isochronic relation to the complexity of the foot in terms of length and number of segments. The durational difference observed by Gordon in some foot types is just a particular case of this isochronic effect and does not need to be explained through a different age of gemination after the light vs. heavy syllable.

Actually, the whole chronology of this kind, based on how widely different types of phonologised gemination are spread across Finnic varieties, might be questioned for its validity.

As seen from Table 5.10, the wideness of spread perfectly correlates with the structural complexity and length of the foot. Increase in foot complexity correlates with two trends: (1) decrease in the wideness of geographical spread of phonologised gemination in each consequent foot type; (2) increase in restrictions on phonological conditions on gemination in each consequent foot type in terms of consonantal types involved, the role of stress etc. In an extreme scenario, age might not be a relevant factor at all in the increase of both geographic and structural restrictions throughout the types of gemination. Due to isochrony, the longer and more complex the structure was, the weaker an "anti-isochronic" effect of secondary gemination was phonetically manifest, and so the smaller the chances for its phonologisation became.

Table 5.10. Finnic types of secondary gemination, placed in the order of the wideness of geographical spread across varieties. The lists of varieties, the names, and the alleged chronology of types are given according to works cited in 5.6.2. In cases where observed similar phenomena might be of different origins and nature, a question mark precedes the variety.

Type (by the wideness of spread)	Alleged relative chronology	English translation of the Finnish name	Qualitative types of consonants involved and prosodic positions	Soikkola Ingrian example	Finnic varieties in which attested
1.	2	"Common (or general) gemination"	all consonantal types before long vowels and certain diphthongs after a light (C)V syllable	**kanā* > *ka**n̆n**ā* 'hen:PRT'	most Finnish dialects; all Ingrian dialects; Eastern Votic; ?Livonian; ?South Estonian
2.	1	"Southwestern dialectal special gemination"	only stops and *s* before long vowels and certain diphthongs after a light or heavy syllable	**poikā* > *poi**k̆k**ā* 'boy:PRT'	South-Western and Eastern Finnish dialects; Soikkola, Hevaha, Oredež Ingrian
3.	3	"Eastern dialectal special (or broadened) gemination"	all consonantal types before long vowels and certain diphthongs after a light or heavy syllable	—	Eastern Finnish; Hevaha Ingrian
4.	4	"Gemination in the trisyllabic words"	all consonantal types after a light syllable before two light syllables of the structure -CV(i)CV(C)	**omena* > *o**m̆m**ēna* 'apple'	Soikkola, Hevaha, Oredež (inconsistently) Ingrian, Lower Luga Ingrian (few words); ?some Estonian dialects
5.	4	"Gemination in the trisyllabic words after the long syllable"	only stops and *s* after a heavy syllable before two light syllables of the structure -CV(i)CV(C)	**murkina*> *mur**k̆k**ina* 'breakfast'	Soikkola and Hevaha Ingrian

5.6.3. Results on Soikkola Ingrian timing in light of speech motor control models

Our results on Soikkola Ingrian added to the evidence from other Finnic languages which challenge certain assumptions even of the most recent versions of the AP/TD framework (cf. 5.3.1). First, they re-confirmed previous findings that phonological length of segments and their position in the foot regulate the level of prominence of phonetic isochronic effects, thus giving further proof for the phonology-extrinsic timing mechanism instead of the phonology-intrinsic one, currently adopted by AP/TD. Additionally, like in earlier research on Finnic varieties, poly-subconstituent isochronic shortening of segments was unequally distributed throughout the foot also in our data. Most importantly, unstressed vowels undergo much stronger isochronic shortening than the stressed ones, up to the level of phonological reduction. Current versions of AP/TD, in turn, predict that stressed vowels would undergo isochronic shortening while the unstressed ones would not (Saltzman et al. 2008).

"Anti-isochronic" lengthening of consonants before long vowels is also difficult to account for in AP/TD. A local clock-slowing mechanism which accounts for initial and final boundary lengthening (a π-gesture) refers only to prosodic boundaries, while "anti-isochronic" lengthening is stronger in the middle of the foot than at the beginning (in C_1). Foot-internal lengthening of short consonants had been so prominent that it was phonologised as secondary gemination in many Finnic varieties, including Soikkola Ingrian.

Even recent AP/TD models are usually restricted to articulatory trajectories and rarely account for muscle contractions (cf. Turk & Shattuck-Hufnagel 2020: 13). Muscle activity and brain control over it still present various challenges for measuring and modelling (see a recent simulation in P. Anderson et al. 2017). An early model by Eek (1990), which might be able to account for most isochronic and "anti-isochronic" effects observed in our data, presumes greater level of muscular effort and tension in the first part of the foot and subsequent relaxation in the second part. Other researchers, too, impressionistically linked Finnic secondary gemination to the tenseness of articulation in the initial part of the foot (which triggers the "close contact"). Eek's model might be possibly represented in AP/TD as a π-gesture regulating the level of muscular contraction throughout the foot, however, this is still an open field for future research.

Eek's model might also be capable of accounting for the two unexpected effects which we preliminarily classified as "anti-isochronic": a slightly longer C_2 after a diphthong than after a monophthong, and a slightly longer V_1 in structures with a sonorant than in those without it (see 5.5.4.2). They could reflect the same physiological mechanism underlying the "close contact" at the syllable boundary between V_1 and C_2, which was held responsible both for a "half-long" V_2 in VCV nucleus and for secondary gemination by Hakulinen (1922). If the “close contact” implies higher tension of articulators, it would likely mean a more controlled pronunciation and shorter durations of involved sounds than a “loose contact”. For example, an extreme compactness of C_2 variance in the VCV nucleus (where this tense and controlled pronunciation is likely held throughout the whole C_2 and released only in V_2), as compared to the C_2 variance in any other structure (see Figures 5.1b and 5.2b), could be seen as another result of this extremely controlled foot-initial articulation.

One could also hypothesise that the contact of C_2 is “closer” with a preceding monophthong than with a diphthong. Durationally, diphthongs were insignificantly shorter by 2.1 ms in our study than long monophthongs, so their own intrinsic duration could not trigger lengthening in C_2. At the same time, diphthongs imply a change in the position of articulators, so the latter are unlikely to maintain the same degree of tenseness by the end of a diphthong as during the the pronunciation of monophthongs. Diphthongisation of initial long monophthongs in some Finnic varieties was explained exactly by a decrease of tenseness half-way through the long vowel (Penttilä 1926: 41-42; Eek 1990). Data on disyllabic Estonian structures containing diphthongs vs. long monophthongs (Eek & Meister 2004: 270) also showed generally longer durations of consonants after diphthongs (cf. especially 200 vs. 178 ms in the geminates in Q3, which roughly correspond to the long geminates of the present study).

The case of longer vowels before sonorants is more complex, as it actually involves two parameters. Stressed first syllables with sonorants in our study (of (C)V(V)R(T) structure) were always heavy, but stressed first syllables without sonorants (of (C)V(V)(T) structure) included also the type with a light first stressed syllable (C)V. Additionally, in the latter group, V_1 always immediately precedes a stop (C_2). Studies on Finnish have reported two separate related effects. First, longer vowels were observed before sonorants than before (voiceless) stops, which correlated with shorter intrinsic duration of sonorants than stops (Suomi 2009: 406). Authors attributed this to a cross-linguistically frequent phenomenon related to consonantal voicing (Chen 1970). Second, Finnic vowels are shorter in a light syllable than in a heavy one, e.g. in a *kala* — *kanto* pair (Leskinen 1978: 123), and this might indeed be related to the speech motor control. A presence of an extra segment in a closed syllable CVR might loosen articulation early in the first syllable, thus making V_1 duration longer, as compared to the “close contact” between V_1 and C_2, after a light syllable. In sum, less controlled articulation of sounds in these two cases, especially a “looser” contact between V_1 and C_2, in these two cases might have resulted in their longer durations. However, these effects and their explanation would need support from more acoustic and articulatory data.

