Natalia Aralova

Vowel harmony in two Even dialects

Production and perception

This dissertation analyzes vowel systems in two dialects of Even, an endangered Northern Tungusic language spoken in Eastern Siberia. The data were collected during fieldwork in the Bystraia district of Central Kamchatka and in the village of Sebian-Küöl in Yakutia.

The focus of the study is the Even system of vowel harmony, which in previous literature has been assumed to be robust. The central question concerns the number of vowel oppositions and the nature of the feature underlying the opposition between harmonic sets. The results of an acoustic study show a consistent pattern for only one acoustic parameter, namely F1, which can be phonologically interpreted as a feature [±height]. This acoustic study is supplemented by perception experiments. The results of the latter suggest that perceptually there is no harmonic opposition for high vowels, i.e., the harmonic pairs of high vowels have merged. Moreover, in the dialect of the Bystraia district certain consonants function as perceptual cues for the harmonic set of a word. In other words, the Bystraia Even harmony system, which was previously based on vowels, is being transformed into new oppositions among consonants.

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Vowel harmony in two Even dialects:

Production and perception

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Natalia Aralova

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Contents

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Author contributions

A preliminary version of Chapter 3 was published as Aralova, Grawunder & Winter (2011). Aralova provided the data, designed the research, interpreted the results, and wrote most of the paper. Grawunder contributed through measurements in PRAAT and comments on the text, and Winter carried out the mixed-effects analysis and provided the description of this analysis.

Abbreviations and symbols

Abbreviations

1	first person
2	second person
3	third person
ABL	ablative
ACC	accusative
ADJR	adjectivizer
AGNR	agent nominalizer
ALL	allative
ANT.CVB	anterior converb
AUG	augmentative
CAUS	causative
CONAT	conative
COND.CVB	conditional converb
DAT	dative
DES	desiderative
ELAT	elative
EMPH	emphatic particle
EP	epenthetic vowel
FUT	future
GNR	generic
HAB	habitual
IMP	imperative
IMPF.PTC	imperfective participle
INCH	inchoative
INCL	inclusive
LOC	locative
MED	medio-passive
NEG.CVB	negative converb
NONFUT	non-future
PF.PTC	perfective participle
PL	plural
EX	exclusive
PLEN	plentitive
POSS	possessive
PRFL	possessive reflexive
PROGR	progressive
PROL	prolative
PROP	proprietive
PST	past
PST.PTC	past participle
PTL	particle
PURP.CVB	purposive converb
Q	question marker
RES	resultative
SG	singular

Symbols

[ ]	phonetic representation
/ /	underlying representation
'	primary stress
.	syllable boundary
-	morpheme boundary
=	clitic boundary

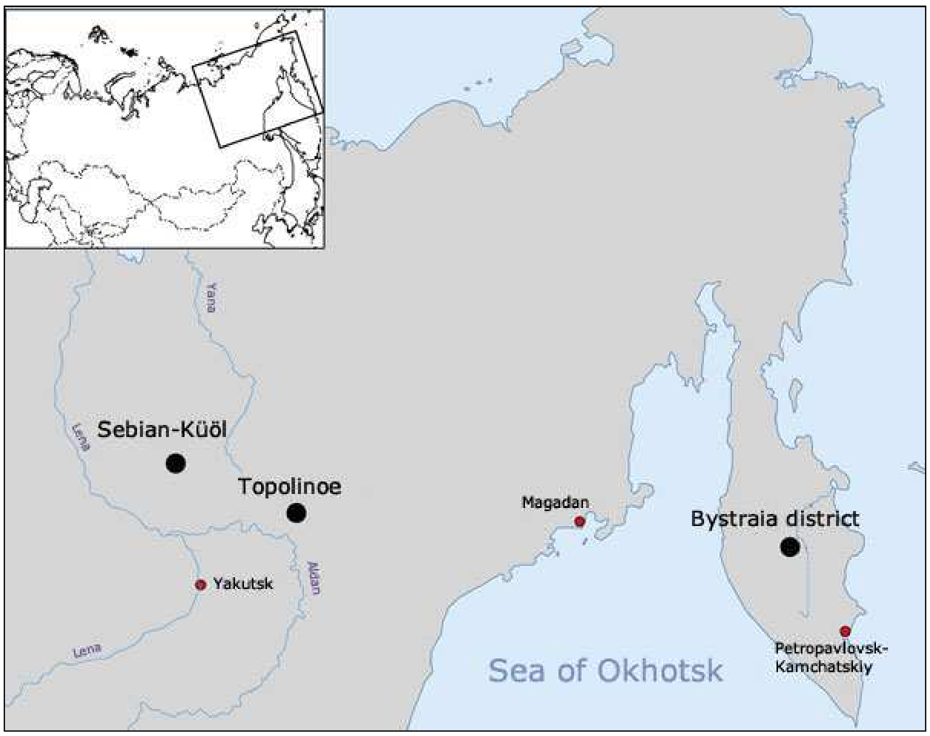
1 Introduction

The project under the auspices of which the present work was carried out ("Documentation of the dialectal and cultural diversity among Evens in Siberia") involved three dialects of Even, a Tungusic language spoken in northeastern Siberia. Two of the dialects concerned are spoken in Yakutia (in the villages Sebian-Küöl and Topolinoe), and the third one is spoken in the Bystraia district in Central Kamchatka (see Fig. 1.1). However, in the present dissertation I focus only on the two peripheral dialects, namely Even of the Bystraia district and Even of Sebian-Küöl. A comparative phonetic and phonological description of Even dialects is needed because of the striking differences between the dialects, the endangered status of this language and the importance of Even data for understanding some basic principles of Tungusic phonology.

For several decades Even has been claimed to be one of the classical examples of a language with a vowel system with tongue root distinction. Ard (1980: 27) wrote: "...it seems clear that for Even at least, the hard vowels are produced by an articulatory gesture involving the retraction of the tongue root". This was deemed to be a characteristic of other Tungusic languages as well and formed the basis on which the hypothesis of "retracted tongue root" (RTR) as a feature of the Proto-Tungusic vowel system was proposed. Nowadays, Siberia is seen as one of the linguistic areas with RTR vowel systems, and the existence of this distinction in Even is accepted by many linguists (Li 1996, Zhang 1996: 213, Kim 2011: 40, Ko 2012: 332-338, Ko, Joseph & Whitman 2014). However, the first hypothesis was postulated on the basis of only one out of thirteen Even dialects. Until recently no acoustic data of any Even dialect were available to draw a conclusion about the plausibility of this hypothesis. The present thesis aims to fill this gap, providing acoustic data and the results of perception experiments for two dialects of Even.

In this Introduction I give a general overview of the Even language, its geographical distribution and its place within the Tungusic family. I also discuss the proposed classifications of Even dialects, the sociolinguistic situation and linguistic contacts with neighbouring peoples and summarize the previous studies on various Even dialects. At the end of the Introduction I explain what kind of data I used in my work.

Fig. 1.1. Field sites of the DoBeS project[1].



1.1 Geographical location and genealogical affiliation

Even is spoken in eastern Siberia, from the Lena river to the east, including the coast of the Sea of Okhotsk and the Kamchatka and Chukotka peninsulas, in several administrative districts of the Russian Federation.

It is commonly accepted that Even belongs to the Northern branch of the Tungusic language family. The question concerning the genealogical relationship among these languages arose more than a century ago. Starting with Shrenk (1883), several classifications of the Tungusic languages were proposed. Cincius (1949) divided these languages into two groups with the following subdivisions:

[1] The map is produced by the Multimedia Department of the Max Planck Institute for Evolutionary Anthropology.

(1.1) Genealogical grouping by Cincius (1949)
1. Northern group (or Tungusic)[2]
    a. Evenki (Negidal and Solon are seen as dialects)
    b. Even
2. Southern Group (or Manchu)
    a. Manchu
    b. Nanai (Ulch, Orok, Kur-Urmi are seen as dialects)
    c. Udege (Oroch is seen as a dialect)

Later Sunik (1997) proposed another division:

(1.2) Genealogical grouping by Sunik (1997)
1. Tungusic group
    a. Siberian group (or Evonki)
        i. Even
        ii. Solon
        iii. Negidal
        iv. Evenki
    b. Amur group (or Nani)
        i. Nanai
        ii. Ulch
        iii. Orok
        iv. Oroch
        v. Udege
2. Manchu group
    a. Written Manchu and its spoken dialects
    b. Extinct Jurchen

There is still no agreement about the exact division of the Tungus languages. Janhunen (1996) proposes a division into four branches: Manchu, Nanai, Udege and Evenki. Doerfer (1978) suggests a division into three groups: Northern, Central and Southern, but also proposes a scheme of relations between languages which is similar to a network. The idea of the network approach was supported by Whaley, Grenoble, & Li (1999), who showed that the Northwestern Tungusic languages cannot be classified using a tree model. Two main reasons for this are the shallow time depth of the Tungusic family,

[2] The spelling of several language names varies in different sources, e. g., Udege (Comrie 1981), Udeghe (Janhunen 1996; Girfanova 2002) or Udihe (Doerfer 1978; Nikolaeva & Tolskaya 2001); Ewenki (Janhunen 1996) or Evenki (Comrie 1981; Doerfer 1978); Ewen (Janhunen 1996), Even (Comrie 1981) or Ėven (Pakendorf 2007), where the ė stands for the Russian grapheme э. I use here the most common spelling variants.

which according to these authors weakens the reliability of sound and morphological correspondences, and a tight contact situation both between speakers of Tungusic languages and with speakers of neighbouring languages (Turkic, Mongolic, Chinese, and Indo-European). This situation of close contact is favourable to the transfer of linguistic features between dialects and languages, which increases similarities between them.

Thus there is still some disagreement on what to count as a separate language or as a dialect (e.g. the position of Solon with respect to Evenki) and on how to classify these languages, i.e. which languages belong to which groups, which groups are more closely related than others etc. Despite these mismatches in the previous classifications, Even is usually grouped together with Evenki, Solon, and Negidal. Oroqen, a variety spoken in northern China that is linguistically close to Evenki, is also included in this group (Lulich & Whaley 2012). This fact is relevant for the current work, since my study is devoted to the phonetic and phonological features of specific Even dialects. Available data on the phonetics of the closest languages or varieties, namely Solon and Oroqen, will be taken into account for comparative reasons.

On a larger scale, the Tungusic languages are considered by some researchers to be a part of the Altaic language family, together with the Mongolic and Turkic languages (and potentially including Japanese and Korean – a unit that Johanson and Robbeets (2010) propose to label Transeurasian). This hypothesis (the so-called "Altaic theory") is still questioned: on the one hand, there are fundamental studies like the *Etymological Dictionary of the Altaic Languages* (Starostin, Dybo & Mudrak 2003) showing evidence for a common Altaic lexicon; on the other hand, there is a contrasting view, explaining lexical and structural similarities by contact between these languages in their prehistory (Doerfer 1985, Georg 2004).

For the goals of the present research the validity of the Altaic theory is not of primary importance, since this study deals with synchronic data of just one Tungusic language. However, the fact that all Altaic languages (Turkic, Mongolic and Tungusic) share the phonological property of vowel harmony cannot be ignored. There have been attempts to trace back the types of vowel harmony exploited in modern Tungusic, Turkic and Mongolic languages to a common single Proto-Altaic system (Vaux 2009).

Interestingly, the property of vowel harmony seems to be an areal typological feature of northeastern Asia. It is found not only in Turkic, Mongolic and Tungusic languages, but also in the Chukotko-Kamchatkan languages Koryak and Chukchi as well as in Yukaghir. At the same time, these languages present a wide range of vowel harmony types, being based on the articulatory feature "advanced tongue root" (ATR), vowel backness, or vowel height. Moreover, these systems differ with respect to the trigger of vowel harmony: the Turkic, Mongolic and Tungusic languages as well as Yukaghir have root-controlled vowel harmony, whereas in Chukchi and Koryak both roots and suffixes can trigger vowel harmony, depending on which vowel they contain.

1.2 Dialects

Even is dialectally highly fragmented. It is difficult to give a precise number of its dialects, since different sources report different dialectal groups. In one of the first detailed Even grammars (Cincius 1947), eleven dialects are discussed:

(1.3) Classification of Even dialects by Cincius (1947)

1. Eastern dialectal group
    a. Kolyma-Omolon dialect
    b. Ola dialect
    c. Kamchatka dialect
    d. Okhotsk dialect
    e. Upper Kolyma dialect
    f. Indigirka dialect (including the dialect of the Moma region)
    g. Tompo dialect
2. Western dialectal group
    a. Sarkyryr (Sakkyryr nowadays) dialect
    b. Lamunkhin dialect
    c. Yukaghir dialect
3. Arman dialect (not included in any dialectal group)

Later this classification of Even dialects was revised by Novikova (1960), who proposed a distinction between eleven dialects divided into three dialectal groups and Arman as a separate language:

(1.4) Classification of Even dialects by Novikova (1960)

1. Eastern dialectal group
    a. Kolyma-Omolon dialect
    b. Ola dialect
    c. Penzhina district dialect
    d. Bystraia district dialect
    e. Okhotsk dialect
    f. Anadyr dialect
2. Central dialectal group
    a. Moma dialect
    b. Tompo dialect
    c. Allaikha dialect
3. Western dialectal group
    a. Lamunkhin dialect
    b. Tyugesir dialect

Novikova bases her grouping on shared phonetic and grammatical features, but she also notes that the dialects spoken in Yakutia (belonging to the Central and Western dialectal group) need further investigation. *The Comparative Dictionary of the Tungusic Languages* (Cincius 1975) contains Even data attributed to fifteen dialects: in addition to the dialects Novikova included into her classification, The Comparative Dictionary contained data on the Anyujsk dialect, the Northern-Even dialect (probably, Gizhiga), the Arman dialect and the Yukaghir dialect. The latest summary on the dialectology of Even is a chapter in Burykin (2004), synthesizing all available published data together with the author's field data. Burykin suggests that dialects were previously defined on the basis of three parameters: linguistics, geography and ethnic (self-)identity. If one takes into account only linguistic data, the division into dialects would look as follows (ibid.: 85).

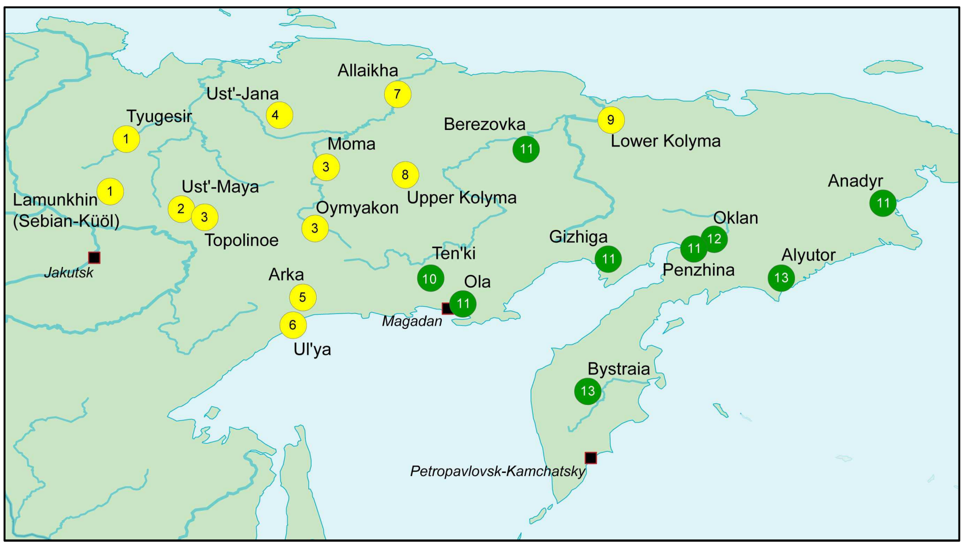
Table 1.1. Even dialects (excluding Arman), from Burykin (2004).

Western dialects	Eastern dialects
1. Sakkyryr dialect	10. Ten'ki district dialect
Lamunkhin	11. Ola dialect
Tyugesir	Ola
2. Ust'-Maya dialect	Berezovka
3. Indigirka dialect	Gizhiga
Oymyakon	Penzhina
Tompo	Anadyr
Moma	12. Oklan dialect
4. Ust'-Yana dialect	13. Kamchatka dialect
5. Arka dialect	Bystraia
6. Ul'ya dialect	Alyutor
7. Allaikha dialect	
8. Upper Kolyma dialect	
9. Lower Kolyma dialect	

The question if the now extinct Arman variety has a dialectal status or is a separate language cannot be answered. The other dialects belong to two dialectal groups, which do not correspond to any grouping proposed before. According to Burykin, the Western dialects are more numerous; they include the group called Central by Novikova, some Kolyma dialects classified as Eastern before, and the westernmost Sakkyryr dialect. The latter unites Lamunkhin and Tyugesir Even, which were previously treated as separate units. Burykin (ibid.: 80) claims that these names are the names of two clans, but that these two Even communities do not differ linguistically. Some Eastern dialects, which were described as different varieties, are also classified by Burykin as one unit (e.g. the Ola dialect is spoken also in the districts of Penzhina, Gizhiga, Anadyr, and Kolyma).

The geographic distribution of the dialects is shown in Fig. 1.2., in which the numbers refer to the dialects in Table 1.1.

Fig. 1.2. Dialect map created with the Interactive Reference Tool (Bibiko 2005) and based on the classification from Burykin (2004).



It is important to note that the terminology used by both Soviet and contemporary Russian scholars differs from that used in the anglophone literature. In the Russian-speaking tradition the term *dialekt* ‘dialect’ is used for a bigger category uniting several local varieties (called *govor*) of Even. Thus, in Cincius (1947: 7) the Western dialect is opposed to the Eastern dialect, and each of them has a number of varieties (Russian *govory*). In English, Sharina (2013) uses the term *subdialect* meaning the Russian term *govor*. However, in the present research I refer to the varieties (*govory*) as dialects. When I speak of the dialect of the Bystraia district I mean the particular local variety *Bystrinsky govor* and not the whole group of the Eastern dialects.

In this thesis the main focus is on the dialects of the Bystraia district (one of the Kamchatka dialects) and Sebian-Küöl (one of the Sakkyryr dialects, traditionally called the Lamunkhin dialect). The dialect of the Bystraia district is spoken in central Kamchatka, mainly in the villages Esso and Anavgai and also in the adjacent fishing camps and reindeer brigades. In 2007, the Bystraia district counted 2727 inhabitants in total,[3] of which nearly 30% were Evens (Gernet 2008: 88). The other dialect which is examined here is spoken in Sebian-Küöl, a village located to the north of Yakutsk in the Sakha Republic. Sebian-Küöl had 753 inhabitants in 2013 (Svedeniya o čislennosti 2013). For 2009, approximately 85% of the population were Evens (Pakendorf 2009: 86). In the further discussion, I will refer to it as "Even of Sebian-Küöl" or "the Sebian dialect", though traditionally in the descriptions of Even dialects it is called Lamunkhin. The dialects of Bystraia and Sebian-Küöl are spoken at the eastern- and westernmost periphery, respectively, of the Even-speaking area. They are hardly mutually intelligible.

1.3 Contact and sociolinguistic situation

All Even dialects have been in contact with other languages to various degrees. This contact has had a strong influence both structurally and sociolinguistically, having reduced the scope of use of some dialects and having led to the extinction of others. The sociolinguistic circumstances of the dialects of the Bystraia district and Sebian-Küöl are very different; therefore these dialects have undergone different contact processes.

The history of the contact of Evens with the indigenous people of Kamchatka started in the middle of 19th century, when several dozens of Evens came to the peninsula from the eastern Siberian mainland (Gernet 2008: 13-14). Due to contact with Koryaks and Itelmens, there are a certain number of lexical borrowings from the Chukotko-Kamchatkan languages Alutor and Itelmen in the Kamchatka dialects of Even. For instance, Even /temujon/ 'slaughtered reindeer'< Alutor *təmjun* 'slaughtered animal' (Kibrik, Kodzasov & Muravyova 2000: 142, 401); Even /koja:lat/ 'herd in mountains' < Koryak *qoja-* 'reindeer' (Moll 1960: 61), and Even /katep/ 'a sort of fish trap' (Russian *morda* 'muzzle') < Itelmen *katet* 'mouth' (Dybowski 1998: 69). Many speakers who contributed to the DoBeS project report that their ancestors were bilingual in Even and Koryak as late as the second half of the 20th century. Nevertheless, in the Bystraia dialect more lexical items of Even origin were retained in comparison to the Western dialects.

Nowadays the dialect of the Bystraia district is highly endangered and being replaced by Russian. Starting from the 1930s the number of Evens literate in Russian grew because of the Soviet language policy which insisted that each Soviet citizen should have a knowledge of Russian. The prestigious status of Russian, together with a Russian-based school education and care in boarding schools and sometimes an explicit prohibition to use Even resulted in people switching from their native language to Russian (see the similar situation in Evenki reported by Grenoble & Whaley 1999; and the general overview of language shift taking place for most peoples of Northern Siberia

[3] The data come from the government of Kamchatka (accessed April 4th, 2015): http://www.kamchatka.gov.ru/?cont=oiv_din&menu=4&menu2=0&id=214&oiv_id=1053

provided by Vakhtin 2001). The Bystraia dialect of Even is not being transmitted to children anymore; the youngest speakers of this Even variety are about 40 years old. It is only the older generation who uses the language to a large degree, but also among these people the use is restricted to the private domain.

The sociolinguistic situation in the village of Sebian-Küöl is different. Even of Sebian-Küöl is influenced by Sakha (Yakut) – a Turkic language which is the official language in the Republic Sakha (Yakutia). Evens are numerically dominant in the village, and the rest of the population is mainly Sakha (Pakendorf 2009: 89). Most Evens are trilingual in Even, Sakha and Russian. But it is Sakha which is used widely in public life (in the local administration, in the stores, etc.) This situation has led to strong morphological and lexical changes in the Sebian dialect. There are numerous lexical borrowings from Sakha (verb and noun stems, particles, and numerals). Structural change in Sebian Even, such as the copying of verbal paradigms from Sakha, was described by Pakendorf (2009, 2014, 2015). Lexical borrowings from Russian can also be detected; the majority of them entered the language via Sakha.

Even of Sebian-Küöl is spoken by people of different ages. It is acquired by children as a first language and also used by young people. But Sakha is spoken more frequently; it is used by default in the communication between Even and Sakha speakers. These situations have increased in frequency: Sakha is used in communication between school children or in families if one of the spouses is Sakha (data from an unpublished sociolinguistic survey conducted by B. Pakendorf in 2009). These factors pose a threat to the continued viability of Even in this village.

Another important problem here is the teaching of Even in schools. There are Even classes in the school as an obligatory subject in Sebian-Küöl and as an optional class in the Bystraia district, and there are also kindergartens with Even classes in all villages. In principle, this could have had a positive influence on language revitalization. However, it is the standard variety of Even (the so-called "literary" language) which is being taught in the schools. Standard Even was created in the 1930s on the basis of the Ola dialect. The first Even writing system was created about the same time. This choice of Ola Even was rather arbitrary[4]. Standard Even was expected to become the language of interdialectal communication and Even literature. But nowadays there is not a lot of communication between different groups of Evens and clearly no communication at all between the peripheral ones. There is also no common TV program in Even or a newspaper in Even which would encourage all Even speakers to use the standard language. Because of this, speakers of dialects other than Ola often make a clear distinction between their spoken variety and the standard language. In recent times there were examples of publications in local dialects of Even: books by A. Krivoshapkin (see

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[4] "…the speakers of which [the Ola dialect, NA] were at that time the most culturally and economically advanced group of Evens" (Novikova 1960:26; translation mine).

Burykin (2004: 81)) in the Sakkyryr dialect and an Even appendix to the local newspaper *Novaya Zhizn'* (New Life) in the dialect of the Bystraia district. It is quite common that people adapt the standard orthography to the needs of their local dialects. Thus, the reduced vowels of the Kamchatka dialect are often written with "ы" (grapheme corresponding to the Russian mid high /ɨ/). In Sebian-Küöl, the Sakha orthography is widely used for Even. It differs from that of Standard Even in having a more explicit way of writing the palatalized consonants /ń/ and /dʒ/: they are written with the corresponding non-palatalized consonants followed by a palatalization sign (Russian *myagkiy znak*) instead of indicating the consonant quality via the following vowel, as is done in Standard Even and Russian. In addition, the pharyngeal fricative /ħ/ is usually written with the Latin letter "h" instead of the Cyrillic "x" used in the standard orthography. Nevertheless, standard Even is taught in school. This fact makes the attempts to maintain Even among children even less efficient, since the language they learn in school differs from the language spoken by their grandparents (and perhaps parents) at home.

1.4 Previous studies on Even

The first Even data were collected in the middle of the 18th century by Lindenau (1983[1742]). After that some samples of data were collected by the members of several Siberian expeditions, e. g. I. Billings (expedition of 1795), G. v Meidel and J. v. Stubendorff (1860-1870s), and Bogoraz (the data collected in 1895 were published in Bogoraz 1931). Systematic studies on Even started in the late 1920s to early 1930s, when the attention of the Soviet government was turned towards the minority peoples, and the description of minority languages, the creation of alphabets, and the improvement of literacy of the indigenous people became a primary task. In the beginning of the 1930s the first Even school books were written (Burykin 2004: 65).

The first detailed Even grammar was written by V. I. Cincius in 1947, who paid special attention to the questions of phonetics and orthography. Unfortunately, it is hard to determine the concrete regional origin of these data. The data were collected from Even students at the *Northern Institute of the Leningad State University* (*Severnyj Institut*), who were originally from different Even-speaking regions: the Magadan region (Ola, Seimchan, Gizhiga), Okhotsk, Yakutia (the Northern region around Verkhojansk, the regions of the Indigirka and Lena rivers) and Kamchatka (Cincius 1947: 9). According to the opinion of the late V. A. Robbek (p. c.) – a native speaker of Even, an expert in Even dialectology, and a former student of V. I. Cincius – these data are very close to the Kamchatka dialects. Some phonetic properties are similar to the ones I observed in my data from the Bystraia district.

A grammar sketch of Even published a few years later as an appendix to the Russian-Even dictionary (Cincius & Rišes 1952) has a brief section on phonetics and orthography. The source for the phonetic description was the manuscript of Novikova's PhD thesis "The Ola dialect of Even" (Novikova 1948; see footnote in Cincius & Rišes (1952) on p. 696). Thus, it was the first publication of Novikova's phonetic analysis, which was released later as part of her description of the Ola dialect.

In 1960 Novikova officially published her description of the Ola dialect (the basis for standard Even) as a separate book. This work contains the most comprehensive phonetic and phonological description of any Even dialect to the present day. Her research was based on fieldwork data, archive materials and the results of experimental studies she conducted in the phonetic laboratory at Leningrad University.

The description of Eastern Even dialects by Benzing (1955) was based on published texts and textbooks, first and foremost on the textbook of Levin (1935). The phonetic section by Benzing was also based only on published data. The description deducts the pronunciation from orthography, which makes it difficult for the reader to distinguish phonetic variants designated by the same symbol.

Later studies focused on separate Even dialects. The research of Lebedev (1978) is devoted to the Even dialect of the Moma district. This work also contains a separate phonetic section, but the author concludes that with respect to the vowel system this dialect is very close to standard Even. A later work by Lebedev (1982) deals with Even varieties of the Okhotsk region, spoken in the districts of Arka, Ul'ya, and some neighbouring areas. The description of Sotavalta & Halén (published in 1978, but the data were collected in 1928) deals with the Bulun dialect spoken in the northern area between the Lena and Jana rivers. However, it is based on the data of only one speaker who was invited to Helsinki to provide linguistic information. Sotavalta gave detailed phonetic notes and examples for his transcription, but there is no phonological analysis as such. The work of Robbek (1989) was devoted to the Berezovka dialect spoken in the Srednekolymsk district. Robbek provided quite a detailed picture of the phonological system in this dialect, highlighting the differences and similarities of Berezovka Even to the other dialects.

As one can see, although a number of scholars paid attention to the various dialects of Even, there were no studies looking specifically at the phonological systems and comparing these in several dialects.

1.5 Types of data used for the analysis

This work is focused on the organization of the vowel system in two Even dialects. To investigate the nature of the harmonic opposition and the number of vowel phonemes I used acoustic and perception data. Acoustic data recorded from four speakers in each dialect allowed me to estimate the variation between the speakers, and also to see the tendencies at the dialectal level. Clearly, more speakers would be desirable for data verification. However, for the acoustic study conducted under field conditions eight speakers is a considerable number, especially if one compares it to the acoustic studies in Tungusic languages published recently. For example, Kang & Ko (2012) used data from only one Even speaker and Lulich & Whaley (2012) presented data from three Oroqen speakers. Moreover, perception experiments have never been used to study how Even speakers categorize vowels. This approach was completely new for the field of Tungusic studies. In general, using a very similar set of stimuli in both dialects is optimal, since in this way these dialects were being studied in parallel. It was helpful for both acoustic and perception studies, because having the comparative data one can contrast the differences in two dialects.

The data for this thesis were collected during three expeditions: I visited the Bystraia district twice (in 2009 and 2011) and I went to the village of Sebian-Küöl once (2010). I started off with the acoustic analysis of vowels (production study), but the question of possible mergers made it necessary to conduct a perception study for a better understanding of the oppositions which are made by the speakers. For the production study the data were recorded from speakers of the Bystraia dialect and the Sebian dialect. The initial stimulus word list was taken from Novikova (1960) and adapted to the local varieties. Recordings of this list became the basis for my description and were used for the acoustic measurements. For the perception test the stimuli were created on the basis of the initially recorded word list and data recorded in addition. More detailed information about the speakers and stimuli can be found in the corresponding chapters within the description of the experimental settings and the recording workflow: Chapter 3 and Chapter 5 (production studies of vowels and some consonants) and Chapter 4 (perception study).

Besides these experimental data, I used a corpus of oral texts of different genres recorded from numerous speakers by Brigitte Pakendorf and me within the DoBeS project and previous work on Even by Brigitte Pakendorf. This text collection consists of spontaneous narratives, conversations, pieces of folklore and procedural texts, which are transcribed, translated, morphologically analyzed and accompanied by phonetic notes. This kind of data enriched and complemented the experimental materials that were specifically elicited for phonetic analysis. Using data from annotated narratives allowed me to search for missing phoneme combinations and to check my hypotheses in a larger text corpus, which is very important for descriptive work.

1.6 Structure of the dissertation

My dissertation is organized as follows. In Chapter 2, I discuss phonological differences between different Even dialects with the Ola dialect as a reference point. Despite my main interest in the vowel system and the process of vowel harmony, my intention here is to give the reader a general overview of the phonology of Even. Thus, I describe the consonant system, the vowel system and various phonotactic phenomena. Besides this, I briefly outline different approaches to the Even vowel systems and describe the state of the art both in terms of methods and in terms of the degree of elaboration of each phonetic description. On the basis of this overview I formulate the research questions which I investigate in the following chapters.

In Chapter 3, I describe the acoustic correlates of the feature ATR/RTR and the corresponding articulation in the different languages of the world. Here I focus specifically on what was done by previous researchers of the Tungusic languages in the field of acoustic phonetics. I move on to present my own analysis of Even vowels. In the discussion section I demonstrate why it is hard to match my results with the data from the other languages and come to the conclusion that my results do not justify the ATR/RTR-hypothesis.

Chapter 4 is devoted to three perception experiments which I conducted in the field. I explain the experimental settings, the motivations for the choice of stimuli and the workflow of the experiments. Further, I present the results of each experiment in each field site. Finally, I discuss the results of these experiments for each vowel opposition. It turns out that in the perception experiments the speakers experienced problems in recognizing words with vowels of different harmonic sets — especially as concerns words with high vowels. Interestingly, in the dialect of the Bystraia district some consonants appear to play an important role in the discrimination of the members of minimal pairs.

Following the results of Chapter 4, in Chapter 5 I concentrate on the acoustic properties of these consonantal cues. I examine the formant structure of the liquid consonants /r/ and /l/ in the context of vowels of different sets. Another object of interest is the variation of velar/uvular voiceless stops in words pertaining to different harmonic sets. In the discussion I stress that in the Bystraia dialect the phonetic realization of these liquids and velar/uvular voiceless stops depends on the harmonic set of the word, although the effect is not statistically significant for the trill-consonant.

In Chapter 6, I summarize the findings of the three previous chapters. I discuss the nature of the vowel opposition and the plausibility of using the label [±ATR] for Even. Using the variationist approach and the concept of 'near-merger' I bring the results of Chapter 3 and Chapter 4 into agreement. I observe strong inter-speaker variation which might be an indication of an ongoing change towards a merger of the harmonic pairs of high vowels. Moreover, the dialect of the Bystraia district shows a tendency to lose the harmonic opposition of vowels whereas some consonants might have acquired a new phonemic status in this dialect.

2 Introduction to Even phonology with a focus on vowels

In this chapter, I provide a general overview of the Even phonological system. This overview is based on the descriptions of standard Even (Cincius & Rišes 1952) and the dialect of Ola, which is the basis for standard Even (Novikova 1960), but known dialectal differences are also specified relying on dialectal remarks from Cincius & Rišes (1952), Burykin (2004), descriptions of individual dialects, such as Lebedev (1978, 1982), Dutkin (1995), and on my own data for the dialect of the Bystraia district and the Sebian dialect (Sebian-Küöl).

In section 2.1 I describe the system of consonants, including allophonic variation and possible phonological processes which involve consonants. Section 2.2 is devoted to the system of vowels and the variation among them. In section 2.3 I discuss Even phonotactic rules, namely the structure of the syllable, possible consonantal clusters and the conditions for the insertion of the epenthetic vowel, and finally the principals of vowel harmony as a process affecting in most cases the whole phonological word. In section 2.4 I draw attention to the differences in the analyses of the Even vowel system by different scholars. On the basis of the phonological overview and the discussion of the various analyses proposed for the Even vowel system, in section 2.5 I formulate the main research questions of the dissertation which I address in the following chapters.

2.1 Consonants

Standard Even has 17 native consonants distributed according to the place and manner of articulation as shown in 0. In addition, the phonemes /f/, /z/, /ʃ/, /ʒ/, /t͡s/ occur in Russian loanwords. In the dialects spoken in Yakutia many borrowings from Sakha are used with Sakha phonology. Thus, two additional consonants of Sakha origins can be listed for the phoneme inventory of Western Even dialects: /x/ and /ɣ/.

Table 2.1. Even consonant phonemes.

		Bi-labial	Alveolar	Palato-alveolar	Palatal	Velar
Obstru-ents	Plosive	p b	t d			k g
	Fricative		s			
	Affricate			t͡ʃ d͡ʒ		
Sonorants	Nasal	m	n		ɲ	ŋ
	Trill		r			
	Approximant	w			j	
	Lateral Approximant		l			

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2.1.1 Phonetic description and allophonic variation

2.1.1.1 Stops

/b/ is a voiced bilabial stop. It occurs in initial, medial and final position in the word: /bebeː/ ‘cradle’, /eb/ ‘moist, urine’. In final position, it is rather rare and in this position it can have a voiceless allophone [p]. This is typical for the Bystraia dialect, but it seems to be relevant to a certain degree for the other Even dialects, too, since this possibility is mentioned in the dictionary by Robbek & Robbek (2005) and in the description of the Moma dialect (Lebedev 1982).

/p/ is a voiceless bilabial stop. It is frequent in medial and final position, but it occurs rarely in word-initial position. In the Toolbox dictionary[1] only 7 lexemes with initial /p/ can be found in almost 1600 lexemes in total. Semantically, all these lexical items can be referred to the field of sound symbolism, e.g. /pekteren-/ ‘to shoot’ (derived from onomatopoeic /pek/ ‘bang’), or /pasak-/ ‘to slap’.

/d/ is a voiced alveolar stop. Novikova (1960) reports that the constriction for this stop is created simultaneously at the teeth and alveolar ridge. It is not restricted to any particular position and occurs in word-initial, word-medial and word-final position: /digen/ ‘four’,

[1] This Toolbox dictionary was compiled on the basis of the texts interlinearized by Natalia Aralova & Brigitte Pakendorf within the DoBeS project “Dialectal and cultural diversity among Evens in Siberia” and previous work on Even by Brigitte Pakendorf referred to in section 1.5. The corpus contains texts recorded in the Bystraia district and in the village of Sebian-Küöl, as well as four texts recorded in the village of Topolinoe (Indigirka dialect).

/adị/ ‘how many, how much’, /gaːd/ ‘half’. Like the bilabial voiced stop, the alveolar stop can occasionally be devoiced in final position, in which case it is realized as [t]: [gụːt] ~ [gụːd][2] ‘high’.
/t/ is a voiceless alveolar stop. It has the same place of articulation as the corresponding voiced stop. Like its voiced counterpart, it is not positionally restricted: /teti/ ‘coat’, /ọraːt/ ‘grass’.
/g/ is a voiced velar stop. In word-initial position and in word-medial position following a consonant and preceding a vowel (in the context (C)VCgV(C)) it is realized as a stop: /gerbe/ ‘name’ [gerbə], /abgar/ ‘healthy’ [abgar]. In word-final and intervocalic position, as well as in word-medial position preceding a consonant, it is predominantly realized as a velar fricative [ɣ]: /tọg/ ‘fire’ [tọɣ], /ereger/ ‘always’ [erəɣər], /agdịrị/ ‘thunder’ [aɣdiri]. The only exception from this seems to be the position before /dʒ/. In this case /g/ is realized as a stop as well: /egdʒen/ ‘big’ [egdʲen]. In some Western dialects the fricative allophone can also alternate with a bilabial approximant [w]: [aɣdị] ~ [awdị] ‘thunder’ (cf. Dutkin 1995). The latter variant is also common for the Sebian dialect: [awdịrị] ‘thunder’, [hawdị] ‘old’ (/hagdị/ in Standard Even).
/k/ has two main realizations depending on the harmonic set of the word. There are two word sets determined by the vowels. Harmonic set 1 and set 2 are working definitions for the words containing vowels which are called by Novikova non-pharyngealized resp. pharyngealized; see section 2.3.2 for more details on set distinction and section 5.4 for a detailed description of these variants in the Bystraia and Sebian dialects. In set 1 words /k/ is realized as a velar stop [k], in set 2 words as a uvular stop [q]. Both realizations occur in all positions in the word: /keńeli/ ‘bad’ [keɲeli], /ikeːli/ ‘sing (imperative)’ [ikeːli], /erek/ ‘this’ [erek], /kam/ ‘dried fish’ [qam], /mụka/ ‘fur coat’ [mụqa], /tak/ ‘salt’ [taq]. For standard Even Novikova (1960) does not describe this variation in more detail and claims that the allophone [q] is obligatory in set 2 words. However, the data of the Bystraia district show that the variation in set 2 words is greater: this phoneme can be realized as a velar stop, uvular stop and uvular fricative (cf. section 5.4). For the Western dialects Novikova notes that the uvular stop is used only in initial and final position of set 2 stops and is restricted to adjacent vowels /a/ and /o/. This contradicts the data from the Sebian-Küöl dialect, where the uvular realization is not found (cf. section 5.4).

In the Allaikha dialect, the opposition of stop consonants seems to be different and probably need further detailed investigation. According to Dutkin (1995: 15), it is characterized as *lax* vs. *tense* articulation rather than *voiced* vs. *voiceless*, as in Standard Even. As Dutkin puts it, “… the consonants of the Allaikha dialect in these pairs [voiced

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[2] In the transcription I use the symbols <ị>, <ụ>, <ọ> and <ịa> for set 2 vowels (see section 2.3.2 for more details about the set distinction). The acoustic details concerning the realization of these vowels are discussed in Chapter 3. For ease of presentation and to enable a direct match with the data of Novikova (1960) I make this opposition in the transcription.

vs. voiceless –N.A.] are distinguished not by the participation of vocal folds, but by the tense/lax articulation. Thus, the consonants called voiceless are in reality strong, and corresponding voiced consonants are weak" (Dutkin 1995: 15, translation mine). Apart from observations on the production of voiced, or lax, consonants, additional evidence for this claim is found in the pronunciation of Russian words: Standard Russian /kuˈda/ 'where'→ Allaikha Russian /kuta/. Allaika Evens perceive the Russian /d/ as corresponding to their tense alveolar stop and thus pronounce it as a sound that Russians perceive as /t/.

2.1.1.2 Fricative

/s/ is a voiceless apical alveolar fricative. The distribution of the allophones of this phoneme differs across dialects so that it has become one of the main isoglosses contrasting Western and Eastern dialects. In standard Even (one of the eastern dialects) it is realized in all positions except word-initially as a fricative sound between [s] and [ʃ], which could be transcribed as retracted [s̠]: /ọsịkat/ 'star' [os̠ịkat], /us/ 'weapon' [us̠], but I will transcribe this sound simply as [s] in the following. In word-initial position it has a pharyngeal realization [ħ]: [ħịrqan] 'knife'. Since in Standard Even these variants are in complementary distribution, Novikova (1960) unites them as one phoneme.

In the Bystraia dialect initial [ħ] was lost ([ịrqan] 'knife') and now this dialect has only one variant of the phoneme /s/: it is realized as a fricative phonetically close to [ʃ]: [ọʃiqat] 'star', [uːʃeʃ] 'your sleeve'. A characteristic feature of the Western dialects is the realization of /s/ as [ħ] in all positions: [ħịrkan] 'knife', [oħịkat] 'star', [ħileħ] 'dew' (as in the Allaikha dialect according to (Dutkin 1995)). But in the Sebian dialect, while [ħ] occurs in word-initial and word-medial position, [s] is kept as an allophone word-finally: /orus/ 'joy' [ɵrus], but /orus-i/ 'joy-prfl.sg' [ɵruħi]. Following the notation accepted in the DoBeS project I use the symbol <h> when I refer to the pharyngeal fricative.

2.1.1.3 Affricates

/t͡ʃ/ is a voiceless palato-alveolar affricate. Novikova (1960) reports variation of this phoneme between palatalized [tʲ] and clearly affricated alveolopalatal [t͡ɕ] not only across speakers, but in the speech of one and the same person. This phoneme is not positionally restricted: /t͡ʃụːrịt/ 'beads', /kụŋat͡ʃan/ 'little child', /tụrkịt͡ʃ/ 'by sled.'
/d͡ʒ/ is a voiced palato-alveolar affricate. Like its voiceless counterpart, /d͡ʒ/ occurs with different degrees of palatalization from [dʲ] to [d͡ɟ̥] and can occur in all positions in the word: /d͡ʒụː/ 'house', /ajd͡ʒịt/ 'truth', /bad͡ʒ/ 'early'.

Further in the text I use the symbols <č> and <dʒ> to denote these phonemes following the notation accepted in the DoBeS project.

2.1.1.4 Nasals

Even has four nasal consonants: bilabial, alveolar, palatal and velar. They are not restricted to any particular position in the word. The following examples illustrate the usage of these consonants:
/m/: /maː-/ 'to kill', /em-če/ 'come-PF.PTC', /ọram/ 'reindeer.ACC'.
/n/: /nek-/ 'do', /hụnadʒ/ 'daughter', /omen/ 'one'.
/ɲ/: /ɲarị/ 'man', /haːɲịn/ 'smoke', /okeɲ/ 'milk'.
/ŋ/: /ŋịn/ 'dog', /nọŋan/ '3sg personal pronoun', /maŋ/ 'hard/be hard'.
For the palatal phoneme /ɲ/ I henceforth use the symbol <ń>.