5.6.4. Perspectives on formal phonological accounts of Soikkola Ingrian quantity and its evolution

5.6.4.1. Why trisyllabic foot?

The foot was defined in 5.2 as the stress group, which can be from one to three syllables long. However, the trisyllabic foot is typologically rare and presents challenges for formal phonological accounts on feet (viz. Martínez-Paricio & Kager 2015; Torres-Tamarit & Jurgec 2015). In this study, we did not consider words longer than three syllables and, therefore, cannot provide here a full list of Soikkola Ingrian facts relevant for this discussion. Still, we will briefly summarise the main arguments relevant for the structures analysed.

The Soikkola Ingrian trisyllabic foot prosodically differs from both the disyllabic foot and the combination of a disyllabic and a monosyllabic foot. This is seen in idiosyncratic types of secondary gemination and the reduction of long V_2 characteristic of the trisyllabic foot only, which are summarised in Table 5.11.

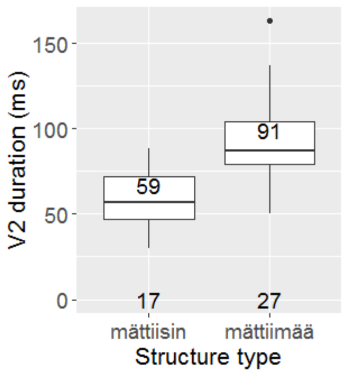
Table 5.11. Idiosyncratic prosodic features of the Soikkola Ingrian trisyllabic foot

Type of structure	**Gemination before a short vowel**	**Long V_2 reduction**
2-syllabic foot	× *kurki* [ˈkurg̊i] ‘crane’	× *kurǩkī* [ˈkurkˑiː] ‘crane:ILL’
2-syl. + 1-syl. bifoot	× *murkinā* [ˈmurg̊iˌnaː] ‘breakfast:PRT’	× *kerǩkīm(m̆)ǟ* [ˈkerkˑiːˌmäː] ‘be_in_time:SUP’
3-syllabic foot	✓ *mur**ǩk**ina* [ˈmur**k**ˑina] ‘breakfast’	✓ *kerǩkīm(m̆)ä* >[ˈkerkˑ**i**mä] ‘be_in_time:1PL’

While the main gemination principles were given in Table 5.10, here we will dwell on the question of V_2 reduction. Sovijärvi (1944: 182-84), who interviewed Soikkola Ingrian speakers in the 1930s, explicitly stated that long V_2 reduction in trisyllabic words concerned only the structures where the third syllable vowel is short [i.e. the trisyllabic feet], while was absent from the structures with the third syllable long vowel [i.e. the bifoot structures], as the long V_3 takes secondary stress, e.g. **pīrāta* > *pīr**a**ta* [ˈpiːr**a**d̥a] ‘pie:PRT’, but *pīr**ā**tā* [ˈpiːr**a**ːˌd̥aː] ‘pie:PRT:3POS’. At Sovijärvi’s time, this reduction was still ongoing in some structures, while already complete in others, e.g. in partitive and illative forms of words like *kiuǩkā* ‘oven’, *pīras* ‘pie’. Notably, this reduction was not yet attested by Porkka (1885), who collected data in 1884 (cf. partitive *kiukaada* without reduction on p. 68). Sovijärvi supposed that this recent reduction and much older secondary gemination have same prosodic roots — especially in trisyllabic words with the first heavy syllable, they manifest nearly the same prosodic conditions.

Our present study did not include structures with a combination of long V_2 and long V_3. However, the difference with respect to long V_2 shortening in trisyllabic feet but its preservation in bifoot trisyllables is traced up to date. As an example, see the duration of originally long V_2 in different trisyllabic grammatical forms of two verbal paradigms *mättīssä* ‘burst_in’ and *hōk̆kūssa* ‘breath’ in a speaker ST (Figure 5.5). The forms were divided into two groups: trisyllabic feet (e.g. *mättīsin* ‘burst_in:PST:1SG’) and bifoot trisyllabic words with a long V_3 (e.g. *mättīmǟ* ‘burst_in:SUP’). ST was one of the three speakers in which long V_2 underwent complete shortening in trisyllabic feet with such foot nucleus structures (cf. 5.5.2.1 and Figure *e* in Appendix 5.4). This shortening is observed also in the small dataset used in Figure 5.5: the mean of originally long V_2 in trisyllabic feet like *mättīsin* was 59 ms. In a regression model with a by-word random intercept, the second syllable original long vowels in bifoot trisyllables like *mättīmǟ* were significantly longer (91 ms**, p=0.001768). Therefore, to our mind, the third syllable in the trisyllabic foot cannot be simply considered extrametrical, as it directly contributes to the prosodic processes happening within the first two syllables.

Figure 5.5. Duration of original long V_2 in trisyllabic feet like *mättīsin* vs. in bifoot trisyllabic words like *mättīmǟ*. Raw means are reported within boxes; number of tokens is given below each box at the bottom.



5.6.4.2. Possibilities for a moraic account of Soikkola Ingrian quantity and its evolution

Observed isochrony-governed long V_2 shortening in Soikkola Ingrian could be modelled as a change in the abstract limit for an overall duration of the foot. Isochrony tends to preserve both the minimal and the maximal durational limit of the foot, irrespective of its phonemic content. Reduction decreased this maximal durational limit of the entire foot, rather than directly affecting individual segments. The more any prosodic position was sensitive to isochrony, the stronger reduction it underwent in longer structures.

Within the Moraic theory (Hayes 1995), Soikkola Ingrian would be likely modelled as requiring both the foot nucleus and the foot (i.e. the “minimal” and the “maximal foot”) to be maximally trimoraic. This requirement stipulates V_2 lengthening in the VCV foot nucleus, which would otherwise contain just two morae (cf. such an analysis for Estonian in Eek &

Meister 1997; for Finnish in Nahkola 1987: 25). Observed reduction of the maximal foot limit could be interpreted as a shortening of the maximal foot by one mora. Those structures which still fit the new moraic limit maintain long V_2, while those which exceeded the limit shorten this vowel.

It is, however, challenging for the Moraic theory to deal with complex quantity systems (cf. a moraic analysis of Soikkola Ingrian in Prillop 2015; critically assessed in Kuznetsova 2018b). In order to describe isochronic shortening of V_2 in Soikkola Ingrian, one would likely need to make the Moraic theory capable of accounting for the structure *mat̆tāla* as having four morae and all other trisyllabic foot structures (*kattīma, mūttīma / toittīma, harkkāma, sūt̆tīma / hoit̆tīma, kerk̆kīmä, vā̆nt̆tīmä*) as those which had five morae before and lost one mora through the reduction of the moraic foot limit. In this way, one could give a general and simple phonological explanation to why *mat̆tāla* kept the long V_2 and all the longer structures lost it. It would be relatively easy to do, if the theory permitted ascribing morae to whole feet or syllables, as well as distributing quantity between several levels of prosodic hierarchy. Current Moraic theory, however, represents all lexical quantity through morae and links morae to individual segments and so would need a complicated machinery to perform this task, not to be attempted here.

5.6.4.3. Possibilities for a formal representation of Soikkola Ingrian quantity through quantity accents

Instead, we will briefly explore a framework in which Finnic lexical quantity is represented as a hierarchic system of the phonemic length contrast and the contrast of foot quantity accents, light /ˊ/ (unmarked) and heavy /ˋ/ (marked). Such descriptions exist for Estonian (e.g. Viitso 1978; Eek 1990; Kuznetsova 2018a), Livonian (Viitso 1975; Kulešov 2012), Soikkola Ingrian (N. V. Kuznecova 2009a, 2009b). Quantity accents function like lexical pitch-accents in Scandinavian or Baltic languages, i.e. they are two distinctive patterns of the lexicalised foot stress. The only difference is that their phonetic cue is a specific quantity pattern of the foot nucleus rather than a specific pitch contour. The phonemic content of the foot nucleus can stay the same, while the phonological difference can be made only with the accent. Consider an Estonian triplet with three degrees of quantity: *lina* [ˈlinaˑ] ‘linen’ (Q1) — *linna* [ˈlinˑa(ˑ)] ‘city:GEN’ (Q2) — *linna* [ˈlinːă] ‘city:PRT’ (Q3). Feet in Q1 and Q2 are interpreted as carrying a light accent, while words differ in their phonemic content: a short C_2 in *lina* and a long one in *linna* (Q2). The heavy accent, in turn, is contrasted to the light accent in *linna* (Q3), which has the same phonemic content as *linna* (Q2) but differs in accent, i.e. /ˊlina/ — /ˊlinːa/ — /ˋlinːa/.

Such an analysis was implemented in the morphological dictionary of Estonian (Viks 1992) and has been in use in all normative Estonian dictionaries since 1999 (the latest is Raadik 2018), which proves its extreme practicality. Crucially, it allows considering all V_2 as phonologically short and to represent its exact duration as an automatic function of the phonetic manifestation of accents.

A proposed Soikkola Ingrian foot accent system is slightly different from the Estonian one, especially from the phonetic point of view, due to two factors: (1) partial maintenance of long V_2 after a heavy syllable; (2) secondary gemination. Synchronically, V_2 duration can already be considered as a function of lexical accent rather than of the phonemic length of V_2. This is similar to Estonian; the only difference is that the heavy accent has a different phonetic manifestation in the two languages.

In Estonian, the main phonetic cue of the heavy accent (e.g. /ˋlinːa/) is coda lengthening in the first syllable combined with a shorter V_2, as compared to the same structure under the light accent (/ˊlinːa/); see phonetic ratios between the three key elements of the foot nucleus in Eek and Meister (2004: 271).

In Soikkola Ingrian, the main phonetic manifestation of the heavy accent is a lengthened V_2 after a heavy syllable and/or, as an additional cue in certain structures, secondary (short) geminates.

As became evident in this study, the contrast of the foot nuclei with secondary geminates before short vs. long V_2 (e.g. **vōt̆tava* vs. **sūt̆tīma*) is now lost. In general, there are no di- or trisyllabic feet where a contrast of short and long vowels after a secondary geminate would remain. In this position, the vowel is durationally either short or long depending on the structure. Therefore, for the sake of morphological convenience and given that secondary gemination was a "strengthening" effect in consonants, all foot nuclei with secondary gemination might be considered as carrying a heavy accent. Monosyllabic feet with a truncated foot nucleus, not discussed here, do not have an accentual contrast and are considered as carrying a default light accent. Certain foot nuclei with singletons and long geminates, in turn, still preserve the contrast of accents. An accentual analysis of quantity patterns from Table 5.2 is given in Table 5.11.

In general, accents reflect existing dependencies between the duration and length of the foot nucleus elements, including both isochronic and "anti-isochronic" effects. At the same time, they code deep prosodic inequality between the first stressed syllable and the non-initial unstressed syllables in their different ways of tackling quantity, vowel height (cf. Ftn. *b* to Table 5.2), and some other features. Additionally, accents allow a parsimonious analysis of quantity alternations in paradigms. They present diverse single quantity alternations within a paradigm as a function of few types of accent alternations at the foot level (see some examples in N. V. Kuznecova 2009b; Kulešov 2012).

Table 5.11. Phonological analysis of Soikkola Ingrian quantity patterns through quantity foot accents

Foot type	*C2+*V2	Accent	VCV	VːCV	V_1V_2CV	VRCV	VːRCV
Monosyllabic	no C *C	ˏ	no ~ ˊno ˊnüt	ˊmā ˊmāt	ˊsai ˊsait	ˊken ˊhänt	ˊsūr ˊsūrt
Disyllabic	*C + *V	ˊ	ˊtapa	ˊlōta	ˊaita	ˊkarta	ˊkārto
	*C + *Vː	ˋ		ˋmāta	ˋaitas	ˋkartas	ˋraenta
	*Cˑ + *Vː	ˋ	ˋtap̆pa	ˋlōt̆ta	ˋait̆ta	ˋkart̆ta	ˋkārt̆to
	*Cː + *V	ˊ	ˊnatta	ˊvōtta	ˊaitta	ˊkartta	
	*Cː + *Vː	ˋ	ˋtappa	ˋnōtta	ˋaitta	ˋkartta	
Trisyllabic	*C + *V	ˊ	ˊlakata	ˊvīkate	ˊleikata	ˊharkata	ˊkērsimä
	*Cˑ + *Vː = *Cˑ + *V	ˋ	ˋmat̆tala	ˋvōt̆tava = ˋsūt̆tima	ˋvoit̆teli = ˋhoit̆tima	ˋmurk̆kina = ˋkerk̆kimä	ˋvā̆nt̆teli = ˋvā̆nt̆timä
	*Cː + *Vː = *Cː + *V	ˏ	ˊkattima = ˊkattila	ˊmūttima = ˊōttele	ˊtoittima = ˊvoitteli	ˊharkkama = ˊmarkkoja	

5.6.5. Soikkola Ingrian prosody: L2 codification and teaching

Ongoing sound changes, such as the one discussed in this study, also present challenges for language codification and teaching as L2 to young members of the community, an acute issue for vanishing Soikkola Ingrian. The reduction of V_2 in tri- but not in disyllabic feet creates two main issues for Soikkola Ingrian codification. First, it produces new length alternations in already very complex inflectional paradigms, which challenge language learners. Consider a small fragment of a non-past active verbal paradigm ‘squeeze_oneself_in’, where the new alternations of long and short V_2 as a function of the number of syllables in the foot evolved:

(old system) **mättī-n* 1SG, **mättī*-d 2SG, **mättī-mmä* 1PL, **mättī-ttä* 2PL >
(new system) *mättī-n*, *mättī-d*, but *mätti-(m̆)mä*, *mätti-ttä*.

Second, individual speakers manifest considerable variation in the level of V_2 reduction (cf. 5.5.2.1), and in some recorded idiolects (e.g. AG, EI) truly long V_2 allophones can still occur in many cases instead of the shortened ones. Therefore, there is a question of how individual data should be transcribed for teaching materials and in a dictionary. In a small language, a statistical weight of each speaker is much higher than in a big one (Whalen & McDonough 2019), and it is more difficult to consider any of them as an outlier. In turn, the quantity accents discussed in 5.6.4.3, which resolve the issue of discrepancy between V_2 duration and length, prove challenging to be used in practical orthography, as they are too abstract for language learners. Unlike dictionaries for L1 Estonian speakers, materials for an endangered language should rather rely on a more phonetically-oriented system of writing to facilitate its L2 students to pronounce the words correctly. For this reason, for example, Viitso, who elaborated the system of accents not only for Estonian but also for vanishing Livonian (1975), did not use it in a L2 community-oriented dictionary (Viitso & Ernštreits 2012).

5.7. Conclusion

This chapter reported the effects of isochrony (temporal compensation) and “anti-isochrony” (lengthening before longer sounds) in Soikkola Ingrian trisyllables and disyllables. Isochrony resulted as a very global phonetic tendency regulating durational effects at several levels of prosodic hierarchy, including syllable, foot nucleus, foot. Its strength indicated a progressive growth from the beginning to the end of the foot nucleus. In trisyllabic feet, isochrony triggered phonological shortening of second syllable long vowels. Length contrast was lost in this position altogether, and vowel duration became significantly reverse to the first syllable length. In this, Soikkola Ingrian trisyllables have reached the typological stage of prosodic development of other cognate languages with the ternary quantity contrast of consonants: Estonian, Livonian, and Saami. Disyllables, being shorter feet, have maintained the length contrast of V_2 and are at a more archaic stage of prosodic evolution. “Anti-isochronic” lengthening, which had historically produced phonological short geminates, appeared as a still active phonetic tendency, local and subordinate to isochrony.