2.1.1.5 Lateral glide

/l/ is a lateral alveolar glide. It is restricted to word-medial and word-final position: /ileŋ/ 'dry', /ŋaːl/ 'hand'. According to Novikova (1960: 74), /l/ has three allophones in the dialect of Ola which are distributed as following: The alveolar lateral [l] is used in the words of set 1. The velarized lateral [ɫ] is used in the words of set 2 (words with pharyngealized vowels in Novikova's terms). The palatalized [lʲ] is used preceding /č/, /dʒ/ and /ń/ in the words of both sets. Examples for the three realization types are: set 1 /belen/ [belen] 'help', set 2 /bụjla/ [bụjɫa] 'in the forest', set 2 /ịltʃar/ [ịlʲtʃar] 'braid'. The data of Bystraia Even match the description of Standard Even concerning the distribution of allophones both with respect to the set of the words and with respect to the palatalizing effect of /č/, /dʒ/ and /ń/. In the data of Sebian Even, allophonic variation is not found; /l/ is consistently realized as a plain alveolar lateral consonant.

In her description Novikova states that /l/ occurs in initial position only in a restricted number of borrowings from Russian. In the majority of borrowings initial /l/ is phonologically adapted in Even and replaced by /n/ or /ń/: Russian /ˈlampa/ 'lamp' → Ola Even /naːmpa/, Russian /ˈlʲenta/ 'band' → Ola Even /ńeːnta/. However, in my data, as well as in the Toolbox corpus mentioned above (see footnote 1 in this chapter), initial /l/ in Russian loanwords does not seem to be problematic and is not replaced by nasals: /laːmpa/ 'lamp', /leːtnij/ 'summer'. This might be related to the increased dominance of Russian in Even society, or at least to the higher level of proficiency of Even speakers in Russian relative to the time when Novikova worked on her description. In the native Even lexemes I am aware of are two examples with initial /l/, both of which were collected in Sebian-Küöl: /lepeter/ 'brassiere' and /lepteku/ 'flat'. However, they might be borrowed (or derived from a borrowed words) from Sakha, cf. Sakha /leppeger/ 'flat-bottommed'.

2.1.1.6 Trill

/r/ is an apical alveolar trill. Like the lateral glide, it also occurs only word-medially and word-finally in native Even words: /urke/ 'door', /gar/ 'twig'. No allophonic variation is reported for /r/. However, perception data from Bystraia Even (Chapter 4) show that there is a difference in the realization of /r/ in the words of different sets. The acoustic evidence for this variation is discussed in Chapter 5 (section 5.2).

In the borrowings from Russian containing initial /r/, Novikova (1960: 1975) observed the insertion of a prothetic vowel in the speech of individual speakers: Russian /raˈjon/ → Ola Even /orojoːn/. But in the contemporary data this process is found in just a few examples: Russian /ˈrovno/ 'exactly' → Tompo Even /o̤ro̤wno̤/[3], Russian /rudˈnʲik/ 'mine' → Sebian Even /urudnik/. The majority of borrowings with initial /r/ do not undergo any phonological adaptation. It is important to note that borrowed lexemes with prothetic vowels are attested only in the Even dialects situated in the Sakha speaking area. They are not found in the Bystaia dialect, where most Even speakers are fully bilingual in Russian. In contrast, Sakha has the same phonological constraint on initial /r/ and uses prothetic vowels to avoid it. Consequently, proficiency in Sakha might cause Evens to keep this process in their own language.

2.1.1.7 Semivowels

/w/ is a bilabial approximant. It is restricted to word-medial and word-final position: /ewte/ 'lungs', /mi̤awan/ 'heart', /kabi̤aw/ 'ptarmigan'. Both in the Bystraia dialect and in the dialect of Sebian-Küöl it is sporadically realized as a labio-dental fricative [v]: Bystraia Even, Sebia-Küöl [kewe] ~ [keve] 'jaw'. Moreover, in the data from Sebian-Küöl variation between [w] and [b] is found, e.g. [kebe] 'jaw', /hi̤awṳs/ 'rotting wood': [hiabas]. Since Sakha lacks a bilabial approximant, Malchukov (2006: 123) following Romanova & Myreeva (1964: 146) relates this to Sakha influence and describes it as a characteristic of the Sakha-Tungusic contact zone.
/j/ is a palatal approximant. In Standard Even, it occurs only in medial and final position: /ho̤ːja/ 'much, many', /bejtʃen/ 'little man', /aj/ 'good'. Novikova notes that some

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[3] /o̤ro̤wno̤/ in Tompo Even might be a borrowing from Russian via Sakha. A similar word form /o̤ro̤wṳna/ 'exactly' occurs in the data of Sebian Even, but it seems to be borrowed from Russian via Sakha, since a form /oruobuna/ with clear phonological influence of Sakha is also documented in the speech of Sebian Evens. Thus, this prothetic vowel was probably added at the stage of borrowing from Russian to Sakha.

scholars identify a phonemic use of /j/ in initial position in the other dialects, but according to her observations all Even dialects lack initial /j/ as a phoneme, it occurs only as part of the diphthongs /ie/ or /ịa/.

2.1.2 Minimal pairs for consonants

The phonemic status of the consonants described in the previous section is established based on the minimal pairs given below. One of the oppositions for the Even obstruents is place of articulation. The minimal pairs for labial, alveolar and velar stops are given in Table 2.2. I also include the opposition between alveolar stops and palato-alveolar affricates in this table, since their pronunciation is quite similar and they alternate in some contexts (see section 2.1.3).

Table 2.2. Place opposition in Even obstruents.

opposition	labial	alveolar
/b/ vs. /d/	/beg/ 'medicine'	/deg-/ 'fly'
	labial	velar
/b/ vs. /g/	/bel-/ 'help'	/gel-/ 'look for'
	alveolar	velar
/t/ vs. /k/	/tụrga-/ 'stretch'	/kụrga-/ 'jump'
/d/ vs. /g/	/dụl-/ 'get warm'	/gụl-/ 'light'
	palato-alveolar	alveolar
/č/ vs. /t/	/čuː-/ 'lick'	/tụː-/ 'get cold'
/dʒ/ vs. /d/	/dʒoːr/ 'two'	/doːr/ 'child saddle'

Table 2.3 provides some minimal pairs supporting the voicing opposition in obstruents. For the phonemes /p/ and /b/ no minimal pairs are available. However, the following examples demonstrate that they occur in similar contexts, for example word-initially /belen/ 'help' vs. /pelpe-/ 'jump out' and word-medially in intervocalic position /abaga/ 'grandfather' vs. /tịrapan/ 'lasso ring'. Moreover, no phonetic variation between /b/ and /p/ is observed in these positions.

Table 2.3. Voicing opposition in Even obstruents.

opposition	voiceless	voiced
/t/ vs. /d/	/teg-/ ‘to seat down’ /ụtan/ ‘twisting’	/deg-/ ‘to fly’ /ụdan/ ‘rain’
/k/ vs. /g/	/urke/ ‘door’	/urge/ ‘hard’
/č/ vs. /dʒ/	/ụčịt-/ ‘gossip’ /čụː-lị/ ‘disappear-IMP.2SG’	/ụdʒịt-/ ‘open a pass’ /dʒụː-lị/ ‘house-PROL’

As for the sonorants, I here provide minimal pairs for the nasal consonants, since they make a natural series with respect to the place of articulation. I encountered some difficulties in collecting a classical set of minimal pairs: it was not possible to find four Even words which would differ in one and the same position with respect to a nasal consonant. Nevertheless, the various oppositions in Table 2.4 demonstrate the phonemic status of Even nasals.

Table 2.4. Place opposition in Even nasals.

opposition		
/m/ vs. /n/	/maː-/ ‘kill’	/naː-/ ‘hit’
/ŋ/ vs. /n/	/eŋi-n/ ‘strong-POSS.3SG’	/enin/ ‘sickness’
	/nọŋan/ ‘pers. pronoun, 3sg’	/nọnan/ ‘at.first’
	/maŋ-/ ‘be hard’	/man-/ ‘finish’
/ń/ vs. /n/	/ńam/ ‘warm’	/nam/ ‘sea’
	/ńọːg/ ‘bridle’	/nọːg/ ‘dense’
	/ańaŋ/ ‘fast’	/anaŋ/ ‘ram’

The opposition between /n/ and /ń/ before /i/ or /ị/ is sometimes neutralized, but this happens rather sporadically in fluent speech. Even though there is some variation in the data (the phonologically alveolar nasal in this context is pronounced as a palatal or vice versa), most speakers tend to differentiate the degree of palatalization for /nị-, nị-/ and /ńi-, ńị-/.

In Ola Even, Novikova (1960: 75) observed variation between /l/ and /r/: [ịrkar] ~ [hịrkal] ‘knives’, [ereger] ~ [eregel] ‘always’. A similar phenomenon in the Sebian data can be explained by a morphological process of regularization of noun plural forms[4], but it does not influence the phonemic status of /r/ and /l/.

[4] The plural morpheme for nouns has two allomorphs: *-l* and *-r*, which are distributed according to the morphological classes (*-l* is used after stems ending with a vowel or after an epenthetic vowel

2.1.3 Regular phonological processes for consonants: Assimilation

Consonantal assimilation occurs frequently at morpheme boundaries. In Even both progressive and regressive assimilation are active. Progressive assimilation is found under the following conditions.

The first process is the devoicing of the voiced stops /d g/ and the affricate /dʒ/ after the voiceless obstruents /t k/ or /č/: [dʒu̥ː-du̥][5] 'house-DAT' – [o̥kaːt-tu̥] 'river-DAT'; [dʒu̥ː-gi̥č] 'house-ELAT' – [o̥kaːt-ki̥č] 'river-ELAT'; [o̥ńa-dʒi̥-m] 'draw-FUT-1SG' – [du̥k-či̥-m] 'write-FUT-1SG'.

Another assimilation process appears in the realization of the lateral /l/ as [n] after the nasal consonants /m n ŋ/: [dʒu̥ː-la] 'house-LOC' – [nam-na] 'sea-LOC' or [ŋi̥n-na] 'dog-LOC'; [ikeː-li] 'sing-IMP.2SG' – [teːleŋ-ni] 'tell- IMP.2SG'.

Another type of progressive assimilation concerns the trill sound and is observed in verbal stems. There are a few nominal derivation suffixes with initial /r/, but in my data their use is restricted to nominal stems with final vowel, so there is no context for assimilation. However, in the verbal morphology there are several suffixes with initial /r/, which are highly frequent: /-rek, -rak/ 'cond.cvb', /-ri, -ri̥/ 'pst, impf.ptc', /-ridʒi, -ri̥dʒi̥/ 'ant.cvb', /-r(a), -r(e)/ 'nonfut', 'neg.cvb'. The context for this type of assimilation occurs when these suffixes follow verbal roots or other suffixes with final /d dʒ t č p s/. Examples are given in Table 2.5.

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attached to a consonant, *-r* is combined with stems which have a so-called "unstable *-ń*"), but in the dialect of Sebian, there are deviations from this rule, namely the words with the "unstable *-n*" are often combined with plural *–l*, as in /o̥ro̥n/ 'reindeer' – Sebian /o̥ro̥l/, Standard Even /o̥ro̥r/ 'reindeer.PL'.

[5] In the phonetic literature it is not common to keep morpheme boundaries in the phonetic representation. However, since I discuss here the processes on the morpheme boundaries, I find it helpful to mark the boundaries.

Table 2.5. Contexts for the progressive assimilation of /r/.

context	examples
no assimilation	[tik-re-n] ‘fall-NONFUT-3SG’ [haː-rak-ụ] ‘know- COND.CVB-POSS.1SG’ [haːrịdʒị] ‘know-ANT.CVB’ [tik-ri-n] ‘fall-PST-POSS.3SG’
/r/ →[d] | /d dʒ[6]/ _	[ọd-da-sị] ‘stop-NONFUT-EMPH’ [teg-e-d-de-n] ‘sit down-EP-PROG-NONFUT-3SG’ [kusči-d-dek-e-n] ‘herd.reindeer-PROG-COND.CVB-EP-POSS.3SG’ [bi-d-didʒu-r] ‘be-PROG-ANT.CVB-PL’
/r/ → [t] | /t č p/ _	[teg-e-t-te-n][7] ‘sit down-EP-RES-NONFUT-3SG’ [gerbu-t-ti-ten] ‘call-RES-PST-POSS.3PL’ [tet-ti-n] ‘put on-PST-POSS.3SG’ [ụlap-tị-tan] ‘get.wet-PST-POSS.3PL’ [tet-tidʒi] ‘put on-ANT.CVB’
/r/ → [s] | /s/ _[8]	[bujus-se-n] ‘hunt-NONFUT-3SG’ [is-si-n] ‘vomit-PST-POSS.3SG’ [ọs-sak-a-tan] ‘clear up-COND.CVB-EP-POSS.3PL’ [as-sịdʒị] ‘be offended-ANT.CVB’

In Standard Even clusters of nasals with a trill sound and lateral with a trill sound do not undergo any assimilation process, cf.: [haːm-ra-m] ‘mix-NONFUT-1SG’, [nuːn-re-m] ‘to be able-NONFUT-1SG’, [em-rek-e-n] ‘come-COND.CVB-EP-POSS.3SG’, [ŋen-rek-e-ten] ‘go-COND.CVB-EP-POSS.3PL’, [hin-ridʒu-r] ‘shove into-ANT.CVB-PL’, [em-ri] ‘come-IMPF.PTC’, [haː-l-rị-tan] ‘know- INCH-PST-POSS.3PL’(Novikova 1980: 68, 94, 95, 87, 106, 133). However, in a group of dialects including the dialects of Tompo, Moma and Allaikha (and according to Burykin (2004) also the dialects of Lower Kolyma, Oymyakon and Ust’-Yana) /r/ turns into the voiced dental stop [d] in the described context: [em-de-n] ‘come-NONFUT-3SG’, [mịal-dak-ụ] ‘wake up-COND.CVB-POSS.1SG’, [ukčen-di-w] ‘tell-PST-POSS.1SG’. In the data from Sebjan I also observe some variation: there are a few cases where /r/ is realized as [d] after /n/: [ukčen-dek-u] ‘tell-COND.CVB-POSS.1SG’, [ukčen-di] ‘tell-IMPF.PTC’. In the other group of dialects including Bystraia, Sebian-Küöl as well as in Arka (see Lebedev 1982: 30), /r/ turns

6 Cincius & Rišes (1952) include the affricate /dʒ/ as a context for this type of assimilation, but do not give an example for that. Unfortunately, my data lack examples of this type as well.

7 In this and the following example the resultative suffix /-č/ is represented by its allomorph /-t/ according to the rule of regressive assimilation (see p. 21 in the bottom).

8 In the dialect of Sebian-Küöl, as well as in the other Western dialects, where /s/ is replaced by /h/, this context is absent: [ịh-ra-n] ‘reach-NONFUT-3SG’, [ịh-rịdʒị] ‘reach- ANT.CVB’.

into a lateral /l/ after /l/ or into an alveolar nasal /n/ after /m n ŋ/. Table 2.6 provides some examples for this process from the data of Bystraia and Sebian-Küöl:

Table 2.6. Progressive assimilation of /r/ in the Bystraia district and Sebian-Küöl.

context	examples
/r/ → [l] | /l/ _	[oke-l-le-n] 'be hot-INCH-NONFUT-3SG' [iːsel-lek-e-n] 'fall (of evening)-COND.CVB-EP-POSS.3SG' [nasal-lịdʒị] 'tear-ANT.CVB-PL' [bel-li-ten] 'help-PST-POSS.3PL'
/r/ → [n] | /m n ŋ/ _	[ulgim-ne-n] 'ask-NONFUT-3SG' [ŋen-ne] 'go-NONFUT' [teːleŋ-ne]'tell-neg.cvb' [em-nek-e-n] 'come-COND.CVB-EP-POSS.3SG' [ukčen-nek-u] 'tell-COND.CVB-POSS.1SG' [họŋ-nak-a-n] 'cry-COND.CVB-EP-POSS.3SG' [em-nidʒu-r] 'come-ANT.CVB-PL' [ukčen-nidʒi] 'tell-ANT.CVB' [taŋ-nịdʒụ-r] 'count-ANT.CVB-PL' [tam-nị-t] 'pay-PST-POSS.1PL.INLC' [haŋan-nị] 'sew-IMPF.PTC' [teːleŋ-ni-wu] 'tell-PST-POSS.1SG'

This type of assimilation can be observed not only at morpheme boundaries, but also in the phonological differences in corresponding lexemes and affixes in different dialects. Correspondingly, the lexeme for 'fish' differs in these dialects as following: Standard Even /ọlra/, Topolinoe /ọlda/, Bystraia /ọlla/ 'fish'. The dialect of Sebian deviates here from the assimilation pattern found on morpheme borders: it has [ọlda, ọldọ] for 'fish'. In morphology, the 2SG subject agreement marker is indicative: while in Standard Even this marker is /-nri, -nrị/, in the Tompo and Moma dialects it is /-ndi, -ndị/, and it is /-nni, -nnị/ in the dialects of the Bystraia district and Sebian-Küöl.

Moreover, in the dialect of Sebian-Küöl, the lateral /l/ is realized as [r] if it follows /r/. This is not the case in the data of the Bystraia district: Bystaia [gọr-la] - Sebian [gọr-ra] 'far-LOC', Bystraia [ur-li] - Sebian [hor-ri] 'go-IMP.2SG'.

In some Western dialects of Even (e.g. in Tompo and Sebian), several additional patterns of assimilation are observed (cf. Malchukov 2006, Pakendorf 2008, my data). Most probably these patterns are caused by Sakha influence. In Sebian, this phenomenon is not a strong rule, but rather a variation between native Even and Sakha patterns. I provide two observed patterns of progressive assimilation below (though this list might be incomplete due to the unstable and variable character of these patterns):

a. The trill sound /r/ after the voiceless velar stop /k/ changes to the dental stop [t]: [tik-ti-n] /tik-ri-n/ 'fall-PST-POSS.3SG', [bak-tịdʒị] /bak-rịdʒị/ 'find-ANT.CVB'.

b. The affricate /č/ completely assimilates to the preceding fricative /s/: [dessi-] /desči-/ 'lie', [dụk-a-ssị-n] /dụk-a-sčị-n/ 'write-EP-CONAT-3SG'.

Besides the phenomenon of progressive assimilation, in Even there are also several contexts for regressive assimilation. First, the affricates: /č/ and /dʒ/ are realized as dental stops before the stops /t/ and /d/ and the lateral /l/. Following examples illustrate this process: [bukeč] 'raw fish head', but [buketti-] 'to eat raw fish head'; [bekeč] 'all', but [beket-le-n] 'all-LOC-POSS.3SG'; /ụdʒ/ 'track', but [ụd-dụ-n] 'track-DAT-POSS.3SG (on his track)'; [tụdʒ] 'tin', but [tụd-la] 'tin-LOC'.

The voiced bilabial /b/ becomes voiceless before voiceless obstruents: [dʒeb-e-d-di-n] 'eat-EP-PROGR-IMPF.PTC-POSS.3SG' – [dʒep-ti-n] 'eat-PST-POSS.3SG'; [čak-a-b-da-j] 'gather-EP-MED-PURP.CVB-PRFL.SG' – [čak-a-p-ča] 'gather-EP-MED-PF.PTC.'

In the context before /s/ the trill sound /r/ assimilates to /s/ completely: /bar-/ 'opposite side', but [baʃ-ʃakị] 'to the opposite side'; /aːtar/ 'dark', but [aːtaʃ-ʃị] 'darkness' (in the last examples /s/ is realized as /ʃ/, since they are from the Bystraia dialect).

In the context of the following affricates /č/ and /dʒ/ the stop consonants might assimilate completely to them. Novikova (1960) reports it as a regular phonological rule for the Ola dialect; however in the data of Bystraia and Sebian there are examples of both assimilation and preservation of the dental stop: [ụt-ča] and [ụč-ča] 'turn-PF.PTC'.

Among the patterns of regressive assimilation, in the Western dialects some types seem to be caused by Sakha influence. As in the case of progressive assimilation, Sakha patterns seem to be in free variation with native ones. Some examples from Sebian dialect are provided in Table 2.7.

Table 2.7. Contexts for regressive assimilation caused by Sakha influence.

context	examples
/n/ → [ŋ] | _ /ŋ/	[aŋŋamta] ~ [anŋamta] 'new'
/n/ → [m] | _ /m/	[ịmmač] ~ [ịnmač] 'fast'
/d/ → [g] | _ /g/	[hor-u-g-gere-n] ~ [hor-u-d-gere-n] 'go-CAUS-PROG-HAB-3SG'
/t/ → [k] | _ /k/	[bebeː-kki] ~ [bebeː-tki] 'cradle-ALL'

Progressive and regressive assimilation can be applied simultaneously. For example, the affricate /č/ in [ajịč] 'well' becomes /t/ in [ajịt = ta] 'well=PTL (and well)', but the voiced consonant in the particle /=da/ becomes voiceless. The same process can also be found in the verb forms with the resultative suffix /č/, cf. the examples in Table

2.4 ([teg-e-t-te-n] 'sit down-EP-RES-NONFUT-3SG' and [gerbu-t-ti-ten] 'call-RES-PST-POSS.3PL').

2.2 Vowels

The description of Even vowels has a central place in my research. Here I provide a brief description of the vowel system mainly for Ola Even, since many authors refer to it (Lebedev 1978, Ard 1984, Svantesson 1985, Kang & Ko 2012, Lulich & Whaley 2012 and others). However, Novikova (1960) also provides some dialectal data, which I include in the description. Moreover, I stress the differences between Ola Even and the dialects of the Bystraia district and Sebian-Küöl. For ease of understanding, I provide a table of correspondences between different vowel transcriptions in section 2.2.1, uniting the IPA transcription, symbols used by Novikova (1960), symbols from the practical phonological transcription I use in this thesis and the Standard Even orthography. In section 2.4, I summarize the studies by other scholars on the issues of vowel harmony in Even. In addition, I mention the work of some scholars working on languages closely related to Even.

Novikova (1960) describes 18 vowels: 16 monophthongs opposed by length and vowel harmony set and two diphthongoid vowels. Table 2.8 shows the distribution of these vowel qualities:

Table 2.8. Even vowel phonemes (practical transcription as in the DoBeS project).

	front	back
high	i iː ị ịː	u uː ụ ụː
mid	e eː i͡e	o oː ọ ọː
low	ị͡a a aː	

Since there is vowel harmony in Even I distinguish the two sets by using a dot below the vowel for the set that harmonizes with /a/; the undotted vowels harmonize with /e/.

In Sakha borrowings, native Sakha vowels can be used, such as /y/, /ø/ and /ɨ/ and their long counterparts, as well as the diphthongs /y͡ø/, /u͡o/ and /ɨ͡a/. However, many Sakha borrowings undergo adaptation processes and are changed according to the Even phonological system. Since Russian, the other source of borrowings, has approximately the same vowel qualities as Even, it is not possible to define any vowel phonemes borrowed from Russian. The only exception here is /ɨ/, which is maintained in some Russian borrowings, like /aˈbɨčna/ 'usually', /aˈkazɨvaitsa/ 'it appears'.

2.2.1 Correspondence of orthographies and transcriptions

In this section, I will describe the transcription of vowels used in this thesis and the orthographical presentation of the data in Novikova (1960). Concerning the transcription of consonants I gave the necessary explanations in section 2.1.1.

Throughout the thesis I follow the revised International Phonetic Alphabet (IPA 2005) for the phonetic transcription, and the practical phonological transcription accepted in the DoBeS-project. However, when referring to Novikova's description, I have to be clear which grapheme corresponds to which phoneme, taking into account the differences between the Latin and Cyrillic orthographies.

Table 2.9 gives an overview of the main differences and correspondences between the systems in IPA, the transcription used by Novikova, the standard Even orthography and the practical phonological transcription used here. In the IPA transcription I give set 2 vowels as pharyngealized vowels to be in line with Novikova; however, pharyngealization is not found in all dialects of Even.

As seen from Table 2.9, the standard Even orthography does not make a distinction between short and long vowels. Moreover, the standard orthography does not differentiate between set 1 and set 2 high vowels. The Cyrillic symbol <у> is used both for /u/ and /ụ/. For the phonemes /i/ and /ị/ the Even orthography uses Cyrillic <и> and <ы>, however the distribution of these graphemes does not depend on the set of the phoneme, but on the preceding consonant: <и> is used after palatalized consonants, while <ы> is used after non-palatalized consonants. The only consistent difference between vowels of different sets made in the standard orthography is that between set 1 /o/, which is written as "ө", and set 2 /ọ/, which is written as "о", as well as between /a/, /e/ and the diphthongoid vowels.

Another difference of a purely typographical nature is that Novikova (1960) places the dot to designate set 2 on top of the vowels, and in the font accepted for the practical phonological transcription in the DoBeS-project the dot is placed under the symbol.

Table 2.9. Correspondence of orthographies and transcriptions.

IPA	Novikova 1960	Standard Even orthography	Practical phonological transcription
i	и	и, ы	i
iː	ӣ	и, ы	iː
iˁ	и̇	и, ы	ị
iːˁ	ӣ̇	и, ы	ịː
e	э	э	e
eː	э̄	э	eː
aˁ	а	а	a
aˁː	а̄	а	aː
i͡e	ᶦе	е	ie
iˁ͡aˁ	æ	я	ịa
o	ө	ө	o
oː	ө̄	ө	oː
oˁ	о	о	ọ
oˁː	о̄	о	ọː
u	у	у	u
uː	ӯ	у	uː
uˁ	у̇	у	ụ
uˁː	ӯ̇	у	ụː

2.2.2 Phonetic description and allophonic variation of vowels

A detailed acoustic analysis of Even vowels is presented in Chapter 3, so here I sum up the description provided by Novikova (1960) for Ola Even. With respect to the articulation of Even vowels, Novikova makes it clear that it is important to distinguish between the vowels of the first syllable and the other positions in the word. The position in the first syllable is often prominent, whereas vowels in the other positions are reduced. However, in the data of the Bystraia dialect and the dialect of Sebian-Küöl, I generally observe different degrees of vowel reduction (less in Sebian-Küöl). Moreover, in my data the prominent position is not restricted to the first syllable only: the opposition is rather between the root vowels and suffix vowels. Some other factors, i.e. a long vowel in the suffix, can prevent suffix vowels from being reduced.

/i/ and /iː/ are non-labialized front high vowels. The long phoneme /iː/ is more closed and pronounced with more tenseness. Some examples of its usages: /hil/ ‘fish soup’, /usi/ ‘rope’, /iːt/ ‘tooth’, /iː-/ ‘enter’.

/ị/ and /ịː/ are non-labialized front high vowels, which are slightly lower compared to /i/ and /iː/. In the Ola dialect these phonemes are pharyngealized. Examples: /nịsa/ ‘beads’, /ịŋa/ ‘gravel’, /ịːmkat-/ ‘to aim’. The front high vowels /i/, /iː/, /ị/ and /ịː/ have a palatalizing effect on the preceding consonants. However, consonants /t/, /d/, /n/, /s/, /l/ and /r/ do not undergo palatalization. In contrast, the front high vowels have allophonic variants after these consonants: they are realized with an increased openness of the lower jaw and transcribed by Novikova (1960, pp. 40-41) as [ɪ], [ɪː] for /i/, /iː/ and as [ɪ̣], [ɪ̣ː] for /ị/,/ịː/.

/u/ and /uː/ are labialized back high vowels. The two do not differ in quality, the only difference is quantitative. Examples: /ujun/ ‘nine’, /hut/ ‘child’, /uːn-/ ‘melt’, /huːre/ ‘tip’. Novikova (1960, p. 47) notes that in the Even dialects spoken in Yakutia /u/ and /uː/ are characterized by a higher degree of labialization and frontness.

/ụ/ and /ụː/ are labialized back high vowels, but slightly lower than /u/ and /uː/. Both vowels are pharyngealized and pronounced with noticeable tenseness. Examples: /hụlańa/ ‘red’, /tụnŋan/ ‘five’ /dʒụː/, ‘house’, /ńụːrma/ ‘sneak’.

/o/ and /oː/ are labialized back mid vowels. The long vowel in the Ola dialect is slightly diphthongoid and starts with a short [u]. Both long and short phonemes occur mostly in first syllables. Examples: /omen/ ‘one’, /koke-/ ‘die’, /dʒoːr/ ‘two’, /boː-/ ‘give’. In the Western dialects, these vowels are pronounced with more labialization and are more fronted (especially the short one). In the dialect of Sebian-Küöl, short /o/ might be less labialized and realized close to [e]. Probably the most frequent example of this variation is the verb /hor-/ ‘go’ which is realized both as [hør] and as [her]. The long vowel is different in the dialects: in the Tyugessir dialect it is pronounced as a clear diphthong, but in the Lamunkhin (Sebian) dialect it corresponds to a long [oː] (Novikova 1960: 49). Moreover, in Even of the Bystraia district both /o/ and /oː/ correspond to /u/ and /uː/ in most contexts: Ola /dʒoːr/, Bystraia /dʒuːr/ ‘two’; Ola /oːdej/, Bystraia /uːdej/ ‘scrape’; Ola /boːdel/, Bystraia /buːdel/ ‘legs’; Ola /okeń/, Bystraia /ukeń/ ‘milk’, Ola /goː-ne-m/, Bystraia /guː-ne-m/ ‘speak-NONFUT-1SG’. In monosyllabic words, /o/ and /oː/ seem to have been diachronically raised in the Bystraia dialect: /tuːr/ (</toːr/) ‘ground’, /muː/ (</moː/) ‘water’, /uːs/ (</oːs/) ‘sleeve’. However, in other contexts /oː/ and /o/ are preserved: /toːr-le/ ‘ground-LOC’, /goːn-de-j/ ‘speak-PURP.CVB-PRFL.SG’. There are also a few lexemes which are not affected by this change in any phonological context: /koːrbe/ ‘male reindeer’, /oleːkči/ ‘cheat-’, /koːje/ ‘horns’. Burykin (2004, p. 69) restricts the diachronic change to the position with a following syllable containing /i, iː, u, uː/ and provides corresponding examples (/uliki/</oliki/ ‘squirrel’, /uksi/</hoksi/ ‘hot’). He also

adds that the change can be observed in verbal roots as well (/ur-li/</hor-li/ 'go-IMP.2SG'). Examples from my Bystraia data show that the vowel change happened in this dialect in more cases than described by Burykin. This change is apparently ongoing, since in the texts and in the data collected during elicitation sessions speakers show some variation: [toːr-teki] ~ [tuːr-teki] 'ground-ALL', [moː-le] ~ [muː-le] 'water-LOC'. Thus, the change which previously may have been blocked by some phonological or morphonological conditions now seems to have started spreading throughout the whole paradigm, and this makes it difficult to specify the exact conditions. Due to this change, especially in monosyllabic words, the number of potential minimal pairs contrasting /o/ with /ọ/ is decreased. This poses a problem for the phonetic study, cf. section 3.2.1.2 and section 4.2.2.

/ọ/ and /ọː/ are labialized back mid vowels, slightly lower than /o/ and /oː/. Both vowels are pharyngealized in the Ola dialect and occur predominantly in first syllables. Examples: /ọkaːt/ 'river', /ọj/ 'clothes, surface', /nọːd/ 'pretty', /họːja/ 'many'.

/e/ and /eː/ are non-labialized front mid vowels. Examples are the following: /bej/ 'man', /eńtil/ 'parents', /teːleŋ-/ 'tell', /heːdʒe/ 'circular dance'. The short /e/ is reduced in non-first syllables. Novikova claims that in Eastern dialects it keeps the same height in this case but often changes its quality towards back vowels and is similar to [ə] or to the Russian /ɨ/. In fast speech it can be significantly reduced quantitatively and pronounced as a very short [ə]. However, the data of the Bystraia dialect shows the reduction of /e/ towards an [ɨ]-like sound not only in the non-first syllables or suffix vowels: /ereger/ [erəɣər] 'always' in Ola (as given in Novikova 1960: 75) and [ɨrəgər] ~ [ərəgər] in the Bystraia dialect. Moreover, in the Bystraia dialect this reduction process is restricted to /e/. In non-first syllables or suffixes, it is also the other vowels, namely /a/, /u/, /ụ/, /i/ and /ị/, which can be reduced to an [ɨ]-like sound.

According to Novikova (1960), in Western dialects /e/ is labialized in all positions and phonetically becomes very close to [ø]. The data of the Sebian Even confirms the observation of Novikova: any short /e/ in the word may be labialized. This process is possible but not obligatory: /heg-/ [heg-, høg-] 'put down branches', /hebgen/ [hebgen] ~ [høbgøn] 'smoke'. The long phoneme /eː/ undergoes neither qualitative nor quantitative reduction, and also does not undergo labialization.

/a/ and /aː/ are non-labialized very tense front-mid (using the term of Novikova, p. 45) low vowels with slight pharyngealization. Examples: /nadan/ 'seven', /ga-/ 'take', /maːwụt/ 'lasso', /ŋaːl/ 'hand'. In non-first syllables /a/ is significantly reduced. The changes accompanying the reduction are similar to the changes in case of /e/: in Eastern dialects, /a/ turns into a [ɨ]-like sound, but lower than the reduced /e/. In Western dialects the reduced /a/ can be labialized. Labialization in the data of Sebian-Küöl seems to be lexeme-specific: for example the words /ọran/ 'reindeer' and /nọŋan/ 'pers. pronoun, 3sg' are as a rule pronounced as [ọrọn] and [nọŋọn], but in some lexemes (e.g., /ịlgam-/ 'stand') /a/ always remains non-labialized. The long /aː/ cannot be reduced.

/i͡e/ is a slightly diphthongized front mid long vowel, starting with [i] with a following transition to [e]. According to Novikova (1960), it does not significantly vary in the dialects. The only peculiarity in the Western dialects is that this phoneme is pronounced as a more expressed diphthong, rather than diphthongoid. Examples (in practical trancription): /ieke/ 'pot', /tiek/ 'now', /kieke-/ 'whistle'.
/i̯͡a/[9] is a non-labialized low front diphthongoid vowel, which starts with [i̯] and changes to [æ]. It is slightly pharyngealized in Ola Even. According to Novikova (1960: 45) this vowel occurs in word-initial, medial and word-final positions. However, in my data from both the Bystraia and Sebian dialects the realization of this phoneme in word-initial position is attested as [ja] and [jæ]. In Bystraia, this is in free variation with [ia], whereas in Sebian [ja] and [jæ] are the only possible realizations in initial position. Examples (in practical transcription): /mi̯an/ 'ten', /i̯ak/ 'what', /gi̯a/ 'other'. Both diphthongoid vowels cause palatalization of the preceding consonants, except for /t/, /d/, /n/, /s/, /l/ and /r/.

The diphthongoid vowels differ in the dialects and sometimes underwent phonological changes. In the dialect of Sebian-Küöl, the usage of /i͡e/ and /i̯͡a/ is similar to that described for Ola Even: the speakers keep these phonemes opposed and consistently use the same vowels in the corresponding lexemes: /ie-ri-n/ 'overtake-PST-POSS.3SG' vs. /i̯a-ri̯-n/ 'do what-PST-POSS.3SG'. In the dialect of the Bystraia district, I observed two tendencies differentiating it from Ola and Sebian-Küöl Even. First, a number of lexemes show a change of /i͡e/ into a long /iː/ or long /eː/. The distribution tends to be the following: in non-initial position /i͡e/ changed into [iː] and in word-initial position into [eː]: Ola [miedej], but Bystraia [miːdej] 'to get lost', Ola [ni̯ekičen], but Bystraia [niːkičen] 'duck', Ola [ieke], Bystraia [eːke] 'pot', Ola [iečen], Bystraia [eːčen] 'elbow'. Burykin (2004: 69) notes that this change occurs before syllables with /i, i̯, u, u̯/ (high vowels), but in my data this restriction is absent, the change occurring also in mono-syllabic words: Ola [hieldej], Bystraia [iːldej] 'start to appear', Ola [mie-r], but Bystraia [miː-r] 'get lost-3PL', Ola [tiek], Bystraia [tiːk] 'now'. Burykin also does not mention the change of /i͡e/ into /eː/ in initial position. However, a few examples show the realization of /i͡e/ as [iː] even in the initial position: Ola [ienŋe], Bystraia [iːnŋe] 'tongue'. Secondly, in many lexemes in which this change did not happen, the speakers vary between /i͡e/ and /i̯͡a/, this variation being observed even within the speech of one and the same speaker: Ola /kabi̯aw/, but Bystraia [kabi̯aw] and [kabiew] 'ptarmigan', Ola /gi̯aki̯/, but Bystraia [gi̯aki̯] and [gieki] 'the other one, different', Ola /hi̯at/, but Bystraia [i̯at] and [iet] 'willow'. This variation is more typical for words with original /i̯a/, but it also occurs in words with initial /ie/, e.g. the same Ola word /ieke/ for 'pot' which I listed

[9] As shown in section 2.2.1, Novikova uses the symbol /æ/ for this phoneme, which seems to be less adequate taking into account the diphthongoid character of this vowel.

above, in Bystraia has a variant [i̹aka] (with a change of the following vowel according to the rules of vowel harmony).

2.2.3 Minimal and quasi-minimal pairs

According to Novikova, the phonemic status of the vowels described above is confirmed by the existence of minimal pairs (see Table 2.10 and Table 2.11). These minimal pairs come from the description of Novikova (1960: 39-52) and my own data. Many minimal pairs from the description of Ola Even were unfortunately not found in the dialects of the Bystraia district and Sebian-Küöl. This is related to the lexical differences in the dialects, e.g. /aːmŋa/ 'dead seal' (as opposed to /amŋa/ 'mouth') refers to an animal specific to the Ola region; this lexeme is found neither in the Bystraia nor in the Sebian dialect. For some reason, one of the members of a minimal pair often happens to be a very specific lexeme which is not present in the other dialect. Below I provide minimal pairs which, to my knowledge, are valid at least in the Ola, Bystraia and Sebian-Küöl dialects. However, the loss of initial /h/ in Bystraia Even should be taken into account: words like /hunŋi/ 'yours', /hu̹nŋi̹/ 'owner', /haːm-/ 'mix' and others are present in this dialect without /h/ in the initial position.

Table 2.10. Vowel harmony set opposition.

opposition	examples
/i/ vs. /i̹/	/ir-/ 'to be cooked' vs. /i̹r-/ 'to drag'
/iː/ vs. /i̹ː/	/iː-n/ 'enter-3SG' vs. /i̹ː-n/ 'cecum-POSS.3SG'
/u/ vs. /u̹/	/hunŋi/ 'yours' vs. /hu̹nŋi̹/ 'owner'
/uː/ vs. /u̹ː/	/uːlen/ 'the process of melting' vs. /u̹ːlan/ 'person who is skilled at mounting a reindeer'
/o/ vs. /o̹/	/oj/ 'top' vs. /o̹j/ 'surface, clothes'[10]
/oː/ vs. /o̹ː/	/moː/ 'water' vs. /mo̹ː/ 'tree'[11]
/e/ vs. /a/	/en-/ 'hurt' vs. /an-/ 'push'
/eː/ vs. /aː/	/heːm-/ 'thread a needle' vs. /haːm-/ 'mix'
/ie/ vs. /i̹a/	/hie-n/ 'appear-3SG' vs. /hi̹a-n/ 'chew-3SG'

Though these examples are present in all dialects, it will be shown on the basis of my data that in the dialects of the Bystraia district and Sebian-Küöl vowels are not

[10] In the Bystraia dialect, due to the vowel change described on page 29, the word for 'top' is pronounced /uj/, but the opposition /o/ vs. /o̹/ is kept with the locative marker: /oj-le/ 'top-LOC' vs. /o̹j-la/ 'clothes-LOC'.

[11] In the Bystraia dialect, the vowel in /moː/ is changed into /u/, but the vowel opposition is kept with the locative marker: /moː-le/ 'water-LOC' vs. /mo̹ː-la/ 'tree-LOC'.

pharyngealized. This impression is confirmed for the Sebian dialect by Novikova who mentions that with respect to the opposition between pharyngealized and non-pharyngealized vowels the Western varieties of Even are exceptional and instead of two pairs /i/ vs. /i̞/ and /iː/ vs. /i̞ː/ they have only length contrast of non-pharyngealized /i/ vs. /iː/ (Novikova 1960, p.41). In addition, she specifies that in the dialects spoken in Yakutia, the area which includes the dialect of Sebian-Küöl, the pair /u̞/ and /u̞ː/ are not pharyngealized either (Novikova 1960, p.47 fn. 27); however she does not specify what the vowel opposition is based on in those dialects. When I transcribed my data, it was almost impossible to distinguish between these two vowel classes. The only help in assigning the vowel to one or another set was the vowel in the suffixes which alternated according to the rules of vowel harmony (see section 2.3.2 below). In Sebian-Küöl, /o/ and /o̞/ and their long counterparts are opposed by frontness, but not /i/, /i̞/ and /u/, /u̞/. In Bystraia, the reduction of the vowel in non-first syllables complicates the situation. In many cases, due to the reduction (namely, the tendency to pronounce the vowels in non-first syllables as [ɨ]) the suffix vowels are hard to trace back to /a/ or /e/. A detailed acoustic analysis of the differences between vowels belonging to different vowel sets in both dialects is presented in Chapter 3.

Table 2.11. Length opposition.

opposition	examples
/i/ vs. /iː/	/i-li/ 'which-PROL' vs. /iː-li/ 'enter-IMP.2SG'
/i̞/ vs /i̞ː/	/hi̞r-/ 'milk' vs. /hi̞ːr-/ 'be angry'
/u/ vs /uː/	/ulen/ 'the process of digging' vs. /uːlen/ 'the process of melting'
/u̞/ vs /u̞ː/	/hu̞lra/ 'cover' vs. /hu̞ː-lra/ 'untie-IMP.2PL'
/o/ vs /oː/	/orin/ 'stop during migration' vs. /oː-ri-n/ 'scrape-PST-POSS.3SG'[12]
/o̞/ vs. /o̞ː/	/o̞d-da-n/ 'finish-NONFUT-3SG' vs. /o̞ː-d-da-n/ 'make-PROGR-NONFUT-3SG'
/e/ vs. /eː/	/tew-/ 'catch' vs. /teːw-/ 'put down'
/a/ vs. /aː/	/dʒaw-/ 'catch, grasp' vs. /dʒaːw-/ 'respond'

The length opposition is also not absolutely clear. Often, the length of the vowels in the same words does not correspond across different dialects, e.g. /alat-/ 'wait' in my data is given as /alaːt-/ in the dictionaries (Cincius & Rišes 1952, Robbek & Robbek 2005); /aːmnak/ 'fast' is found with a long /aː/ in my data from Bystraia and as /aːmrak/ in Cincius & Rišes (1952), but as /amrak/ in Robbek & Robbek (2005). Sometimes the description of the Ola dialect differs from others, e.g. /koje-/ 'watch' is given in Novikova's description with a short /e/ and is supposed to contrast in a minimal pair

[12] For this opposition I lack a minimal pair in my data from the dialect of the Bystraia region; in the Bystraia dialect, these words are realized as /urin/ vs. /uːrin/.

with /koːje/ 'horns'; however, both in the dictionary (Robbek & Robbek 2005) and in my data from the Bystraia and Sebian dialects this word is realized with a long /eː/, so it cannot constitute a true minimal pair with /koːje/ 'horns'. Interestingly, Cincius & Rišes (1952) give both 'watch' and 'horns' with two long vowels as /koːjeː/ (i.e. as a homophone).