Finnic quantity is one of the most complex in the world, and Soikkola Ingrian has one of the most complex quantity systems in the Finnic space, if evaluated by a combination of length contrasts in phonology, quantity alternations in morphology, and dynamic phonetic tendencies that influence duration and length. A study on such a system brings us to a better understanding of these systems and the challenges they present to existing phonetic and phonological theories, raising our typological awareness of how quantity can work.

Appendix 5.1. *Full list of dependent variables, predictors, and random effects used in maximal and final models*

Segmental durations in structural positions (Dependent variables):

C1dur	1st syllable consonant (C_1)
V1dur	1st syllable vowel/diphthong (V_1)
sondur	sonorant (R)
C2dur	stop after V_1 or R (C_2)
V2dur	2nd syllable vowel (V_2)
C3dur	consonant after V_2 (C_3)
V3dur	3rd syllable vowel (V_3)

Fixed effects:

1) length classes of segments:
— binary length (*v1length*, *v2length*, *c3length*, *v3length*)*: short* vs. *long*;
— synchronic durational classes of V_2 (*V2RealDur*): *true short* vs. *true long*;
— ternary length of C_2 (*gem*): *sing* (singleton) vs. *second* (secondary/short geminate) vs. *prim* (primary/long geminate);
2) presence of a segment in the structure:
— sonorant (*son.x*): (*no* vs. *yes*);
— C_1 (*C1pres*): (*no* vs. *yes*);
3) long V_1 is a diphthong (*dip*): *no* vs. *yes*;
4) number of syllables in the foot (*Syl*): *2* vs. *3*

Random intercepts:

1) speaker (*spkr*)
2) wordform (*word*)
3) quality of segments: *C1*, *V1*, *son.y* (type of a sonorant), *C2*, *V2*, *C3*, *V3*

Appendix 5.2. *List of reported regression models, fitted in lmer*

The models are arranged by the two studies and by the order of positions in foot. Number of tokens in each sample is reported in paretheses after each model.

STUDY 1

C_1 duration:

5.5.4.2, 5.5.5: C1dur ~ v1length + (1|spkr) + (1|word) + (1|V1) + (1|C1), data=x_c1 (3600)

V_1 duration:

5.5.2.3, 5.5.4.1, 5.5.4.2, 5.5.5: V1dur ~ son.x*v1length + v1length* gem + C1pres*v1length + (1 | spkr) + (1 | word) + (1|C1) + (1|V1), data=x (3812)

5.5.5, Ftn. 1 to Table 5.8: V1dur ~ son.x + gem*v1length + C1pres*v1length + (1 | spkr) + (1 | word) + (1|C1) + (1|V1), data=x (3812)

V_1 as long monophthong vs. diphthong (only a balanced subset of data, see columns V:CV - V1V2CV in Table 5.2)

5.6.3: V1dur ~ gem + dip + (1|spkr) + (1|word) + (1|V1) + (1|C1), data=x_v1long_dip (1718)

R duration:

5.5.4.1, 5.5.5: sondur ~ v1length + gem + (1 | spkr) + (1 | word) + (1|son.y), data=x_r (1399)

C_2 duration:

5.5.2.3, 5.5.4.1, 5.5.4.2, 5.5.5: C2dur ~ gem*dip + gem*son.x + gem*v1length + (1|spkr) + (1|word) + (1|V2), data=x (3812)

5.5.5, Ftn. 1 to Table 5.8: C2dur ~ dip + son.x + gem*v1length + (1|spkr) + (1|word) + (1|V2), data=x (3812)

V_2 duration:

5.5.2.1, 5.5.2.3, 5.5.5: V2dur ~ v1length*son.x*gem + v2length_etym + (1|spkr) + (1|word) + (1|V2), data=x (3812) (rank-deficient by 1 column, due to the lack of a combination V:RC: in the language)

5.5.2.1, Ftn. 57: (1) V2dur ~ v1length*son.x*gem + (1|spkr) + (1|word) + (1|V2), data=x (3812); (2) V2dur ~ Struct + (1|spkr) + (1|word) + (1|V2), data=x (3812)

5.5.2.3: V2dur ~ V2RealDur + (1|spkr) + (1|word) + (1|V2), data=x (3812)

5.6.5: Dataset on long V_2 in trisyllabic feet vs. bifoot trisyllables in ST: V2dur ~ Structure + (1|word), data=x_3 (44)

C_3 duration:

5.5.2.3, 5.6.1: C3dur ~ C3length + (1|spkr) + (1|word), data=x (3812)

V_3 duration:

5.5.2.3: V3dur ~ v3length + (1|spkr) + (1|word), data=x (3812)

STUDY 2

C_1 duration:

5.5.4.2, 5.5.5: C1dur ~ (1|spkr) + (1|word) + (1|C1), data=x_c1 (745)

V_1 duration:

5.5.4.1, 5.5.5: V1dur ~ C1pres + (1 | spkr) + (1 | word) + (1 | C1), data=x (812)

C_2 duration:

5.5.3, 5.6.1: C2dur ~ Struct*Syl + (1|spkr)+ (1|word), data=x (812)

5.5.5: (1) C2dur ~ gem*Syl + v2length_etym*Syl + (1|spkr) + (1|word), data=x (812); (2) Ftn. 1 to Table 5.8: C2dur ~ gem + v2length_etym*Syl + (1|spkr) + (1|word), data=x (812)

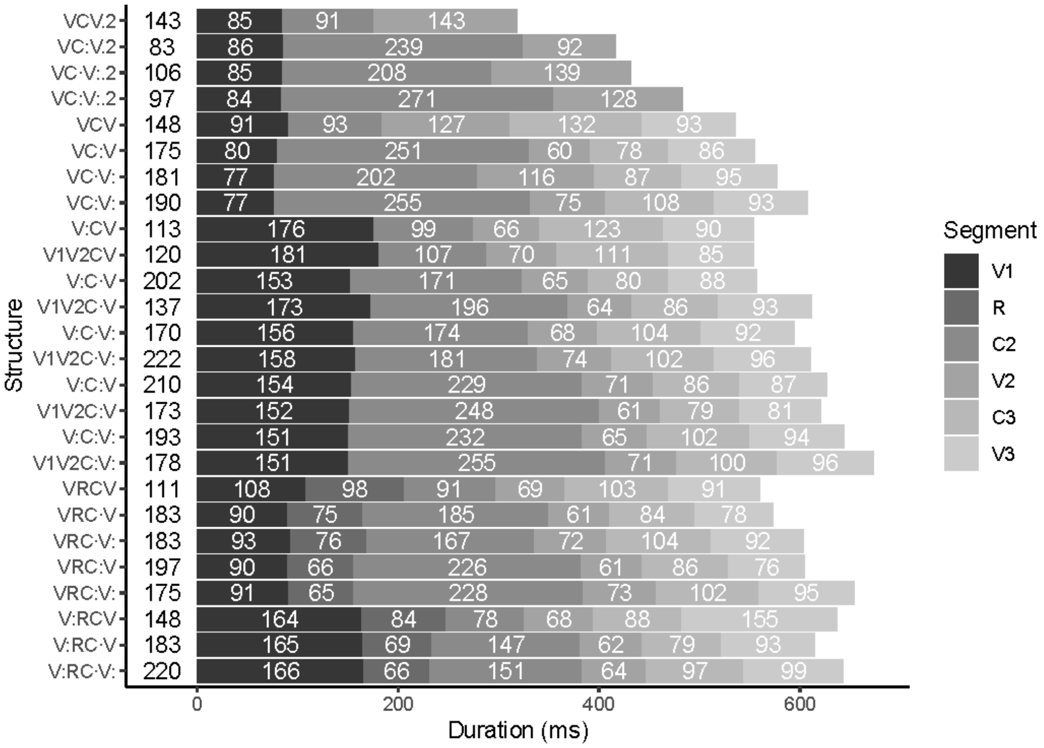
V_2 duration:

5.5.3: V2dur ~ Struct*Syl + (1|spkr) + (1|word), data=x (812)

5.5.5: V2dur ~ gem*Syl + v2length_etym*Syl + (1|spkr) + (1|word), data=x (812)

__Appendix 5.3.__ Mean durations of segments in all structures, pooled over tokens and speakers

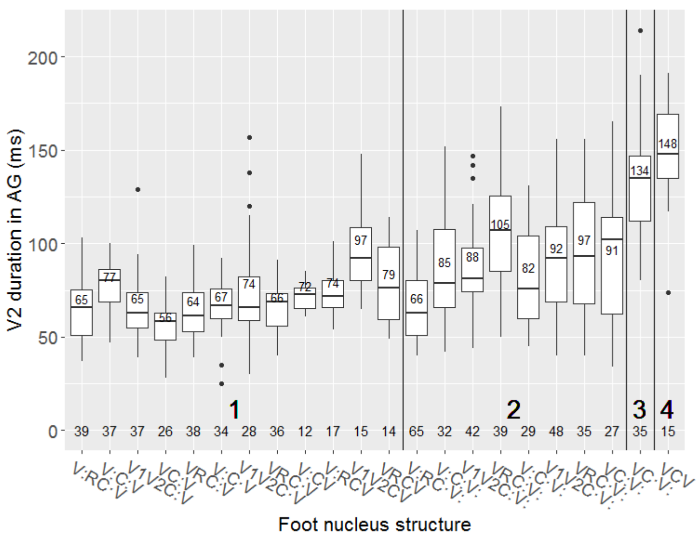
Raw mean durations of all segments, apart C_1, are reported in ms in each box. Structures are coded by their foot nucleus types; number of tokens is given after the structure code before the bar. The first four are the disyllables (in 3 speakers), followed by the 22 trisyllables (in 5 speakers). This plot was designed by the author and executed by Irina Brodskaya.



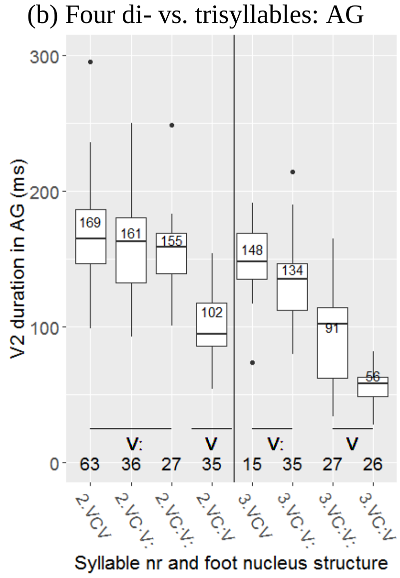
__Appendix 5.4.__ Duration of V_2 in 22 trisyllables and four shortest di- vs. trisyllables in each speaker

For abbreviations, see legend to Figures 5.1–5.2.