2.3 Phonotactics

2.3.1 Syllable structure

Even syllable structure can be represented as follows: (C)V(C). This means that there are four possible syllable types, V, CV, VC and CVC, as exemplified with the following examples: [iː-če] (iː.če)[13] 'enter-PF.PTC', [bi-če] (bi.če) 'be-PF.PTC', [ọːn] 'how', [dʒoːr] (dʒoːr) 'two'. Syllables with the structure V and VC occur mostly as first root syllables. Consonant clusters of maximally two consonants can be found only in word-medial position and these consonants belong to different syllables (hetero-syllabic clusters). To prevent longer consonant clusters, which can occur due to the combination of various affixes (consisting underlyingly of one consonant or having a two-consonant cluster), epenthetic vowels are inserted. The choice of epenthetic vowel depends on the harmonic set of the word (see section 2.3.2) and on the place of articulation of the stem-final consonant. Novikova (1960, p. 78) describes a strict rule for the choice of epenthetic vowel: after palatal (/j/ and /ń/) and palato-alveolar (/č/ and /dʒ/) consonants in words of set 1 the epenthetic vowel is /i/ and after the same consonants in words of set 2 the epenthetic vowel is /ị/: [eːrbeč-**i**-l] (eːr.be.čil) 'goose-**EP**-PL', [bej-**i**-l] (be.jil) 'man-**EP**-PL', [aj-**ị**-l] (a.jịl) 'good-**EP**-PL', [hụnadʒ-**ị**-l] (hụ.na.dʒịl) 'daughter-**EP**-PL'. After all other consonants the epenthetic vowel is /e/ in words of set 1 and /a/ in words of set 2: [tet-**e**-d-de-n] (te.ted.den) 'put on-**EP**-PROGR-NONFUT-3SG', [nek-**e**-d-de-n] (ne.ked.den) 'do-**EP**-PROGR-NONFUT-3SG', [badʒịkar-**a**-kla] (ba.dʒị.ka.rak.la) 'morning-**EP**-ALL.LOC', [maːwụt-**a**-lkan] (maː.wụ.tal.kan) 'lasso-**EP**-PROP'. However, in the data from the Sebian dialect epenthetic /a/ and /e/ are used after palatal and palato-alveolar consonants as well, and forms like [hụnadʒ-**a**-lkan] (hụ.na.dʒal.kan) 'daughter-**EP**-PROP' or [bej-**e**-l] (be.jel) 'man-**EP**-PL' are even more frequent in my data than forms with /i/ or /ị/.

The number of syllables has no strong restriction: while words of two to four syllables are probably the most frequent, longer words (up to nine syllables and possibly more) often occur in speech as well. Some examples can be found in Table 2.12.

[13] Here in the discussion of syllabication I provide forms with syllable boundaries in brackets after the phonological transcription with morpheme breaks.

Table 2.12. Possible number of syllables per word (as they occur in the text collection).

Number of syllables	Examples
one	[ịak] (ịak) ‘what’, [ńọːg] (ńọːg) ‘bridle’, [noː] (noː) ‘younger sibling’
two	[tarak] (ta.rak) ‘distal demonstrative’, [tewte] (tew.te) ‘berries’, [eken] (e.ken) ‘mother’
three	[keńeli] (ke.ńe.li) ‘bad’, [asatkan] (a.sat.kan) ‘girl’, [anŋamta] (an.ŋam.ta) ‘new’
four	[pektereːwun] (pek.te.reː.wun) ‘gun’, [bald-ụka-nị-n] (bal.dụ.ka.nịn) ‘be born-CAUS-PST-POSS.3SG’
five	[abaga-maja] (a.ba.ga.ma.ja) ‘grandfather-AUG’, [ọmọlgọ-la = gụ] (ọ.mọl.gọ.la.gụ) ‘boy-LOC=Q’
six	[tụrkị-čaka-lka-hal] (tụr.kị.ča.kal.ka.hal) ‘sled-PLEN-PROP-PL’, [teːleŋ-e-dʒi-l-le = si] (teː.le.ŋe.dʒil.le.si) ‘tell-EP-PROG-INCH-NONFUT =EMPH’
seven	[orelde-deŋ-e-l-bu = de] (o.rel.de.de.ŋel.bu.de) ‘be happy-PST.PTC-EP-PL-POSS.1SG=PTL’, [abaga-maja-l-dụk = ta] (a.ba.ga.ma.jal.dụk.ta) ‘grandfather-AUG-PL-ABL=PTL’
eight	[kojeːč-i-sči-d-dek-e-n-e = si] (ko.jeː.čis.čid.de.ke.ne.si) ‘look at-EP-CONAT-PROG-COND.CVB-EP-POSS.3SG-EP=EMPH’
nine	[taŋ-a-dʒ-ị-l-ụkan-ị-tan-a = sị] (ta.ŋa.dʒị.lụ.ka.nị.ta.na.sị) ‘read-EP-PROG-EP-INCH-CAUS-EP-POSS.3PL-EP=EMPH’

In the Bystraia dialect there is a tendency to have open final syllables, which is expressed by adding an epenthetic vowel /e/, /a/, /i/ or /ị/, often very reduced, after final closed syllables. This is especially clear when separate words are pronounced in isolation, as I recorded them for the phonetic investigation. Thus, lexemes that in many dialects are attested as [awdaj] (aw.daj) ‘wash’, [gadaj] (ga.daj) ‘take’, [nam] ‘sea’, [hut] ‘child’ and many others are pronounced by the speakers of Bystraia Even as [awdajị] (aw.da.jị), [gadaji] (ga.da.ji), [nama] (na.ma) ~ [namɐ] (na.mɐ), [ute] (u.te) ~ [utə] (u.tə) (recall that initial /h/ is lost in this dialect).

In the dialect of Sebian-Küöl an interesting restriction concerning hetero-syllabic consonant clusters is observed: /s/ as the second consonant of hetero-syllabic clusters is prohibited. Instead, the /s/ is realized as [h] and metathesizes with the preceding consonant. The pattern is illustrated by the following examples: Standard Even [kansa], Sebian Even [kahna] ‘pipe’; Standard Even [imse], Sebian Even [ihme] ‘fat’. The same process works across morpheme boundaries, eg.: Standard Even [aman-sị], Sebian Even [amahnị] ‘father-POSS.2SG’, Standard Even [ič-e-m-se-n], Sebian Even [ičehmen] ‘see-EP-DES-NONFUT-3SG’. There are no constraints on the second consonant in the cluster, more examples with various consonants are as follows: Standard Even [maŋ-sị], Sebian Even [mahŋị] 'be.hard-IMPF.PTC'; Standard Even /dal-sị/, Sebian Even [dahlị] 'be.tasty-IMPF.PTC'; Standard Even /haːtar-sị/, Sebian Even [haːtahrị] 'be.dark-IMPF.PTC'; Standard Even /hok-si/, Sebian Even [hohki] 'be.hot-IMPF.PTC'[14], Standard Even /awsa/, Sebian Even [ahwụ] 'bag for sewing'. This phenomenon is also found in the other Western dialects; e.g. in their research on tundra dialects of Even spoken in Yakutia (Ust'-Yana, Allaikha and Lower Kolyma), Dutkin & Bel'anskaja (2009) stress that there is variation with respect to metathesis between different social lineages or clans: [ńahmị] and [ńamhị] for 'warm', [dʒalhị] and [dʒahla] for 'saliva'. In the glossary they have metathesized [kahna] for 'pipe', but [imhe] and [imse] without metathesis for 'fat'.

Besides this context for metathesis, several other cases of metathesis are observed in the dialect of Sebian-Küöl. One of them is a non-adjacent metathesis of the final /s/, as in the example of Standard Even /bokes/, Sebian Even [bøhke] ~ [bøhkø] 'ice'. This pattern is found only in a few lexemes (the only other example which I am aware of is Standard Even /ekes/, Sebian Even [ehke] 'fish scales'), and does not spread across morpheme boundaries, e.g. Standard Even /bi-sek-e-s/ 'be-COND.CVB-EP-POSS.2SG' does not change into expected [bihehke] in Sebian Even and remains [bihekes]. In addition, there are a number of lexical items with a final /s/ in Sebian Even in which this metathesis does not occur either: /elekes/ 'at first', /hịːlụs/ 'trouble', /orus/ 'joy', /hịawụs/ 'rotting wood', /dʒọːtịs/ 'icings' (Russian: *nal'ed'*). A few other Western dialects have [bøhke] 'ice' and [ehke] 'fish scales' with metathesis, namely Even of Ust'-Yana, Allaikha and Lower Kolyma (Dutkin & Belyanskaja 2009), as well as the Moma dialect (Lebedev 1978). The other example of metathesis concerns final /n/ in the second and third person plural possessive markers, which switches its position with the preceding vowel: Standard Even /-sen, -san/, Sebian Even [-hne(n), -hna(n)] 'POSS.2PL' and Standard Even /-ten, tan/, Sebian Even [-tne(n), -tna(n)] 'POSS.3PL'. In her description of the Lamunkhin (Sebian) dialect Kuz'mina (2010) gives these markers as /-hno, -hnọ/ and /-tno, -tnọ/. Besides the transcription with labialized vowels, Kuz'mina also gives it without the final /n/, but in my data both variants (metathesized marker with and without an optional final /n/) occur. The labialized variants occur in my data as well; however they compose a minority as compared to non-labialized forms. Moreover, most examples with labialized vowels have a labialized vowel in the syllable preceding the discussed markers. However, in my opinion these two additional cases of metathesis (a non-adjacent metathesis as in [bøhke] 'ice' and metathesis in the possessive markers)

[14] With respect to this lexeme there is some variation in the data, it seems that the Standard form /hoksi/ is also used in Sebian. However, Kuz'mina (2010) provides the form with metathesis for Sebian dialect. In my data, this form can be found also with a further assimilation as [hokki].

are not regular phonological patterns, but phenomena restricted to particular lexical and morphological items.

2.3.2 Vowel harmony

One of the most salient processes in Even phonotactics is vowel harmony, which causes an alternation in suffixes depending on the vowels in the root. According to Novikova (1960), the vowel inventory is divided into two groups of vowels opposed by pharyngealization, namely the non-pharyngealized set /e eː i iː o oː u uː ie/ vs. the pharyngealized set /a aː ị ịː ọ ọː ụ ụː ịa/. Throughout this thesis I refer to the first one as set 1 and to the second one as set 2. Novikova claims that the vowels of set 2 are tenser and produced with a noise caused by the restriction of the pharyngeal cavity. Using X-ray photographs, Novikova shows that the pharyngeal restriction is formed by retracting the tongue root and stretching the muscles of the pharynx. Moreover, the pharyngealization of the vowels is accompanied by a raising of the larynx (Novikova 1960: 40). Throughout her description of set 2 vowels Novikova notes the consistently lower position of the tongue and a greater tenseness in comparison with set 1 vowels. In the discussion of the articulatory differences between the sets, Novikova proposes to call pharyngealized vowels "back", since their articulation involves the retraction of the tongue body. This retraction results in a larger resonance cavity in the front part of the mouth, which Novikova sees as a prerequisite for great tenseness. The non-pharyngealized vowels are called "front" vowels by Novikova, since during the production of these vowels the tongue body is advanced.

The rule of vowel harmony formulated for the Ola dialect, but applicable to all Even dialects, is the following: within a word vowels harmonize with respect to set, i.e. either set 1 vowels or set 2 vowels are possible in a word. The vowels in the suffixes are determined by the vowels in the root. For this reason, all suffixes containing a vowel have at least two allomorphs: one with set 1 vowel and one with set 2 vowel, cf. the two variants of augmentative and locative markers in example (2.1):

(2.1) a. [hịakịta-ńdʒa-la]
larch-AUG-LOC

b. [toŋer-e-ńdʒe-le]
lake-EP-AUG-LOC (Novikova 1960: 53)

The influence of vowel harmony can also be seen in the vowel changes which happen during compound formation, e.g. the formation of numerals:

(2.2)	a.	[dʒoːr]	[ịlan]	[mʲịan]
		two	three	ten
	b.	[dʒoːrmʲier]	[ịlanmʲịar]	
		twenty	thirty	(Novikova 1960: 54)

As I noted in section 2.2.2, the diphthongoid vowels behave differently in the Sebian-Küöl and Bystraia dialects. This can also be seen in compound numerals. While in Sebian Even the numerals from twenty to ninety are composed as in Standard Even, namely with harmonized vowel in the second part [-mịar] resp. [-mier], in the Bystraia district a regular harmony of the vowel is observed in the speech of only one of my four main informants. The other three speakers show more variation. Two of them use one and the same diphthongoid vowel, namely [ie], for the second part of these compounds: [dʒoːrmier, dʒuːrmier] 'twenty', [ịlanmier] 'thirty', [digenmier] 'forty', [tụnŋanmier] 'fifty' etc. The third one has [ie] in [dʒoːrmier] and [ịa] in [ịlanmịar], but uses [ịa] in all other numerals independent of the vowels of the first part: [digenmịar] 'fourty', [ńuŋenmịar] 'sixty'. The absence of harmony in these examples in the speech of three speakers might be an indication that they treat compounds as two separate words, and the vowel in the word /mịan/ 'ten' varies among and within speakers.

Describing vowel harmony in the Ola dialect, Novikova draws attention to the global character of this process. It affects not only vowels, but also consonants: some of them have allophones that are distributed depending on the set of the surrounding vowels. Novikova (1960: 74) notes a common tendency for all consonants to be retracted in the context of set 2 vowels. According to her, within a word containing set 2 vowels, labials become nasalized, dental stops get secondary dorsal articulation, and the velar voiceless stop becomes uvular. As noted in section 2.1.1.5, The lateral approximant has a palatalized variant within the context of set 1 vowels and a velarized variant within the context of set 2 vowels. I provide some measurements and discuss the interaction between vowels and consonants in the dialects of the Bystraia district and Sebian-Küöl in Chapter 5.

2.4 Description of the vowel opposition by different scholars

The description of Cincius (1947) was probably the first published work on Even where the phoneme inventory and phonological processes, and among them vowel harmony, were discussed. Cincius made a distinction between "soft" and "hard" sets of vowels (resp. set 1 and set 2) and between "narrow" and "wide" vowels. In the terminology of Soviet linguistics, from an articulatory point of view "narrow" and "wide" are associated with the degree of openness of the lower jaw. Usually it is high vowels which fall into the category of “narrow” vowels, while low and mid vowels are called “wide”. For this reason, in what follows I will refer to “narrow” vowels as high and to “wide” vowels as mid and low. Cincius’ (1947) classification is shown in Table 2.13. Note that in the table /äː/ is not transliterated, but given as it was in the original text. Apparently Cincius refers to the pronunciation of German “a-umlaut” and to the same phoneme which is /æ/ in Novikova’s notation and /ịa/ in the DoBeS practical transcription.

Table 2.13. Vowel inventory in Even from (Cincius 1947: 29) in Latin transliteration.

<table>
<tr><td rowspan="2">set</td><td colspan="2">low and mid vowels</td><td colspan="2">high vowels</td></tr>
<tr><td>normal</td><td>long</td><td>normal</td><td>long</td></tr>
<tr><td>set 1</td><td>e</td><td>eː i͡e u͡o</td><td rowspan="2">i u</td><td rowspan="2">iː uː</td></tr>
<tr><td>set 2</td><td>a o ^{i}e</td><td>aː äː oː</td></tr>
</table>

It is important to note that Cincius did not distinguish two sets for the high vowels. However, the notation /^{i}e/ is my transliteration of the Cyrillic letter “e” (a iotated /e/, which is pronounced as [je]), but Cincius did not call it a diphthong or a diphthongoid vowel. So, my interpretation is that in the IPA transcription this vowel would be close to the open mid /ɛ/. In a later analysis (Cincius & Rišes 1952), this vowel was not viewed as a separate phoneme but as a variant of set 2 /ị/ (cf. Table 2.14). Another interesting point deserving additional comment is that the diphthong /u͡o/ corresponds to the long set 1 /oː/ in the analysis of Novikova. However, the short set 1 /o/ is absent in this analysis of Cincius.

The rule of vowel harmony was formulated by Cincius as follows: a syllable with a set 2 low vowel /a/ can follow only syllables with set 2 low or mid vowels /a/, /o/, /^{i}e/ etc.; a syllable with a set 1 mid /e/ or with other set 1 vowels can be followed only by a syllable with a set 1 mid /e/. As for the high vowels /i/ and /u/, they can follow syllables with vowels of both sets. At the same time some words with these vowels can be combined only with set 1 suffixes, the others only with set 2 suffixes, as in example (2.3) (from Cincius 1947:31):

(2.3) a. ńur ńur-taki ńur-la
bullet bullet-ALL bullet-LOC

b. tur tur-teki tur-le
earth earth-ALL earth-LOC

As can be seen from example (2.3), both set 1 /e/ set and 2 /a/ can follow high vowels. It appears that the speakers have to learn which words belong to which harmonic set. Cincius (1947: 31) explained the reason for the opacity with respect to the choice of following vowels by the historical development in Even. Historically there were two different /i/-like phonemes and two different /u/-like phonemes, which are not phonetically distinguishable in the modern language. At the same time Cincius noted that in the majority of cases the /i/-phoneme that historically belonged to set 2 was changed into a more open set 2 phoneme /^{i}e/. These two claims together lead to a contradiction: on the one hand, two /i/-like phonemes are supposed to have merged, on the other hand, the majority of hard /i/'s are supposed to have changed into /^{i}e/. This contradiction was solved later in the analysis of Novikova.

A few years later Cincius & Rišes (1952) presented another version of the vowel system of Even in the section on phonetics of their grammar sketch. The vowel inventory given in this description was quite different from the one given by Cincius (1947, cf. Table 2.13):

Table 2.14. Vowel inventory in Even from Cincius & Rišes (1952).

	front	mid	back	
	non-labial			labial
high	i iː ieː ị ~ ^{i}e ịː			u uː ɵ ɵː ụ ụː
mid		e eː		o oː
low	äː		a aː	

This system looks more symmetrical. There are more phonemes and the relationship between them is more regular. There are at least two points in which this system differs from the one given in Cincius (1947). First, in the phonetic description of Cincius & Rišes (1952) there are two pairs of high vowels: /i/ vs. /ị/ and /u/ vs. /ụ/. The mid vowel /^{i}e/ which was described by Cincius (1947) as a separate phoneme is a phonetic variant of the short set 2 /ị/. Every member of the pairs /i/ vs. /ị/ and /u/ vs. /ụ/ has also a long counterpart, which was different in Cincius (1947), because the vowel /^{i}e/ had only a short variant. Secondly, in the description of Cincius (1947) both /o/ and /oː/ belonged to set 2, whereas in the description of 1952 there are in addition /ɵ/ and /ɵː/ as phonemes of set 1. Among the /o/-like phonemes of set 1 Cincius (1947) listed only the diphthong /u͡o/.

Thus, in the description of Cincius & Rišes (1952) the division of vowels into two sets is symmetrical and systematical (see Table 2.15): every vowel has a counterpart in the other set and most of the vowels have a length counterpart (with the exceptions of /äː/ and the diphthong /ie/). The authors describe the distinction between the two sets as relative height, i.e. every dotted vowel is lower than its counterpart without a dot.

Table 2.15. Division of the vowels into two sets from Cincius & Rišes (1952).

set 1	e	eː	ɵ	ɵː	ie	i	iː	u	uː
set 2	a	aː	o	oː	äː	ị	ịː	ụ	ụː

Cincius & Rišes (1952) formulated the rule of vowel harmony as follows: within one word vowels of only one set – either set 1 or set 2 – are possible; in case of suffixation the vowels of the suffixes are determined by the vowels of the root. This rule seems to be more general than the rule proposed in Cincius (1947): it involves all vowels without making an exception for the high vowels.

As noted in Chapter 1, the phonetic section in the description of Cincius & Rišes (1952) was written on the basis of research by Novikova. In her phonetic and phonological description of the Ola dialect, Novikova (1960) expanded the summary provided in the grammar sketch by Cincius & Rišes (1952): she gave many examples, provided details of articulation, and paid special attention to phonetic variation and differences between the Ola and other dialects. One of Novikova's phonetic findings was a pharyngealization distinction between the two classes of vowels.

Novikova explicitly argued against the idea of Cincius (1947) about the merger of high vowels. She claimed that there were two distinguishable pairs of vowels /i/ vs. /ị/ and /u/ vs. /ụ/, and also pairs for their long counterparts. According to her, the vowels /i/, /iː/, /u/, and /uː/ are clearly opposed to /ị/, /ịː/, /ụ/, and /ụː/ by their articulation in most Even dialects, and she provided numerous examples to show that this opposition is phonological. Novikova also referred to the intuition of the speakers who confirmed the differences between set 1 and set 2 vowels. Novikova proposed a more precise description of the articulation of the long fronted open vowel /äː/, for which she uses the symbol [æ]. Previously it was treated as a monophthong (Cincius 1947; Cincius & Rišes 1952). Novikova defined its status as a slightly pharyngealized diphthongoid vowel.

The Even phonological system proposed by Novikova was described in detail in the previous sections of the current chapter (sections 2.1, 2.2 and 2.3). This description has an additional value for phoneticians because Novikova demonstrated the pharyngeal articulation using X-ray photographs. In their classical textbook on phonetics, Ladefoged and Maddieson (1996: 306-307) described Even vowels as an example of a consistent pharyngealization opposition and provided the X-ray data from Novikova (1960). At the same time, they criticized the contours of the original photographs, which implied unexpected nasalization of all vowels. They concluded that one "should be cautious in fully accepting the validity of the rest of the indicated vocal tract shape". I should add that information about the experimental circumstances which could shed light on this nasalization effect is unfortunately lacking.

In 1978 Lebedev published his research on Moma Even (one of the Indigirka dialects in the classification of Burykin 2004). He provided a detailed characterisation of the vowel articulation. Following Novikova he noted the advanced position of the tongue for one set of vowels and a tendency towards a retracted (or less advanced) position for the other. Referring to these groups he used the terms "soft" and "hard" (set 1 and set 2), which correspond to palatal and guttural articulations. Lebedev claimed the universal character of this opposition not only for Moma Even, but for Even in general. However, his description contained a contradiction: insisting on a harmonic opposition for all vowels, he wrote that the difference between the pairs of /u/ and /i/ vowels of different sets is so slight both acoustically and articulatorily that the set opposition might be rejected for high vowels. Lebedev also provided X-ray contours, but for long vowels only.

In later work on Even varieties of the Okhotsk region, Lebedev (1982) reported the lack of a pharyngealization distinction for the vowels of these dialects. The opposition between vowels of different sets was described as being based entirely on relative height. Lebedev recognized only one diphthong with phonemic status, but this diphthong had different phonetic realizations depending on its position and the set of the other vowels in a given word.

Robbek (1989) pointed out that despite the existence of /ị/, /ị:/, /ụ/ and /ụ:/ as separate phonemes in Standard Even and a number of dialects, these vowels cannot be analyzed as phonemes independent of the non-pharyngealized vowels in the Even of Berezovka. Though they differ articulatorily from their harmonic counterparts, they are not used to distinguish members of a minimal pair. He described the phonetic distinction between the harmonic counterparts in terms of relative height: [ị], [ị:], [ụ] and [ụ:] are lower allophones of /i/, /i:/, /u/ and /u:/, respectively.

Dutkin (1995) and Dutkin & Belyanskaja (2009) working on the tundra dialects spoken in the north of Yakutia described the vowels of the "hard" set (set 2) as being pharyngealized. However, they did not provide any arguments for this claim other than referring to Novikova (1960). An interesting comment to support this claim was given by Burykin, the editor of Dutkin & Bel'anskaja (2009: p. 62 fn. 15): he insisted on the pharyngealization opposition for all vowels (including high vowels), despite the intuition of some native Even linguists who suggest a merger for the high vowels. According to Burykin, the opposition remains productive, even if native speakers deny it. They are supposedly incapable to focus on it due to strong Russian-Even interference.

The recent description of Kuz'mina (2010) deals with the Sebian dialect. In her brief review of the sound system Kuz'mina discusses the number of phonemes and some positional variation. The important point here is that she does not mention pharyngealization. According to her, the opposition between the two sets of vowels is based on relative height and different degrees of labialization (for back vowels). Since the Even of Sebian-Küöl is one of the main objects of my thesis I discuss the acoustic analysis of this variety in Chapter 3. Further, in Chapter 6 I discuss certain parallelism between my analysis and Kuz'mina's description.

To summarize the information about previous research, the attention of different scholars was drawn to the phonetic and phonological oppositions in Even vowels from the beginning of the structural studies of this language. However, it is only the Ola dialect – the basis for standard Even – which has received a detailed phonetic description. Vowel harmony is characteristic for all the described dialects, though descriptions vary with regards to which vowels are involved in the process in different dialects. Moreover, there is evidence that Even dialects differ in the underlying parameter by which the vowel sets are opposed with respect to vowel harmony – height, retractedness of the tongue or pharyngealization. Most dialectal descriptions are based on impressionistic facts or refer to the similarity with standard Even. Experimental methods were used only for the description of the Ola dialect (X-ray photographs) and the Moma dialect (length measurements and X-ray photographs).

Vowel harmony is a common feature of all Tungusic languages. But in the description of the vocalic systems of Tungusic languages the two vowel sets were called differently: “front” vs. “back”, “soft” (palatal) vs. “hard” (guttural), and in descriptive work on China’s Tungusic languages (Solon, Oroqen) the sets are described as “yang” vs. “yin” vowels (Li 1996). In the last decades researchers were interested in the phonetic and phonological explanation for this vowel opposition both in individual languages and in the common proto-Tungusic system.

The first study arguing for an interpretation of this distinction in terms of tongue root position was Ard (1980). His hypothesis was based on previous phonetic descriptions of Tungusic languages and on comparisons with some African languages (primarily Akan) described as having an ATR vowel distinction. Ard concluded that the underlying feature of the Tungusic system of vowel harmony was an RTR distinction and that Even represented the most robust RTR system among the Tungusic languages (see the arguments for this claim in chapter 3, section 3.1.4.)

Despite the general acceptance of this hypothesis, acoustic evidence for this feature is based on sparse data from Solon (Svantesson 1985), Oroqen (Lulich and Whaley 2012) and Even (Kang & Ko 2012). Relying on these data, the authors suggest rather an ATR vowel distinction for Oroqen than an RTR one as proposed by Ard (1980). I will discuss the acoustic parameters mentioned in connection with ATR and RTR further in Chapter 3.

2.5 Research question

As described in the previous sections, Even was the first among the Tungusic languages for which the RTR property was proposed. Until recently, there were no acoustic studies that provided evidence for this hypothesis in Even. The only data for Even, from Kang & Ko (2012), are very sparse. The other Tungusic languages for which acoustic data are available are Solon and Oroqen – Northern Tungusic varieties close to Evenki. Thus, one of the main goals of this study is to present acoustic data for Even to clarify the distinction between the two sets of vowels and to examine if these data can provide evidence for an RTR/ATR opposition. This allows not only the impressionistic comparison of auditory data, as was done before, but also makes it possible to compare the acoustic data from other languages with the Even data. Ideally, for the complete analysis of Even phonetics articulatory data have to be investigated as well. However, this work remains a subject for the future research.

The main question of my thesis is how the vowel systems are organized in the dialects under consideration. This question can be reformulated in several sub-questions: What is the number of vowel phonemes? Are there two harmonic sets and which vowels do they consist of? If there are two sets, what are the underlying features for the vowel oppositions? Is there a consonantal contribution to vowel discrimination? I focus on the distinction between two sets of vowels, examining a number of parameters. In a production study I investigated the acoustic features of formant values, spectral slope, and length, and looked at the significance of these parameters for the discrimination of corresponding vowels. This included the question about a possible merger of the high vowels of different sets, reported in previous studies. To present a full picture of the sound system, the acoustic investigation is supplemented by perceptual data.

Another important factor is the comparative view on the data, which allows me to follow the commonalities and independent developments in dialects of the same language. As presented above, previous phonetic studies of Even dialects were sometimes rather superficial. More detailed research was based on different dialects and did not consider any comparable materials. In this thesis I present comparable data from two dialects collected and analysed with the same methods as far as possible[15].

[15] It was only partly possible to get comparable word lists due to lexical differences between the dialects and the endangered status of the language. Recording lexical data of an endangered language is complicated because the speakers often do not have sufficient lexical knowledge in all semantic fields.

3 Acoustic characteristics of Even vowels and the question of RTR/ATR

In this chapter, I discuss the phonetic properties of the vowel sets analyzed as pharyngealized or as RTR vowels by phoneticians in various languages and provide the results of the acoustic analysis of Even data. In section 3.1, I focus on the notion of RTR/ATR and how it was introduced into the phonetic discourse (3.1.1); then I compare several descriptions of RTR/ATR sets in different African and Mon-Khmer languages, both from a purely descriptive impressionistic point of view (3.1.2) and from an acoustic perspective (3.1.3); after that I summarize what is known to date about pharyngealization and RTR/ATR in Tungusic languages. Section 3.2 is devoted to the acoustic analysis of the Even data. First, I give an overview of the methodology used during the recording and analysis of the data; moreover in this section I discuss some limitations of the data caused by the endangered status of Even. Then I provide details of the acoustic analysis comparing the data of two dialects (Bystraia and Sebian-Küöl) and summarize the results. In the discussion, I project the results of the acoustic study on the possible patterns found in ATR/RTR languages. The variability in these patterns makes it hard to draw definitive conclusions about the presence or absence of an ATR/RTR contrast in Even. However, the acousic analysis reveals a merger of at least one harmonic pair, namely /i/ and /i̧/ in the data from Sebian-Küöl, and an interesting tendency for duration to support the distinction between two vowel classes.

3.1. Pharyngealization and RTR/ATR

As shown in sections 2.2, 2.3.2 and 2.4 the features of pharyngealization and tongue root position (RTR/ATR) are especially important for the study of Tungusic vowel harmony. According to the phonetic and experimental data of Novikova (1960), the Ola dialect of Even has a vowel harmony system based on pharyngealization. In the research of Ard (1980) the Proto-Tungusic vowel system was defined as an RTR/ATR-system and it was claimed that some Tungusic languages still have this distinction, both as an articulatory characteristic and as an active phonological feature. In this section I summarize what is known to date about the articulation details of different tongue root positions and pharyngealization and its influence on the acoustic characteristics of vowels in different languages. In addition, I compare the available acoustic data from Northern Tungusic languages (Solon and Oroqen) with data from two regions which are known for ATR languages – West Africa and Southeast Asia.

3.1.1 The RTR/ATR distinction: a brief history

A phonological feature based on the position of the tongue root is found in languages of several regions of the world. ATR/RTR was first introduced based on data of Niger-Congo languages and attracted the attention of linguists in the 1960s (Ladefoged 1964, Stewart 1967, Halle & Stevens 1969). A similar pattern was found later in Southeast Asia in Austroasiatic languages (Gregerson 1976). The third region where ATR/RTR is assumed to be an active phonological feature is northeastern Siberia. In all of these cases, the vowel systems have two opposed sets of vowels, and the opposition is presumably based on the position of the tongue root together with certain pharyngeal settings. However, as I show below, despite the similarity of the phonological processes involved in this opposition, neither descriptive auditory characteristics nor acoustic parameters are systematically shared by the same sets of vowels in the languages of the world. Moreover, even the languages of Western Africa which are reported to have an ATR distinction show a number of differences with respect to some acoustic parameters. Thus, in the absence of a good reference point (i.e. linguistic data for comparison) and poor acoustic data available for the Tungusic languages, the label "ATR/RTR" should be taken with caution when applied to these languages. I discuss the arguments stated for this label in section 3.1.4.

According to the brief history of ATR described by Fulop et al. (1998), the notion of ATR/RTR as a phonological feature was introduced into the scientific discourse by Ladefoged (1964) in his description of the cineradiographic tracings taken of an Igbo speaker (Niger-Congo) and was later used by Stewart (1967) for the phonological description of Akan. In Stewart's terminology, before the introduction of the term ATR, the contrasting vowels were called "unraised" vs. "raised", but he himself was very critical about these labels and rejected the tongue raising hypothesis in favor of root advancing. By now a feature of ATR has been proposed in a number of descriptions of African languages (Niger-Congo languages such as Yoruba, Igbo, Degema; Nilo-Saharan languages such as Ateso, Dho-Luo, Maa, Kalenjin and others). Before this articulation was discovered and shown to be relevant as a basis for phonological opposition, there had been attempts to describe the differences in vowel sets of some African languages using a tense/lax distinction (see the critique of this approach to Akan by Stewart (1967: 196-202)). But the instrumental investigation by Ladefoged (1964) showed that the differences in tongue height which had been interpreted as evidence for a tense/lax distinction of the vowels can be explained by the process of tongue root movement. Ladefoged and Maddieson (1996: 302) claim that the distinction in tongue root position and the tense/lax distinction differ both acoustically and articulatorily. The description of Akan by Stewart gave rise to the term "ATR/RTR distinction" in studies of the phonologies of many African languages.

Another genetic group where similar phonological processes were observed is the group of Mon-Khmer languages (cf. Gregerson 1976). The vowel opposition in this language family was described in terms of 'registers', defined by a number of phonetic features: vowels of the first register are relatively lower, have clear resonance, and are sometimes pharyngealized; in contrast, vowels of the second register are relatively higher, breathy, and are characterized as 'dark sounding'.

From the beginning of the 1980s the region of Siberia and broader Northern Asia – first of all the Altaic languages – was recognized as another area where the feature of tongue root position is exploited widely. The first scholar who applied the ATR/RTR approach to the Tungusic languages was Ard (1980). Svantesson (1985) supported the hypothesis about the involvement of the tongue root and pharyngeal cavity in the articulation of vowels in Solon (a Northern Tungusic variety close to Evenki). He introduced the term 'pharyngeal vowel harmony' in his description of the vowel opposition in the eastern Altaic languages, in which he includes Tungusic, Korean and East Mongolian, as opposed to the 'palatal harmony' found in western Altaic languages, namely Turkic and West Mongolian (ibid.: 297). In his recent study Vaux (2009) proposed an ATR vowel system for proto-Altaic language (Tungusic, Mongolic and Turkic) and suggested articulatory and phonological arguments for the shift from an ATR vowel harmony to the backness vowel harmony characteristic of most Turkic languages. Mongolic and Tungusic languages would have retained, according to Vaux (2009), the ATR proto-system. Some evidence for an ATR opposition in the Korean vowel system was provided in historical studies of Korean by Ko (2010). However, Ko et al. (2014) argue that the system of vowel harmony of proto-Korean, proto-Mongolic and proto-Tungusic should be reconstructed as RTR vowel harmony.

3.1.2 Description of the RTR/ATR distinction

The features ATR/RTR are associated with a range of different articulations: these movements change the size of the pharyngeal cavity, influence the relative height of the tongue, and have an impact on the phonation type, or voice quality and voice timbre. In some languages the movement of the tongue root is also accompanied by a change of larynx position (e.g. in Mon-Khmer languages (Gregerson 1976)), which can result in the breathiness of the vowel. The advancement and retraction of the tongue root are complex articulations, and there does not seem to be a direct association between one of these tongue root positions and a specific phonation type. Physiologically, retraction of the tongue root leads to the constriction of the pharyngeal cavity, while advancement leads to its enlargement. For this reason, Lindau (1975, 1979) proposed the feature [expanded] instead of ATR. According to Ladefoged & Maddieson (1996), the body of the tongue is higher during production of the advanced vowels than the retracted ones.

Changes in relative height and voice quality make this articulation similar to the articulation of tense/lax vowels. In a review of languages with vowel oppositions which were described as tense/lax, Jessen (1999: 149) mentions three groups of languages: Germanic languages, certain African languages and certain Asian languages. In each of these areas the phonetic properties of the tense/lax distinction are different. The Germanic type is characterized by differences in duration and vowel quality, the distinction in African languages is based on the advancement vs. retraction of the tongue root, while in the Asian languages the distinction is realized primarily by contrastive voice quality. Similar terminological labels (e.g. tense/lax) applied to different phenomena can also be confusing, since in the discussion of voice timbre lax and tense configurations of the pharyngeal cavity are mentioned (Tiede 1996). Interestingly, in South East Asian linguistics the terms tense/lax vowels are used with an opposite meaning from that commonly used in German studies and refer to opposite phenomena than those found in Germanic languages, e.g. the term "lax" denotes longer and higher vowels (Maddieson & Ladefoged 1985: 435). But it is broadly accepted now (see e.g., Halle & Clements 1983, Ladefoged & Johnson 2010) that the tense/lax vowel distinction (as known from Germanic languages) does not correspond to a systematic RTR/ATR distinction, though articulatorily tense and lax vowels might differ in tongue root position. However, analysis of articulation data from English and German by Ladefoged & Maddieson (1996: 304) shows that "there is no common setting of the tongue root for the so-called lax vowels that distinguishes them from the so-called tense vowels." In contrast, vowels opposed by the position of tongue root (RTR/ATR vowels) have this articulatory distinction systematically.

In the rest of this section I focus on the phonetic characteristics of vowels which were analyzed as having an RTR/ATR contrast. This is, however, not an exhaustive review, since the feature ATR is applied to the phonological descriptions of a wide range of languages, especially in African linguistics. For example, Casali (2008: 505) examines the typology of ATR systems in Africa; in addition, he mentions a number languages outside Africa analyzed as having some form of ATR harmony. Among these are the Sahaptian languages Nez Perce and Palouse, the Chukotko-Kamchatkan language Chukchee, Palestinian Arabic, Catalan, various Spanish dialects, Tibetan, Korean, Javanese, and others.

Many researchers note an audible difference in voice quality between vowels contrasting with respect to RTR/ATR. However, descriptions of these sets contradict each other cross-linguistically. Stewart (1967: 199) discusses creakiness vs. breathiness in connection with [-ATR] and [+ATR] vowels, respectively, in Akan, also referring to previous studies of Berry (1952, 1955) and Pike (1947). Tucker & Mpaayei (1955 cited in Guion et al. 2004) describe the [+ATR] vowels in Maa as having breathy voice quality. Local & Lodge (2004) also report different kinds of phonatory activity during the production of [-ATR] and [+ATR] vowels in the Tugen dialect of Kalenjin. But in contrast to Akan and Maa, in Tugen Kalenjin it is [-ATR] vowels which are pronounced with noticeable breathy phonation. Moreover, as Fullop et al. (1998: 84) note, this peculiarity "is not observed in all languages with ATR harmony". They did not find any phonation distinction for Degema. In Maa (Guion et al. 2004), the authors confess that only one of them can distinguish auditorily a slight voice quality opposition (breathiness of [+ATR] vowels), but not in all cases. The same was pointed out by Ladefoged & Maddieson (1996: 302): "in most cases that we have heard, the West African languages using ATR do not have markedly different voice qualities." Casali (2008: 510), discussing voice quality in connection with the ATR contrast in African languages, writes: "I believe the voice quality distinction to be much more subtle than some of the impressionistic labels might imply <…> it is certainly not something that is so striking that it cannot be overlooked." Nevertheless, vowels opposed by the [±ATR] distinction can show differences in what is called voice timbre, despite the lack of a salient distinction in phonation.

There is also some discrepancy in the auditory description of [±ATR] vowels. On the one hand, Ladefoged & Maddieson (1996: 301) find that advanced vowels sound "brighter". On the other hand, Guion et al. (2004: 523), referring to previous studies on ATR, characterize advanced vowels as "deep", "hollow" or "breathy", and non-advanced as "brighter", "brassy" or "creaky". This also holds for the description of Mon-Khmer languages: "sepulchral", "deep" vowels belong to the second register, the one which Gregerson (1976) re-labeled as the ATR vowel class.

Different studies of Mon-Khmer languages further illustrate the discrepancies in description. The vowels of these languages are composed of two "registers" which differ in vowel quality (openness, height), voice quality and compatibility with initial consonant. As described by Shorto (1966, via Gregerson 1976) for Mon the "chest register" is characterized by breathy voice quality, general laxness of speech organs and centralized articulation, while vowels of the "head register" are pronounced with clear voice, relative tenseness and peripheral articulation. At the same time, Jenner (1966, cited in Gregerson 1976) distinguishes between two loci of resonance: oral resonance, which corresponds to the "head register", and pharyngeal, corresponding to the "chest register". But his description of the articulation contradicts that of Shorto: in the description of Jenner, oral vowels are lax and pharyngeal vowels are tense.

Another mismatch which was discussed by Gregerson (ibid.: 340-341) concerns additional pharyngealization of the vowels, which does not show the same pattern among Mon-Khmer languages. Thus, in the languages Jeh and Halang belonging to the group of North Bahnaric languages, vowels of the second register (ATR) are accompanied by additional pharyngealization, while pharyngealization was reported as an additional feature of the first register (RTR) for a different language, Sedang, belonging to the same language group. Thus, the data of Mon-Khmer languages show that additional pharyngealization can appear with vowels of both registers, both with advanced and retracted vowels.

Table 3.1 summarizes the data on differences in auditory impression between vowel classes in several languages. In these studies, all researchers agree that two vowel sets are opposed, but the phonetic characteristics, such as phonation type, voice timbre, tenseness of the voice organs, and pharyngealization do not match the same vowel classes in different languages.

Table 3.1. Differences in descriptions of ATR/RTR features.

Feature in Conflict	Language (Study)	+ATR	-ATR (or RTR)
Phonation	Akan (Stewart 1967)	breathiness	creakiness
	Mon (Shorto 1966 via Gregerson 1976)	clear voice	breathy voice quality
	Kalenjin (Local & Lodge 2004)	no information	breathy
	Degema (Fulop et al. 1998)	no phonation distinction	
	Maa (Tucker & Mpaayei 1955 via Guion et al. 2004)	breathy	no information
	Maa (Guion et al. 2004)	slight to inaudible voice quality opposition	
Timbre	Degema (Ladefoged & Maddieson 1996)	bright	no information
	Mon, Khmer (Gregerson 1976)	sepulchral deep	no information
Tenseness	Mon (Shorto 1966 via Gregerson 1976)	relative tenseness	laxness of speech organs
	Khmer (Jenner 1966 via Gregerson 1976)	lax	tense
Pharyngealization	Jeh and Halang (Gregerson 1976)	additional pharyngealization	no information
	Sedang (Gregerson 1976)	no information	additional pharyngealization

Typologically, the vowel systems with an ATR/RTR distinction are quite diverse, both from a viewpoint of the number of segments and in terms of phonological rules. Casali (2008) gives an interesting typological overview of ATR languages spoken in Africa. He categorizes languages by the number and characteristics of underlying phonemes. The main systems are: ten-vowel ATR system, nine-vowel ATR system and seven-vowel ATR system, with the latter further divided into two types. The ten-vowel ATR system is charactherized by two sets of five phonemes each, namely a [+ATR] set consisting of /i e ə o u/ and a [-ATR] set consisting of /ɪ ɛ a ɔ ʊ/. Such a system is most common and can be found in a number of sub-Saharan African languages (e.g. Bongo, Deg, Diola, listed by Casali, and Degema and Kalenjin mentioned above). Compared to this system the nine-vowel ATR system lacks the central low vowel of the [+ATR] set (e.g. Ngiti, Nawuri, and mentioned above Maa). The two types of seven-vowel systems differ in the contrasting sets of vowels. One type has a [+ATR] set of only the high vowels /i u/ and a full [-ATR] set consisting of /ɪ ɛ a ɔ ʊ/ (e.g. in Kinande). The second one has a set of four [+ATR] vowels consisting of /i e u o/ and a [-ATR] set consisting of the three vowels /ɛ a ɔ/ (as in Yoruba). Both of these types have an eight-vowel variant with a non-high central vowel /ə/ functioning as the [+ATR] counterpart of /a/ (Casali 2008: 503, cf. Wolof as an example of the second type with /ə/ specified as [+ATR] in Unseth 2009).

From a segmental perspective, Even is not similar to any of the systems described by Casali (2008). Instead of contrasts between front non-high vowels /e/ vs. /ɛ/ and between mid non-high vowels /ə/ vs. /a/, Even has an oposition of /e/ vs. /a/. As shown in Chapter 2, Even has eight monophthongs (if one does not assume any mergers), which are divided into two symmetrical sets, namely /i e o u/ vs. /ị a ọ ụ/. Even if one assumes that Even /e/ functions like /ə/[1], the Even vowel system does not fit into any eight-vowel system mentioned by Casali. In comparison to the system of the first type (including an additional /ə/) Even would still lack a front mid /ɛ/ of the [-ATR] set, but it would have a back mid /o/ of the [+ATR] set, contrasting with a [-ATR] /ọ/. If one compares the Even system to Casali's eight-vowel system of the second type, Even would again lack a front mid /ɛ/ of the [-ATR] set, but it would have both high vowels of the [-ATR] set, namely /ị/ and /ụ/, which are absent in Casali's system.