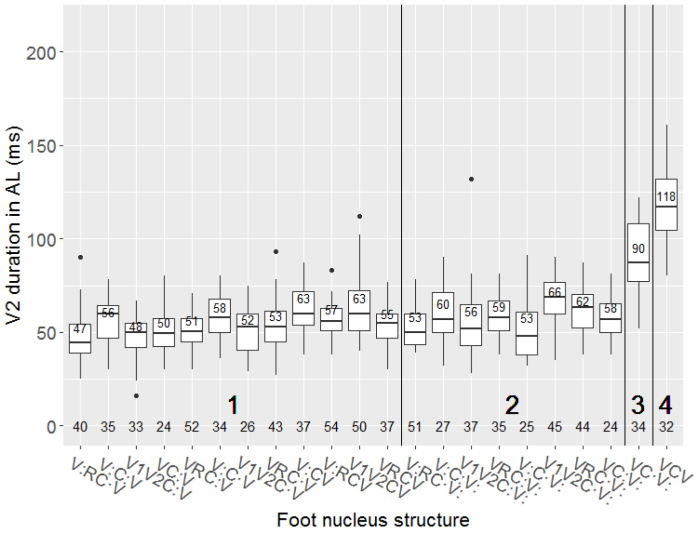
(a) 22 trisyllables: AG



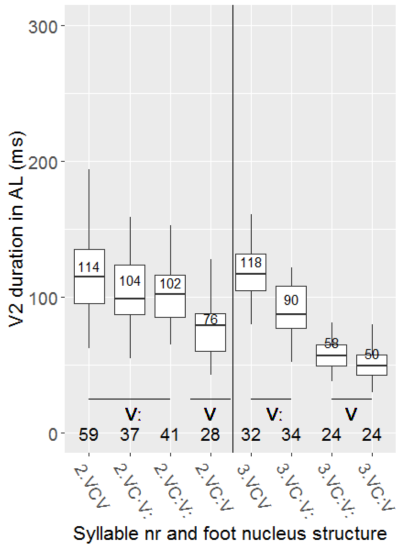
(b) Four di- vs. trisyllables: AG



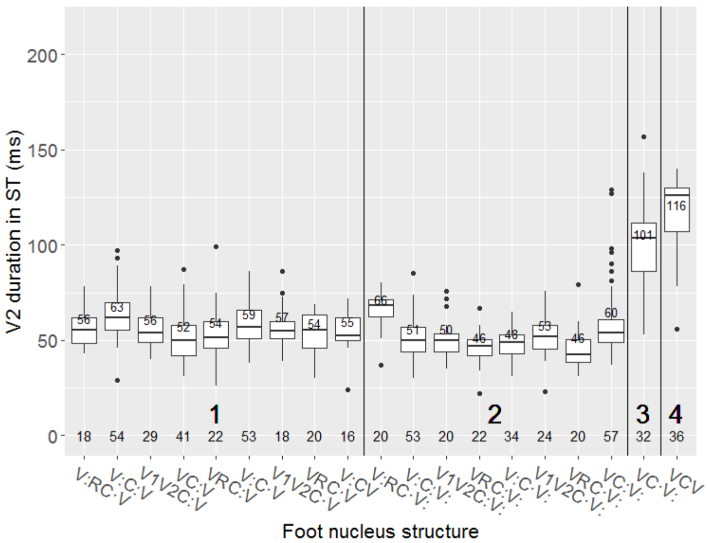
(c) 22 trisyllables: AL



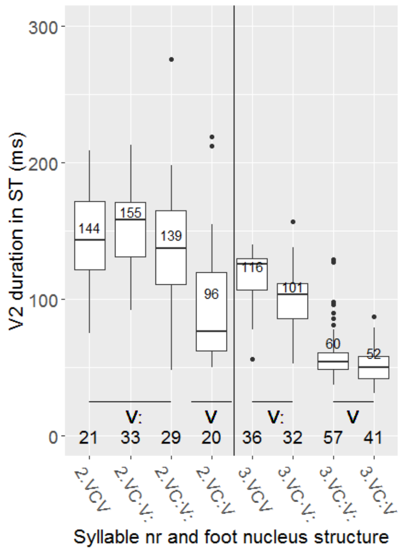
(d) Four di- vs. trisyllables: AL



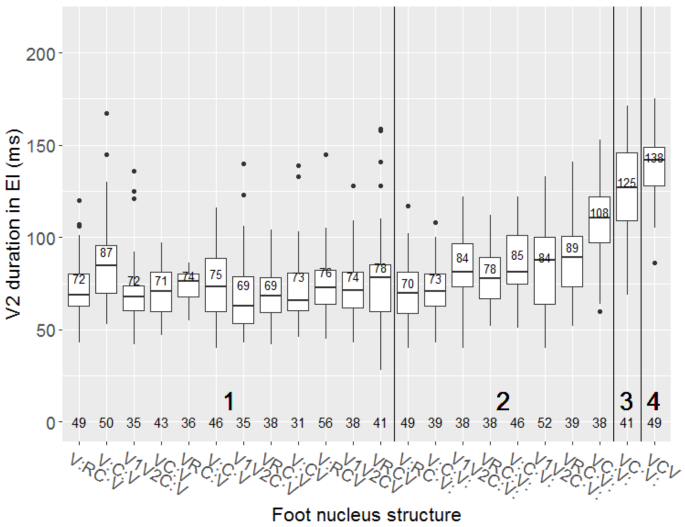
(e) 22 trisyllables: ST



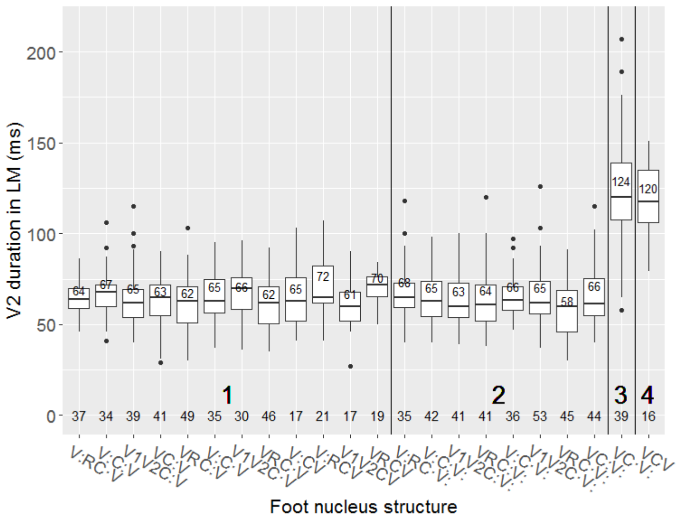
(f) Four di- vs. trisyllables: ST



(g) 22 trisyllables: EI



(h) 22 trisyllables: LM



Appendix 5.5. *Detailed statistics on effects reported in 5.5.4.1*

References to the corresponding figure numbers are provided in the first column. Differences between least squares means are reported. Kenward-Roger's approximation of the degrees of freedom and a confidence level 95% were used for *t*- and *p*-statistics.

Fig.	Variable	Structure	Contrast	Estimate	SE	df	t-ratio	p-value
5.3a	V1 dur	v1=short	C2-C2·	16.4	4.64	129	3.5	0.0006
			C2-C2:	12.0	4.41	125	2.7	0.0072
			C2·-C2:	-4.4	3.43	119	-1.3	0.2048
		v1=long	C2-C2·	18.1	3.64	116	5.0	<.0001
			C2-C2:	27.8	3.96	111	7.3	<.0001
			C2·-C2:	10.7	3.28	117	3.3	0.0015
5.3b	C2 dur	c2=sing	V1-V1:	3.2	5.97	116	0.5	0.5922
		c2=second	V1-V1:	25.1	4.01	112	6.2	<.0001
		c2=prim	V1-V1:	20.6	5.13	107	4.0	0.0001
5.3c	C2 dur	c2=sing	no-yes R	19.0	5.90	117	3.2	0.0017
		c2=second	no-yes R	29.4	4.19	111	7.0	<.0001
		c2=prim	no-yes R	34.0	4.95	117	6.9	<.0001
5.3d	R dur		V1-V1:	11.3	2.1	44.5	5.3	<.0001
5.3e	R dur		C2-C2·	19.2	2.2	42.9	8.7	<.0001
			C2-C2:	29.7	2.7	45.9	11.2	<.0001
			C2·-C2:	10.6	2.2	45.1	4.9	<.0001
5.3f	V1 dur	v1=short	no-yes C1	13.3	7.87	33	1.7	0.1003
		v1=long	no-yes C1	31.2	7.67	29	4.1	0.0003
5.3g	V1 dur (Study 2)		no-yes C1	26.6	8.7	8.6	3.1	0.0142
5.4a	C1 dur		V1-V1:	-8.9	2.3	112.0	-3.8	0.0002
5.4b	V1 dur	v1=short	no-yes R	-9.6	3.16	122	-3.0	0.0029
		v1=long	no-yes R	-4.7	4.52	121	-1.0	0.2987
5.4c	C2 dur	c2=sing	no-yes dip	-11.3	7.81	119	-1.4	0.1519
		c2=second	no-yes dip	-8.5	4.90	114	-1.7	0.0856
		c2=prim	no-yes dip	-18.4	5.08	111	-3.6	0.0004

Appendix 5.6. *Distribution of tokens across the carrier words, the experiments (Study 1 and 2), the foot nucleus structures, and the speakers*

Underlined vowels refer to the long mid vowels of the initial stressed syllable which could be pronounced in a range from mid to high (cf. Table 5.1).

Word	Study	Structure	AL	AG	ST	LM	EI	Word	Study	Structure	AL	AG	ST	LM	EI
agal(l)e	1-2	VCV	7	3	0	3	5	hargada	1	VRCV	7	4	0	3	7
hübim(m)ä	1-2	VCV	0	0	2	0	0	kelgal(l)e	1	VRCV	7	3	0	3	8
jädäm(m)ä	1-2	VCV	3	3	8	4	12	londil(l)e	1	VRCV	7	3	0	4	7
kugil(l)e	1-2	VCV	5	0	0	0	0	palgal(l)e	1	VRCV	8	3	0	5	7
odam(m)a	1-2	VCV	3	3	18	3	18	törgädä	1	VRCV	8	1	0	4	12
tabam(m)a	1-2	VCV	7	3	8	3	7	jalkoja	1	VRC·V	8	7	4	7	8
ugol(l)e	1-2	VCV	7	3	0	3	7	kantele	1	VRC·V	4	0	0	4	0

kakkara	1-2	VC:V	3	3	11	8	10
kattila	1-2	VC:V	4	4	11	7	8
kukkoja	1-2	VC:V	3	0	0	4	0
kukkoro	1-2	VC:V	0	3	12	7	8
petteri	1-2	VC:V	7	8	4	8	9
tappele	1-2	VC:V	7	8	3	7	8
mataala	1-2	VC·V:	3	6	12	9	9
papeeri	1-2	VC·V:	7	8	6	9	10
pikaari	1-2	VC·V:	7	7	3	7	9
puteeli	1-2	VC·V:	7	7	4	7	6
sukuuri	1-2	VC·V:	3	0	0	0	0
tapuuna	1-2	VC·V:	0	0	3	0	0
väköövä	1-2	VC·V:	7	7	4	7	7
hukkaam(m)a	1-2	VC:V:	7	8	4	8	7
hüppääm(m)ä	1-2	VC:V:	0	4	6	9	8
hüppiim(m)ä	1-2	VC:V:	3	0	16	1	0
kattiim(m)a	1-2	VC:V:	3	4	13	9	7
lakkaam(m)a	1-2	VC:V:	0	0	1	0	0
lükkääm(m)ä	1-2	VC:V:	8	8	5	7	7
mittaam(m)a	1-2	VC:V:	3	3	12	10	9
pliidal(l)e	1	V:CV	5	0	0	0	0
saadam(m)a	1	V:CV	7	3	8	3	8
söödäm(m)ä	1	V:CV	14	3	0	7	8
suudum(m)a	1	V:CV	11	6	8	7	15
haugada	1	V1V2CV	4	0	0	0	0
koigal(l)e	1	V1V2CV	13	3	0	3	8
laugal(l)e	1	V1V2CV	7	3	0	3	7
lougada	1	V1V2CV	8	3	0	3	8
näüdäm(m)ä	1	V1V2CV	10	3	0	4	7
soidam(m)a	1	V1V2CV	8	3	0	4	8
laatana	1	V:C·V	8	4	13	0	0
luutoja	1	V:C·V	0	0	5	0	0
naapuri	1	V:C·V	0	0	10	0	0
naatala	1	V:C·V	0	7	4	6	11
piikoja	1	V:C·V	7	6	4	8	7
riitele	1	V:C·V	3	3	14	7	8
siikoja	1	V:C·V	9	7	3	5	9
vootava	1	V:C·V	7	7	0	9	11
hoiteli	1	V1V2C·V	0	0	4	3	6
lautoja	1	V1V2C·V	7	8	5	8	10
oikeni	1	V1V2C·V	7	8	3	7	8
peukolo	1	V1V2C·V	8	8	5	7	7
voitele	1	V1V2C·V	1	0	0	0	0
voiteli	1	V1V2C·V	3	4	1	5	4
hookaam(m)a	1	V:C·V:	6	12	22	11	23
hookuum(m)a	1	V:C·V:	0	0	3	4	0
laatiim(m)a	1	V:C·V:	13	17	8	21	16
preetiim(m)ä	1	V:C·V:	3	0	1	0	0
lankoja	1	VRC·V	0	0	0	5	0
märkeni	1	VRC·V	7	8	4	7	8
mertoja	1	VRC·V	8	7	4	9	7
murkina	1	VRC·V	6	7	4	7	8
pünkärä	1	VRC·V	2	0	0	0	0
velkoja	1	VRC·V	8	7	4	7	7
antiim(m)a	1	VRC·V:	3	0	0	4	0
henkääm(m)ä	1	VRC·V:	3	0	0	0	0
hülkääm(m)ä	1	VRC·V:	6	14	8	9	6
kenkiim(m)ä	1	VRC·V:	7	0	0	8	10
kerkiim(m)ä	1	VRC·V:	8	15	8	8	7
kertaam(m)a	1	VRC·V:	7	6	4	7	8
lankiim(m)a	1	VRC·V:	3	0	0	0	0
vertaam(m)a	1	VRC·V:	7	0	0	9	8
kelkkoja	1	VRC:V	9	7	3	7	8
kerttele	1	VRC:V	4	8	6	8	7
küntteli	1	VRC:V	4	0	0	4	0
markkoja	1	VRC:V	4	5	1	7	7
Markkoja	1	VRC:V	6	4	2	1	0
palkkoja	1	VRC:V	8	7	3	7	7
talkkuna	1	VRC:V	3	0	4	0	0
tarkkoja	1	VRC:V	8	7	0	8	7
tilkkoja	1	VRC:V	0	0	0	3	0
vankkuri	1	VRC:V	3	0	0	0	0
värttänä	1	VRC:V	3	0	3	4	0
harkkaam(m)a	1	VRC:V:	6	8	4	7	7
palkkaam(m)a	1	VRC:V:	7	7	4	8	8
solkkaam(m)a	1	VRC:V:	7	7	5	9	7
sorttiim(m)a	1	VRC:V:	0	0	0	0	7
sorttuum(m)a	1	VRC:V:	7	8	0	8	0
tarkkaam(m)a	1	VRC:V:	2	0	0	0	0
törkkääm(m)ä	1	VRC:V:	6	9	9	9	9
käändelöö	1	V:RCV	12	2	0	3	6
keerdelöö	1	V:RCV	16	4	0	12	36
peendaraa	1	V:RCV	7	5	0	3	7
väändelöö	1	V:RCV	9	3	0	3	7
veerdelöö	1	V:RCV	10	3	0	0	0
käänteli	1	V:RC·V	7	7	4	6	12
keerteli	1	V:RC·V	8	16	7	15	16
peentara	1	V:RC·V	7	9	4	7	13
vääntele	1	V:RC·V	1	0	0	0	0
väänteli	1	V:RC·V	9	7	3	7	8
veerteli	1	V:RC·V	8	0	0	2	0
kääntiim(m)ä	1	V:RC·V:	6	13	7	7	17
keeltiim(m)ä	1	V:RC·V:	8	12	4	8	0
keertiim(m)ä	1	V:RC·V:	0	0	0	9	25
vääntiim(m)ä	1	V:RC·V:	7	26	9	11	7
veertiim(m)ä	1	V:RC·V:	30	14	0	0	0

suutiim(m)a	1	V:C·V:	3	0	0	0	7
hautaam(m)a	1	V1V2C·V:	8	7	2	10	8
hiukaam(m)a	1	V1V2C·V:	8	8	0	5	0
hoitiim(m)a	1	V1V2C·V:	7	7	5	9	12
kaipaam(m)a	1	V1V2C·V:	0	4	3	0	0
kiukaada	1	V1V2C·V:	8	8	3	7	7
laukaam(m)a	1	V1V2C·V:	7	7	7	11	15
oikaam(m)a	1	V1V2C·V:	7	7	4	7	10
poikiim(m)a	1	V1V2C·V:	0	0	0	4	0
miikkula	1	V:C:V	7	9	14	6	10
oottele	1	V:C:V	3	4	30	6	11
pliittoja	1	V:C:V	7	9	3	8	11
puukkoja	1	V:C:V	7	8	4	8	7
saattaja	1	V:C:V	7	7	3	6	11
voittele	1	V:C:V	4	0	0	0	0
käütteli	1	V1V2C:V	9	8	3	7	7
laukkoja	1	V1V2C:V	7	7	5	7	7
loukkula	1	V1V2C:V	7	7	3	8	7
soikkola	1	V1V2C:V	7	7	7	7	7
veitteli	1	V1V2C:V	0	0	3	0	0
voitteli	1	V1V2C:V	3	8	8	10	7
loottiim(m)a	1	V:C:V:	0	0	0	0	7
muukkaam(m)a	1	V:C:V:	7	8	7	8	7
muuttiim(m)a	1	V:C:V:	11	3	11	8	8
praakkaam(m)a	1	V:C:V:	3	4	0	8	8
praakkuum(m)a	1	V:C:V:	0	0	15	0	0
sööttiim(m)ä	1	V:C:V:	3	9	4	8	0
vaattiim(m)a	1	V:C:V:	3	8	16	10	9
haukkaam(m)a	1	V1V2C:V:	8	7	4	7	7
leikkaam(m)a	1	V1V2C:V:	0	4	0	0	0
loukkaam(m)a	1	V1V2C:V:	7	6	1	9	6
luikkaam(m)a	1	V1V2C:V:	7	7	3	9	8
näüttiim(m)ä	1	V1V2C:V:	7	8	2	9	8
paikkaam(m)a	1	V1V2C:V:	0	4	3	0	0
peittiim(m)ä	1	V1V2C:V:	0	0	3	0	0
toittiim(m)a	1	V1V2C:V:	8	6	4	7	9

ide	2	VCV	5	4	2
kada	2	VCV	4	6	5
kide	2	VCV	4	5	0
küdü	2	VCV	5	8	0
lugi	2	VCV	4	5	0
nägi	2	VCV	8	8	0
regi	2	VCV	5	3	4
rigo	2	VCV	4	5	0
siga	2	VCV	4	4	0
taba	2	VCV	4	7	4
tegi	2	VCV	4	4	0
togu	2	VCV	8	4	6
kokka	2	VC:V	4	5	4
kukka	2	VC:V	4	4	4
lukku	2	VC:V	4	4	4
otti	2	VC:V	4	4	4
püttü	2	VC:V	4	3	4
rokka	2	VC:V	4	4	0
tükkü	2	VC:V	4	11	0
jokee	2	VC·V:	6	11	10
läkää	2	VC·V:	4	4	5
lukoo	2	VC·V:	5	5	4
näköö	2	VC·V:	12	7	8
rekee	2	VC·V:	4	5	6
teköö	2	VC·V:	6	4	0
kokkii	2	VC:V:	6	0	0
kukkii	2	VC:V:	4	6	0
nokkii	2	VC:V:	3	5	8
püttüü	2	VC:V:	8	6	6
rikkoo	2	VC:V:	4	4	2
rokkaa	2	VC:V:	8	3	9
tappaa	2	VC:V:	4	3	4
tükküü	2	VC:V:	4	0	0