[1] Lulich and Whaley (2012) use the symbol /ə/ for Oroqen in cases corresponding to Even /e/. However, the Even data reveal that /e/ is clearly a front vowel. Allophonic [ə] appears in case of reduction in non-first syllables and fast speech as a result of reduction of several vowels, including /e/, but also /a/, /u/, /ụ/, /i/, /ị/, especially in the Bystraia dialect.

3.1.3 Acoustic correlates of the RTR/ATR distinction

The acoustic parameters discussed most frequently in studies of languages with a supposed ATR system are the first two formants and the spectral slope. The first formant (F1) is claimed to be the most reliable acoustic correlate of the advancement of the tongue root (Lindau, 1978; Hess 1992; Guion et al. 2004). According to Halle & Stevens (1969) an expanded pharyngeal cavity results in a lower frequency for F1. This was also supported by Fulop et al. (1998: 83): "If the back cavity volume is increased (by advancing the tongue root, for instance), then the associated resonance (i.e. F1) will drop in frequency." This is consistently attested in a number of African languages with [±ATR] vowel harmony: Akan (Lindau 1979, as cited in Ladefoged, Maddieson 1996), Degema (Fulop et al. 1998), and Maa (Guion et al. 2004).

The second formant (F2) has been found "to vary systematically across the ATR vowel sets. This variation, however, does not seem to be consistent from language to language" (Guion et al. 2004: 523). In Maa, the [±ATR] vowel pairs are not reliably distinguished by F2. However, data on Degema show higher F2 values for [+ATR] vowels (Fulop et al. 1998). Trigo (1991: 115) discussing the general mechanisms of the retraction and advancement of tongue root and their implications for the acoustic signal points out the following effect for the tongue root retraction: it raises F1 while depressing F2 and F3.

As I mentioned before, the ATR-contrast has often been compared to the tense/lax distinction (Stewart 1967, Gregerson 1976, Ladefoged and Maddieson 1996). The contrast of the ATR-feature with respect to the tense/lax opposition is clear when considering the values of F1 and F2 of ATR vowels. Ladefoged and Maddieson (1996: 304) note that in most cases the [+ATR] vowel "appears to be raised and advanced in acoustic space" in comparison to the [-ATR] vowel. In contrast, lax vowels are typically centralized relative to their tense counterparts. This means that front [+ATR] vowels, which are raised and advanced relative to front [-ATR] vowels, resemble tense vowels because tense vowels are also higher and more fronted relatively to their lax counterparts. However, back [+ATR] vowels, being raised and advanced relative to back [-ATR] vowels, differ from back tense vowels. High back tense vowels are further back in the acoustic space than their lax counterparts.

The differences in voice quality that have been discussed in section 3.1.2 from a purely auditory point of view look controversial from an acoustic perspective as well, rather than being a stable characteristic. Acoustically the differences in voice timbre ("deep" and "hollow" vs. "bright") and phonation type ("breathy" vs. "modal") correlate with the spectral tilt, or slope – the difference in the amount of energy in different parts of the spectrum. Stevens (1998) shows that breathy voice is characterized by a steeper spectral slope in comparison with modal voice. Considering the finding of Stevens (1998), [-ATR] vowels are associated with a lower spectral slope, i.e. less amplitude difference. Different ways of measuring spectral tilt were proposed for phonation differentiation. Gordon & Ladefoged (2001: 397) define spectral tilt as the "degree to which intensity drops off as frequency increases". They discuss the amplitude difference resulting from the comparison of fundamental frequency (F0) and the second harmonic (H2) and resulting from the comparison of fundamental frequency (F0) and the first formant (F1) with respect to different phonation types. Breathy phonation turned out to have the greatest drop and to be most steeply negative for both measures (H2-F0 and F1-F0). Keating et al. (2011) use a number of measures distinguishing phonation categories, and the difference between normalized first and second harmonics (H1-H2) is seen "to be the most important measure of phonation contrasts across languages" (p. 1049).

I use the term "slope" in my analysis, since I follow the approach of Fulop et al. (1998) and Guion et al. (2004) in choosing the measure of the difference between formant amplitudes, which is called "spectral slope" by these authors. According to Fulop et al. (1998: 84), "the tension in the vocal tract can alter damping of one or more formants, thereby affecting the relative amplitude of the formants". In their analysis, Fulop et al. (1998) used the normalized relative intensities of the first two formants (A1-A2) to provide evidence for timbral changes accompanying ATR vowels in Degema. Their results show that only two out of five vowel pairs opposed by the [±ATR] distinction have significant spectral slope differences. Those which do differ significantly with respect to this parameter, namely /i/ and /o/ vowel pairs, differ exactly as expected for ATR vowels, i. e. [-ATR] members of the pairs have a lower value of A1-A2 than [+ATR] (i.e. a less steep spectral tilt for [-ATR] vowels). Thus, the spectral slope is less steep for [-ATR] than for [+ATR].

Guion et al. (2004) investigate the same acoustic phenomenon in Maa. They discuss possible patterns and articulatory origins of spectral slope, connecting a lesser degree of damping with muscular tension, but conclude that "it is unclear whether greater muscular tension is more likely to occur in the [+ATR] or the [-ATR] vowels" (p.524). This suggestion seems to weaken the role of spectral slope as an acoustic proof of one vowel set being advanced or retracted. In other words, even if there is a significant difference in the spectral slope, one cannot definitely conclude on the basis of spectral slope whether a given vowel set is advanced or retracted. However, the authors also found a similar tendency for [+ATR] vowels to show a greater amplitude difference than for [-ATR], i.e. the spectral slope is steeper in the case of [+ATR] vowels than in the case of [-ATR] vowels. Overall, the effect of ATR was statistically significant, taking into account all vowel qualities, but five separate ANOVA tests (one per vowel quality) showed that only /e, ɛ/ and /o, ɔ/ were statistically significant.

The importance of spectral slope as a phonetic cue for vowel distinction was shown by Anderson (2003) in Ikposo (Niger-Congo, Kwa). In this language, the high vowels of different ATR classes cannot be distinguished on the basis of formant values. The members of the pair /i, ɪ/ entirely overlap with each other in the acoustic F1/F2-

space, and the same holds for /u, ʊ/. However, the opposition exists phonologically: the corresponding minimal pairs are not homophonous for the native speakers. A detailed acoustic investigation demonstrates that this opposition is based on a voice quality difference which correlates with the difference in amplitude between first and second harmonics (H2-H1). This harmonic differential is significant and consistent for both pairs of high vowels. However, the values of this parameter do not correspond to the pattern found in Maa and Degema described above. According to Anderson (2003: 87) "the harmonic differential for the [-ATR] vowel proved to be higher than for the [+ATR] vowel." Actually, the other harmonic vowel pairs (/o, ɔ/ and /e, ɛ/) show the opposite tendency, but the difference in harmonic amplitudes is not significant. Moreover, mid vowels in Ikposo are clearly opposed by the values of F1. Referring to Edmonson & Gregerson (1993) Anderson discusses the fact that vowels of different heights can behave differently. However, this seems to be language specific, as it was not the case in Degema, where /i/ and /o/ vowel pairs show the same tendency.

Thus, from an acoustic point of view the feature of ATR correlates with the following patterns (see Table 3.2, which summarizes the data from the above studies): [+ATR] vowels tend to have a lower F1 and a higher value of spectral tilt than [-ATR] vowels, though cross-linguistically there are counterexamples. With respect to F2 the data show discrepancies cross-linguistically (Guion et al. 2004). The role of spectral slope was shown to be important as a correlate of voice quality differences. However, the evidence for the role of spectral slope in Maa and Degema was based on significant differences for two vowel pairs only. Overall, the predictions for vowels of different heights and different ATR values are not clear.

Table 3.2. Acoustic parameters of the ATR distinction.

Feature	Language	+ATR	-ATR / RTR
F1	Akan, Maa, Degema, but not high vowels in Ikposo	lower	higher
F2	Maa	no significant difference	
	Degema	lower	higher
Spectral slope	Maa	higher	lower
	Degema		
	Ikposo (high vowels)	lower	higher

With respect to pharyngealization, which is often mentioned in the description of ATR systems, Ladefoged and Maddieson (1996: 307, referring to Catford, ms.) note that the properties of a pharyngealized vowel are a markedly lower frequency of the third formant and higher frequency of the first formant.

The information about perceptual differences of the [±ATR] vowels is also controversial. Stewart (1967), citing Westermann & Ward (1933), writes about their problems in perceptually differentiating vowels of different groups from each other (/i/ and /ɪ/; /u/, /ʊ/ and /o/), because they are very near to each other acoustically. Casali (2008) also notes that field linguists experience difficulties in hearing and transcribing ATR vowels of different sets, especially in distinguishing high [-ATR] vowels /ɪ/ and /ʊ/ from [+ATR] vowels /i/ and /u/ or from mid [+ATR] vowels /e/ and /o/. This contradicts the statement by Ladefoged and Maddieson (1996: 300) that the difference between [+ATR] and [-ATR] vowels "is often most obvious in the case of high vowels". However, the vowel plots on their p. 305 suggest that in several languages (e.g. Akan, Ateso, Dho-Luo) advanced and retracted high vowels are less distinct in terms of F1 and F2 than advanced and retracted low vowels. For Akan Stewart (1967: 199) claims the phonation differences to be very important: "It seems, in fact, that breathy voice is the main auditory correlate of root advancing." But as I mentioned before, this characteristic does not seem to be universal, since some ATR languages (e.g. Degema) lack a phonation distinction.

3.1.4 Acoustic and articulatory data in Tungusic languages

With regard to the articulatory peculiarities of Even vowels, the first pertinent description is that of Novikova (1960). As I mentioned in Chapter 2, Novikova suggests that in Ola Even two groups of vowels are clearly opposed by the feature of relative height accompanied by pharyngealization. As can be seen from Novikova's X-ray photographs of the vocal tract, pharyngealization is achieved by considerably constricting the pharyngeal cavity. During production of pharyngealized vowels the whole body of the tongue is retracted, so that a large resonance cavity is created in the front part of the mouth. For all pharyngealized vowels Novikova reports some degree of tenseness. She does not provide any evidence for timbre or voice quality differences.

Another available source on experimental studies in Even phonetics is the phonetic section of the description of Lebedev (1978), which deals with the dialect of the Moma district. The description of articulation and some remarks by Lebedev were mentioned in Chapter 2, section 2.4. He also provides X-ray tracings (for long vowels only) and provides some brief information about the speakers and the settings of the experiment. Unfortunately, the different vowels were not recorded within one experiment: As Lebedev writes in the introduction (1978: 11), X-ray photographs for /o/, /ọ/, /u/ and /ụ/ were made in 1962, whereas the data for the remaining vowels were obtained only in 1968-1969. Therefore it is not possible to generalize across all vowels, since the experimental settings were apparently not the same. The tracings obtained from the two experiments differ in the degree of detail and for that reason are hard to compare. In addition, the size of the pharynx cannot be seen for most of the vowels, so one cannot judge about the role of pharyngeal size on the base of these tracings. The author explains the difference between the two vowel sets as relative height and greater tenseness for the guttural (back) vowels.

One of the most influential studies on this problem was the paper by Ard (1980). His main claim is that the proto-Tungusic vowel system must be based on tongue root position, namely vowels pronounced with retracted tongue root (RTR) were opposed to vowels with neutral tongue root position. His arguments are based on descriptions of Tungusic languages and on a comparison with some African languages. According to Ard, Even has robust vowel harmony of the RTR type. Observations of Novikova (1960) and other researchers about relative height in pairs of "hard" vs. "soft" vowels, backness, tenseness and lower timbre of "hard" vowels are very similar to the description of Akan vowels (Stewart 1967), which are also opposed in tongue root position. Though for Akan the advanced tongue root (ATR) position was claimed to be the underlying feature, it is possible to see some similarities in the behavior of vowels. In Akan the higher set of vowels, which would correspond to Novikova's "soft" vowels, is relatively more fronted than the lower set. In other African languages described as having an [ATR] distinction, the lower of two vowels differing in relative height was reported to be produced with greater muscular tension in line with Novikova's "hard" vowels. Moreover, Ard explains the pharyngealization in the Ola dialect as a result of the decrease of pharynx size, triggered by tongue root retraction. As an additional argument, Ard mentions the auditory similarity between corresponding high vowels (/i/ and /ị/, and /u/ and /ụ/). Researchers of both African languages with an [ATR] distinction and of Tungusic languages notice that height is not the most salient difference for distinguishing high vowels of different sets (Lindau 1975, Novikova 1960).

Another goal of Ard's was to show that the tense/lax distinction was not a plausible explanation for the Tungusic vowel system, though it looked like an alternative solution. Some properties which make the Tungusic vowel system unlike a system with a tense/lax opposition are the fronting of "soft" back mid vowel and a velar/uvular alternation in the context of "hard" vowels. In African languages, [+ATR] vowels are in some cases more central; in particular, [+ATR] back vowels tend to be fronted. The same picture can be found in some Tungusic languages, for example in Negidal, where "soft" /o/ has become fronted and centralized. According to Ard, such behavior is not characteristic of lax vowels. Uvularization of velar consonants is also not typical for phonological systems with a tense/lax vowel distinction. Thus, together with the arguments coming from the comparison with African languages, Ard (1980: 25) argues for an original [RTR] distinction in Tungusic vocalism.

The first acoustic evidence supporting Ard's assumption was data from Solon (Svantesson 1985). These data were recorded by Svantesson from one Solon speaker who was originally from the Ewenki Autonomous County, Inner Mongolia. As Svantesson concludes from the acoustic measurements, the formant values show considerable similarity with Akan data (Lindau 1979). In addition, Solon is closely related to Even, which possesses pharyngealization according to Novikova (1960). This fact favours an interpretation of a vowel distinction in Solon in terms of pharyngealization or tongue root position. Svantesson calls this type of vowel harmony pharyngeal vowel harmony. According to his data, Khalkha Mongolian possesses the same type of vowel harmony. After Svantesson's study, the idea of Tungusic vowel harmony being based on tongue root position was accepted and mentioned by phonologists as one of the robust examples of this feature. However, data of only one speaker do not seem to be sufficient for making such a generalization and one has to be cautious in fully accepting it.

Li (1996) provides a detailed auditory phonetic description of the Oroqen vowel system and comes to the conclusion that the nature of the distinction in Oroqen and Even is not the same. He specifies the phonetic values of the opposition members as follows: the Tungusic family presents either an ATR vs. RTR distinction (Oroqen) or Neutral TR vs. RTR distinction (Even).

Recently Kang & Ko (2012) published an acoustic analysis of the data of Western Buriat, Tsongol Buriat (Mongolic), and Even. These data were recorded in 2006 within the project of the Altaic Society of Korea – Researches on the Endangered Altaic languages (ASK REAL). Their sample for Even consists of the recordings from a single speaker of one of the dialects of Magadan Oblast. The acoustic study included the analysis of the following parameters: fundamental frequency, main formants (F1, F2, F3), amplitudes of the formants (A1, A2, A3), bandwidths (B1, B2, B3), the two first harmonics (H1, H2), spectral slope (H1-A2, H1-A3, normalized A1-A2, center of gravity). The significance of each parameter was checked for each harmonic vowel pair. Their results show that it is only F1 which is significantly different for every harmonic pair in every language. The analysis of vowels in Western Buriat and Tsongol Buriat shows several parameters responsible for the opposition between harmonic counterparts: F1, A2, H1, H1-A2 and center of gravity show a significant difference in all vowel pairs in both Buriat varieties. In the Even data it is only F1 which differs consistently between all vowel pairs. Two parameters show a difference in three vowel pairs each (B1 for /i ~ ɪ/, /ə ~ a/ and /u ~ ʊ/, and center of gravity for /ə ~ a/, /u ~ ʊ/ and /o ~ ɔ/). Nevertheless, their overall conclusion is that these data confirm "that the Even vowel system is based on a tongue root contrast" (Kang & Ko 2012: 199). The authors take the existence of the [ATR] distinction in the languages under examination for granted and find different sets of acoustic correlates in each of them.

The study by Lulich and Whaley (2012) treats Oroqen data from an acoustic point of view. Their data were recorded from three speakers of Oroqen in the northeastern region of China. The authors found consistent differences in F1 and F3, which they see as prerequisites for a vowel harmony system that is based on an [±ATR] distinction. These acoustic results might suggest both pharyngealization and ATR distinctions as a common articulatory movement. However, the authors see less evidence for pharyngealization, since the F3 difference was significant only for two speakers out of three and the difference in F1 is larger. Thus, the authors claim that an ATR distinction is more likely, "although the feature [RTR] or [Pharyngealization] has not been decisively ruled out" (ibid., p. 73). The acoustic property of spectral tilt did not reveal a common pattern among all three speakers. To measure that, Lulich and Whaley used the difference between the amplitudes of the first harmonic (H1) and of the third formant (A3). Two of three speakers showed a smaller spectral tilt for [+ATR] vowels. This is the opposite tendency to the one described for Maa and Degema in section 3.1.3. Only for one of these two speakers was the difference in spectral tilt significant. For the third speaker the pattern was reversed, but also statistically non-significant. Nevertheless, the difference in spectral tilt is seen by the authors as an argument for an ATR distinction in Oroqen.

Thus, the acoustic studies on three varieties of Northern Tungusic languages – Solon, Oroqen and Magadan Even – suggest an ATR opposition as the basis for vowel harmony. Li (1996) specifies the distinction as an ATR vs. RTR contrast. The data on Even, according to Ard (1980), demonstrate the same opposition, but Li (1996) argues rather for neutral position of tongue root vs. RTR. Kang & Ko (2012) do not observe any F3 lowering for [-ATR] vowels, consequently they do not see [ATR] and [RTR] as two distinct features. However, it seems problematic to draw final conclusions on an articulatory feature like ATR/RTR based only on acoustic data, since, as shown in Table 3.2, no consistent cross-linguistic patterns are found for the acoustic behavior of vowels in ATR/RTR languages. Moreover, the Solon data were recorded from only one speaker and thus are not sufficient evidence for an ATR distinction. In the Oroqen study (Lulich & Whaley, 2012), the data and analysis are more detailed. However, some of their results (e.g. differences in spectral tilt) are hard to interpret in the way it is done by the authors, because the data of other ATR languages show opposite tendencies.

3.2 Even data on vowel quality: analysis of vowel production

The data discussed in this section were recorded in the Bystraia district (Kamchatka) and the village of Sebian-Küöl (Yakutia). Below in section 3.2.1, I describe the conditions of the recording, the word list recorded, and the acoustic analysis of the data. In section 3.2.2 I give the results of the measurements, and in section 3.2.3, I summarize differences and similarities between the two dialects. Further on, in section 3.3 I discuss the possible implications of these results.

3.2.1 Methods

3.2.1.1 Speakers and recording settings

As explained in Chapter 1, my intention was to collect a comparable set of data from different dialects. So I recorded two male and two female speakers in both field sites.

The recording in the Bystraia district took place in summer 2009. My informants were 55 and 50 years old (male), and 54 and 69 years old (female). All of them can be considered proficient Even native speakers. All speakers are bilingual in Even and in Russian. They use Even in everyday communication with their spouses, apart from one speaker, and have a wide network of Even-speaking friends in the villages. One of the female speakers was involved in the translation of the local newspaper from Russian into Even for several years. The other speakers did not have any special language-related activities. However, two of them were previously involved in reindeer herding – the traditional national Even activity which rather favors speaking Even and is seen as a factor in preserving traditional lifestyle and culture.

The recording sessions were performed either at the speaker's house, when the other family members were away, or at the house I was staying in. In both cases the room was quiet and shielded from background noises from the outside. I also eliminated all possible noises inside the recording room.

The recordings in the village of Sebian-Küöl were made in February and March 2010. The speakers were 17 and 23 years old (male), and 38 and 46 years old (female). Thus, the male speakers belong to a younger generation than the female speakers in Sebian-Küöl and than all the speakers from the Bystraia district. Nevertheless, they speak their heritage language fluently since they were raised in Even-speaking families. Both female speakers have a university degree in philology, and one of them works as a teacher of Even language and literature in the school. She also speaks standard Even and she noted the difference between the standard and local varieties during the recording sessions. All speakers from Sebian-Küöl who contributed to my study speak fluently both Russian and Sakha (Yakut). In general, trilingualism in Russian, Even and Sakha in Sebian-Küöl is quite common (see Chapter 1, section 1.3).

All recording sessions were made at the house where I stayed. Usually only the speaker and I were present in the room where the recordings took place, so it was quiet. In case of noise from the outside – the house was on the main street of the village – we interrupted the recording.

Most of the recordings were done with a Zoom H4n audio recorder (44.1 kHz/16 bit). One of the male speakers of the Bystraia dialect was recorded with another audio recorder – Marantz PMD 660 with the same settings.

3.2.1.2 Data

The initial word list was based on the examples from Novikova (1960). However, because of the lexical differences between Ola Even and other Even dialects, this list had to be adapted to the local dialect in both field sites. It contains about 500 items (different lexemes and grammatical forms) exposing all the major phonetic/phonological distinctions and processes. The recording of this list took about three hours with every speaker, so it was divided into several shorter sessions, which were spread out over different days. Before every session, the speakers looked through the list of words that was to be recorded on that day, in order to make sure they knew all required lexemes. The stimuli were written both in Russian and Even (in Latin transcription). Very often speakers changed the orthography (in accordance with their style and pronunciation) or even chose different lexemes to simplify the flow of the recording.

Each item on the list was repeated at least three times in isolation and three times in a carrier phrase. I used different carrier phrases in the Bystraia district and in Sebian-Küöl, because the analysis of the Bystraia data showed some difficulties with the carrier phrase chosen initially. It turned out that a labial consonant preceding the target word can influence the initial vowel of the target word. The target word was in the middle position in both phrases to avoid a falling intonation pattern at the end of the phrase. The carrier phrase used in the Bystraia district is given in (3.1), and the carrier phrase used in Sebian-Küöl in (3.2):

(3.1)	Bi	goː-weːt-te-m	_________	ereger.
	1sg	say-GNR-NONFUT-1SG		always
	I always say _________.			

(3.2)	Maša	_________	haːdụn	goː-ŋne-n.
	Masha	_________	seldom	say-HAB-3SG
	Masha says _________ seldom.			

There was also a slight procedural difference with respect to the repetitions. For the Bystraia dialect, each word was repeated three times immediately, followed by three repetitions of the carrier phrase with the target word. For Sebian-Küöl, the word list was recorded three times one after another, so that the speaker pronounced one item in isolation and the same item in the carrier phrase, and this was done for the whole list, after which this procedure was repeated two times. The recording procedure was changed because I observed that the speakers of the Bystraia dialect tended to employ a typical intonation of list reading when they had to produce all words in isolation three times in row. The possible influence of the “list” effect on the results was taken into account in the statistical model described in section 3.2.1.4 in such a way that the interaction of the factors DIALECT and TRIAL NUMBER was included in the model as fixed effect.

For the vowel analysis a smaller subset of items was chosen, where the vowel under examination is in a prominent position and the effect of the consonantal environment is minimal. It was impossible to use the same word list (based on Novikova's list from 1960) for the two dialects for several reasons mostly resulting from the high degree of dialectal differentiation and the endangered status of the language. First, some items recorded by Novikova in 1960 in Ola are unknown both in the Sebian and the Bystraia dialect. For example, the minimal length distinction for vowel quality /a/ was illustrated by Novikova with the minimal pair /amŋa/ 'mouth' vs. /aːmŋa/ 'dead seal' from the Ola data, but a word with the meaning 'dead seal' is absent in both the Sebian and Bystraia dialects. Another example for this problem is the minimal pair for the set-distinction for the short /u/: in the Ola dialect it was documented as /us/ 'weapon' vs. /ụs/ 'guilt'. Only two speakers of the Bystraia dialect knew the lexeme /us/ 'weapon', and none of the four informants was aware of the word /ụs/ 'guilt'[2]. Both lexical items are unknown in the Sebian dialect. The situation when a lexeme is known and used by some speakers and unknown to the others is not uncommon in both dialects.

Secondly, the items listed in the appendices 1 and 2 do not have the same number of instances for every speaker in my data set. This concerns especially the speakers from the Bystraia dialect (Appendix 1) who often gave four instances of the words in isolation. This is taken into account by adding the parameter TRIAL NUMBER into the statistical model. At the same time, for some length-quality combinations I did not have enough examples. For that reason, I included different grammatical forms of the same lexeme recorded from all four speakers. This concerns mostly long vowels, for instance, /ị:/ (both /ị:-da-j/ 'rub-PURP.CVB-PRFL.SG' and /ị:-D-DA-N/ 'rub-PROGR-NONFUT-3SG' are included in the Bystraia list) and /uː/ (both /uː-n/ 'blow-NONFUT.3SG' and /uː-de-j/ 'blow-PURP.CVB-PRFL.SG' are included in the Bystraia list; in the Sebian list there are /huː-de-j/ 'blow-PURP.CVB-PRFL.SG', /huː-n/ 'blow-NONFUT.3SG' etc.). I nevertheless miss data for the long /ị:/ for two speakers in the Bystraia district, although I have data from the other speakers of the same dialect.

Thirdly, the recorded word lists overlapped only partly due to dialectal differences. For example, some lexical items recorded in Bystraia were not found in the Sebian dialect: /oleː-t-te-j/ 'cook-RES-PURP.CVB-PRFL.SG', /ekič/ 'very', /buː/ '1PL.EX' etc. Furthermore, the vowel change of set 1 /o/ and /oː/ into set 1 /u/ and /uː/ in the

[2] However, according to the Comparative Dictionary of the Tungusic Languages (Cincius 1975) both of these items were at some point present in the dialect of Bystraia. The absence of /ụs/ 'guilt' and restricted usage of /us/ 'weapon' in the actual state of the dialect can probably be explained by the endangered status of the dialect and the result of language attrition.

Bystraia dialect discussed in Chapter 2 on the one hand reduces the number of minimal pairs for this dialect; on the other hand, it increases the differences in the word lists between the dialects. With respect to this vowel change, I have to add that I did not include into the list for acoustic measurements any recently developed /u/ or /uː/ which correspond to /o/ and /oː/ in other dialects. As discussed in Chapter 2, this vowel change occurred in most monosyllabic words, which constitutes a problem for finding minimal pairs reflecting the opposition of /o/ vs. /ọ/ and /oː/ vs. /ọː/. This opposition is kept only in the context of certain suffixes which block the change of /o/ and /oː/ into /u/ and /uː/ (cf. the locative marker in footnotes 9 and 10 in section 2.2.3). Thus, I deal here with quasi-minimal pairs, since it is not only the root vowels that differ, but also the suffix vowels. Generally, due to this change and the variation between the speakers it is hard to find many lexemes retaining /o/ and /oː/.

Moreover, although I had initially intended to use only stem vowels for the acoustic measurements, I included several suffix vowels in the data set in order to add more items of several vowel qualities: e.g., /ewe-di/ 'Even-ADJR', /irel-du/ 'summer-DAT' in the Sebian data, /ekmu/ 'mother.POSS.1SG' from both dialects.

Despite my initial plan to record a data list with vowels in similar consonantal contexts, the recorded list turned out to be unbalanced with respect to the consonantal environment. Another factor that was not kept constant is the position of the vowel within the word and the number of syllables in the word. However, I control for these factors in the statistical model, providing corresponding information about each lexeme (lexeme itself and the consonantal context before and after the vowel). The way of analyzing the data was also aimed at decreasing possible consonantal influences (see details in the section 3.4.1.3 on labeling principles).

The total number of vowel instances recorded in the Bystraia dialect that were included in my data set is 1706. The number of vowel instances recorded in the Sebian dialect in my data set is 1660. The difference between the numbers of recorded items in Bystraia and Sebian can be explained by the way of recording the repetitions: some speakers of the Bystraia dialect tended to pronounce every word not three, but four times (the first time to give a kind of standard pronunciation and then three repetitions in a row). In those cases, all instances of the word were included in the dataset. The work flow in the Sebian dialect was clearer to the speakers and required just three repetitions of the whole list. In total, the data set for the vowel analysis thus consists of 3366 instances. The methods of the acoustic measurements are described in the next section.

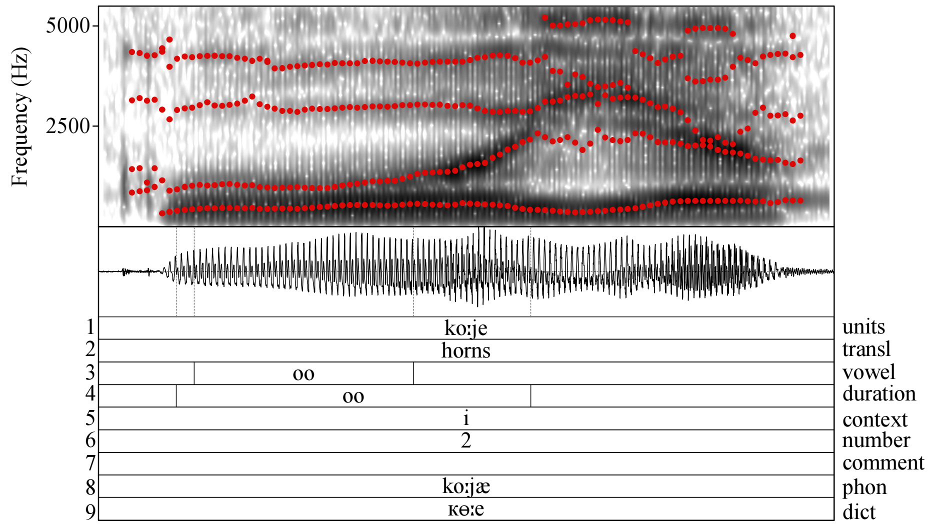
3.2.1.3 Acoustic analysis

The data on the acoustic parameters were obtained with the help of the software Praat (Boersma & Weenink 2010[3]). The initial mark-up of the data was performed with the annotation tool Elan (Sloetjes & Wittenburg 2008). At this stage, the whole data set was annotated in such a way that all recorded items were provided with a transcription and translation, and in many cases also with the lexical form from standard Even and comments. For further analysis these files in Elan (Sloetjes & Wittenburg 2008) format were converted into Praat Textgrid files for more detailed transcription and labeling of the start and end points of the vowel portions. (The onset and offset of F2 were taken to be the beginning and end of a vowel). For the formant measurements, only the steady portions of the vowels were used.

An example of an annotated long vowel /oː/ can be seen in Fig. 3.1. The first and second annotation tiers show the phonological representation and translation of the word, respectively. The next tier contains the intervals which are used for the formant measurements: only the part of the vowel with the stable formant configuration is marked. The following tier contains intervals corresponding to the vowel duration. The fifth tier shows whether the word was recorded in isolation or in a phrase (the corresponding labels are "i" or "p"). The sixth tier provides the position in the sequence of repetitions of this word. The seventh tier includes comments or additional information, which are absent in the given example. The last two tiers provide a phonetic transcription and the dictionary form of this word, respectively.

[3] For the measurements described in the following chapters the later version of Praat were used.

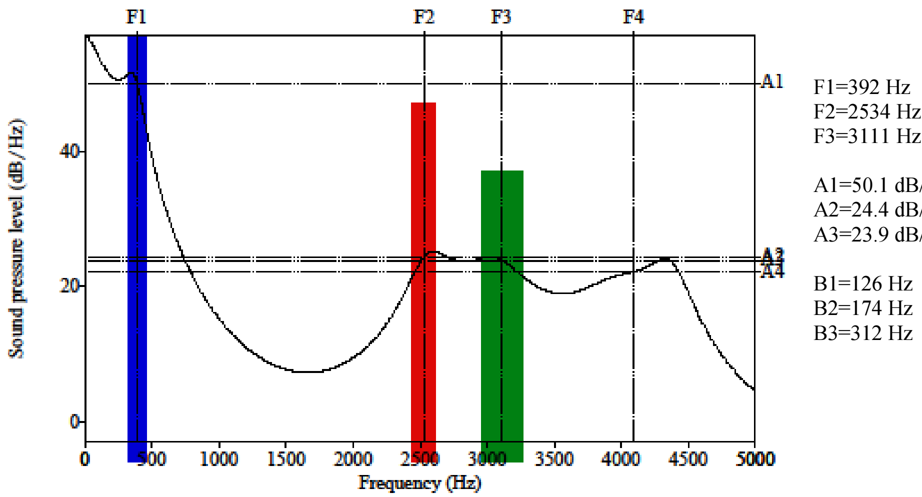
Fig. 3.1 An example of the mark-up of the data in the vowel data set.



The values of the acoustic data were obtained with a script developed by Dr. Sven Grawunder for vowel analysis in Praat (Grawunder 2011). For vowels, F0, F1, F2, F3, bandwidths and amplitudes of F1, F2, F3 were measured. It is important to mention some settings which were used for these measurements. A Hann filter was used with the lower edge of the pass band being 50 Hz, the highest one 16,000 Hz and the smoothing value 10 Hz. For the formant analysis the method "burg" was used with standard values of time step (0.0 sec) and maximum number of formants (5). For male speakers the maximum formant value was set at 5000 Hz, for female speakers at 5500 Hz.

An additional advantage of this Praat script was the possibility to visually check the configuration of formants, bandwidths, and amplitudes predicted by Praat. Fig. 3.2 shows the spectral slice for the vowel /iː/ (in the word /tiːniw/ 'tomorrow') and values of formant and amplitude measurements defined by Praat. The analysis by Praat was accepted if the vertical lines corresponding to formants coincide with the amplitude peaks. In case of a wrong analysis, the results for this item were saved in a separate table. Later all the missing data for these items were checked manually.

Fig. 3.2. Visual checking of the correspondence between formant peaks, formant bandwidths (the coloured bars) and formant recognition.



3.2.1.4 Statistical analysis

To investigate whether a given acoustic parameter differed significantly between vowels of different sets, I ran a General Linear Mixed Model (Baayen 2008). Fixed effects were DIALECT (“Bystraia” or “Sebian”), SET that the vowel belongs to (“advanced” or “retracted”), VOWEL QUALITY (“i”, “u”, “o” or “e”), LENGTH (“short” or “long”), the TRIAL NUMBER (“1”, “2”, “3” or “4”), CONTEXT (“isolation” or “carrier phrase”) and SEX of speakers (“m” or “f”). Parameter VOWEL QUALITY corresponds to the harmonic oppositions of vowels, so both /a/ and /e/ fall into the vowel quality of “e”. Random effect factors were recorded words, consonantal environment (two random effects controlling for consonantal onset and the following context) and the speakers. Since I expected the difference between vowels of the “advanced” and “retracted” sets to depend on dialect, and furthermore that this dependency would vary according to the combination of vowel quality and vowel length, I included, in addition to these main effects, all the interactions up to four into the model. As described in section 3.2.1.2, there was a slight procedural difference with respect to the repetitions of the same word in the Bystraia and Sebian dialects. To control for that, I also included in the full model the interaction between the dialect and the trial number.

It seems plausible to assume that different speakers do not only vary with regard to their overall pitch (which is modelled by random intercepts), but also that the difference between, for instance, different vowels varies between speakers. Hence, I included into the model random slopes within speakers of the following parameters: SET, VOWEL QUALITY, LENGTH, TRIAL NUMBER and CONTEXT. Including such random slopes into the model avoids anti-conservative tests of the respective fixed effects (Schielzeth & Forstmeier 2009).

To establish the overall significance of the parameters DIALECT and SET I compared the full model as described above with a null-model which lacks these two main effects and all interactions they were involved in, but includes all other terms comprised in the full model. This comparison was done using a likelihood ratio test (Dobson 2002). Having established the significance of the full model, I tested if the four-way interaction between SET, VOWEL QUALITY, LENGTH and DIALECT was significant. The model was fitted in R (R Core Team, versions from 2010 to 2012) using the function *lmer* of the R package *lme4* (Bates & Maechler 2010).

3.2.2 Results

In this section I present the results of the acoustic measurements for Even monophthongs and discuss the influence of different factors on these results and the statistical significance of each factor. First of all, I am interested whether the factor SET significantly influences the formant values, spectral slope and duration. Another important factor might be the difference between dialects. Moreover, within a dialect different vowel qualities might show different patterns with respect to the acoustic parameters under examination. I will examine each acoustic parameter separately and give an overview of the full picture at the end of this section.

3.2.2.1 F1

The full model created as discussed in section 3.2.1.4 with the values of F1 taken as a response was clearly significant as compared to the null model (likelihood ratio test: χ^2= 189.66, df=25, P=2.95e-27). Statistical analysis shows a significant influence of the four-way interaction of the parameters SET, DIALECT, VOWEL QUALITY and LENGTH on the F1 data (χ^2=17.05, df=3, P=6.91e-04). Having thus established the significance of this interaction, I further consider the data from the two dialects separately and divide them into subsets according to vowel qualities.

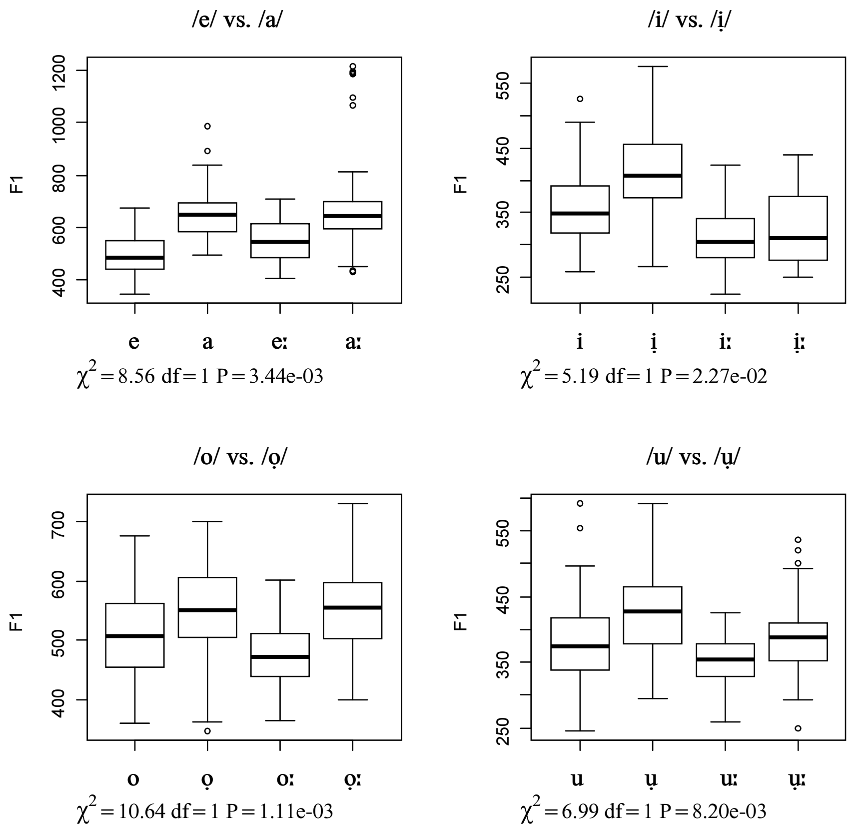
The Bystraia dialect

The three-way interaction of SET, VOWEL QUALITY and LENGTH for all Bystraia vowels is not significant (likelihood ratio test: χ^2=3.18, df=3, P=0.37). However, two two-way interactions are significant for these data: the interaction between SET and

VOWEL QUALITY (χ^2=36.82, df=3, P=5.03e-08) and the interaction between VOWEL QUALITY and LENGTH (χ^2=59.51, df=3, P=7.46e-13).

On the level of the individual vowel qualities one can see a clear tendency for set 1 vowels to have a lower F1 than set 2 vowels regardless of length. This is confirmed statistically: SET as a main effect reveals statistically significant results for each of the vowel qualities (see the significance levels in Fig. 3.3).

Fig. 3.3. The distribution of the F1 values for different vowel qualities in the Bystraia dialect.

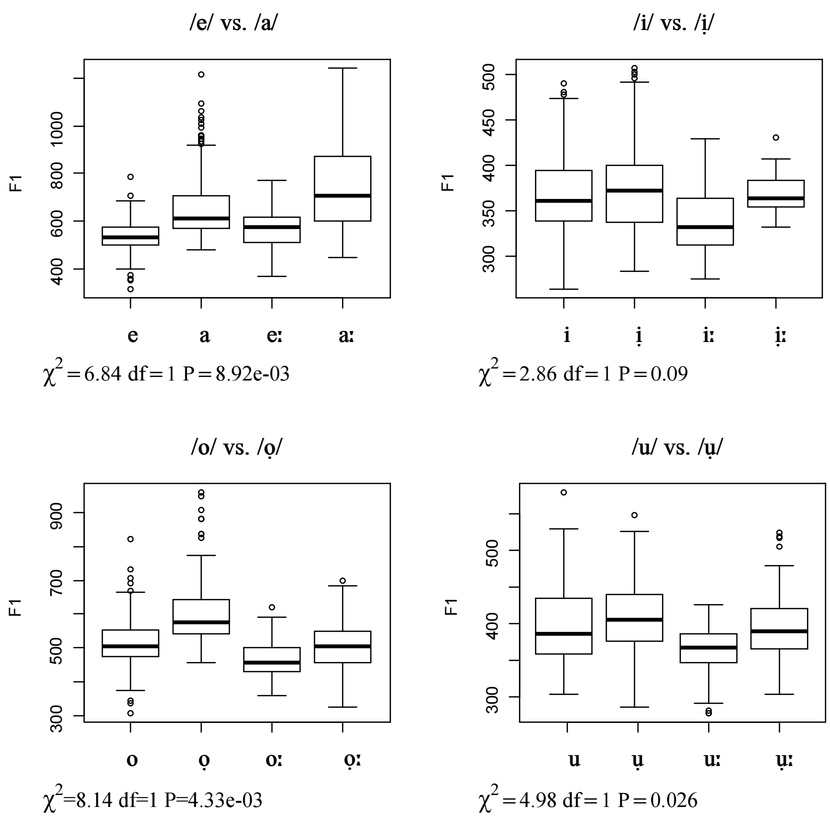


<u>The Sebian dialect</u>

The three-way interaction of SET, VOWEL QUALITY and LENGTH for all Sebian vowels is not significant (likelihood ratio test: χ^2= 7.05, df=3, P=0.07). However, as in the Bystraia dialect, a two-way interaction between SET and VOWEL QUALITY shows significant influence (χ^2=19.97, df=3, P=1.72e-04), as does the interaction between VOWEL QUALITY and LENGTH (χ^2=27.08, df=3, P=5.66e-06). This suggests that both SET and LENGTH influence the distribution of F1 values specifically for each vowel quality.

Further dividing the Sebian data set into subsets according to the vowel qualities shows that the interaction of the factors SET and LENGTH is not significant for any vowel quality. However, the factor SET is significant for some vowels as a main fixed effect (opposition of /a/ vs. /e/, /o̯/ vs. /o/, and /u̯/ vs. /u/), regardless of the vowel length, see Fig. 3.4. It is non-significant for the opposition /i̯/ vs. /i/. For the Sebian data the same tendency as in the Bystraia dialect is noticeable: set 1 vowels have a lower F1 than set 2 vowels regardless of the length.

Fig. 3.4. The distribution of the F1 values for different vowel qualities in the Sebian dialect.



3.2.2.2 F2

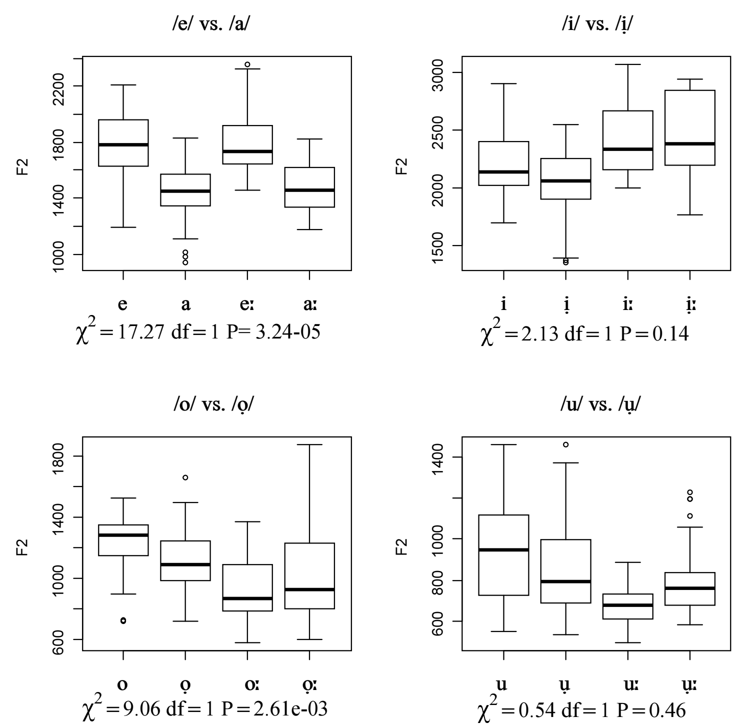
The four-way interaction of SET, DIALECT, VOWEL QUALITY and LENGTH with the data of F2 taken as the response is significant (χ^2= 17.32, df=3, P=6.08e-04).

<u>The Bystraia dialect</u>

The three-way interaction of SET, VOWEL QUALITY and LENGTH for all Bystraia vowels with respect to the data of F2 is not significant (χ^2=2.79, df=3, P=0.43). However, all the two-way interactions (SET and VOWEL QUALITY, VOWEL QUALITY and LENGTH, SET and LENGTH) show a significant influence on the distribution of F2 data.

At the vowel level no single pattern can be found (see Fig. 3.5). For the opposition of /e/ vs. /a/ SET is significant as a main fixed effect. For the pair of /o/ vs. /ọ/ the interaction between set and length reveals a significant influence. However, the oppositions /e/ vs. /a/ and /o/ vs. /ọ/ reveal no common tendency with respect to F2. For the high vowels /i/ and /u/, set does not significantly influence the distribution of F2.

Fig. 3.5. The distribution of the F2 values for different vowel qualities in the Bystraia dialect.



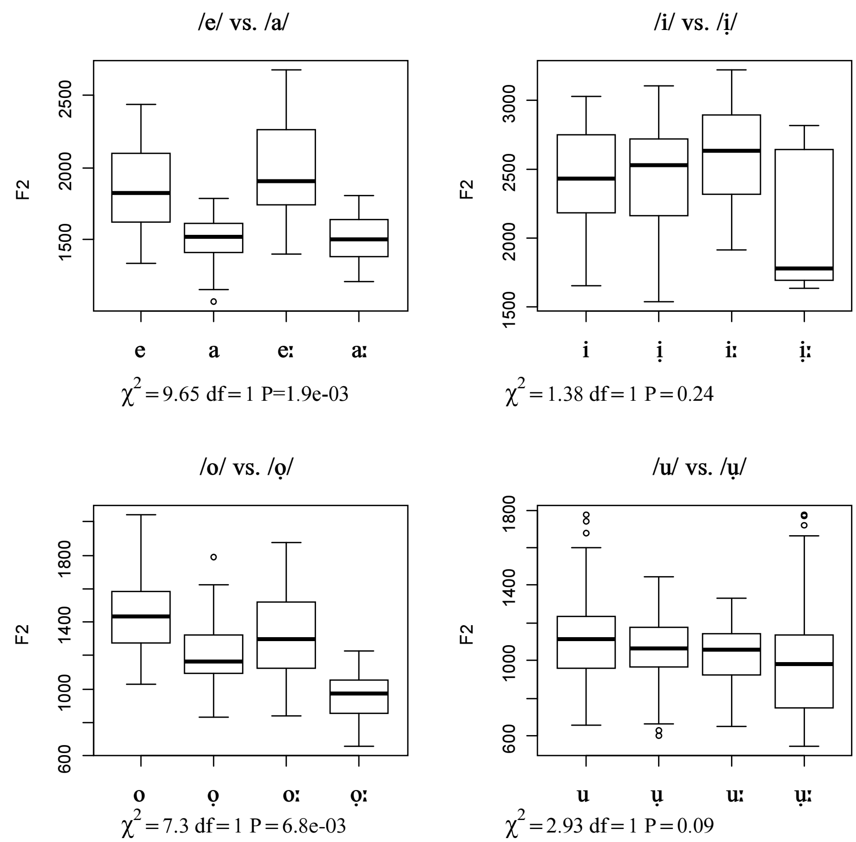
However, it is noticeable that the pairs of /o/ vs. /ọ/, /u/ vs. /ụ/ and /i/ and /ị/ show the same tendency: the short vowels of set 1 have a higher F2 than the short ones of set 2, but the F2 values of the long set 1 vowels are slightly lower than those of the long set 2 vowels.

The Sebian dialect

The three-way interaction of SET, VOWEL QUALITY and LENGTH for all Sebian vowels is significant (χ^2= 15.01, df=3, P=1.81e-03).

The factor SET as a main fixed effect is consistently significant for the pairs /e/ vs. /a/ and /o/ vs. /ọ/ (see the significance values in Figure 3.6). The difference in SET for the high vowels is not significant. The plots in Figure 3.6 show a clear pattern only for the pairs /e/ vs. /a/ and /o/ vs. /ọ/. The vowels of set 1, namely /e/ and /o/, have higher values of F2 than the vowels of set 2, /a/ and /ọ/. For the pair of /e/ vs. /a/, this can be explained by the natural manner of articulation: /e/ is normally more fronted in the acoustic space (which implies higher values of F2) than /a/. This also holds for the Bystraia data. At the same time, the fronted position of set 1 /o/ in Sebian was also expected from the auditory experience, as described in Chapter 2. The pair /u/ vs. /ụ/ also shows a similar pattern, but not that strongly. For this vowel quality the vowels of set 2 also have a lower F2 than the vowels of set 1, but there are also some notable differences. Compared to the pattern of /e/ vs. /a/ and /o/ vs. /ọ/, the F2 values of the set 1 /u/ are just slightly higher than those of the long set 2 /ụ/. The other observation concerns the relative difference in F2 between set 2 short vowels and set 1 long vowels: /a/ has a lower F2 than /eː/ and /ọ/ has a lower F2 than /oː/. However, there is almost no difference between /ụ/ and /uː/.

Fig. 3.6. The distribution of the F2 values for different vowel qualities in the Sebian dialect.



3.2.2.3 F3

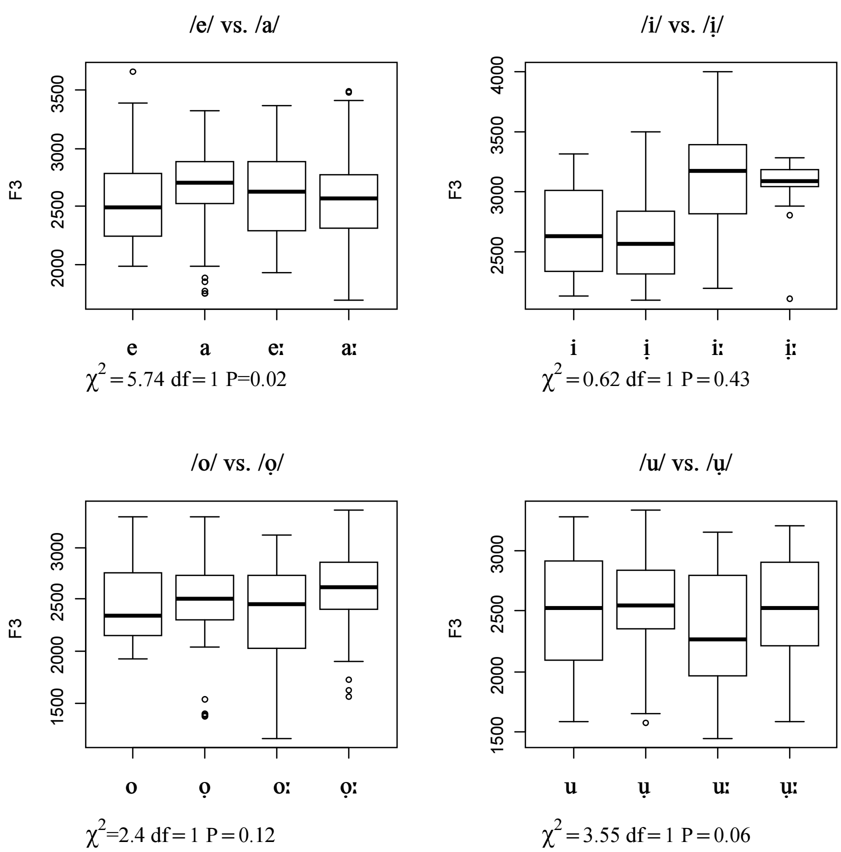
The four-way interaction of SET, DIALECT, VOWEL QUALITY and LENGTH with the data of F3 taken as the response is significant (χ^2= 16.01, df=3, P=1.13e-03).

<u>The Bystraia dialect</u>

The data of the Bystraia dialect do not show a significant influence of the three-way interaction of SET, VOWEL QUALITY and LENGTH on the distribution of F3. Among the possible two-way interactions, the interaction between SET and LENGTH is the only one which is significant (χ^2=40.56, df=3, P=8.12e-09).

Statistical analysis for the individual vowel qualities does not reveal a clear pattern. An interaction between SET and LENGTH reveals significant results only for the pair of /e/ vs. /a/ (see Fig. 3.7). But long and short vowels of this opposition do not show a common tendency. SET as a main effect is not significant for any other vowel quality. Special note has to be taken of the F3 values of the /i/-vowel: the influence of SET is not significant, but the data is clearly distributed according to the length opposition. The difference in F3 is statistically significant for the opposition of long and short /i/, whereas it does not play a role for the SET opposition.

Fig. 3.7. The distribution of the F3 values for different vowel qualities in the Bystraia dialect.

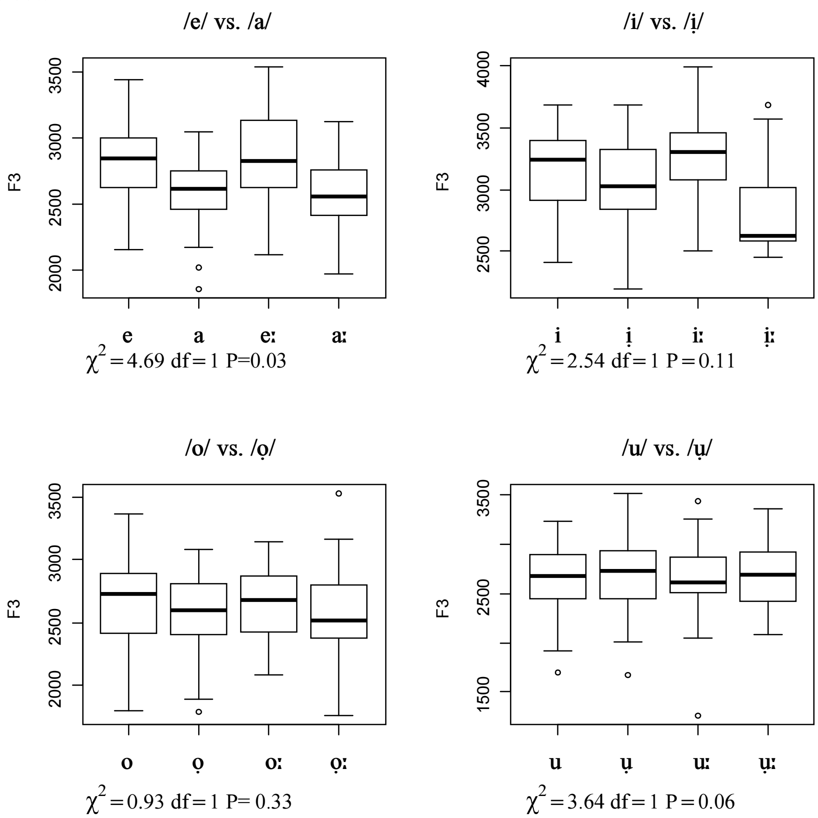


<u>The Sebian dialect</u>

As in the case of the Bystraia dialect, the F3 data for the Sebian dialect do not reveal a significant three-way interaction of SET, VOWEL QUALITY and LENGTH, but the two-way interaction of SET and VOWEL QUALITY is significant (χ^2=24.16, df=3, P=8.93e-06).

On the level of individual vowel qualities the factor SET as a fixed effect shows a statistically significant influence only for the pair of /e/ vs. /a/. It does not significantly influence the distribution of F3 values for any other vowel pairs (see Fig. 3.8). However, one can discern a slight tendency for the set 2 vowels to have a lowered F3 in comparison with the corresponding set 1 vowels. It is only the pair of /u/ vs. /ụ/ which falls out of this pattern.

Fig. 3.8. The distribution of the F3 values for different vowel qualities in the Sebian dialect.



3.2.2.4 Spectral slope

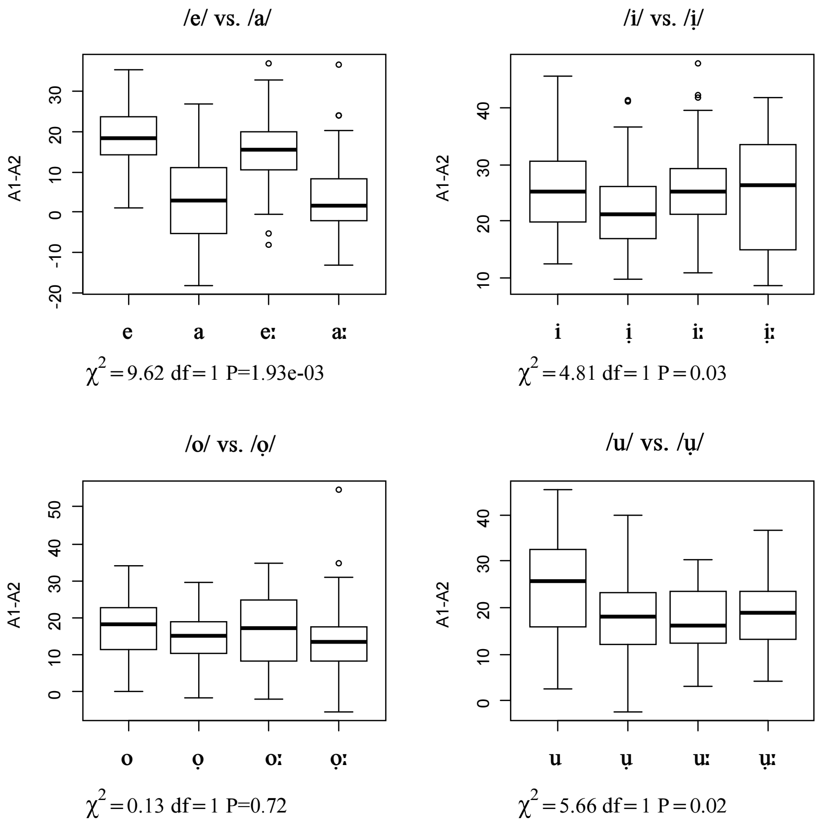
One of the important acoustic characteristics of ATR/RTR vowels is the amplitude difference A1-A2, also called spectral slope. Statistical analysis of this parameter shows a significant four-way interaction of SET, DIALECT, VOWEL QUALITY and LENGTH (χ^2= 9.84, df=3, P=0.02).

The Bystraia dialect

The data of the Bystraia district do not reveal a significant three-way interaction between SET, VOWEL QUALITY and LENGTH. However, all two-way interactions of these factors play a significant role with respect to the spectral slope. The significant interaction of SET and VOWEL QUALITY (χ^2=44.33, df=3, P=1.28e-09) is most interesting for my study, since it says that SET has a specific influence on each vowel pair.

The analysis of the individual vowel qualities shows that the values of spectral slope do not significantly differ between /o/ and /ọ/. For the other vowels SET has a significant influence with respect to spectral slope. At the same time, the difference in the spectral slope is not consistent for all vowels (Fig. 3.9). While /e/ and /e:/ have a larger spectral slope than /a/ and /a:/, the high vowels have different patterns for different vowel lengths. The short vowels of set 1 have a larger spectral slope than the short vowels of set 2, but the long vowels of set 1 have a slightly smaller spectral slope than the long vowels of set 2.

Fig. 3.9. The variation of the spectral slope for different vowel qualities in the Bystraia dialect.

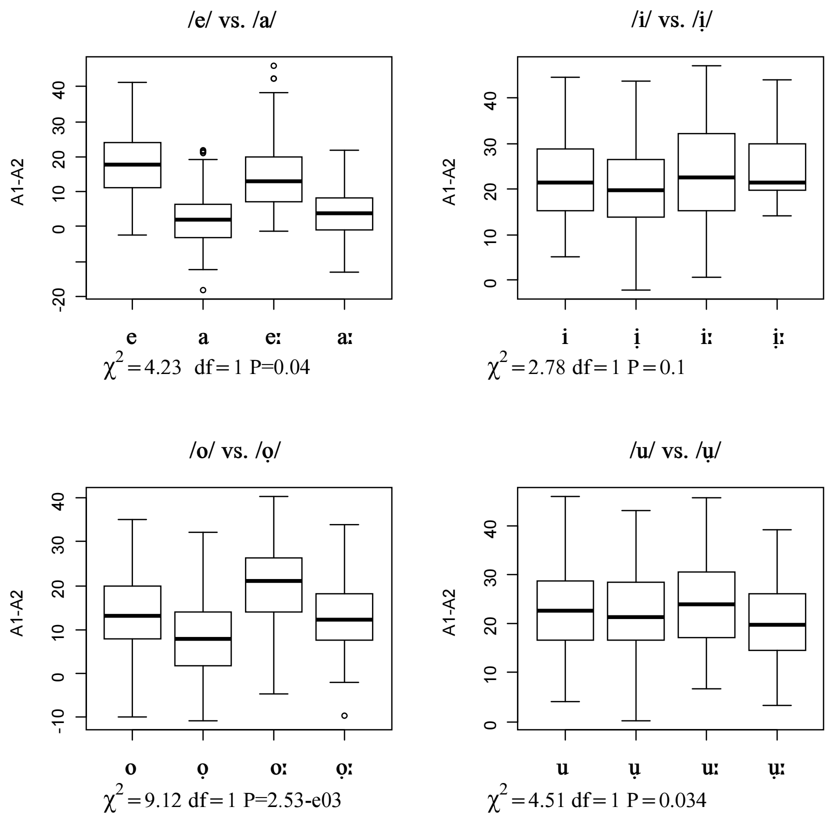


<u>The Sebian dialect</u>

The three-way interaction of SET, VOWEL QUALITY and LENGTH is significant for the data of the Sebian dialect (χ^2=9.15, df=3, P=2.74e-02).

The variation of spectral slope is not significant for distinguishing /i/-vowels of different sets. The other vowels show a statistically significant tendency to have a larger spectral slope for set 1 and a smaller spectral slope for set 2.

Fig. 3.10. The variation of the spectral slope for different vowel qualities in the Sebian dialect.



3.2.2.5 Duration

Duration has so far not been known as a crucial parameter for distinguishing between ATR and RTR vowels. Guion et al. (2004) analyzed this parameter in Maa and concluded that it did not differ between [+ATR] and [-ATR] vowels in this language. Jessen (1999) also notes that a vowel opposition based on an ATR distinction does not involve durational differences, unlike the tense/lax distinction. Nevertheless, I included duration into the group of acoustic measurements to be analyzed, since it seems reasonable to explore the duration differences in a language described as having a length distinction. Unexpectedly, this parameter shows an interesting tendency for short vowels to differ depending on set (stronger for the Bystraia dialect than for Sebian). It is particularly visible looking at the data of individual speakers. Below I examine the duration of vowels belonging to the different harmonic vowel sets independently for each dialect and each length.

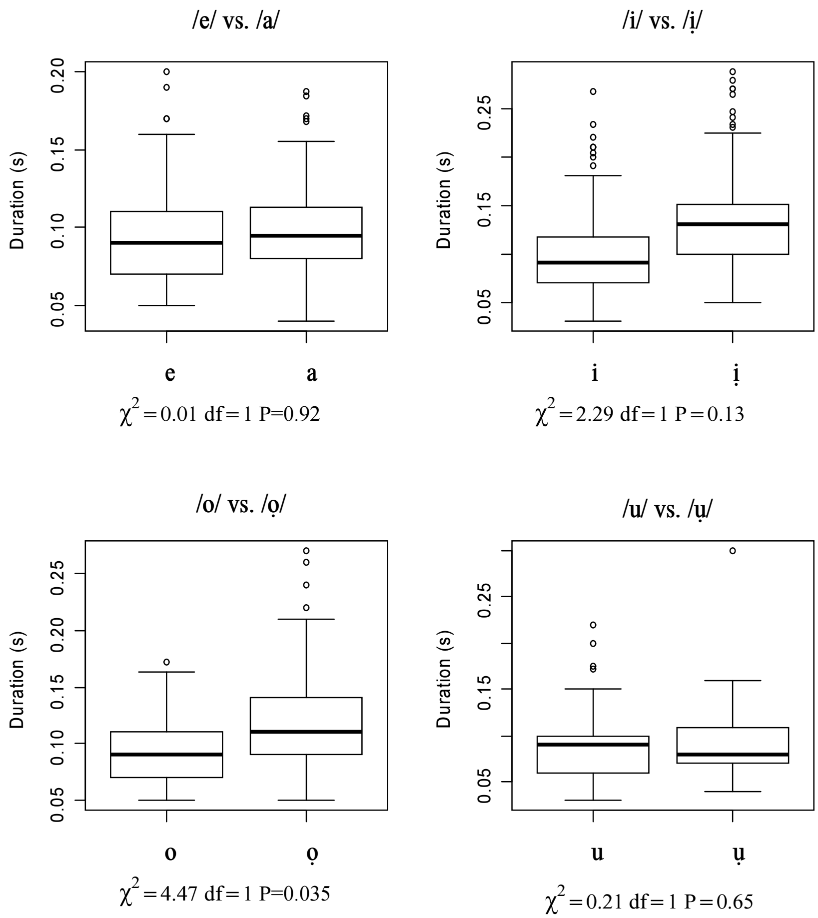
The full model comprising a four-way interaction of SET, DIALECT, VOWEL QUALITY and LENGTH compared to the reduced model which lacks the factor SET was not significant (χ^2= 6.37, df=3, P=0.08). That means that the factor SET does not have an influence on duration when comparing the 2 dialects. However, exploring data within individual dialects gives more insights.

The Bystraia dialect

The duration data of the Bystraia dialect reveal a statistically significant three-way interaction of SET, VOWEL QUALITY and LENGTH (χ^2=12.82, df= 3, P=0.005). Since Even has been described as a language with contrastive vowel length (Novikova 1960: 34), it is worth exploring if duration differs between Set 1 and Set 2 within vowels of different length in the same way or not. When analyzing only the short vowels the factor SET is significant as a main effect (χ^2=5.32, df=1, P=0.02).

Differences in duration between the sets of short vowels can be seen in Fig. 3.10. For the pairs /e/ vs. /a/ and /u/ vs. /ụ/ there is no duration difference between set 1 and Set 2. However, the pairs /i/ vs. /ị/ and /o/ vs. /ọ/ reveal a consistent difference: the vowels of Set 2 tend to be slightly longer than the vowels of Set 1. This difference does not hold statistically for the pair /i/ vs. /ị/. The only pair which distinguishes the two sets by duration is /o/ vs. /ọ/.

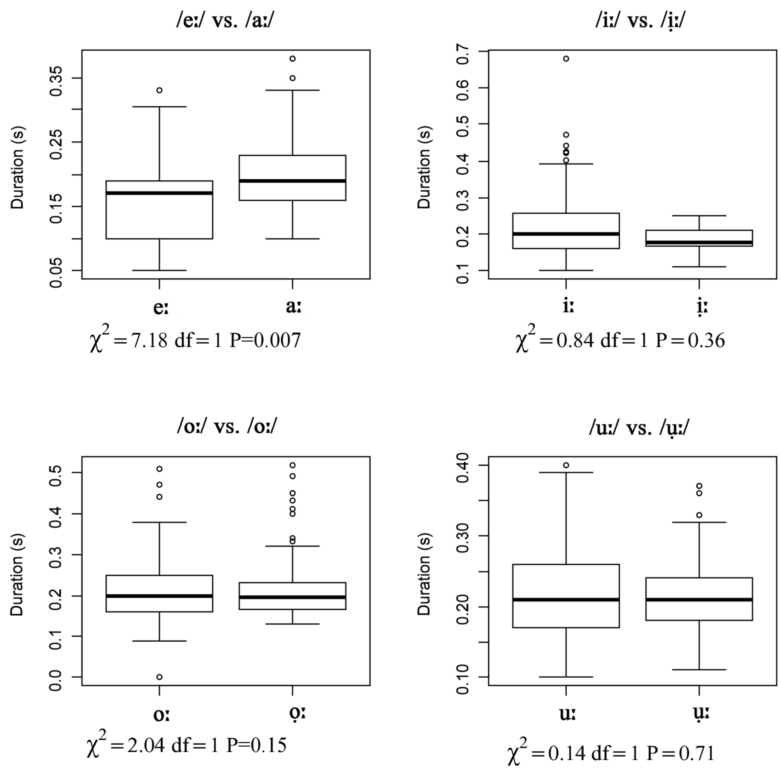
Fig. 3.10. The variation in duration of the short vowels of the Bystraia dialect.



In contrast to the short vowels, the long vowels of the Bystraia dialect do not reveal any statistically significant results with respect to duration and vowel opposition between Set 1 and Set 2 (χ^2=0.81, df= 1, P=0.37).

On the level of the individual vowels, it is only the pair /eː/ vs. /aː/ which reveals a statistically significant difference with respect to duration. The other vowel pairs do not show any significant differences in duration (see Fig. 3.11).

Fig. 3.11. The variation in duration of the long vowels of the Bystraia dialect.



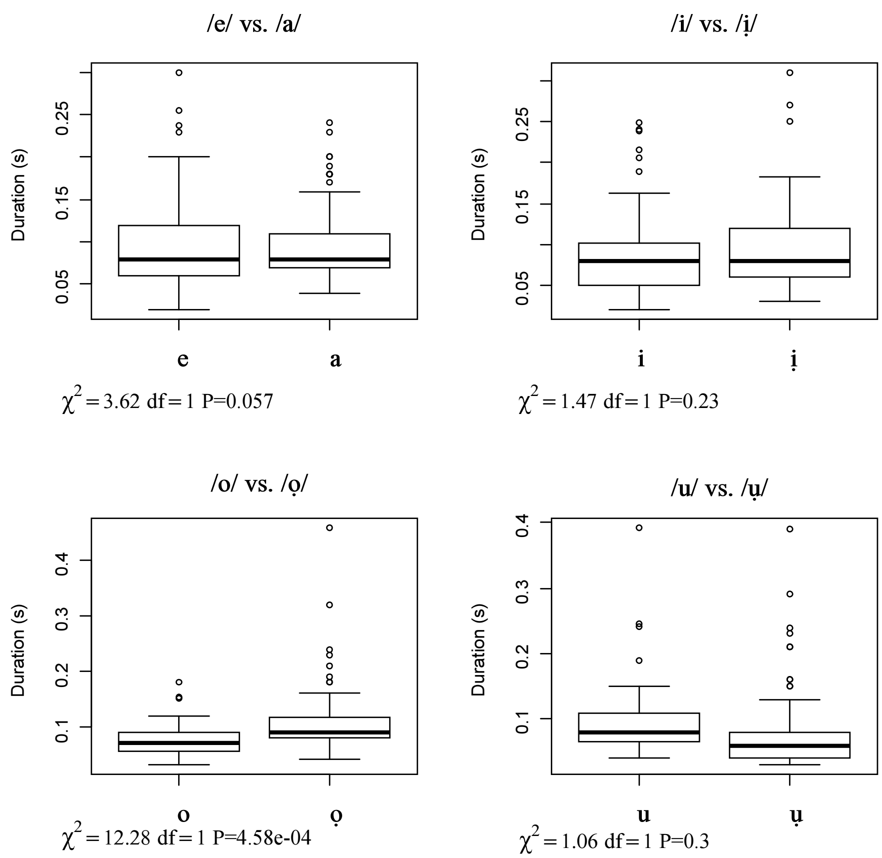
It is notable that the duration between /eː/ and /aː/ differs significantly in this case, unlike in the case of the corresponding short vowels. One would expect the duration differences to be the same for long and short vowels if they are driven by the differences in articulation of these vowels. So far I do not have an explanation for this phenomenon.

<u>The Sebian dialect</u>

The durational data of the Sebian dialect differ strongly from those of the Bystraia dialect. Unlike the Bystraia dialect, the data of the Sebian dialect do not reveal a significant three-way interaction between SET, VOWEL QUALITY and LENGTH (χ^2=5.49, df= 3, P=0.14). Within short vowels, the factor SET does not show any significant influence on duration either (χ^2=2.52, df= 1, P=0.11).

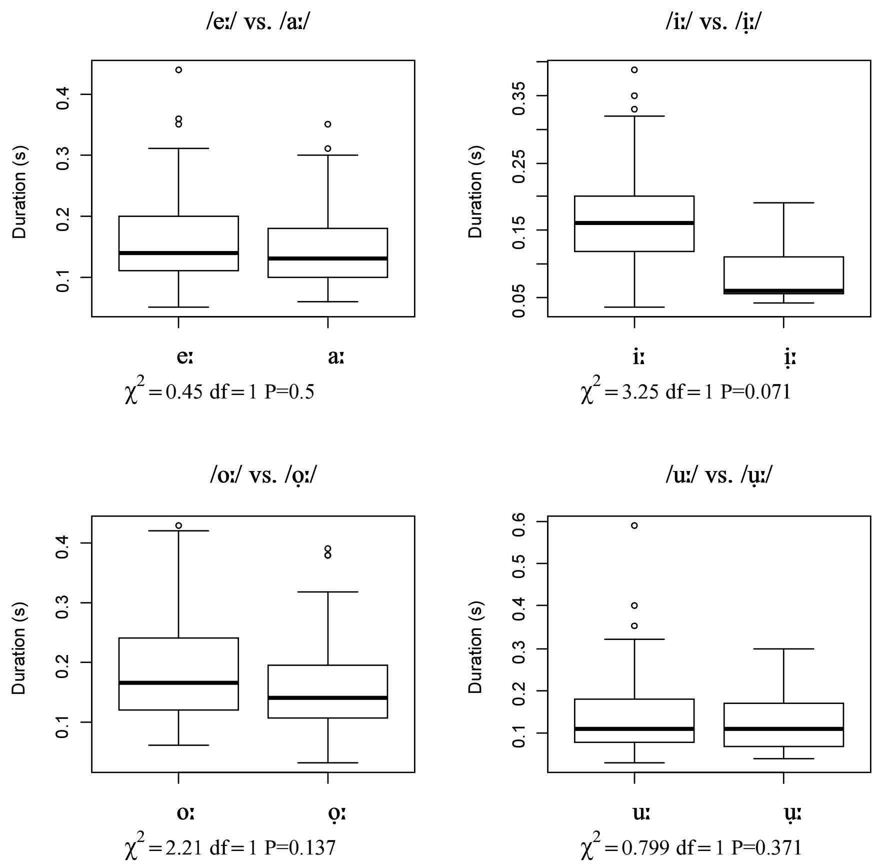
Also at the level of individual vowels, most of the vowels are not divided into two groups by their durational properties (see Fig. 3.12). The only vowel opposition for which this parameter reveals a statistically significant effect is /o/ vs. /ọ/. The character of difference between the two sets is in this case the same as in the Bystraia dialect, namely the vowels of set 2 are longer that the vowels of set 1.

Fig. 3.12. The variation of the duration in the short vowels of the Sebian dialect.



For the data of long vowels with all vowel qualities examined together the interaction between SET and VOWEL QUALITY is significant (χ^2=8.03, df=1, P=0.045). However, among the individual vowels, none of the vowel pairs reveals a significant difference which is opposed by duration (see Fig. 3.13). A common tendency, though not significant, can be seen for the pairs /o/ vs. /ọ/ and /i/ vs. /ị/. But unlike the previous patterns, here it is vowels of set 1 which are relatively longer.

Fig. 3.13. The variation in duration of the long vowels of the Sebian dialect.



Another way of exploring the data is to check the possible patterns within each speaker. Although the factor SPEAKER was always included in the statistical analyses I described above, presenting the duration data individually for each speaker shows up some interesting patterns.

As shown for both the Bystraia and the Sebian short vowels, /i/ and /o/ have a tendency to vary with respect to the duration depending on the set of the vowels (see Fig. 3.14).

Fig. 3.14. Vowel duration per speaker (short vowels). The black line refers to the vowels of set 1, the dashed one to the vowels of set 2.

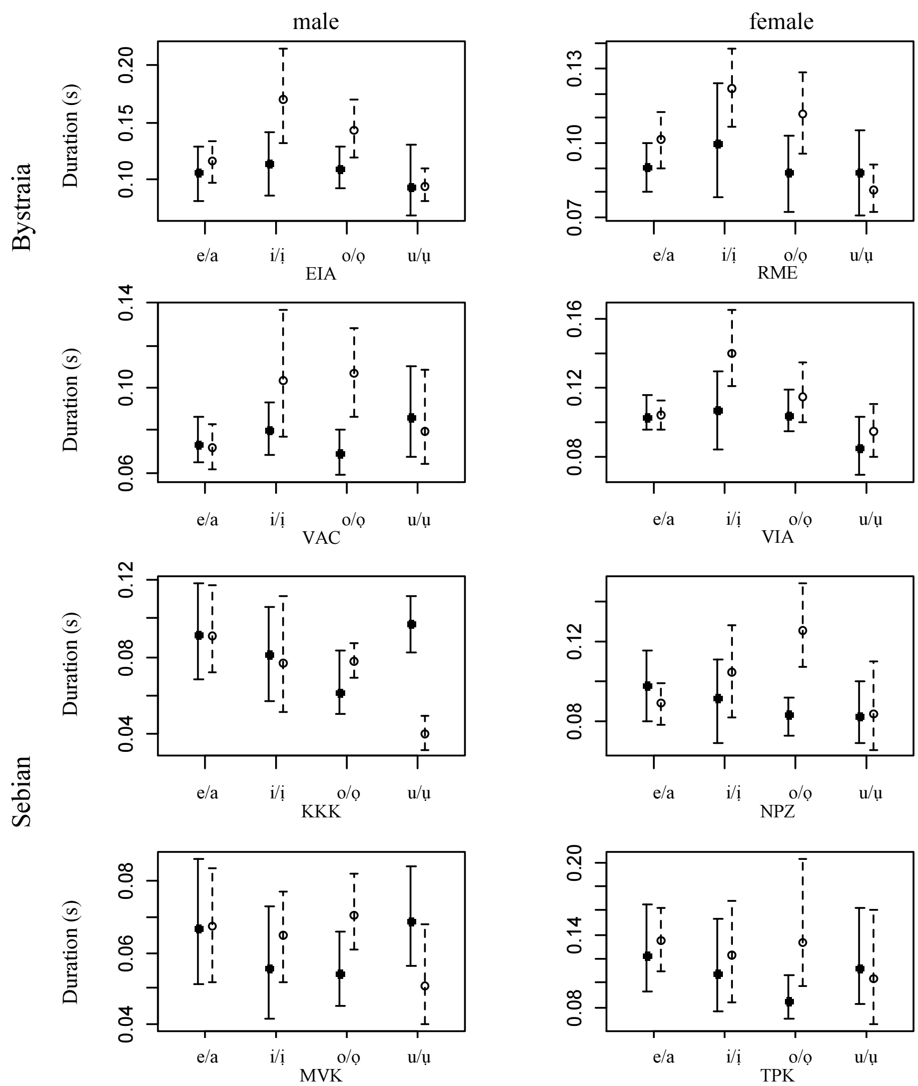
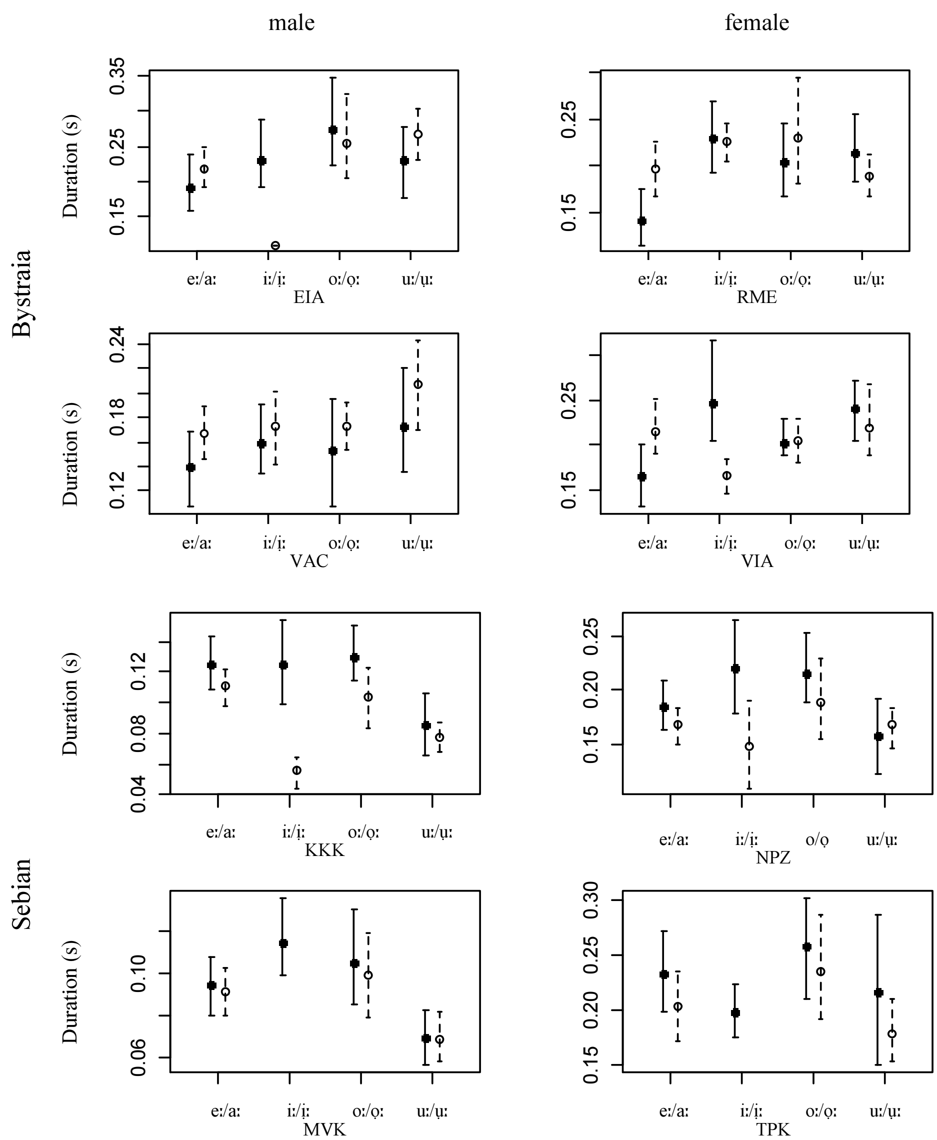


Fig. 3.14. shows that the vowels of set 2 are slightly longer than the corresponding vowels of set 1. This tendency does not hold statistically for either of the dialects for both for /i/ vs. /ị/ and for /o/ vs. /ọ/; however, as one can see in Figure 3.14, this pattern holds for most speakers (seven out of eight: only the data from the speaker KKK do not support this tendency). The tendency is more pronounced in the Bystraia dialect than in Sebian. Within the Sebian dialect, the duration difference between /o/ and /ọ/ is more striking for the female speakers than for the male speakers.

As to the duration of the long vowels, the situation differs in the two dialects (see Fig. 3.15), although there are some limitations in the data. Unfortunately, for one speaker of the Bystraia dialect (EIA) and for two speakers of the Sebian dialect (MVK and TPK) the data for the long set 2 /ị:/ are missing due to the rare occurrence of this phoneme and different sets of lexemes recorded with each speaker (see the discussion of this problem in section 3.2.1.2). The dashed line corresponding to the set 2 for /ị:/ for these speakers is therefore absent in Figure 3.15.

Nevertheless, the available data still allow one to speak about different tendencies in the two dialects. In the Bystraia dialect, long /a:/ and /e:/ differ significantly in duration for all speakers. This was also reflected in Fig. 3.11, where the duration difference was significant only for the opposition /a:/ vs. /e:/. With respect to the other vowels, no consistent pattern can be found across speakers. However, in the Sebian dialect, there is a general tendency for set 1 vowels to be of greater duration compared to set 2. With respect to the tendency observed for the short vowels – set 1 /i/ and /o/ are shorter than their set 2 counterparts – the long vowels of the Sebian dialect show rather the opposite pattern. Set 1 /i:/ and /o:/ tend to be longer than set 2 /ị:/ and /ọ:/. However, it has to be taken into account that the data for /ị:/ are not available from three speakers..

Fig. 3.15. Vowel duration per speaker (long vowels). The black line refers to the vowels of set 1, the dashed one to the vowels of set 2.



3.2.3 Summary

The statistical analysis of the acoustic data shows clear differences between the Bystaia and Sebian dialects. All the four-way interactions that include the factor DIALECT reveal significant results.

The only parameter which shows the same significant tendency in both dialects is the first formant. However, it is only the Bystraia dialect where all vowel pairs reveal a significant difference between set 1 and set 2 vowels with respect to F1. Within each vowel quality the vowels of set 1 have a lower F1 than the vowels of set 2. The same tendency can be discerned for the vowels of the Sebian dialect. In Sebian the factor SET has a significant influence only for three vowel pairs out of four (the difference in F1 was not significant for /i/ vs. /i̩/, but the same tendency holds for this vowel pair as well).

With respect to the second formant, the factor SET is significant only for the vowel pairs /e/ vs. /a/ and /o/ vs. /o̩/, not for the high vowels /i/ vs. /i̩/ and /u/ vs. /u̩/. However, in the case of the opposition of /o/ vs. /o̩/ in the Bystraia dialect, it is the interaction of SET and LENGTH which has a significant influence on the data. The distribution of F2 values for short and long vowels is significantly different for this vowel pair. As to the Sebian dialect, the factor SET is significant as a main effect for non-high vowels. The plots in Figure 3.6 show the same pattern for both pairs /e/ vs. /a/ and /o/ vs. /o̩/: set 1 vowels have higher values of F2 than set 2 vowels.

The data of the third formant show no consistent tendencies. In both the Bystraia and the Sebian dialect SET has a significant influence on the distinction between /e/ and /a/. But while in Bystraia the distribution of F3 values for /e/ and /a/ is different depending on length, in Sebian /e/ has a higher F3 than /a/, regardless of length. For the other vowels, SET is not significant in either Bystraia or Sebian. However, in the Sebian dialect there is a tendency (with the exception of the /u/-vowels) for set 1 vowels to have a higher F3. In the Bystraia dialect it is hardly possible to discern any regularity.

The amplitude difference, or spectral slope, also has different tendencies in the dialects. In the Bystraia dialect, SET has a significant influence on this parameter for all vowels except for /o/ vs. /o̩/, but in the Sebian dialect it is significant for all vowels except for /i/ vs. /i̩/. There is no common pattern in the data distribution with respect to SET in Bystraia, but in Sebian set 1 vowels have larger values of spectral slope than set 2 vowels.

Duration had never been seen in other languages as a parameter which can vary depending on the vowel set. However, the analysis of the duration in the Even dialects reveals some tendencies. First, it concerns the short vowels /o/ and /i/: the set 2 counterparts of the harmonic pairs are longer than the set 1 counterparts. This pattern is common for both the Bystraia and the Sebian dialect. For the long vowels, an opposite tendency can be observed only for the data of Sebian. The long /iː/ and /oː/ of set 1 tend to be longer than their set 2 counterparts. However, as mentioned above, this tendency is weakened by the insufficient data for /ị:/ in the Sebian dialect.