Conclusion

This study was devoted to the dynamic quantity-related prosodic processes observed in now nearly vanished Finnic varieties of Ingria: Ingrian, Votic, Ingrian Finnish, mixed Siberian Ingrian/Finnish. It was based on the field material collected from the last speakers by the author and colleagues throughout the last 15 years. A special focus of the project was on the processes of isochronic non-initial vowel reduction and “anti-isochronic” prosodically motivated gemination, as well as on several phonological rarities observed in these varieties

The Soikkola Ingrian phonology presents relatively clear cases of two cross-linguistic phonological rarities: the ternary quantity contrast (Ladefoged & Maddieson 1996; Blevins 2004) and the ternary foot rhythm (Martínez-Paricio & Kager 2015; Torres-Tamarit & Jurgec 2015; Golston 2019). Secondary gemination before short vowels in a trisyllabic foot makes this type of foot clearly stand out both in contrast with a disyllabic foot and a trisyllabic word consisting of a disyllabic and a monosyllabic foot, and in general does not have parallels in the Finnic space. The other still surviving dialect of Ingrian, the Lower Luga dialect, in turn, contains voiceless vowels, also a very rare feature (Ladefoged & Maddieson 1996; Blevins 2004). A similar mixed variety of Lower Luga Ingrian and Ingrian Finnish situated in Siberia manifests a rare series of consonants which are both palatalised and labialised (cf. Golston & Kehrein 2015) and opposed to plain, aspirated, palatalised, labialised series.

One might wonder why so small and closely related varieties concentrate so many phonological cross-linguistic rarities. It has been noted that small languages often exhibit typologically rare features (Whalen & McDonough 2019). Suggested reasons include a sociolinguistic distance observed between those varieties and big languages (Mansfield & Stanford 2017), or an especially strong motivation of their speakers to be different (Bird & Kell 2017). Statistically, rarer language use might also increase the probability for preserving the quirks of random drift (Jäger forthcoming).

An additional reason might be exactly the status of small non-standardised languages and the fact that they are being documented on the verge of extinction. For example, the case of the ternary contrast in Soikkola Ingrian is purer than similar Estonian, Livonian, and Saami cases; moreover, it is probably the purest case attested up to now. This is due simply to the fact that the prosodic system of Soikkola Ingrian is a bit more archaic and still partially preserves the length contrast of second syllable vowels. The observed language drift under a combined influence of isochrony and “anti-isochrony” is exactly the same as in Estonian, but the system just has not arrived there yet.

However, due to the language shift into Russian, the remaining few speakers of Soikkola Ingrian do not communicate in the language any more, and do not adjust to each other's speech behaviour, which would be a necessary prerequisite for a sound change to be completed. Each speaker conserved the language learnt in early childhood. Soikkola Ingrian, therefore, is likely never to arrive at the state of the Estonian prosodic system and to remain in phonological typology the way it was documented and described in these last years, although the current stage of its prosodic development might actually be just a very brief period in the life of a big vital language. The same considerations are valid also for the rare series of voiceless vowels in Southern Lower Luga Ingrian and of labiopalatalised consonants in Siberian Ingrian / Finnish.

In this sense, all these cases might be possible examples of how an unfinished sound change in a moribund language could also contribute to the reasons of the numerosity of rare features documented for endangered speech communities. As progressively more world languages are disappearing or become endangered, while more archived material on them is coming into use, such sociolinguistic factors should probably be considered by the phonological typology more often. Not just a mere structural feature in itself should be important, but also in which sociolinguistic conditions it was documented and for how long it has survived in the language.

Appendix I. Glosses

1, 2, 3 — 1, 2, 3 person

ACT — active

AD — adessive

ALL — allative

GEN — genitive

CND — conditional

CMP — comparative

IMP — imperative (by default, 2SG)

ILL — illative

IN — inessive

INF — infinitive

IPS — impersonal

PL — plural

PRS — present

NMLZ — nominalisation

NOM — nominative (default; not marked in glosses)

PC — participle

PL — plural

PRS — non-past (default; marked only in participles)

PRT — partitive

POS — possessive

PST — past

PTC — participle

SG — singular

SUP — supine.

TRL — translative

Appendix II. Other abbreviations

Es — Standard Estonian

EsCN — Central North Estonian dialect

Fi — Standard Finnish

FiI — Ingrian Finnish

FiRyž — mixed Siberian Ingrian/Finnish variety of the Ryžkovo village

FiSK — South-Eastern Finnish dialects of Karelia

InCLL — Central Lower Luga Ingrian

InLL — Lower Luga Ingrian

InNLL — Northern Lower Luga Ingrian

InS — Soikkola Ingrian

InSLL — Southern Lower Luga Ingrian

VoL — Votic of the Luu(di)tsa village

ct — categorisation

int. — interviewer

ms — milliseconds

pr — production

σ — standard deviation

Appendix III. Signs of phonetic and phonological transcription

a. Generalised signs for the types of segments

C — singleton/short consonant

C̆C / Cˑ — short geminate

CC / Cː — long geminate (in case of the ternary quantity contrast); long consonant

C' — palatalised consonant

C˚ — labialised consonant

C'˚ — labiopalatalised consonant

R — sonorant

T — stop

V — short vowel

V̀ / Vˑ — lengthened vowel

Vː — long vowel

VV — long vowel or diphthong

V_1V_2 — dipthong

V_1 — first syllable vowel (but in diphthong V_1V_2 — first vowel)

V_2 — second syllable vowel (but in diphthong V_1V_2 — second vowel)

b. Phonetic signs

Prosodic signs

[-] — syllable boundary (when it should be explicitly marked)

[ˈ] — primary stress

[ˌ] — secondary stress

[Ø] — vowel loss

Vowels (quantity)

[^{i}] — reduced eliding vowel

[i̯] — non-syllabic vowel

[ĭ̥] — reduced devoiced vowel

[ĭ] — reduced vowel

[i] — short vowel

[ì / iˑ] — lengthened vowel

[ī / iː] — long vowel

[ī̀] — overlong vowel

Some particular vowel qualities

[ü] — high rounded front vowel (also *y*, in Finnish orthography)

[ö] — mid rounded front vowel

[ä] — low unrounded front vowel

[ə] — “schwa”, mid unrounded mid vowel

[ɵ] — “rounded schwa”, mid rounded mid vowel

[ɨ] — high unrounded mid vowel (also *ы*, in Russian orthography)

[õ] — mid unrounded back vowel (esp. used in Estonian and Votic orthography)

Consonants (quantity, voicedness, and articulatory elaborations)

[d] — voiced consonant

[ᴅ / d̥] — half-voiced consonant

[t] — short/singleton consonant

[t̀] — lengthened consonant (could contain or not contain syllable boundary)

[t̆t] — short geminate (contains a syllable boundary)

[tt] — long geminate (contains a syllable boundary)

[t̀t] — overlong geminate (contains a syllable boundary)

[t̄] — long consonant not containing a syllable boundary

[t'] — palatalised singleton/short consonant

[t't'] — fully palatalised geminate

[t't] — geminate palatalised only in the first half

[t°] — labialised consonant

[t'°] — labiopalatalised consonant

[t^h] — aspirated consonant

Some particular consonantal types

[ł] — velarised lateral approximant

[š] — voiceless double-peak (“hissing”) sibilant

[ž] — voiced double-peak (“hissing”) sibilant

[č] — voiceless double-peak affricate (also *tš*, in Votic orthography)

[ŋ] — velar sonorant

c. Phonological signs

i. Prosodic signs

´ — light accent

` — heavy accent

ii. Segmental signs

i — short vowel

ī / *ii* — long vowel

ĭ — reduced vowel

t — singleton/short consonant

ť̆t — short geminate

tt — long geminate (in case of the ternary quantity contrast); long consonant

t̄ — long consonant (does not contain a syllable boundary)

t' — palatalised consonant

t° — labialised consonant

t'° — labiopalatalised consonant

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