Table 3.3 below gives an overview of the analyzed parameters and their significance level with respect to the factor SET. This table provides the significance of the difference between vowels sets for given parameters, but it does not account for the direction of the difference.

Table 3.3. Overview of the analyzed parameters ("✓" stands for significant difference, "×" stands for non-significant difference; "*" and "**" stand for significance at the 5% and 1% level, respectively).

		F1	F2	F3	Spectral slope	Duration	
						short	long
Bystraia	/e/ vs. /a/	✓**	✓**	✓*	✓**	×	✓**
	/i/ vs. /ị/	✓*	×	×	✓*	×	×
	/o/ vs. /ọ/	✓**	✓**	×	×	✓*	×
	/u/ vs. /ụ/	✓**	×	×	✓*	×	×
Sebian	/e/ vs. /a/	✓**	✓**	✓*	✓*	×	×
	/i/ vs. /ị/	×	×	×	×	×	×
	/o/ vs. /ọ/	✓**	✓**	×	✓**	✓**	×
	/u/ vs. /ụ/	✓*	×	×	✓*	×	×

3.3 Discussion

In this section I compare the Even data with data from other languages which were described as having a vowel contrast based on tongue root position. With respect to the parameters discussed in section 3.1.3, the Even data reveal different tendencies in the Bystraia and Sebian dialects, which are of interest in this discussion. Nevertheless, there is one articulatorily predictable similarity. The harmonic pair of /a/ vs. /e/ reveals the same pattern in both dialects. These vowels contrast with respect to all formant values and spectral slope (Table 3.3). This is expected, since /a/ and /e/ are so different auditorily. The possible differences between the other harmonic pairs are more intriguing. I have problems with auditory discrimination between the vowels of different sets, but not for /a/ vs. /e/ in prominent positions. For this reason, in the further discussion I focus on the oppositions of /i/ vs. /ị/, /o/ vs. /ọ/ and /u/ vs. /ụ/.

In the Bystraia dialect, the vowels of different sets in these three remaining vowel pairs differ significantly with respect to F1. The consistently lower values for set 1 vowels correspond to the [+ATR] set. The same tendency can be observed for the data of the Sebian dialect, except for the non-significant difference for the pair /i/ vs. /ị/. However, even for the /i/-pair in Sebian there is a tendency for F1 of set 1 /i/ to be lower than F1 of set 2 /ị/ (especially for the long vowels). Thus, this parameter shows a similarity of Even with ATR languages.

As mentioned above, F2 is not the most stable parameter in ATR languages. Although F2 reveals significant differences for /o/ vs. /ọ/ in both the Sebian and Bystraia, it shows different tendencies in these dialects. While in Bystraia there is no consistent pattern, in Sebian F2 is higher for set 1 /o/, i.e. set 1 /o/ is more fronted, which is fully consistent with the auditory impression. The frontness of set 1 /o/ was one of the arguments of Ard (1980) for the ATR/RTR distinction. He claimed the fronting, or centralization, of the back ATR vowels to be a common development in ATR/RTR systems. However, nowadays more data on ATR languages have become available, and recent studies show that back ATR vowels are not necessarily always fronted (cf. Guion et al. 2004).

No difference in F3 was detected in either dialect. This also reflects the auditory impression because pharyngealization was not attested in any of the examined dialects.

Spectral slope reveals significant results for both pairs of high vowels in the Bystraia dialect (Table 3.3), but does not show a consistent pattern for vowels of different length. I would expect the articulation of vowels of different sets to remain the same irrespective of length. The difference may be in the degree of the intensity, e.g. if one expects phonation differences (breathiness for ATR vowels), this parameter might be more pronounced in long vowels than in short vowels. But in the case of high vowels in Bystraia, spectral slope has different tendencies for short and long vowels. Therefore, it is not possible to count spectral slope in the Bystraia dialect as a meaningful parameter supporting the contrast between vowel sets. In contrast, the data of Sebian show a consistent pattern for the back vowels, namely set 1 /o/ and /u/ have significantly higher values of the spectral slope than set 2 /ọ/ and /ụ/. This picture conforms to the results of Fullop et al. (1998) and Guion et al. (2004), but as discussed above, there are also data from ATR languages which contradict this tendency.

It is interesting to note that no difference was found between /i/ and /ị/ in Sebian for any acoustic parameter. This fact provides strong evidence for a phonetic merger between these phonemes in the Sebian dialects.

With respect to the high vowels, to my auditory impression the high vowels of different sets are very hard to distinguish. This fact led me to hypothesize a merger in both /i/- and /u/-pairs. However, the acoustic study shows that high vowels in Bystraia and the /u/-pair in Sebian differ between set 1 and set 2 with respect to F1 and spectral slope.

Table 3.4 below provides vowel systems for the two dialects based on the results of the acoustic measurements (Table 3.3). Each vowel opposition is supported by at least two parameters from Table 3.3. However, as discussed above, these parameters are not the same across all vowels, and even the same parameters can have different patterns (as in the case of high vowels in the dialect of the Bystraia district).

Table 3.4. Systems of monophthongs in the Bystraia and Sebian dialects (on the basis of the acoustic measurements).

	Bystraia dialect			Sebian dialect		
	front	mid	back	front	mid	back
high	i iː ị ịː		u uː ụ ụː	i iː		u uː ụ ụː
mid	e		o oː ọ ọː	e	o oː	ọ ọː
low		a			a	

Table 3.4 shows that in the Bystraia dialect harmonic oppositions are present in the production data, and that the number of oppositions is the same as in the Ola dialect (cf. Chapter 2, section 2.2). However, the underlying parameter for the opposition between harmonic classes differs from that found in the Ola dialect. As noted above, the difference in pharyngealization found in Ola is reflected in F3. The data from the Bystraia dialect do not reveal any differences between harmonic sets with respect to this parameter (with the exception of /e/ vs. /a/, but this vowel pair is opposed in all examined parameters, so the difference in F3 in this pair is not relevant). On the other hand, the only parameter which has a consistent pattern for all four vowel qualities, independent of vowel length, is F1. F1 is regarded as the most reliable parameter in the

ATR systems, but it seems that F1 alone without any additional evidence, e.g. spectral slope or F3, is not sufficient to speak about acoustic evidence for ATR. As discussed above, even though the spectral slope differs significantly in high vowels, it has different patterns depending on vowel length. Thus, with only F1 as the basis for the opposition, I do not see any arguments for an ATR opposition in the Bystraia dialect. It seems more plausible to describe this system in terms of relative height, with set 1 vowels being systematically higher than set 2 vowels.

In the Sebian dialect, acoustic measurements reveal a clear merger of the front high vowels, i.e. /i/ vs. /ị/ and /iː/ vs. /ịː/ do not differ with respect to any parameters. The remaining vowels have retained the opposition between harmonic sets, but by means of different combinations of parameters for each vowel pair. As in the Bystraia dialect, /a/ and /e/ reveal differences in all three formants and spectral slope. The back mid vowels /o/ and /ọ/ are different with respect to F1, F2 (i.e. both height and backness), and spectral slope, whereas the back high vowels /u/ and /ụ/ differ in F1 and spectral slope. On the one hand, the pattern of F1 and spectral slope for back vowels corresponds to what was found in some ATR languages (Degema and Maa; however, a reverse pattern of spectral slope was found for u-vowels in Ikposo). So, one could see this as evidence for an ATR distinction at least for the back vowels of the Sebian dialect. On the other hand, set 1 /o/ has a significantly higher F2 than set 2 /ọ/, which suggests that this parameter is also important for differentiating between these vowel qualities. Thus, even for the back vowels, a single parameter ATR which comprises F1 and spectral slope is not sufficient to describe all acoustic oppositions. In other words, for the Sebian dialect I find some evidence for ATR in the back vowels accompanied by a clear backness opposition for back mid vowels.

Concluding the discussion of the acoustic parameters, I provide a F1/F2 distribution plot, which can give an overview of the different tendencies in the two dialects. Figures 3.16 and 3.17 show the acoustic space of Even vowels in the Bystraia and Sebian dialects for each of the eight speakers. The median values of F1 and F2 were taken to represent each vowel.

Fig. 3.16. F1/F2 distribution for vowels of the Bystraia dialect (e, i, u, o stand for set 1 vowels; a, I, U O stand for set 2 vowels).

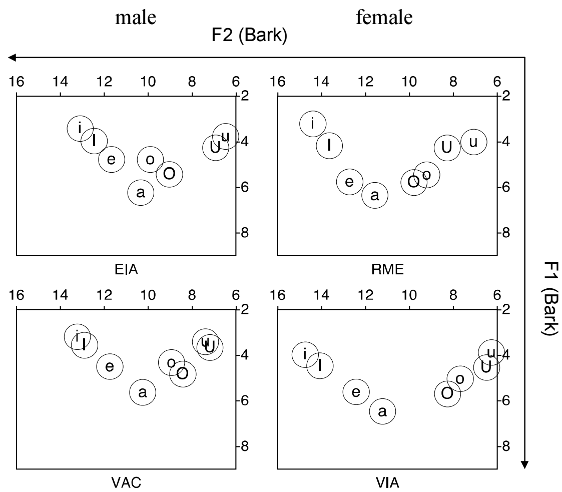
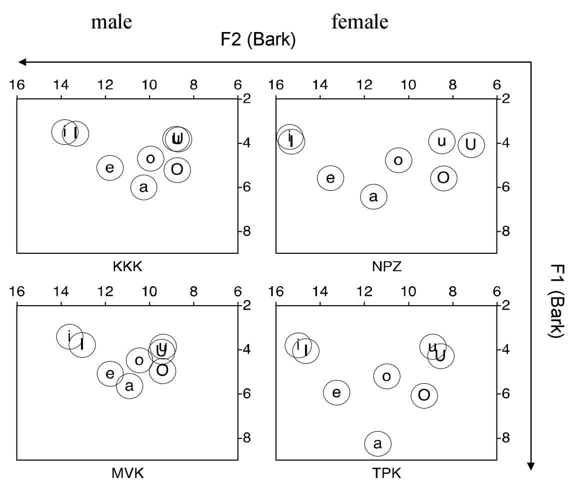


Fig. 3.17. F1/F2 distribution for vowels of the Sebian dialect (e, i, u, o stand for set 1 vowels; a, I, U O stand for set 2 vowels).



Some observations can be made at first glance. First, there is generally a high degree of overlap between vowels within the same pair with exception for /e/ vs. /a/ in both dialects and /o/ vs. /ọ/ in Sebian-Küöl. Secondly, the location of the set 1 and set 2 vowel pairs resembles a vowel system with an ATR contrast, in that set 1 vowels have lower F1 and higher F2 values. Furthermore, there is a tendency for high vowels of the different sets to overlap with each other, especially in the Sebian dialect. With respect to the opposition /u/ vs /ụ/ in Sebian-Küöl, there is a striking difference between male and female speakers: in the data from the male speakers these vowels fully overlap (at least for F1 and F2, the spectral slope is not shown here). This difference might be caused by age, since the male speakers were relatively young. However, both observations are purely speculative and would need data from more speakers from different age groups and both sexes for a stronger statement. In addition, Sebian set 1 /o/ is clearly more fronted than set 2 /ọ/ (represented as O in Fig. 3.16). As for the opposition /o/ vs. /ọ/ in the Bystraia dialect, the tendency is different for male and female speakers: while the males have a raised and advanced set 1 /o/, the females' set 1 /o/ is more back relative to the set 2 /ọ/.

The measurements of duration suggest that duration may play a role in the contrast as well. The data of short vowels show a tendency for /i/ and /o/ to vary with respect to the duration depending on the set of the vowels. The nature of this variation, namely that set 2 vowels are longer than set 1 vowels, could be explained by articulatory factors, if the tongue root opposition was active in the previous stage of the language and has been lost by now. In that case, the vowels of the more complex articulation (set 2) would need a longer time to be produced. The influence of duration on the perception of a vowel as belonging to one or another set can be checked experimentally, but it has to be kept in mind that duration may not be the main perceptual cue to distinguish between two vowel sets.

The state of affairs concerning phonetic research in the African languages (mainly Niger-Congo and Nilo-Saharan), which I use for the comparison, differs strongly from the situation of the Tungusic family. In many cases of African languages, the presence of the feature ATR was confirmed by articulatory data which were collected using special techniques, such as cineradiology films (Ladefoged (1964) for Igbo, Lindau (1975, 1979) for Akan), X-ray tracings (Jacobson (1978) for Dho-Luo), MRI (Tiede (1996) for Akan) and ultrasound imaging (Hudu et al. (2009) for Dagbani)[4], or was suggested from historical reconstruction (as in the case of Degema (Fullop et al. 1998) and Maa (Guion et al. 2004)). The acoustic research of African languages having an ATR system provides phonetic details about different parameters important for this vowel contrast. In the case of the Tungusic languages, the only articulatory data comes from two sources: X-ray tracings from Novikova (1960) and Lebedev (1978). As discussed above (section 3.1.4), Novikova interpreted her data as evidence for pharyngealization; Lebedev describes the vowel contrast in terms of tenseness and

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[4] However, cf. the remark by Casali (2008: 507): "it needs to be kept in mind that the number of languages for which direct instrumental observation of articulatory gestures has been obtained is still quite small in relation to the overall number of languages with ATR harmony."

relative height. From a historical perspective, the current idea that the underlying contrast is based on tongue root position appeared on the basis of intra-group language comparison and a re-interpretation of Novikova's data (Ard 1980), and is not strongly supported by the data of the other presumably related families (Mongolic and Turkic), as in the case of West African languages. Thus, it seems somewhat premature to assign the label ATR to the Even vowel sets on the basis of available articulatory data.

Moreover, I want to highlight again that some parameters are rather language-specific and are discrepant at a cross-linguistic level. As shown in sections 3.1.2 and 3.1.3, the phonetic representation of the category phonologically analyzed as ATR can be very diverse and vary greatly from language to language. For instance, the spectral slope is recognized by most researchers as an important phonetic property for the ATR contrast. In Ikposo (Anderson 2003), it is even the only parameter enabling differentiation between the ATR harmonic pairs of high vowels. Auditorily, this acoustic parameter reflects the differences in phonation type reported in some ATR languages. Unfortunately, no clear cross-linguistic picture has been gained yet for either the acoustic properties of spectral slope or for the distribution of the phonation types between ATR vowel types (cf. Table 3.1 and Table 3.2). Thus, it seems to be problematic to speak of a prototypical set of acoustic properties characteristic for an ATR language. Having no set of prototypical ATR acoustic parameters makes it hardly possible to postulate ATR as a phonetic feature on the basis of exclusively acoustic data. Such a statement has to be supported by experimental articulatory data, such as MRI or ultrasound technology. Since I only have acoustic data, I cannot prove or disprove the existence of the ATR/RTR category in Even.

Thus, it is problematic to come to a conclusion about the similarity of the Even vowel system with respect to ATR. The only consistent argument in favour of an ATR opposition, which holds for most vowels, is F1. Statistical analysis of F1 measurements does provide evidence for two opposed vowel sets in both dialects, with an exception for the /i/-pair in Sebian. However, it seems premature to postulate the existence of the ATR/RTR feature based only on differences in F1 data. The data for spectral slope, which could provide some additional evidence for ATR/RTR, are consistent only for /o/ and /u/ in the Sebian dialect. The findings concerning duration suggest that duration might also be important for the vowel contrast. The aim of the perception experiment described in the next chapter is to examine the speakers' ability to discriminate vowels of different sets, to answer the question of possible mergers, and to test the hypothesis about the role of duration in vowel discrimination.

4 Perception study of harmonic vowel sets

The acoustic analysis described in Chapter 3 shows that both the Bystraia and Sebian-Küöl dialects have two vowel sets which differ with respect to F1. The only clear exception from this pattern is the pair of /i/ vs. /ị/ in the Sebian dialect which does not reveal any difference for any of the examined parameters. The acoustic measurements provide strong evidence for a phonetic merger of these two phonemes in the Sebian dialect. Taking into account the fact that several vowel pairs sound very similar (/u/ and /ụ/ in Sebian and the vowel pairs /i/ and /ị/, /u/ and /ụ/, and /o/ and /ọ/ in Bystraia), it is questionable if Even speakers can perceptually distinguish the two opposed sets of vowels.

In this chapter I describe the perception study I conducted under fieldwork settings with speakers of Even.[1] The study consists of three experiments aimed at clarifying the nature of the vowel opposition in the two dialects. In section 4.1, I discuss the traditional methodology of perception tests and review the experiment by Fulop et al. (1998) with a question related to my study, namely the perception of two ATR vowel sets in Degema. Moreover, I explain an important difference between the previous experiments and my own study. In section 4.2, I present the design and the settings of the three experiments and describe the results of each of them. In section 4.3, I summarize these results and discuss them in connection with the acoustic findings.

4.1 Experiments in perception

In studies of speech perception two basic designs of experiments are used: discrimination and identification experiments. In discrimination experiments, the ability of the speakers to differentiate stimuli is tested. There are several types of this design. Common to all of them is that the subjects are usually presented with several stimuli per trial. The task might vary slightly: the speakers can be asked if these stimuli are different or the same, or if one of the stimuli is more similar to one or another (the so called ABX design). However, to investigate the question about two opposed vowel sets in Even the identification experiment is more suitable. In identification experiments, one stimulus is presented to the subject per trial, and the subject has to label the stimuli in a certain way (e.g. orthographically or with special phonetic symbols or by clicking on a picture of the matching word). There are different ways of organizing a perception experiment

[1] I would like to thank Prof. Bernard Comrie for suggesting a perception study after my first presentation of acoustic data from the Bystraia dialect in the Department of Linguistics at MPI for Evolutionary Anthropology.

depending on the goals and the available settings. One of the main differences is the type of stimuli used in the experiment.

In the classical perception studies of Lisker and Abramson (1964, 1970, 1973), the role of the Voice Onset Time (VOT) in perception of the stop consonants as voiced or voiceless was analysed under laboratory settings with synthesized stimuli. The values of VOT in the stimuli ranged between -150 and +150 ms. This way of creating the stimuli allowed the researchers to control for all other parameters while testing only the change of VOT. The results show language-specific settings for VOT for different languages (English, Spanish and Thai). Hayward (2000: 114) recommends such an experimental design where a single acoustic dimension serving to distinguish between the sounds of interest is established and a continuum of stimuli varying along this single acoustic dimension is synthesized. However, this is not always applicable.

The problem that arises when one designs a perception study involving [ATR] is that this category is very complex acoustically (see section 3.1, Chapter 3). There is no single acoustic dimension which can be manipulated so that the vowel would be perceived as belonging to the other vowel harmony set. The only perception experiment I am aware of which was conducted on an ATR language is the study by Fulop et al. (1998: 95) on the data of Degema, an ATR language spoken in Nigeria. The aim of the researchers was to test the importance of the first two formant frequencies for the perception of Degema vowels. For this experiment, a special program was developed which allows for an ad-hoc synthesis of vowels with different F1 and F2 values. The subjects were facing a computer screen with a matrix of possible sounds within certain F1 and F2 limits and a Degema word with translation. The task was to match a particular vowel in this word with a sound synthesized by the program. By clicking on the different parts of this matrix it was possible to change the formant values and to synthesize a sound closest to the vowel of interest. The authors report that the subjects did not have any problems with understanding and performing the task, in spite of having no prior experience with such kind of experiments. The stimuli contained examples of 10 vowels of Degema (five harmonic pairs) and were presented to the subjects twice during two experimental sessions. Thus, their experiment had a sort of a reversed identification design: In the classical identification task, a speaker is presented with an acoustic stimulus and has to label it. In the Degema experiment, speakers were shown a written word with a specific vowel and various synthesized stimuli among which they had to choose the best acoustic exemplar of the written vowel.

The results of the experiment revealed a clear-cut opposition only for two pairs of mid vowels (/e/ vs. /ɛ/ and /o/ vs. /ɔ/). As expected from the acoustic study on Degema, the [+ATR] vowels /e/ and /o/ have a lower F1 than their [-ATR] counterparts. However, with respect to the other vowels the five subjects "do not behave alike" (Fulop et al. 1998: 96). This brings the authors to the conclusion that "formant frequency alone is a poor indicator of the vowel category" (Fulop et al. 1998: 97).

As I showed in Chapter 3, the category of ATR/RTR cannot be determined just by formant frequencies. Limiting the research only to the frequencies of the two first formants cannot provide satisfactory results. Other parameters such as spectral slope, fundamental frequency and formant bandwidth were also claimed to be acoustic correlates for ATR/RTR. The possibilities to vary fundamental frequency, phonation type, and jitter and shimmer effects were built into the program by Fulop et al., although they were not used during the experiment, since this would have increased the matching task. The reason for excluding these parameters from the scope of research was “the inexperience of the subjects in performing complex matching tasks” (Fulop et al. 1998: 95). In my opinion, it is hardly possible to implement all the variables just mentioned into a single experimental design. To control for all these parameters one would have to include an immense number of stimuli, which would lead to a very long experiment session that would be exhausting for subjects. This means that a researcher working on vowel perception in an ATR language needs to choose a design different from the one just described or would need to severely limit the amount of synthesized stimuli. A further point of criticism concerns the use of synthesized stimuli with inexperienced subjects. Supposedly the synthesized vowels were as close as possible to the natural ones. But it still seems to be a nontrivial task to match one synthesized segment to vowels of words of a natural language. The number of stimuli and the subjects in the experiment of Fulop et al. were not high: five subjects participated in two sessions each, where they were presented with ten words each containing one vowel. With such a small amount of data the experiment does not amount to much more than a pilot study. However, the method, which was implemented under difficult fieldwork settings, is still remarkable and should be taken into consideration for further research in this field.

In the case of Even, the main question I would like to investigate does not concern the exact acoustic features that are responsible for the opposition, but rather whether, in case the opposition is still kept by the speakers, the minimal pairs can be distinguished perceptually. Similar questions were investigated using natural stimuli (non-modified recordings of the minimal pairs) in a number of languages, e.g. in Slovene (Steenwijk 1992), Franconian (Köhnlein 2011), and Ingrian (Kuznetsova 2015). Steenwijk (1992) tested the discrimination of rounded and unrounded mid centralized vowels in the Slovene dialect of Resia, both with speakers of this dialect and with professional linguists. Both the linguists and the native speakers successfully discriminated between the two kinds of vowels (although the former had a higher success rate), and it was concluded that the phonological opposition is still present. Köhnlein (2011: 24) showed that there is a robust tone accent opposition in the Franconian dialect of Arzbach: “the vast majority of the judges were able to distinguish between the accents with highest accuracy”. In Köhnlein’s design the subjects (native speakers of Franconian) had to listen to the stimulus sentences and to reply by choosing between two pictures corresponding to the minimal pairs. The study of Kuznetsova

(2015) is devoted to the loss of reduced vowels in two varieties of Ingrian: Southern Lower Luga Ingrian and Siberian Ingrian Finnish. Since neither of the two varieties has a standard written form, the speakers were asked to write down the stimuli based on their intuition. The stimuli were previously recorded for the acoustic study. The phonemic categorization obtained in this way revealed two categories for Southern Lower Luga Ingrian (with vowel loss and without), whereas in Siberian Ingrian Finnish vowel loss was complete. These results were also supported by acoustic data. The common feature of the perception studies described is that in all of them recordings of natural language are used as the stimulus material.

In the next section I describe the strategy for studying vowel perception which I used with Even speakers. First of all, I shift the focus from the search for an adequate acoustic dimension to the fundamental question whether a vowel opposition is actually perceived by the speakers. Moreover, I examine a hypothesis which might be proposed on the basis of the results of the acoustic study, namely that vowel duration might influence the perception of a vowel as belonging to one or another set. In addition, the importance of other possible cues, e.g. alternating /a/ and /e/ in the suffixes, is also taken into account.

4.2 Experimental data from Even speakers

4.2.1 Research questions and experiments

The main question I want to answer with this perception experiment is if there are two opposed sets of vowels in both dialects, more precisely, if the speakers are able to discriminate minimal pairs differing only in the set of their vowels. I pay special attention to the harmonic pairs of high vowels. This question is quite different from the question Fulop et al. (1998) asked, viz. whether formant frequencies are important for vowel discrimination. My question does not necessarily imply an investigation of a particular acoustic parameter. Focusing on the more general question of the ability to discriminate between two vowel sets allows me to avoid the use of synthesized stimuli and to design the experiment using naturally produced words, thus making the task easier for the subjects.

However, I am also interested in the investigation of one specific dimension: in the acoustic study (Chapter 3) it was shown that for short vowels duration plays a significant role in the vowel opposition. To test whether duration is also used as a cue in speech perception, I prepared a second experiment with stimuli that were manipulated with respect to duration.

In a third experiment I check if the stem vowels can be perceived correctly without additional information from suffixes. In many Even suffixes there is an alternation of /a/ ~ /e/ (see section 2.3.2). This obvious cue might help speakers assign the vowels to one of the sets. Trying to eliminate the influence of this factor I produced a third set of stimuli where the suffix vowel is replaced with noise.

Thus, to provide answers to the general question of my dissertation about the number of opposing vowels and to the more specific questions of the role of two cues (duration and vowel alternation in suffixes) I use both stimuli consisting of unmodified natural words and natural stimuli that were modified.

4.2.2 Stimuli

Performing an experiment which relies on the orthographic representation of the phonemes, as the one by Fulop et al. (1998) or one of the labeling designs by Lisker and Abramson (1973), would be difficult with speakers of Even because the standard Even orthography does not make a distinction between opposed sets of high vowels (see section 2.2.1). Mid back vowels of different sets are opposed in the standard orthography, but the speakers of the Bystraia dialect use the local orthography, which makes no distinction between set 1 /o/ and set 2 /ọ/. For this reason, the matching task described above would not work in the case of Even.

As experimental stimuli I used Even words which I had previously recorded for the acoustic study. Using proper words instead of meaningless syllables makes it possible to avoid the problem of orthography. Instead of asking speakers to match a sequence of sounds with its orthographical representation, it was possible to ask for a Russian translation of the lexical items, since all the speakers involved in the experiment were literate in Russian and Russian was the default intermediate language during my fieldwork. This procedure was used in all three experiments I conducted.

For each of the three experiments, a list of word pairs was compiled. Consonantal layout in the pairs is the same, and the vowels do not differ in any parameter but “set”, as in the example in (4.1):

(4.1)	Set 1	Set 2
	a. /ussin/ ‘(he) splashed’	c. /ụssịn/ ‘(he) cut off’
	b. /hutten/ ‘(he) pierced’	d. /hụttan/ ‘(a reindeer) ran away’

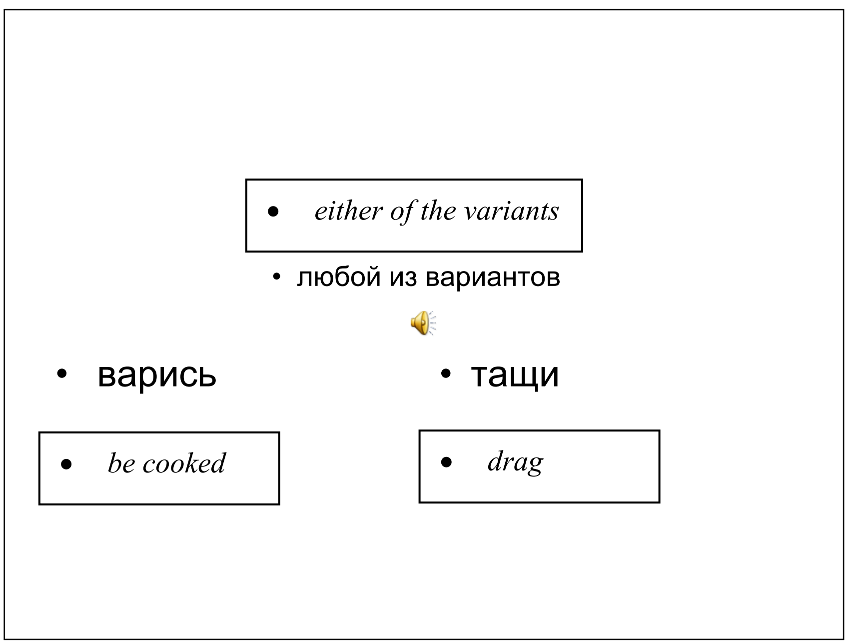
Each stimulus corresponds to an Even word as recorded initially or modified in a special way depending on the experiment. Two Russian translations, the correct one and the translation of the quasi-miminal pair of that Even word, were given as response categories.

For each experiment, the stimuli were presented in the form of a PowerPoint presentation (see the example of a slide in Fig. 4.1.). An Even word was played to the subjects. The task was the same in each of the three experiments, namely to choose the appropriate translation between the ones presented on the screen. All the items presented as stimuli were recorded with a male and a female speaker of Even. In the Bystraia dialect the speakers were EIA (male, 55) and VIA (female, 69), in the dialect of Sebian-Küöl MVK (male, 17) and NPZ (female, 38). For each subject the stimuli were randomized.

Experiment 1

The stimuli for the first experiment consisted of the original recordings of quasi-minimal pairs without any modification. Due to the strong dialectal variability, the number of stimuli for the first experiment differed between the Bystraia and the Sebian dialects. In the Bystraia district, responses to 45 stimuli were analyzed, while in Sebian-Küöl this number is 49. The lists of the stimuli can be found in appendices 3 and 4. An example of a slide with a stimulus and its two possible translations is given in Fig. 4.1:

Fig. 4.1. A slide from the PowerPoint presentation for experiment 1 as presented to speakers (the English translation in italics was absent in the experimental stimuli).



The subject listened to the stimuli over headphones. When the experimenter clicked on the icon in the center, the sound file with an Even word was played. The subject read both translational variants and chose the appropriate one. The subjects were encouraged to give all kinds of comments on the pronunciation of the stimulus or the accuracy of the translation. Some of the speakers in the Sebian-Küöl dialect (who were tested first in May 2011) insisted that there was no difference in pronunciation of the Even words with corresponding translations. For that reason, I included the third option "either of the two variants" when conducting the experiment with the Bystraia speakers two months later.

The stimulus list for the Bystraia dialect had 5 additional words with a set 1 /u/ in the stem which corresponds to set 1 /o/ in the other Even dialects. As a result of the sound change from /o/ to /u/ (and together with the loss of the initial /h/) many homophones have appeared in the Bystraia dialect. Cf. example (4.2):

(4.2)	Bystraia[2]	other dialects		
	a. ustej	ostej	'yank'	set 1
	b. ustej	hustej	'splash'	set 1
	c. ụstaj	hụstaj	'cut off'	set 2

My intention here was to check if word pairs as in (4.2a) and (4.2b) are fully homophonic in Bystraia, or whether they can be discriminated. However, since I included a second item belonging to set 1 (a lexeme with a sound change), I gave three possible translation variants for these stimuli. This does not impede the discrimination between items of set 1 and set 2, since words with this vowel change still belong to set 1. At the same time having these items within the first experimental block is helpful for the analysis of the o→u change.

Experiment 2

The second research question I want to investigate is the role of duration in vowel discrimination. The acoustic study (section 3.2.2.5) revealed systematic differences in duration between short /o/- and /i/-vowels of different sets. This finding led me to the idea that duration might play a significant role in discriminating between the two sets of these vowels. From a perceptual point of view, my expectation was that longer vowels would be associated with set 2 and shorter ones with set 1 vowels. To examine this hypothesis I used stimuli with natural words and words in which vowel duration was modified. First, I compiled a list of natural words that do not contain any cues which could facilitate the discrimination between the sets. For each dialect, I chose four words (see the list in the appendix 5). Despite the fact that the duration differences were established not only for the pairs of short vowels /i/ vs. /ị/ but also for the short /o/

[2] According to Burykin (2004: pp. 68-85), this change is also characteristic for the Alyutor dialect, which together with the Bystraia dialect is united under the Kamchatka dialect group, and the Ul'ya dialect, which is classified as belonging to the Western dialectal group. The other dialects do not systematically show this change.

vs. /ọ/, the latter were not included in the stimulus list. This decision had two reasons. First, in the Bystraia dialect, due to the change mentioned above, there are no words containing set 1 /o/ and no /e/ in the suffix, which would be an obvious cue for set identification. So, it was not possible to choose appropriate examples for this dialect. In the Sebian dialect, the difference between set 1 /o/ and set 2 /ọ/ is quite prominent even if one does not take duration into account: as shown in the acoustic study, set 1 /o/ is significantly more fronted than set 2 /ọ/. Thus, one cannot consider duration alone to be the decisive cue. However, the duration hypothesis was also checked for the pair /u/ vs. /ụ/. Including stimuli with /u/-vowels could help both to investigate the validity of my duration hypothesis for /u/ as well as for /i/ and to show if the stimuli with /u/ which had no additional cues can be discriminated by the speakers in general. The results of this experiment were important both for the clarification of the role of duration and for the main question of my perception study about the ability of vowel discrimination.

In this second experiment I had four categories of stimuli for both vowel sets: the original duration of vowels, and three modified stimuli. For set 1, the modification consisted of one shortened and two lengthened stimuli, for set 2 it consisted of two shortened and one lengthened stimulus. An overview of the stimuli is given in Fig. 4.2 below:

Fig. 4.2. Four types of stimuli for experiment 2.

	(1)	(2)	(3)	(4)
Set 1	extra-short	**original short**	long (the same as the original set 2 vowel)	extra-long
Set 2	extra-short	short (the same as the original set 1 vowel)	**original long**	extra-long

First, I compared the duration of the vowels in the corresponding quasi-minimal pairs. As expected, the vowels of set 1 were usually shorter than the vowels of set 2. For examples, see Fig. 4.3 and Fig. 4.4 from the Bystraia dialect:

Fig. 4.3 An example of the stimulus /issi/ ([iʃʃi] 'tearing off') with set 1 vowels pronounced by EIA, in the Bystraia dialect. Duration of the first vowel is 0.108 sec.

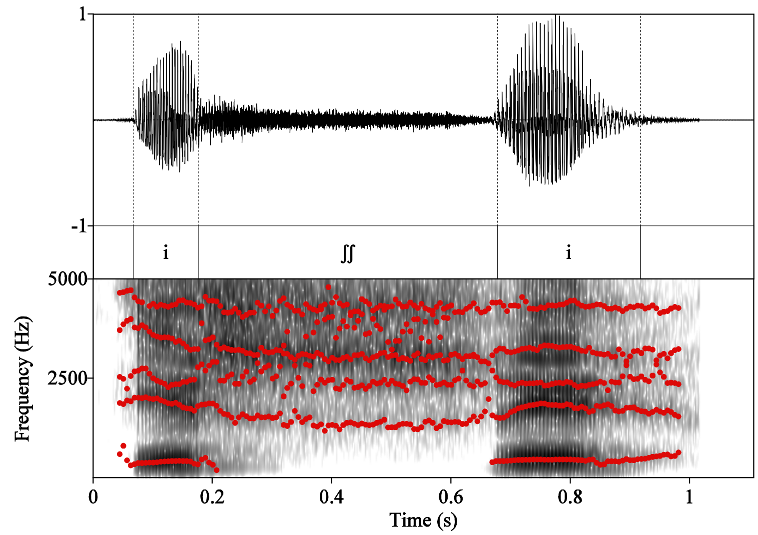
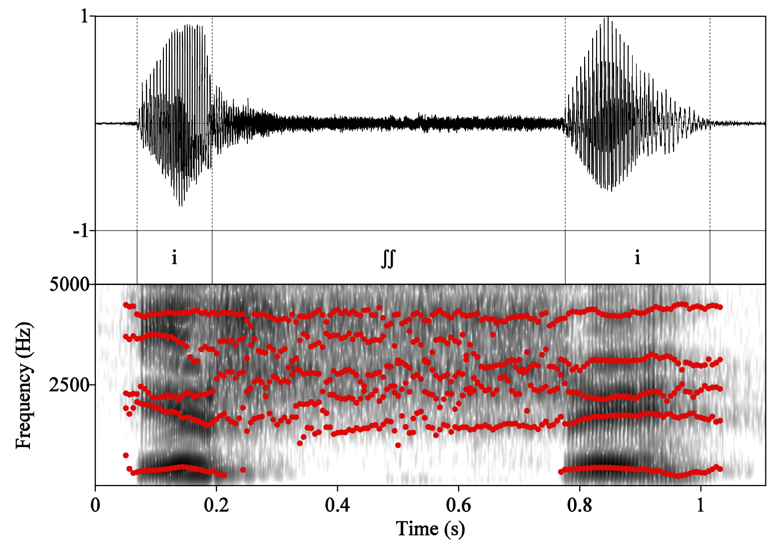


Fig. 4.4. An example of the stimulus /i̥ssi̥/ ([iʃʃi] 'reaching') with set 2 vowels pronounced by EIA, in the Bystraia dialect. Duration of the first vowel is 0.123 sec.



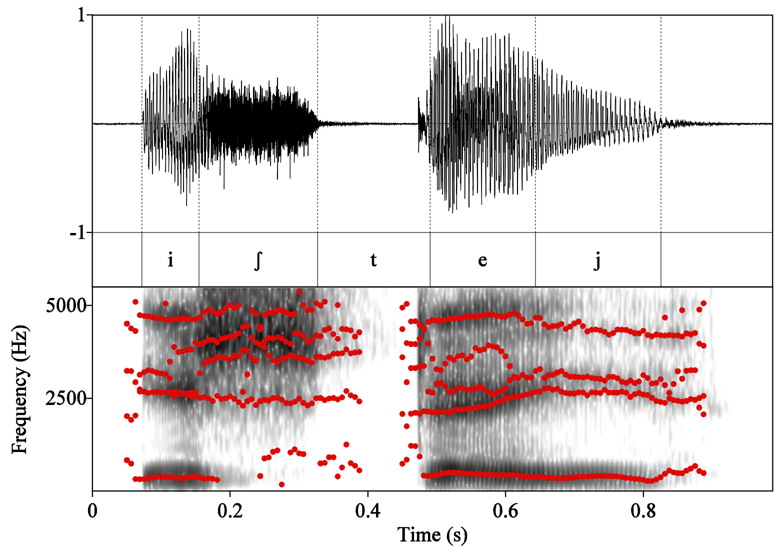
All modifications of duration were made with Akustyk (Plichta 2010), an application for Praat. For each stimulus with the vowels of set 1, I first lengthened the originally short stimulus so that it had the same duration as the original corresponding set 2 vowel (see column (3) for set 1 in Fig. 4.2). For each stimulus of set 2, I first shortened the originally long stimulus so that it had the same duration as the original corresponding set 1 stimulus. A third, extra-long stimulus was created for each set by further lengthening the long stimuli. This was done by multiplying the duration of the long stimuli with the ratio between short and long stimuli. In our example in Fig. 4.4, this ratio is 0.123/0.108≈1.14, thus the extra-long stimulus is 1.14 times longer than the long one. The fourth, extra-short stimulus was created by multiplying the short stimulus of each set with (2 – ratio between short and long stimuli). In the example in Figure 4.4, this factor is (2 – 1.14) = 0.86.

For the Bystraia dialect, the list of stimuli contained four quasi-minimal pairs pronounced by a male and a female speaker, which makes 16 original words. Together with the stimuli with a modified duration, the total number of stimuli for Bystraia in experiment 2 was 64. In Sebian-Küöl, the picture is not that symmetric: I have different numbers of stimuli for the male and female speaker. I included five quasi-minimal pairs from the female speaker which makes 40 stimuli in total for the female speaker including original and modified words. However, I could include only three full quasi-minimal pairs recorded from the male speaker, which corresponds to 24 stimuli. In addition, I had only one word from each of the other two pairs, but not full minimal pairs, recorded from the male speaker which adds 8 more stimuli (see appendix 5, the list for Sebian-Küöl). Thus, the total number of stimuli used in Sebian-Küöl for experiment 2 was 72. This imbalance comes from the different degree of language proficiency and familiarity with different layers of the lexicon. As mentioned in section 3.2.1.1, the female speaker NPZ (38) is a school teacher of Even, whereas the male speaker MVK (17) belongs to a younger generation. He speaks Even within his family, but apparently does not have further areas of life connected with his native language. This fact could be an explanation why quite a few of the harmonic equivalents are absent from his lexicon.

Experiment 3

For the third experiment, I compiled a list of quasi-minimal pairs with alternating suffixes and replaced the suffix vowels with white noise (random signal with a constant spectral density) using the program Audacity (Version 1.2.6). The speakers had to guess the meaning of the word on the basis of the stem vowel. In order to hide any cue to the nature of the suffix vowel, I also masked the transition area between the suffix vowel and the consonants surrounding it. Below I give the example of a word with set 1 vowels (Fig. 4.5) and of a word with set 2 vowels (Fig. 4.6) in their original form and with the masked suffix vowels. In these figures, it can be seen that the formant structure of the surrounding segments does not give a cue for the vowel quality in the suffix.

Fig. 4.5.a. An example of the stimulus with set 1 vowels /istej/ ([iʃtei] ‘tear off’) pronounced by VIA, the Bystraia dialect.



b. The same stimulus with the masked suffix vowel [e].

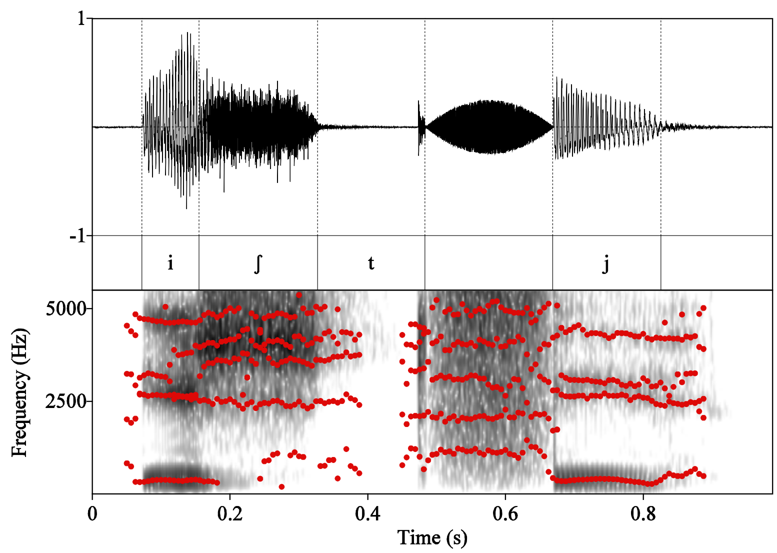
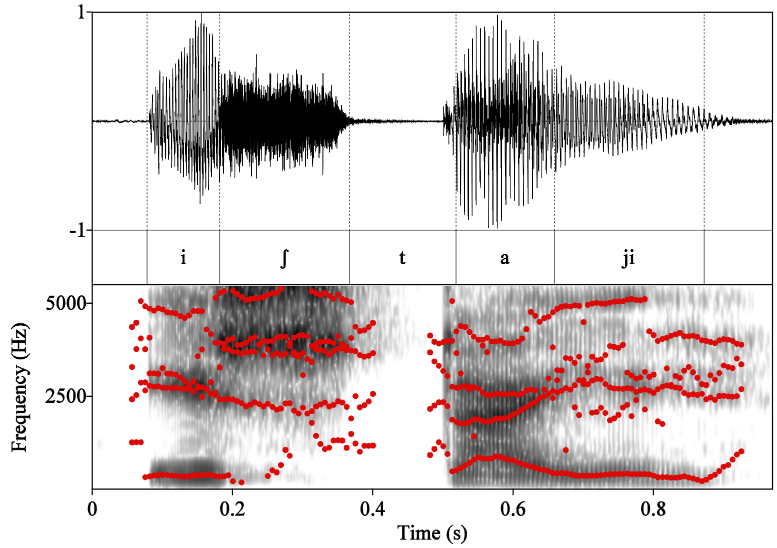
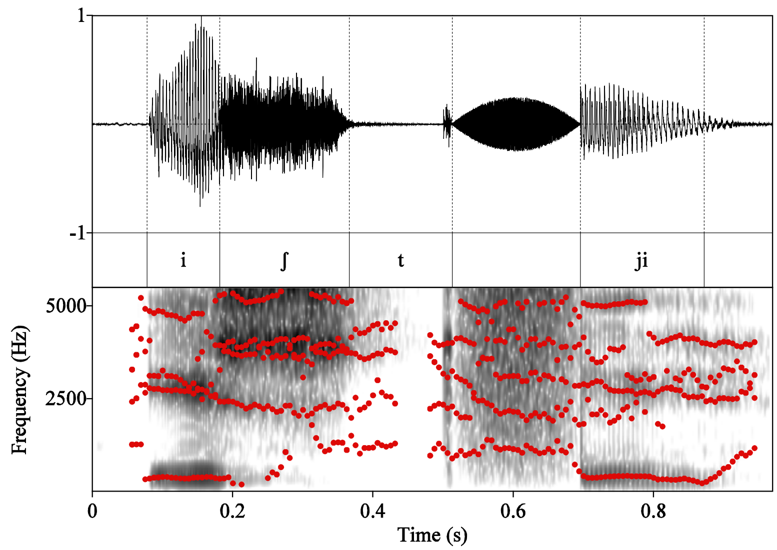


Fig. 4.6 a. An example of the stimulus with set 2 vowels /ịstaj/ ([iʃtaji] 'reach') pronounced by VIA, the Bystraia dialect.



b. The same stimulus with the masked suffix vowel [a].



To avoid the influence of the right consonantal context, I also exchanged the remaining consonantal segments between corresponding quasi-minimal pairs. If these segments are irrelevant for the vowel discrimination, the stimuli with the original right edge and the right edge of the opposite harmonic word should be categorized the same. However, if the context is important for assigning the word to one or another set, this change will lead to difficulties in the discrimination.

The stimulus list in the Bystraia dialect contains 35 stimuli, of which 14 words had the original suffix consonant and 7 words did not have any consonants to the right of the masked vowel. 14 words had the suffix consonants from their harmonic equivalent. Most items were pronounced by a male and a female speaker (see Appendix 6 for the details). In Sebian, the total number of stimuli for this experiment was also 35 words, out of which 20 words kept the original suffix consonant and 15 stimuli had the modified suffix segment. The total number is less than the doubled number of items for the same reason as in the experiment 2 (an imbalance with respect to the speakers who provided the original data, see Appendix 7).

Overall, the subjects did not have any problems with performing the tasks during the experiments. The third experiment was received by the subjects rather as an entertaining one. They were told that the imperfections in the recordings might be reminiscent of noise during a phone call, in spite of which the meaning could still be retrieved. Having this model in mind, they attempted to choose the right translation for each stimulus.

4.2.3 Participants and settings

In the Bystraia district, 18 Even speakers who belong to the older generation (45 - 72) and are fluent in Even took part in the perception study. The data were collected during my fieldwork in the Bystraia district in July 2011. For the Sebian dialect, I included in my analysis the data from nine speakers recorded in Yakutsk in 2011 and in Sebian-Küöl in 2012. However, the overall number of the Sebian speakers participating in this study was 20. I collected some data partly during my stay in Yakutsk, partly in the village of Topolinoe from speakers of the Sebian dialect in May and June 2011. The reason why I could not use all the collected data is that due to the presence of some specific Even terms in the stimulus list, the task of the experiment turned out to be too difficult for the young Even speakers (19 – 22, 29) who do not use Even as their everyday language and who formed the main part of the subjects in Yakutsk and Topolinoe. Fortunately, Brigitte Pakendorf was able to perfom the experiment in Sebian-Küöl in spring 2012 with seven speakers of the older generation and speakers for whom Even was the dominant language. In the final data set I included all the data collected in Sebian-Küöl and the data from two speakers recorded in Yakutsk in 2011.

The experiment sessions were organized in a similar way in both fieldsites. All experiments were performed one after the other, starting with the experiment with original words, then proceeding with the experiment with manipulated duration and completing the session with the experiment with masked vowels. One session normally took from 30 minutes to an hour, depending on the subject. The first and the third experiments were preceded by short training sessions, which consisted of several slides taken from the corresponding stimulus block (ten training slides for experiment 1 and eight training slides for experiment 2). I decided not to include an additional training session before the second experiment, since the stimuli in the first two experiments are very similar from the speaker's perspective and the first experiment itself is a good training for experiment 2. The stimuli in the third experiment are rather unusual because of the noise insertion, so the third experiment needed some training trials in order to accustom the subjects with this type of stimulus. Both the stimuli and the answers of the speakers were recorded.

4.2.4 Results

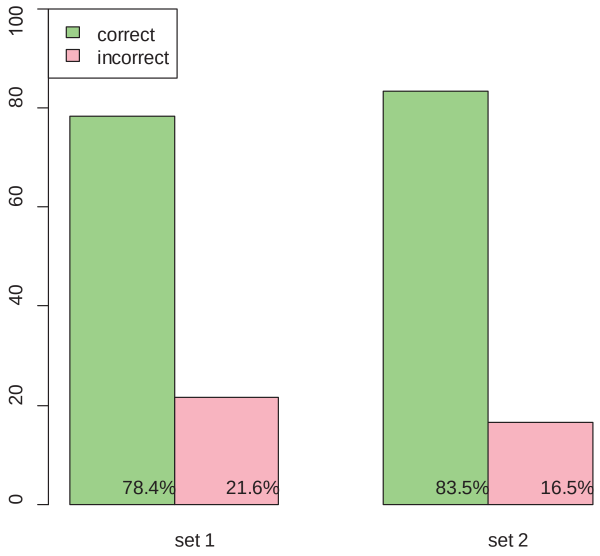
All three experiments show different tendencies between the Bystraia and Sebian dialects. I give an overview of the results below.

4.2.4.1 Experiment 1

The Bystraia dialect

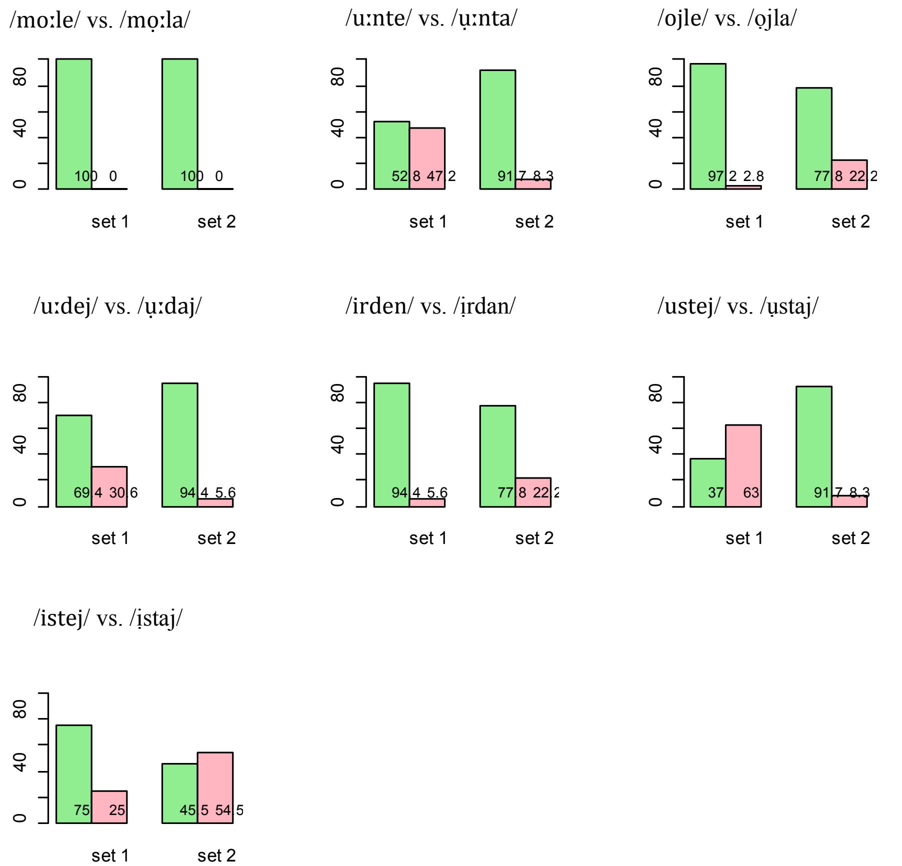
The success of the perception of the original non-modified words in the Bystraia dialect depends on the presence or absence of /a/ or /e/ in the word. These vowels directly indicate the set of the vowels and they help the subjects choose the correct answer. For this reason, first I examine the stimuli containing /a/ or /e/ (26 out of 45). The remaining stimuli not containing /a/ or /e/ are analyzed later. The percentage of the correct answers for the stimuli containing /a/ or /e/ is quite high (see Fig. 4.7). The amount of incorrect answers for the stimuli of set 1 is slightly higher than for the stimuli of set 2 (21.6% vs. 16.5%).

Fig 4.7. Percentage of the correct and incorrect answers for the stimuli of set 1 and set 2 containing e/a in the suffixes.



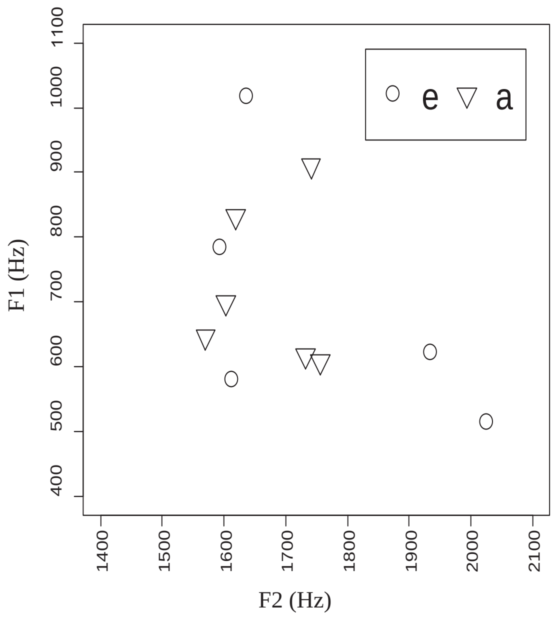
However, this is just a generalized presentation of the data, without taking into account differences in perception of each individual stimulus. The perception of the individual stimuli shows a more diverse picture (cf. Fig. 4.8). Only one quasi-minimal pair /moːle/ ‘in the water’ vs. /mọːla/ ‘on the tree’ was identified with 100% correct responses. Some other minimal pairs are recognized slightly less successfully, but the tendency for correct recognition is still kept: for the pair /ojle/ ‘on the top’ vs /ọjla/ ‘on the clothes’ the subjects gave 97.2% and 77.8% correct responses, respectively; for the pair /irden/ ‘to be cooked’ vs. /ịrdan/ ‘to drag’ 94.4% and 77.8% correct responses, respectively. But in some cases the asymmetry between the recognition of members of one minimal pair is striking. For example, in the pair /uːnte/ ‘different’ vs. /ụːnta/ ‘deep’ the subjects recognized the set 2 word /ụːnta/ much better (91.7% correct responses) than the set 1 word /uːnte/ (only 52.8% correct responses, which is close to random). In the case of the minimal pair /istej/ ‘tear away’ vs. /ịstaj/ ‘reach’, it is the stimulus of set 1 which was recognized better: 75% vs. 45.5% correct answers. Thus, the data of the Bystraia dialect show that some stimuli are perceived correctly (both set 1 and set 2 members), but for some stimuli there are factors other than the phonological composition which influence the perception and which were unforeseen when compiling the stimulus list.

Fig. 4.8. Percentage of the correct and incorrect answers for the stimuli of experiment 1, plotted for the individual minimal pairs containing /e/ and /a/.



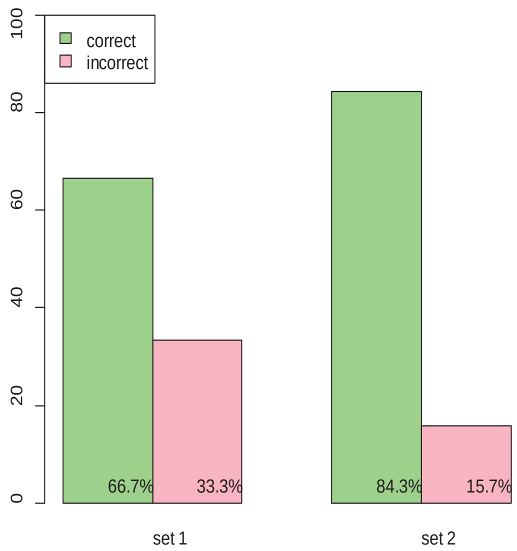
Another case of the asymmetric performance for set 1 and set 2 stimuli can be observed for the pair /ustej/ 'sprinkle' or 'pull out' vs. /ụstaj/ 'cut'. The subjects gave 37% and 91.7% correct responses, respectively. The results for the set 1 member of the minimal pair look lower than would be expected not only for correct recognition, but even for random guessing. However, these results might be influenced by the pronunciation of the word /ustej/ by this speaker. To my auditory impression, the vowel in the suffix of /ustej/ sounds very close to /a/. However, while compiling the stimulus list I doubted that I can rely on my judgment of phonetic proximity of contrasting phonemes since I am not a non-native speaker of Even. Therefore I retained this token. But I had a similar impression that the suffix vowels in set 1 and set 2 words are very close if not the same while collecting data from other speakers of Bystraia Even as well, while working on the texts recorded for the DOBES project. In Fig. 4.9 I present the F1/F2 distribution of the vowels /e/ and /a/ from several tokens of the words /ustej/ and /ụstaj/, respectively, all pronounced by the speaker VIA. This plot shows that with respect to the first two formants, the suffix vowels are very close and probably indistinguishable in the speech of this speaker. For several tokens of /e/ F2 is not higher than for /a/. This means that if subjects were using suffix vowels as perception cues, they were probably confused by the pronunciation of this speaker and perceived the set 1 word /ustej/ as having /a/ in the suffix, and hence erroneously took it for the set 2 word /ụstaj/.

Fig. 4.9. F1/F2 distribution of /e/ in the word /ustej/ 'pull out' (5 tokens) and /a/ in the word /ụstaj/ 'cut' (6 tokens) in the speech of the female speaker VIA (69).



Let us look now at the stimuli without the contrast /e/ vs. /a/. Recognizing these words becomes more difficult for the subjects. It is important to note that in this case the stimuli contain only /i/- and /u/-vowels, since as mentioned in section 4.2.2, set 1 /o/ is always followed by a syllable with /e/. Fig. 4.10 shows that the performance of the task with the stimuli of set 1 without /e/ in the suffixes is less successful than in the previous case. The difference between the two distributions of the set 1 stimuli containing and not containing /e/ is statistically significant (Fisher's Exact Test, $p=0.003$).

Fig. 4.10. Percentage of the correct and incorrect answers for the stimuli of set 1 and set 2 not containing e/a in the suffixes.



Interestingly, the picture differs between the success rates for the stimuli of set 1 and of set 2. The stimuli of set 1 were recognized less successfully (66.7% in comparison to 78.4% in Fig. 4.7). But the discrimination success of set 2 stimuli not containing /a/ is about the same as in the previous case when the subjects had to judge stimuli containing /a/ (84.3% and 83.5%, respectively). The difference in performing this discrimination task must be explained by some other acoustic cues than /a/ in the suffix. As described in Chapter 2, within the context of set 2 vowels some consonants have very salient allophones which signal unambiguously that the word belongs to set 2.

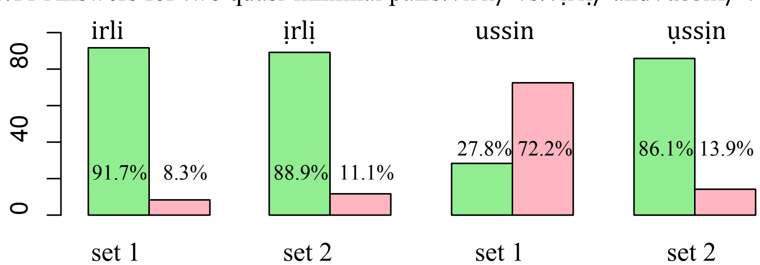
The stimuli included in this sample can be seen in Table 4.1: the set 2 words /ịrlị/ ‘drag’ and /ụkrịn/ ‘removed the bark’ contain liquid consonants and /ụkrịn/ additionally contains a velar stop consonant. These consonants change most strikingly in the context of set 2 vowels. The influence of set 2 vowels on liquid consonants is discussed further in section 4.2.4.2 below in connection with experiment 2.

Table 4.1. Stimuli not containing e/a in the suffixes.

Even	Translation	Set
irli	be cooked	set 1
ịrlị	drag	set 2
ụkrịn[3]	removed the bark	set 2
ussin	sprinkled	set 1
ussin	pulled out	set 1
ụssịn	cut	set 2
uttin[4]	fixed	set 1
uttin	had a rest	set 1
uttin	pierced	set 1

Table 4.1 contains an uneven amount of set 1 and set 2 stimuli. However, this should not have influenced the distribution of correct and incorrect answers. To make the tendency more evident, below in Fig. 4.11 I give the distribution of the answers for the two quasi-minimal pairs which are both represented in my stimulus set: /irli/ 'be cooked' vs. /ịrlị/ 'drag' and /ussin/ 'sprinkled' or 'pulled out' vs. /ụssịn/ 'cut'.

Fig. 4.11 Answers for two quasi-minimal pairs: /irli/ vs. /ịrlị/ and /ussin/ vs. /ụssịn/.



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[3] Unfortunately, a set 1 counterpart for /ụkrịn/ 'removed the bark' is missing in my stimulus set. However, a lexeme /ukrin/ 'suckle' (from /ukeń/ 'milk') exists in the language and its translation was shown to the speakers as an alternative together with the correct translation 'removed the bark' for the sound stimulus /ụkrịn/.

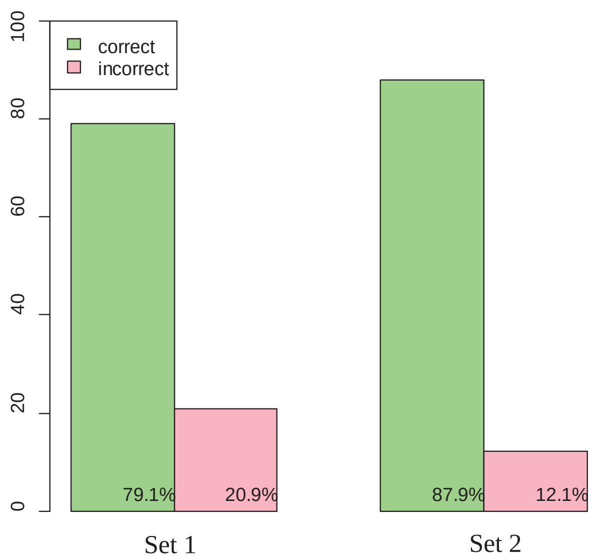
[4] The set 1 /uttin/ with translational variants 'fixed', 'had a rest' or 'pierced' appears in the stimuli three times pronounced both by a male and a female speaker in order to compare stimuli with etymologically different /u/. The set 2 counterpart for this lexeme exists in the language, too (/ụttịn/ 'twisted'), but was rejected by my primary consultant, apparently because of an unfortunate Russian translation. However, the translational variant 'twisted' was sometimes proposed by the subjects when they heard one of the set 1 lexemes /uttin/ 'fixed', 'had a rest' or 'pierced'.

Fig. 4.11 shows that both the set 1 and the set 2 members of the pair /irli/ vs. /ịrlị/ were recognized successfully. The performance for the pair /ussin/ vs. /ụssịn/ is different for set 1 and set 2. As argued above, good recognition of the pair /irli/ vs. /ịrlị/ is most likely caused by the liquid consonants. /l/ in the context of set 1 vowels is very palatalized while it has a velarized allomorph in the context of set 2 vowels. According to my observations, /r/ might be an important cue as well (see comments to experiment 2 in section 4.2.4.2 and Chapter 5). As for the pair /ussin/ vs. /ụssịn/, the distribution of the replies remains unclear. It was expected that the resulting bars in the plot (Fig. 4.11) for both set 1 /ussin/ and set 2 /ụssịn/ would be around 50%, since /s/ (which is mostly [ʃ] in the Bystraia dialect) does not seem to be a cue distinguishing between the two sets. But instead of a chance-level performance, a very poor recognition of set 1 /ussin/ (only 27.8% correct answers) and a very good recognition of set 2 /ụssịn/ was observed.

<u>The Sebian-Küöl dialect</u>

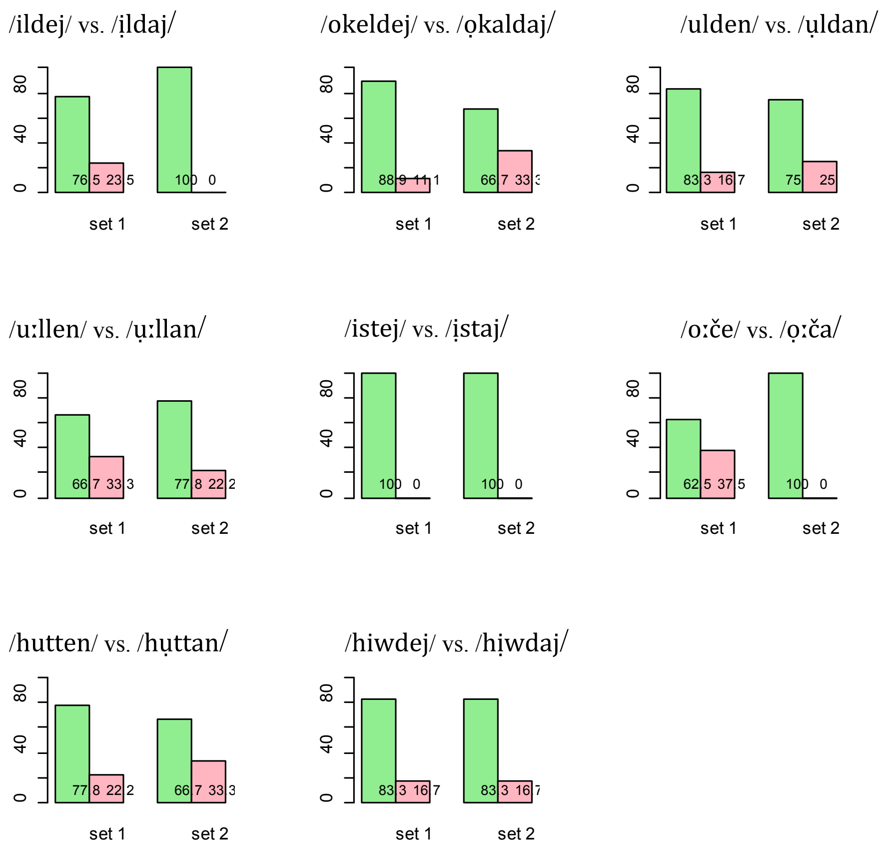
The recognition task with the stimuli containing /a/ or /e/ in the suffixes was also performed successfully by the subjects from Sebian-Küöl (see Fig. 4.12). As in the Bystraia dialect, the recognition of set 1 words is slightly less successful than that of set 2 words (79.1% and 87.9% of correct answers, respectively).

Fig. 4.12. Percentage of the correct and incorrect answers for the stimuli of set 1 and set 2 with e/a in the suffixes.



At the level of individual stimuli one can observe some differences in the perception of different minimal pairs (see Fig. 4.13), but it is not as strong as in the dialect of Bystraia. The worst performance was observed for the set 1 /oːče/ 'scraped reindeer hide', which was recognized correctly by only 62.5% subjects, though the corresponding set 2 stimulus /ọːča/ 'made, became' was recognized with 100% success[5]. The other stimuli were recognized with a success rate between 66.6% and 100%.

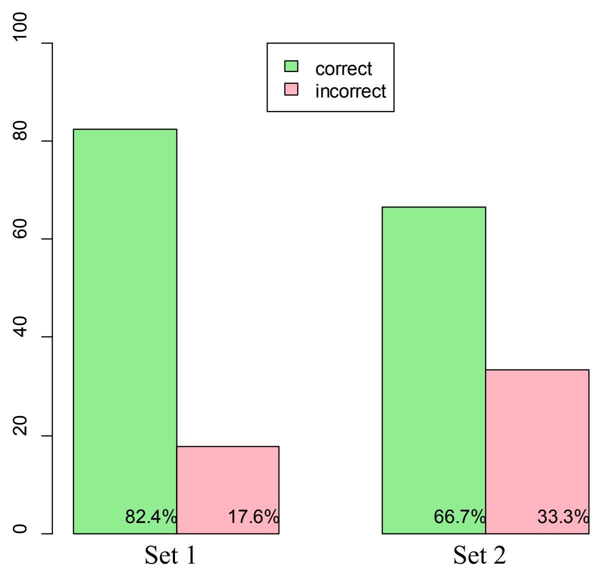
Fig. 4.13. Percentage of the correct and incorrect answers for the stimuli of experiment 1, plotted for the individual minimal pairs (containing /e/ and /a/).



[5] This might be due to the influence in frequency: in the corpus of interlinearized texts from Sebian-Küöl there are more than 500 occurrences of the set 2 stem /ọː-/, whereas the set 1 /oː-/ does not occur in the texts at all. However, the subjects were asked prior or after the experiment if they are familiar with the set 1 /oːče/ 'scraped reindeer hide'.

As in the case of the Bystraia dialect, it is interesting to compare the distribution in Fig. 4.12 with the distribution of the answers for the stimuli not containing /e/ or /a/ in the suffixes. But in contrast to the experimental setting in the Bystraia dialect, in this subset of stimuli for the Sebian dialect I was able to include only one minimal pair which shows the contrast between /o/ and /ọ/. Because the vowels /o/ vs. /ọ/ differ acoustically, it is reasonable to consider the perception data for this vowel opposition apart from high vowels. The distribution of the responses to the stimuli /moː/ 'water' and /mọː/ 'tree' is shown in Fig. 4.14. The performance in the task for the set 1 /moː/ 'water' is successful (82.4% of correct answers). The performance for the set 2 mọː 'tree' is less successful (only 66.7% of answers are correct)[6]. However, despite the blurred result for set 2 it seems to be plausible to say that the subjects are able to identify words containing o-vowels of different sets, and consequently they perceive /o/ and /ọ/ as two different phonemes.

Fig. 4.14. Percentage of the correct and incorrect answers for the stimuli /moː/ 'water' (set 1) and /mọː/ 'tree' (set 2).

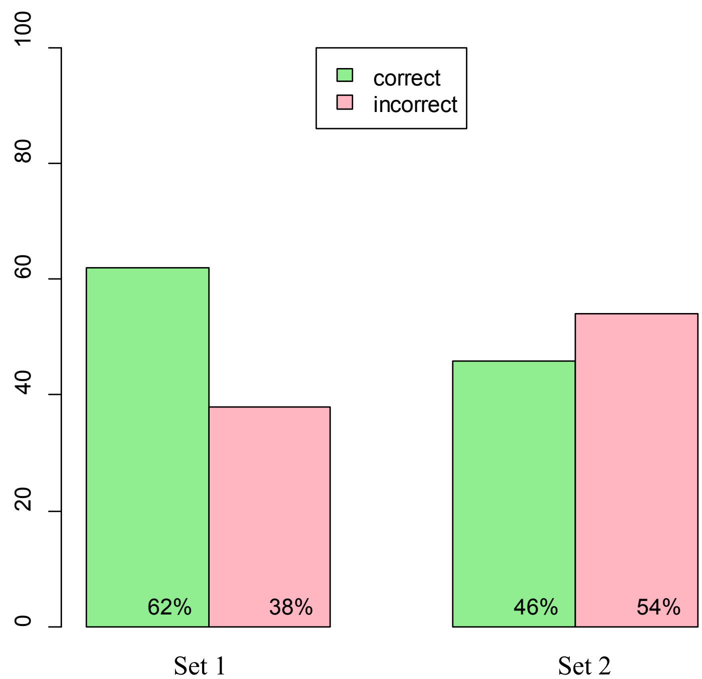


However, concerning the Sebian data, it is questionable if the speakers can successfully perfom the task with stimuli containing only high vowels. In this connection

[6] In order to investigate whether there is a specific factor driving this difference or whether it is a sporadic phenomenon, more minimal pairs contrasting only with respect to /o/ should be investigated in the future.

it is important to keep in mind that the acoustic study did not reveal any significant differences between /i/ and /ị/, which in my opinion signals a merger of these two phonemes. Auditorily, I found the u-vowels of different sets very similar to each other too[7]. My expectations for the results of this experiment were that the stimuli containing only high vowels would be difficult (if not impossible) to categorize correctly. The distribution of the answers to these stimuli is given in Fig. 4.15 below.

Fig. 4.15. Percentage of the correct and incorrect answers to the stimuli of set 1 and set 2 containing only high vowels.

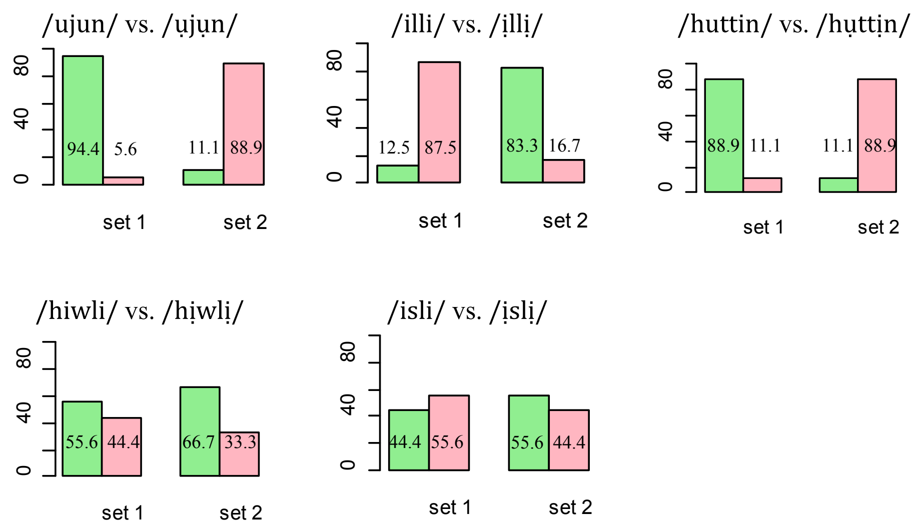


The distribution of the answers given to the stimuli of set 2 is close to random, which matches my prediction. The recognition task with the stimuli of Set 1, on the other hand, looks more successful than I expected. The better performance with the set 1 stimuli might be explained by the unfortunate choice of the stimuli: the influence of the different frequency of usage of set 1 and set 2 stimuli and the inexact translation of one stimulus.

[7] However, the acoustic data show that both F1 and spectral slope differ significantly between /u/ and /ụ/ (see 3.2.2.1 and 3.2.2.4).

As Fig. 4.15 gives a rather simplified average impression of the distribution of the responses to the stimuli of the two sets and does not take into account some conflicting tendencies, Fig. 4.16 gives the distribution of the answers in a more detailed way.

Fig. 4.16. Distribution of the correct and incorrect responses according to the individual stimuli of set 1 and set 2 containing only high vowels.



Among the stimuli I have the pair /ujun/ 'nine' vs. /ụjụn/ 'ford a river'. Apart from the fact that these lexemes belong to different parts of speech, which might also be a disturbing factor, set 1 /ujun/ seems to be used more frequently and known by more subjects[8]. For the stimuli /ujun/ and /ụjụn/ the answer 'nine' was given much more often than the answer 'ford a river' (33 times and 3 times, respectively). The asymmetry of the responses for the stimuli /illi/ 'remove the bark' vs. /ịllị/ 'stand up' can possibly be explained in a similar way. Another possible factor influencing this distribution might be a problematic translation given as an option for one of the stimuli, namely set 2 /hụttịn/ was translated as 'ran away' in the experiment, but the more precise translation would be 'tore itself loose and ran off (about reindeer)'. However, it seems quite remarkable that the results for some of the stimuli are so strikingly low (11.1% correct responses for set 2 /ụjụn/ 'ford a river' or 12.5% correct responses for set 1 /illi/ 'remove the bark'). The

[8] E.g. in the situation described in section 4.2.3. the younger speakers of the Sebian dialect were not familiar with set 2 /ụjụn/ 'ford a river'.

results for the minimal pairs /hiwli/ 'go out' vs. /hịwlị/ 'turn inside out' and /isli/ 'tear off' vs. /ịslị/ 'reach' are close to random choice. This seems to be strong evidence for the absence of an opposition between /i/ and /ị/ which goes in line with my acoustic findings (see 3.2.3).

No influence of the consonants (in this subset it can be checked only for /l/) was detected in the Sebian dialect. This can be seen in the the distribution of the responses for the stimuli /isli/ 'tear off' vs. /ịslị/ 'reach' (Fig. 4.16): the presence of a liquid consonant does not improve the perfomance of the subjects for any set.

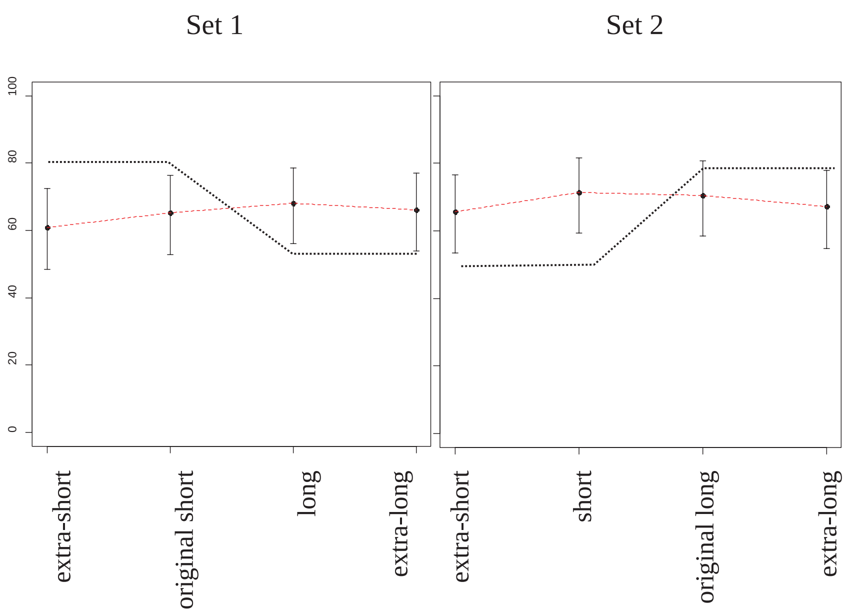
4.2.4.2 Experiment 2

The aim of the second experiment is to check the hypothesis induced by the acoustic study that duration can influence the perception of a vowel as belonging to set 1 or set 2. According to my hypothesis, the shorter the vowel the more likely it is to be perceived as a set 1 vowel; and vice versa, the longer the vowel, the more probable it is to be associated with set 2. Moreover, the results of this experiment can provide some further interesting insights into the system of Even vowels: since the stimuli contain only high vowels, it might be an additional test for their merger.

The Bystraia dialect

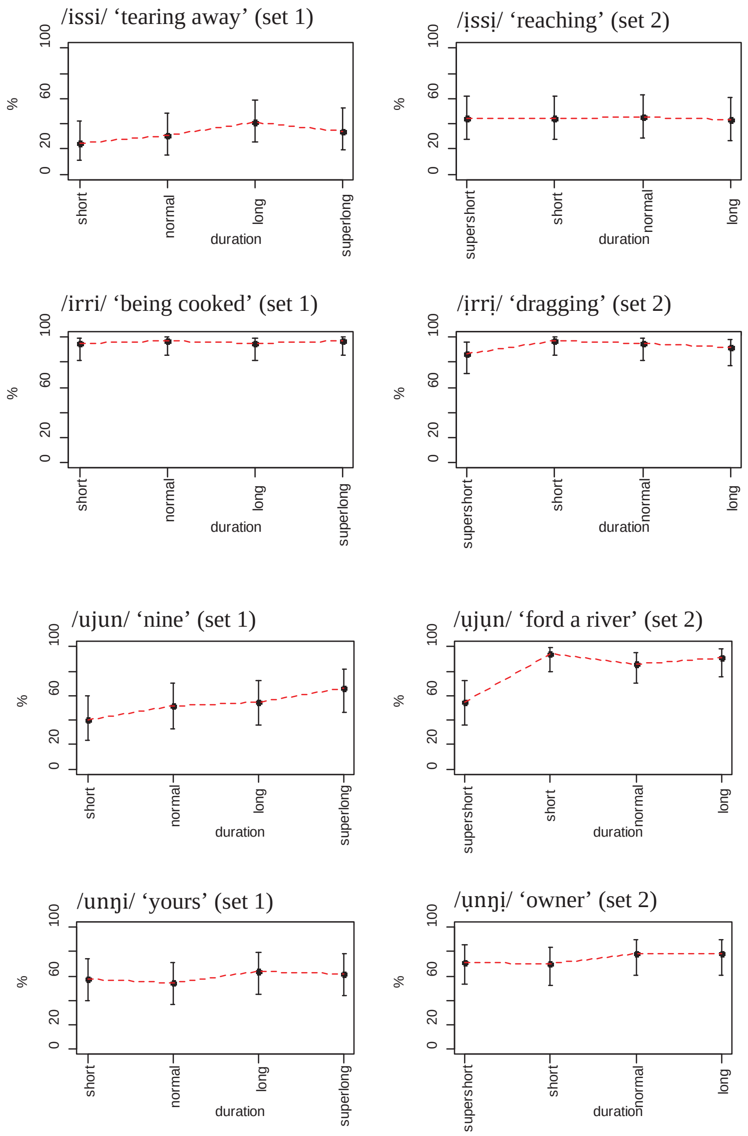
Fig. 4.17 shows that in the Bystraia dialect the shorter stimuli of set 1 are not perceived better than the longer ones; at the same time, there is no big difference in performance between longer and shorter stimuli of set 2. Generally, the performance of the task is around 70% of correct answers for both sets. A common pattern for both set 1 and set 2 stimuli is that the performance becomes worse at the edges: extra-short and extra-long stimuli are perceived worse for both sets.

Fig. 4.17. Percentage of correct answers for the stimuli of the different duration categories (the black line corresponds to the expected results, the red one depicts the observed results).



The results for the individual stimuli provide no correlation between the level of perfomance and the duration of the vowels, neither for the stimuli containing /i/ vs. /ị/ nor for the stimuli containing /u/ vs. /ụ/. The individual words were recognized better or worse but irrespective of duration of the vowels (see Fig. 4.18). Interestingly, the stimuli containing set 2 /ụ/ /ụjụn/ 'ford a river' and /ụŋnị/ 'owner' were recognized better than their counterparts of set 1 /ujun/ 'nine' and /uŋni/ 'our'. The tendency for a better recognition of set 2 stimuli was also reflected in Fig. 4.12 above.

Fig. 4.18 Percentage of correct answers for the individual minimal pairs of the different duration categories.



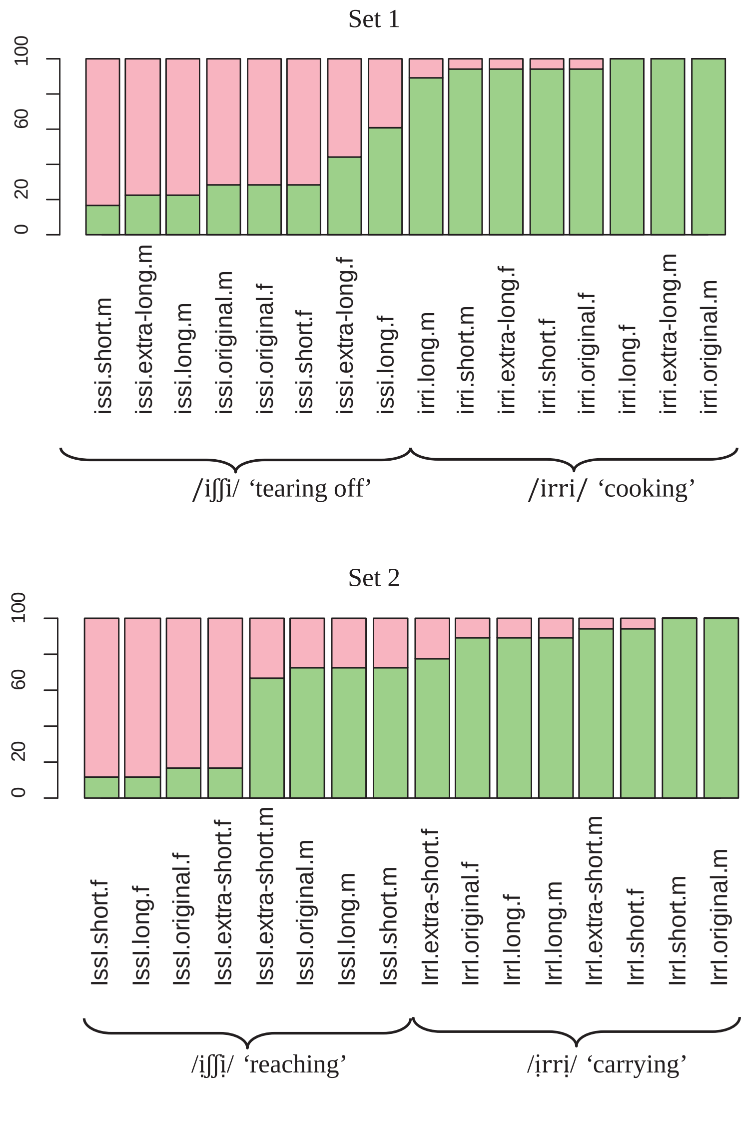
An interesting tendency can be observed if we look at the level of the individual stimuli for the stimuli containing /i/ and /i̜/. For the two quasi-minimal pairs /irri/ 'being cooked' vs. /ịrrị/ 'dragging' and /issi/ 'tearing off, vomiting' vs. /ịssị/ 'reaching', the stimuli containing /r/ were recognized much better than those containing /s/, independently of the duration category of the stimuli. This difference can be explained with the influence of the liquid consonant (/r/), which to my auditory impression differs depending on vowel context. Apparently the fricative /s/ is less influenced by the vowel context; therefore it does not seem to function as a perceptual cue,. As noted above in section 4.2.4.1, similar consonantal cues in the Bystraia dialect are the lateral liquid (/l/) and the alternation between the voiceless velar/uvular (k/q).

The upper part of Fig. 4.19 (responses to the set 1 stimuli) on the next page shows a distinct difference between the perception of the stimuli containing /r/ and the stimuli containing /s/. The bottom part of Fig 4.19 (responses to the set 2 stimuli) does not, however, show a clear border between the stimuli containing /r/ and the stimuli containing /s/. But the tendency observed for the responses to the set 1 stimuli is still apparent for the responses to the set 2 stimuli.

The bottom half of Fig. 4.19 is peculiar in the way that the performance with respect to the stimuli containing /s/ does not increase homogeneously, but is unsuccessful for the first four stimuli (only two or three subjects gave correct answers, 11.1% - 16.7%) and quite satisfactory for the second four stimuli (about 12-13 subjects out of 18 gave correct answers, 66.7% - 72.2%). This difference does not correlate with the duration category, but is explained by the identity of the original speaker: the first four bars of the plot correspond to the female speaker (the stimulus of the "original" duration was recorded from a female speaker, and the other three have slight modifications with respect to duration). The second four stimuli containing /s/ correspond to the male speaker. Since I included original stimuli recorded from only two speakers in this experiment, it is impossible to make any generalizations concerning the influence of sex of the speaker on the perception of the stimuli. However, as the results for the other stimuli recorded from this female speaker do not show any specific pattern, one can presume that this particular token of this stimulus (/ịssị/) was not pronounced as clearly as the other ones by this speaker.

Despite this potential problem with the recording of one stimulus from the female speaker, the perception data of the Bystraia dialect show a difference in perception of stimuli which have a different consonantal make-up.

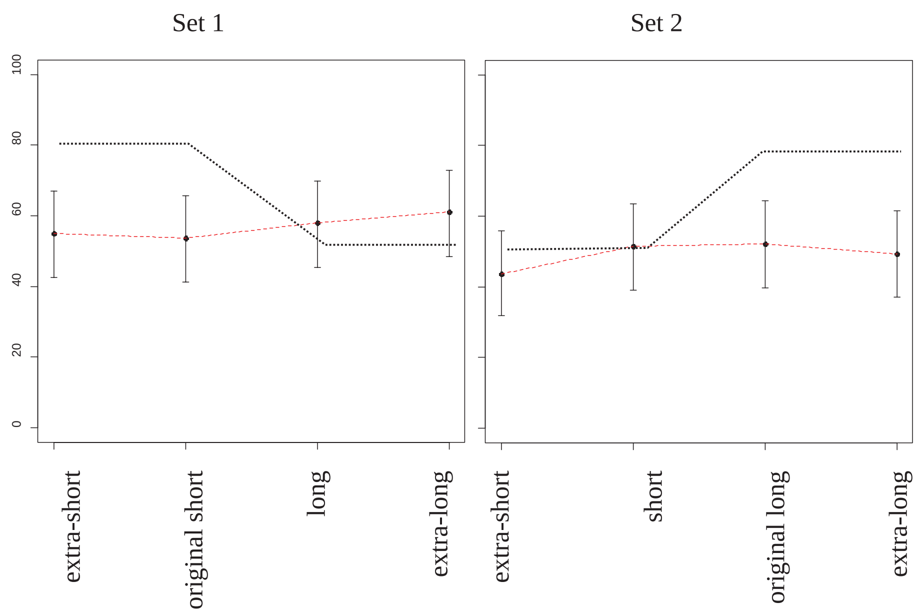
Fig. 4.19. Number of correct answers for the stimuli of different duration categories (the labels at the x-axis signify the lexeme, duration category and sex of the speaker).



<u>The Sebian-Küöl dialect</u>

The data from the Sebian dialect do not confirm the proposed hypothesis about the connetion between the set distinction and the duration either. Fig. 4.20 shows the distibution of the correct responses to the stimuli of different duration categories. On average, 60% correct responses were given to the set 1 stimuli, with slightly better performance with the long and extra-long stimuli than the extra-short and original short ones. This pattern contradicts my initial hypothesis according to which the shorter set 1 stimuli are recognized better than the long ones. Moreover, it is striking that among the set 1 stimuli, the stimuli with original duration (original short) were recognized by the subjects less successfully than the stimuli with modified duration (long and extra-long). The responses to the set 2 stimuli are close to random: only about 50% of responses were correct on average. Obviously, one cannot speak about any influence of duration, since the perception task was not performed sucessfully for any of the duration categories.

Fig. 4.20. Percentage of correct answers to the stimuli of the different duration categories (the blue line corresponds to the expected results, the red one depicts the observed results).



As in the Bystraia dialect, the results for the individual stimuli do not show any consistent influence of duration on the recognition of the words. For instance, the stimuli /ihli/ 'tear off' and /ịhlị/ 'reach' both show better results for the stimuli with extra-long vowels, in contrast to my hypothesis that set 1 words with extra-long vowels would be recognized less successfully.

Another important point which should be mentioned concerns the data distribution within a minimal pair. The stimuli for experiment 2 in the Sebian dialect were exactly the same stimuli not containing /a/ or /e/ included in experiment 1, but with modified vowel duration. The average results for individual stimuli were very diverse, but at the same time repeating the result of experiment 1, i.e. reflecting the same tendencies for each minimal pair which were shown in Fig. 4.16.

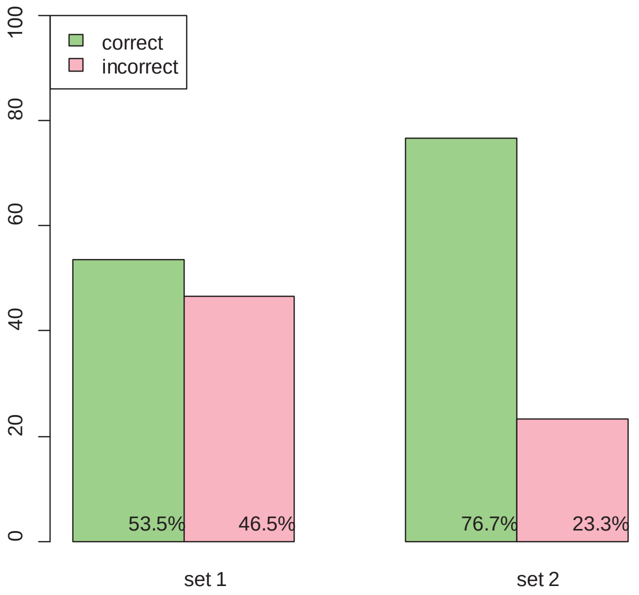
4.2.4.3 Experiment 3

In experiment 3 I used the stimuli with /a/ and /e/ in the suffixes, but these vowels were masked with a special noise. My intention was to find out if the correct recognition of the lexeme is possible in cases where the subjects can judge the set of the full word based only on the root vowel (or some other cues in the word, but not the suffix vowels).

The Bystraia dialect

The distribution of the responses to the stimuli of experiment 3 can be seen in Fig. 4.21. The success of the performance is different for set 1 and set 2 stimuli: the amount of correct responses to set 1 stimuli is almost the same as the amount of incorrect ones (53.5% vs. 46.5%); the set 2 stimuli were recognized with 76.7% of correct responses.

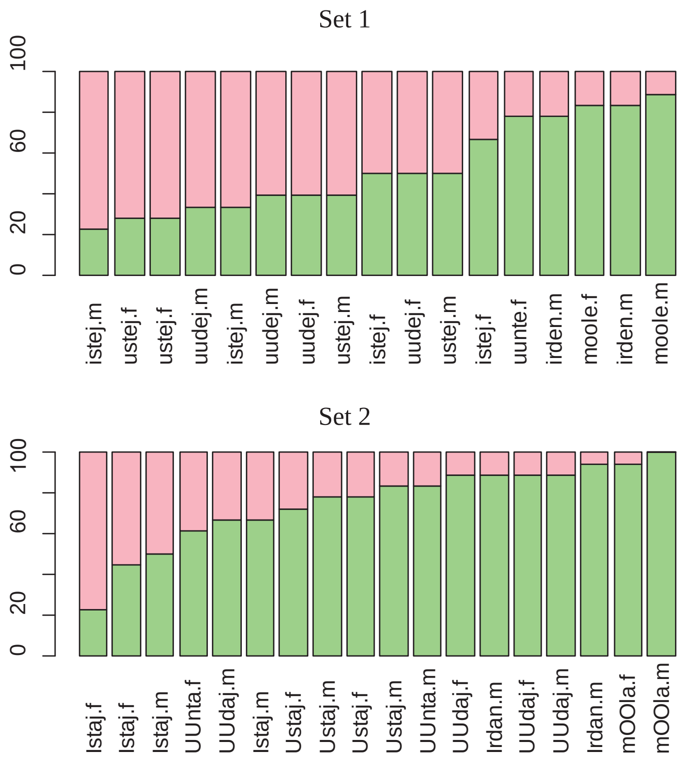
Fig. 4.21. Percentage of the correct and incorrect answers for the "masked" stimuli.



The factor of the presence of a "right edge" consonant which was discussed in section 4.2.2 does not influence the performance: among the stimuli of set 1 with original consonants there is the same amount of incorrect responses as among the stimuli of set 1 with the consonants of the corresponding set 2 stimuli to the right of the obscured vowel. The same is true for the set 2 stimuli. The stimuli which do not have any consonants after the obscured vowels (/moːle/ 'in the water', /mọːla/ 'on the tree', /uːnte/ 'different' and /ụːnta/ 'deep') are on average recognized better than those which have a "right edge".

However, it is interesting to see if there is any pattern in the correct recognition of stimuli. Fig. 4.22 shows the percentage of correct responses to the stimuli of experiment 3. Comparing the performance for the set 1 and set 2 stimuli (the upper and the lower plot, respectively) it can be seen that among set 1 stimuli the words which were identified better (those which are grouped to the right) contain the consonants /l/ and /r/. A similar tendency can be observed for the set 2 stimuli; however, the stimulus /ụːdaj/ 'to mount a reindeer', which does not contain a liquid consonant, is recognized as well as /ịrdan/ 'dragged', which contains /r/. But the set 2 words with /r/ and /l/ are all grouped at the right.

Fig. 4.22. Number of correct and incorrect responses to the stimuli with obscured vowels (the labels on the x-axis signify the lexeme and sex of the speaker).



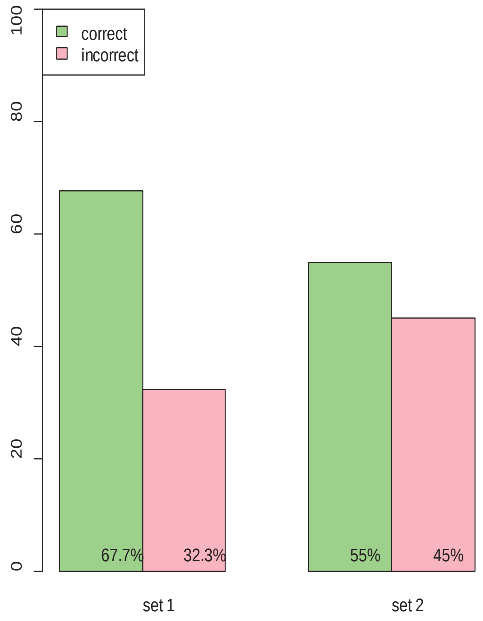
Thus, even if it is not possible to speak about the decisive role of the liquid consonants for recognition (there is no clear borderline between the results for the words with and without /r/ and /l/), they seem to be an important cue for the perception, as was also found in the results of the experiment 2.

<u>The Sebian dialect</u>

The results of the third experiment performed with the Sebian subjects are shown in Fig. 4.23. In contrast to the results obtained in the Bystraia district, in Sebian-Küöl the stimuli of set 1 were recognized better than the stimuli of set 2. The performance with the stimuli of set 1 shows 67.7% of correct responses. As in the

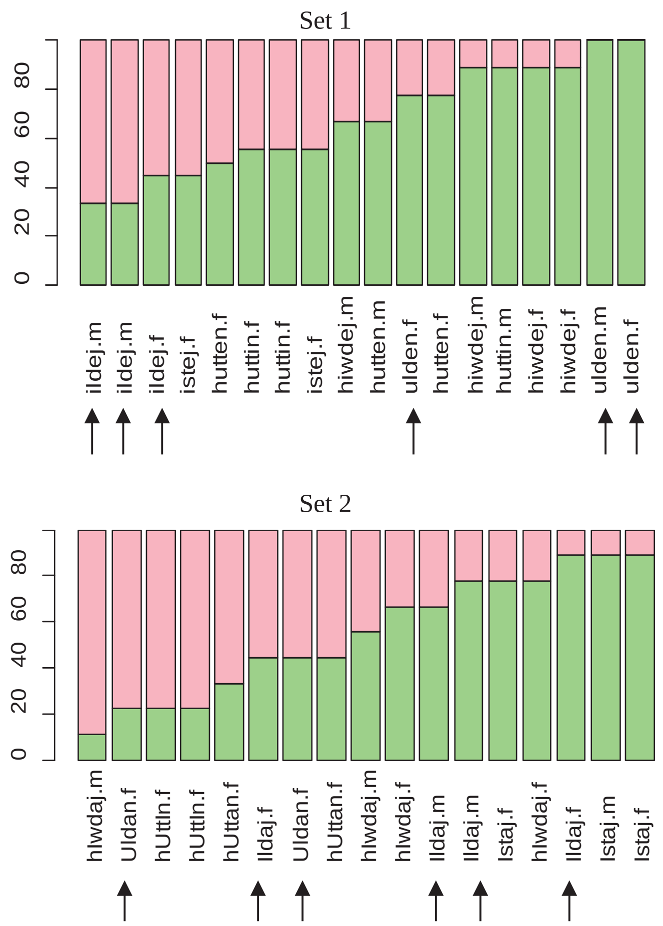
Bystraia distrrict, in Sebian-Küöl the suffix consonants to the right from the masked vowel do not influence the performance level.

Fig. 4.23. Percentage of the correct and incorrect answers for the “masked” stimuli.



A comparison of the responses to the individual stimuli in the Sebian dialect with those in the Bystraia dialect also reveals different tendencies. The distribution of correct responses to the stimuli used in this experiment is given in Fig. 4.24. In contrast to what was found for the Bystraia dialect, the stimuli containing the liquid consonant /l/ are not among those which are recognized better. For instance, in the plot for the set 1 stimuli the stimulus /ildej/ ‘remove the bark’ pronounced by the male speaker as well by the female speaker is in the very left part of the plot, meaning that it was recognized the least successfully, but the stimulus /ulden/ ‘its meat’ is recognized in 100% of the cases.

Fig. 4.24. Number of correct and incorrect responses to the stimuli with obscured vowels (the labels on the x-axis signify the lexeme and sex of the speaker, the stimuli containing /l/ are marked with an arrow).



It seems, however, that this result reflects the influence of the frequency of the lexical items, which was observed in the other experiments as well. The stimulus /ulden/ 'its meat' from the example above composes a quasi-minimal pair with the set 2 stimulus /ụldan/ 'has been heard', which is used less frequently: the corpus of interlinearized texts from Sebian-Küöl comprising over 50,000 words contains 51 entries of /ulde-/ and only three entries of /ụlda-/ (with all instances of /ụlda-/ occurring in one and the same text).

Thus, it is not surprising that the two individual stimuli for /ụldan/ were correctly recognized by only 22.2% and 44.4% of subjects, respectively (Fig 4.24, bottom plot). The same tendency can be observed for the quasi-minimal pair /istej/ 'to tear off' and /ịstaj/ 'to reach': the more frequent set 2 stimulus (84 entries in the corpus) is recognized correctly by most subjects, but the recognition of its harmonic counterpart (which does not occur in the corpus at all) was rather poor.

4.3 Discussion

The results of the three experiments described above show that the dialects of Bystraia and Sebian-Küöl are very different from each other. One of the few commonalities between them is that the subjects from both dialects experience difficulties in recognizing words that contain only high vowels. Moreover, neither the data of the Bystraia dialect nor the data of the Sebian dialect confirm my hypothesis about the role of duration in set discrimination. Thus, it is hard to make any generalizations about both dialects, since in each of them some specific tendencies can be observed. Below I summarize the results of all experiments and draw conclusions about the ability of set discrimination in each dialect.

<u>The Bystraia dialect</u>

The results for experiment 1 differ for the two groups of stimuli: the stimuli containing /a/ and /e/ in the suffixes were recognized quite well (78.4% correct responses for the set 1 stimuli and 83.5% for the set 2 stimuli), but the stimuli of set 1 not containing /e/ were recognized less succesfully (only 66.7% correct responses), whereas the set 2 stimuli not containing /a/ elicited 84.3% correct responses. However, the asymmetry in the distribution of the stimuli of the second group is caused only by one minimal pair /ussin/ 'sprinkled; pulled out' vs. /ụssịn/ 'cut', for the set 2 member of which the speakers gave 86.1% correct responses (in contrast to the set 1 member: only 27.8%, see Fig. 4.11). For the time being I am unable to explain why most of the subjects were inclined to give the set 2 response. One could speculate that the frequency of usage might be an influencing factor here, but the corpus of texts collected in the Bystraia district comprising ~16,700 words is not large enough to provide that information: neither root occurs in the collected texts.

In both groups of stimuli the stimuli containing liquid vowels (/moːle/ vs. /mọːla/, /ojle/ vs. /ọjla/, /irden/ vs. /ịrdan/ in the first group; /irli/ vs. /ịrlị/ in the second group) are recognized best and with approximately the same proportion of correct responses for the set 1 and set 2 stimuli. I observed the same tendency in the results of experiment 2: stimuli containing /r/ were recognized considerably better than those containing /s/ (see Fig. 4.19). My proposal is that in the Bystraia dialect the presence of some consonants plays an important role in word discrimination. These consonants are the liquids /l/ and /r/ as well as /k/, which has velar and uvular allophones depending on the vowel set. These consonants function as perceptual cues that signal the set of the word. The results of experiment 3 provide additional evidence for the important role played by these consonants: all words containing liquid consonants were recognized successfully (if not in 100% cases, but the tendency for their consistent discrimination can still be observed, Fig. 4.21).

On the other hand, experiment 2 shows that words with /u/ and /ụ/ are identified relatively well even when the consonantal cues mentioned above are absent (Fig. 4.18). This concerns especially the words of set 2. I do not think that these results are caused by the frequency of the words. For instance, in the pair /unŋi/ 'yours' vs. /ụnŋị/ 'owner', the set 2 /ụnŋị/ happened to be recognized better (around 75% of correct responses). Both words seem to be rather rare, since neither word occurs in the corpus of recorded texts. Moreover, I observed a better discrimination of the set 2 stimuli in experiment 3. Probably those stimuli which lack consonantal cues in Fig. 4.22 are recognized better because they contain /ụ/. But it remains unclear why it is only the set 2 member of the minimal pair which is recognized better by the subjects. In the presence of consonantal cues, both set 1 and set 2 stimuli are discriminated successfully.

Thus, it is problematic to speak about the unequivocal ability of the subjects to distinguish between two full sets of vowels in the Bystraia district. The goal of these experiments was to look at the vowel opposition from the perspective of perception. But the design of my experiments has certain limitations: it allows me to compare only the recognition of full words, not single vowels. It means that for the comparison of full words I should take into account also other factors than vowels, namely consonants. This is especially important with respect to the results of experiment 2 (see Fig. 4.19): the members of the pair /irri/ vs. /ịrrị/ are identified correctly, but the pair /issi/ vs. /ịssị/ caused problems with correct identification of the sets for the subjects. This leads me to the conclusion that it is the two variants of /r/ which helped subjects to recognize the words in the first case. The vowels /i/ and /ị/ themselves without consonantal cues are not opposed perceptually, as can be seen by the pair /issi/ vs /ịssị/. Consequently, it means that the words /irri/ vs. /ịrrị/ are opposed rather by consonants than by vowels, and /issi/ vs. /ịssị/ have become homophones. If this analysis is correct, then the allophones of /r/ (as well as /l/ and /k/) are now used to discriminate between minimal pairs, i.e. they become phonologically opposed and one can observe the emergence of new consonantal phonemes at the cost of a merger in vowel phonemes. Chapter 5 is devoted to the acoustic analysis of these consonants.

However, despite the loss of the phonological opposition between /i/ and /ị/, the speakers still consistently follow the rule of vowel harmony in terms of choosing the suffix allomorphs with /e/ or /a/ depending on the set of the original root. This phenomenon can be explained if the original set of the root vowel (or rather the information about which suffix allomorph – with /e/ or with /a/ – can be combined with this root) is specified lexically for each root. A similar analysis was proposed by

Bulatova & Grenoble (1999) for high vowels in Evenki. The authors describe the high vowels /i/, /iː/, /u/, and /uː/ as neutral vowels. These vowels can occur after any vowel, but if a root contains a high vowel only one type of suffix can be attached to it – either with /e/ or with /a/. However, "which suffix vowel occurs is unpredictable from a synchronic point of view." (ibid., 4).

At the same time, as mentioned in section 4.2.4.1 in the description of the results of the first experiment, I observe a reduction of the suffix vowels in Bystraia Even. This is commonly found in the Eastern Even dialects (Novikova 1960: 35). The suffix vowels /e/ and /a/ seem to be neutralized relatively often, both in fluent speech and in the single words recorded for phonetic analysis. But usually this is not just a centralization of both vowels towards [ə], but a slight quantitative reduction of /a/ and a shift of /e/ towards a short [a]. It was observed in the results of experiment 1 above that the set 1 word /ustej/ 'sprinkle' or 'pull out' was pronounced by the speaker with a suffix vowel very close to [a], which caused difficulties in perception for the subjects. In my opinion the tendency to neutralize the difference in the suffix vowels supports the scenario of merger of some vowels opposed by set. It might be a sign that the phonological system is being restructured towards eliminating the set opposition in general. However, since I collected monosyllabic minimal pairs for the opposition /e/ vs. /a/, it is evident that in prominent positions these vowels are opposed. It was interesting to see the tendency to neutralize the difference between them in the peripheral suffix positions. Despite this noticeable tendency, the stimuli containing /a/ and /e/ in the suffixes were recognized accurately. Thus, for the moment these vowels are still reliable cues for the speakers.

The other vowel pairs in the Bystraia dialect do not show such a clear picture. Unfortunately, I do not have comparable data for the pair /u/ vs. /ụ/ with the same consonantal differences as I have for the /i/-vowels. The results of the discrimination tasks between /u/ and /ụ/ are equivocal: on the one hand, the set 2 stimuli are recognized quite successfully, but on the other hand most of the set 1 stimuli with /u/ are recognized only in 50% of the cases or even less. For the moment, the question about the opposition /u/ and /ụ/ remains open.

It is also hard to draw any conclusions concerning the opposition of /o/ and /ọ/, since I lack appropriate stimuli in my sample. All the stimuli I have in my sample (/moːle/ vs. /mọːla/, /ojle/ vs. /ọjla/) contain /l/ which is probably the reason why they were recognized so well. However, there is some evidence that these vowels are not opposed phonologically any more. The evidence comes not from the perception data, but from the distribution of set 1 /o/, which is quite restricted due to the change /o/ → /u/. Set 1 /o/ never occurs in monosyllabic words, and in polysyllabic words it is always followed by a syllable with /e/, whereas set 2 /ọ/ may occur both in mono- and polysyllabic words; in the latter case it requires suffixes containing /a/. The lack of monosyllabic words with /o/ results in a lack of minimal pairs which could support the opposition /o/ vs. /ọ/. Thus, these vowels are in complementary distribution and, hence, they are two allophones of one phoneme. If this analysis is correct, then the perception data from experiment 3 would be explained by a phonemic opposition of the two consonants /lʲ/ and /l/: the data was created from the recordings of the words /moːle/ and /mọːla/ where the suffix vowels were masked with noise.

<u>The Sebian dialect</u>

As in the Bystraia district, in Sebian-Küöl the original stimuli containing /e/ and /a/ were identified successfully (79.1% correct responses for the set 1 stimuli and 87.9% correct responses for the set 2 stimuli). The data of experiment 1 with the stimuli not containing /e/ and /a/ will be discussed in two steps. First, the discrimination between the members of the minimal pair /moː/ 'water' and /mọː/ suggests that subjects perceive /o/ and /ọ/ as two different phonemes. It also conforms well to my acoustic findings (significantly fronted set 1 /o/) and to my auditory impression. Second, the recognition of the stimuli containing only high vowels shows very diverse results depending on the minimal pair (Fig. 4.15).

The difficulties with recognizing the words containing only high vowels provide evidence for the merger of high vowels belonging to different sets, i.e. /i/ and /ị/ as well as /u/ and /ụ/ are not phonologically opposed any more. Visually, it is most obvious in Fig. 4.16, where the distribution of the correct and incorrect answers is shown for each member of the individual minimal pairs. One would think that in order to claim the inability of the subjects to discriminate between two vowels and, hence, the clear perceptual evidence of a merger, both set 1 and set 2 members of a minimal pair would be recognized with 50% chance. But in the data the picture is more complex. Indeed, two minimal pairs, namely /hiwli/ 'extinguish' vs. /hịwlị/ 'turn inside out' and /isli/ 'tear away' vs. /ịslị/ 'reach', reveal the expected results: their recognition is close to random. The other minimal pairs show some asymmetry in the distribution toward one or another member of the minimal sets. In the minimal pair /illi/ 'remove the bark' vs. /ịllị/ 'stand up' it is the set 1 member which was recognized remarkably worse. Given the conditions of the experiment, this means that the translation for the set 2 stimulus was provided much more often. The same picture can be observed for the minimal pairs /ujun/ 'nine' vs. /ụjụn/ 'ford a river' and /huttin/ 'pierced' vs. /hụttịn/ 'tore itself loose and ran off', but in these cases the set 1 members were recognized better, i.e. the translations for the set 1 item were given considerably more often. These results are also supported by the fact that the same distribution of these stimuli was also obtained in the second experiment. Comparing the translations of the stimuli which were supposedly identified better or worse, it turns out that the answers which were given more often are just more common and frequent words[9]. It was checked with the speakers during the acoustic recordings that in each minimal pair both words were known to the speakers. However,

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[9] The estimate is based on the number of the occurrences in the corpus of interlinearized texts.

when they heard one of them they always chose the most frequent translation. My assumption is that if these words were indeed phonetically opposed, frequency would not play such a striking role in the identification task. Apparently, the words from the minimal pairs which were recognized with 50% belong to the common lexicon (both set 1 and set 2 stimuli), and for this reason the translation of set 1 and set 2 stimuli were chosen equally often. Thus, the data of the identification of the words containing only high vowels provides evidence for phonetic mergers. The subjects cannot identify the words from two different sets.

However, the suffix alternation is still consistent in Sebian-Küöl and, unlike Bystraia and the other Eastern dialects, the reduction of the suffix vowels is less noticeable. To explain the correct choice of suffixes for roots containing only high vowels, I would like to propose the same mechanism I described above for the Bystraia dialect: the information about the original set of the root vowel must be specified at the lexical level.

In addition, I would like to highlight that the consonants which are very important for the word recognition in the Bystraia dialect do not play such a decisive role in the dialect of Sebian-Küol. This can be seen both in Fig. 4.16 (the presence of /l/ does not improve the recognition of the pairs /hiwli/ vs. /hịwlị/ or /isli/ vs. /ịslị/) and in Fig. 4.24 (the distribution of the words containing /l/, which are marked with arrows, does not reveal any pattern).

Thus, the data of the perception experiments show that in Sebian Even set 1 consisting of /e/ and /o/ is opposed to set 2 consisting of /a/ and /ọ/[10]. The high vowels /i/ and /u/ have become opaque vowels.

Finally, I would like to make a remark concerning the use of vowel duration in both dialects. Both the Bystraia and Sebian data disprove my tentative hypothesis that the longer stimuli are more likely to be recognized as set 2 stimuli, and the shorter ones as set 1 stimuli. As seen in Fig. 4.17 and Fig. 4.20, the tendency predicted by this hypothesis does not match the real data.

[10] In addition, in the Sebian dialect the diphthongs /ie/ and /ịa/ are also opposed by set, but they were not included in the perception study.

5 The role of consonants in the system of vowel harmony

As shown in Chapter 4, some consonants have allophones depending on the harmonic vowel set that play an important role in the correct perception of Even words. In the Bystraia district, recognition of the stimuli containing liquid consonants is less difficult than recognition of the stimuli containing fricatives. This tendency is, however, absent in the data of the Sebian dialect. Thus, in Bystraia, some consonants have become perceptual cues helping to discriminate words which were expected to be opposed only by vowels of different sets. Besides the liquid consonants, which were in the scope of discussion in the previous chapter, my auditory impression and descriptions of other Even dialects suggest that the voiceless velar/uvular stop also belongs to this type of consonants that reflect the harmonic set of the word.

The focus of this chapter lies in the acoustic analysis of possible consonantal cues in the dialect of the Bystraia district and in the dialect of Sebian-Küöl. In section 5.1 I present typological evidence for the consonantal allophony in the systems of vowel harmony as well as some facts from Even reported in the descriptions of other dialects. Section 5.2 and 5.3 are devoted to the analysis of the liquid consonants /r/ and /l/, respectively. In section 5.4, I present data on the allophonic variation of the velar/uvular voiceless stop in the words of different sets. As in the previous chapters, in each section I describe the Bystraia and Sebian-Küöl data separately. Section 5.5 summarizes the results of this chapter.

The results of Chapter 3 and Chapter 4 suggest that it is doubtful whether a consistent, systematic distinction between sets of vowels exists in the Bystraia and Sebian dialects. It therefore does not make much sense to talk about a vowel distinction in the present chapter, especially if one of my hypotheses is that the distinction between minimal pairs which used to be expressed by vowels might be actually borne by consonants. But for my analysis I still need the notion of set, even if it might not be applicable to vowels. Thus, in this chapter while using the term vowel set in the description of previously published studies, I will switch from the notion ‘set of the vowel’ to the notion ‘set of the word’ when I discuss my own data.

5.1 Cross-linguistic evidence and the data from Even dialects

Consonantal allophonic variation in phonological systems with vowel harmony is a widespread phenomenon cross-linguistically. In Kalendjin, a language with ATR vowel harmony, the stop consonants /p/, /t/, /k/ are articulated with burst release or close approximation before [+ATR] vowels. In contrast, in the context of [-ATR] vowels the burst is weaker and these consonants are 'lenited' (lax fricative consonants and consonants with open approximation, according to Local & Lodge (2004)).

In the systems of backness vowel harmony, a velar/uvular alternation conditioned by vowel set is attested widely. In Kolyma Yukaghir, the distribution of velar and uvular consonants depends on the [±backness] of the word: "the velars /g/, /k/ occur in front stems only, the uvulars /h/, /q/, in back stems only" (Maslova 2003: 36). In Turkic languages, the velar and uvular stops are also distributed depending on the vowels, front or back, in each particular word (e.g. in Sakha (Ubryatova 1982: 77) and in Kazak (Somfai Kara 2002: 15)). Moreover, palatalization in the context of front vowels is also common for this type of vowel harmony. In Tatar, all consonants preceding front vowels are slightly palatalized, whereas their non-palatalized allophones precede back vowels (Zakiev 1995: 95). However, in most cases this variation is purely phonetic and does not affect the phonological system. But at least in one case this allophonic distribution has become crucial for the restructuring of the phonological system. Stachowski (2009) shows that in the Turkic language north-western Karaim [1] the opposition between palatalized and non-palatalized consonants is not just allophonic anymore. Simultaneously with the process of restructuring the vowel system, "the consonants became the actual carriers of the harmony" (Stachowski 2009: 159). On the one hand the classical Turkic eight vowel backness system was violated with the change of non-initial /ö/ and /ü/ into /o/ and /u/, /ɨ/ into /i/, and /e/ into /a/ (with the exception of some suffixes). On the other hand, the consonants adjoining originally front vowels consistently kept their palatalization. These changes together indicate the shift from vowel harmony to consonant harmony in north-western Karaim.

Consonantal allophonic variation depending on the set of the vowels in the word is also common for Tungusic languages, and for Even in particular. In the description of the Ola dialect, Novikova (1960: 55-56) mentions that vowel harmony influences the articulation of the consonants. As mentioned in Chapter 1 (section 1.6), the parameter underlying the vowel opposition in Ola Even is claimed to be pharyngealization. Thus, the consonants differ in the context of pharyngealized and non-pharyngealized vowels. The general observation is that the articulation of consonants in the context of pharyngealized vowels is retracted towards the back of the oral cavity. In this case, for instance, the labial plosives /p/ and /b/ are pronounced with a slight nasal articulation, which happens due to the additional movement of the soft palate. The

[1] The north-western dialect of Karaim is spoken in Lithuania and is also known as Trakai dialect. During the last six hundred years Karaim has been in close contact with Slavic languages (Russian and Polish, see Csató 2001) and Lithuanian. Nowadays north-western Karaim is highly endangered.

alternation between the voiceless velar and uvular stop existing in Ola Even is also very striking auditorily: the velar variant is found in the context of non-pharyngealized vowels, the uvular one in the context of pharyngealized vowels. Another example of vowel-consonant interaction given by Novikova is the allophonic variation of /l/. In the words with pharyngealized vowels /l/ has a non-palatalized allophone, but within the context of non-pharyngealized vowels /l/ becomes palatalized, so it is comparable to the Russian “soft” /l/.

However, looking at other dialectal descriptions one can see that the velar/uvular alternation is not universal for all dialects, but the dialects which have it and those which lack it do not form any geographical pattern. On the one hand, the data of Robbek (1989), who studied one of the eastern dialects (Berezovka), show this alternation. Dutkin (1995: 17) also observes the same alternation in Allaikha Even, one of the western dialects. On the other hand, this alternation is not found in the data of Bogoraz collected around the Omolon river, i.e. in an eastern dialect (Benzing 1955: 8). The Okhotsk dialect (Arka and Ulya, see the map in Fig. 1.2, Chapter 1) belonging to the western group of dialects also lacks this variation (Lebedev 1982: 29). A phonetically detailed transcription of the Bulun dialect, another western dialect close to the Sebian dialect, by Sotavalta (undertaken in 1928, but published only later as Sotavalta & Halen 1978) based on one speaker differentiates between at least three ways of transcription for the velar voiceless stop; however, judging from the examples, the distribution of these variants does not seem to be conditioned by the set of vowels.

In his description of the Berezovka dialect, Robbek (1989) mentions palatalized and velarized variants of /l/. However, their distribution is not directly determined by the set of vowels. The palatalized [lʲ] appears in the middle of the word preceding the palatal consonants /dʒ/, /č/ and /ń/, e.g. [hiːtelʲetʃʲe] ‘pressed’[2], [alʲdʒʲị] ‘grave’, and in some cases adjacent to the “front row” vowels which correspond to set 1 vowels in my terminology and to Novikova’s non-pharyngealized vowels, e.g. [ilʲdej] ‘tear off’. In the final position, only velarized [ɫ] is used, e. g. [tʃʲọːŋaːɫ] ‘closed place in the tent to store things’, [neɫ] ‘decorated part of a woman's apron’. In the examples given by Robbek (1989:476), the palatalized [lʲ] is used in the context of set 2 vowels (not necessarily preceding palatal consonants), and velarized [ɫ] in the context of set 1 vowels: [hụlʲrịdaj] ‘to make sharp’, [hiːɫeːr] ‘white reindeer’.

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[2] The transliteration of the Cyrillic transcription is made by me. In Robbek’s transcription the velarized allophones are not marked (as opposed to palatalized ones, which are marked with an apostrophe in line with Russian grammarians). However, in the section on phonetic variation he specifies that if /l/ is not palatalized it has a velarized realization.

5.2 Acoustic variation of /r/ in Even

In order to investigate what parameter might vary in trill sounds in a language which has an ATR vs. RTR opposition, I took into consideration a language where trill sounds are described as having an opposition between "advanced" and "retracted" variants. In the description of Ladefoged & Maddieson (1996: 222) the Dravidian language Malayalam has such an opposition. They report that “the more forward trill has a higher locus for the second formant,” and the retracted one “has a lower third formant, as is commonly found in apical post-alveolar sounds.” This suggests that F2 and F3 are acoustic parameters to investigate in Even trills.

5.2.1 Methods

For the analysis of trill sounds in Even I used the acoustic data recorded during the field trips to the Bystraia district (2009, supplemented with data recorded in 2011) and to Sebian-Küöl (2010)[3]. To investigate the possible correlation between the set of the word and the realization of the r-sound I compiled a list of words of set 1 and of set 2 that contain /r/. Due to the limited amount of data with a comparable vowel context, I included in this list words where /r/ occurs in different positions: in word-final position, intervocalic position, and in the position of the first consonant in a consonantal heterosyllabic cluster. In word-initial position /r/ does not appear in native Even lexemes. Due to the lexical differences between the Bystraia and Sebian-Küöl dialect, it was not possible to use the same word list for the analysis of the data from both dialects. The list from the Bystraia dialect used in this study can be found in Table 5.1, the one for Sebian in Table 5.2.

[3] See Chapter 3 (sections 3.2.1.1 and 3.2.1.2) for the details of the recording settings and speakers.

Table 5.1. Words used for the analysis of the trill sound, Bystraia dialect.

set 1			set 2		
Even	position	translation	Even	position	translation
dʒuːr	VR	two	ajịr	VR	gloves
toŋeːr	VR	lake	ọngar	VR	bring down
ereger	VRV, VR	always	aːtar	VR	darkness
irdej	VRC	to be cooked	ịrdaj	VRC	to drag
irli	VRC	be cooked (imperative)	ịrlị	VRC	drag (imperative)
urke	VRC	door	ịrkan	VRC	knife
irri[4]	VRV	being cooked	ịrrị	VRV	dragging
ureːkčen	VRV	hill, mountain	tụrakị	VRV	crow
urin[5]	VRV	stop	ọːrịn	VRV	made
eriki	VRV	newt	ńarị	VRV	man
			ọran	VRV	reindeer

[4] I classified this geminated trill, which occurs at the boundary between the root and participial suffix (as well as its set 2 counterpart /ịrrị/ 'dragging'), as belonging to the category of intervocalic position, since the morphological boundary between the two trill consonants does not seem to influence the acoustic form.

[5] The standard Even form is /orin/, the change /o/→/u/ is an ongoing process in Bystraia Even (see 2.2.2).

Table 5.2. Words used for the analysis of the trill sound, Sebian dialect.

set 1			set 2		
Even	position	translation	Even	position	translation
dʒoːr	VR	two	gọr	VR	far
toŋeːr	VR	lake	haŋaːr	VR	hole
ńimer	VR	neighbor	haːtar	VR	darkness
ereger	VRV, VR	always	ọrar	VR	reindeer (pl)
horli/horri[6]	VRC/VRV	go (imperative)	ọrkakan	VRC	little reindeer
urke	VRC	door	ụrdaj	VRC	revive
turkuttej	VRC	not be able	tụrkịdadaj	VRC	go by sled
ureːkčen	VRV	mountain	tụrakị	VRV	crow
iredden	VRV	is being cooked	ọran	VRV	reindeer
ierin	VRV	chewed	ńarị	VRV	man
			ajgaran	VRV	improve (3 Sg)

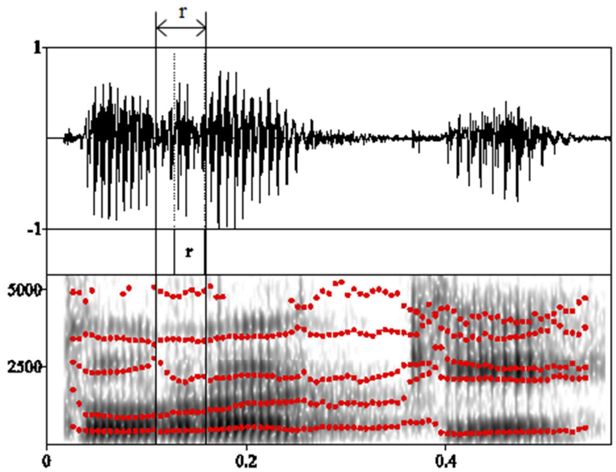
Using the software Praat (Boersma & Weenink 2014) I labeled the intervals with steady states of F2. The length of the labelled interval depended on the surrounding vowels (and, hence, the formant transitions), speed of speech of individual speakers and the manner of articulation of the trill (a flap[7] or a trill with several periods of vibration). The minimal length of the interval was 20 ms and the maximal length was limited to 80 ms, with the exception of a limited number of tokens recorded from one speaker of the Bystraia dialect: in the tokens /irri/, /ịrrị/, /irdej/ and /ịrdaj/ produced by the speaker EIA (male, 55) the length of the labeled interval is generally longer, and the maximal length of the interval (a geminate in the token /ịrrị/) reaches 190 ms. In the given tokens, this speaker has a trill sound with multiple periods and stable formant structure. I left out items where a detectable trill was less than 20 ms long due to the instability of the formants in such a short interval. As a minimum, I cover one closure (or drop in the intensity, as in the example in Fig. 5.1) and one open phase of a trill period. Fig. 5.1 illustrates the principles of labelling: the whole trill sound marked with an arrow is longer than the interval used for measurements marked with dotted lines, because I included only the segments with stable formant structure, and in the beginning of the trill

[6] This variation occurs because of interference between the standard form /horli/ and the local /horri/.

[7] A flap sometimes occurs in intervocalic position within the root.

period there is a noticeable fall of F3. As for word-final /r/, it is often realized as a voiceless allophone, especially when produced in isolation; these tokens with a voiceless allophone were not included in the analysis.

Fig. 5.1. An example of the labeled token [turak^{j}i] 'crow' (speaker VAC, male, 50): the interval marked with dotted lines in the sound wave corresponds to the trill period where F2 was measured; the interval marked with an arrow corresponds to the full length of the trill sound.



The measurements of F2 were obtained automatically using a script. The settings were identical to those described in Chapter 3 (section 3.2.1.3): Hann filter with the lower edge of the pass band being 50 Hz, the highest one 16,000 Hz and the smoothing value 10 Hz; method "burg" used for the formant analysis with standard values of time step (0.0 sec) and maximum number of formants (5); the maximum formant value for male speakers was set at 5000 Hz, for female speakers at 5500 Hz. To check the validity of the measurements, I checked the distribution of the F2 values (mean) for all lexemes for every speaker. Those tokens which appeared to be outliers or were strongly dispersed[8] with respect to F2 were checked manually and, if needed, corrected.

I checked the statistical probability that the distribution of F2 (the mean values within labeled intervals) of the trill consonant differs depending on the set of the word. As in Chapter 3, I applied a General Linear Mixed Model (Baayen 2008). I took into account the following fixed effects: DIALECT, SET of the word, CONTEXT ("isolation" or

[8] If the measurements in the instances of one and the same example in one and the same speaker show a wide range of values, it is probable that some of them were obtained erroneously.

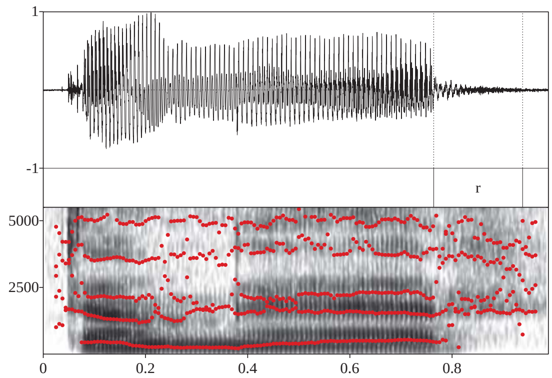
"carrier phrase") as well as SEX of speakers. As random effect factors I included recorded words, position in the word ("VRV", "VRC" and "VR"), the speakers and VOWEL (the possible influence of the preceding vowel). I also included into the model random slopes of SET and CONTEXT within speakers, random slopes of SEX and CONTEXT within recorded words, and random slopes of SEX, SET and CONTEXT within position in the word. This was done since, theoretically, F2 can pattern differently with respect to these parameters within the data of each speaker, each recorded word or each position.

It was not possible to obtain the data for the third formant in the same systematic way, due to its unsteady configuration and low intensity in many cases. However, below I provide some illustrative examples to show that where F2 tends to vary depending on the set of adjacent vowels, this tendency holds for F3 as well.

5.2.2 Types of /r/ in Even

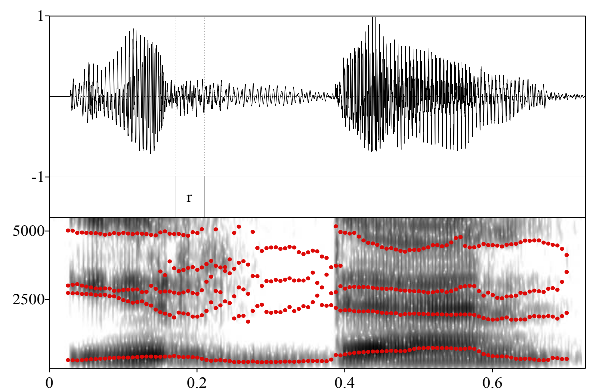
During the process of labeling the data from both dialects, I noticed a number of frequently occurring non-canonical trills. However, the distribution between these non-canonical trills and normal trills has no clear pattern. For instance, as mentioned above in the principles of labeling, in word final position and in the word medial coda the trill sound often has a voiceless realization (see 5.2 for illustration).

Fig. 5.2. An example of the token [toŋeːr] 'lake' (speaker EIA, male, 55) illustrating the voiceless realization of the trill sound.



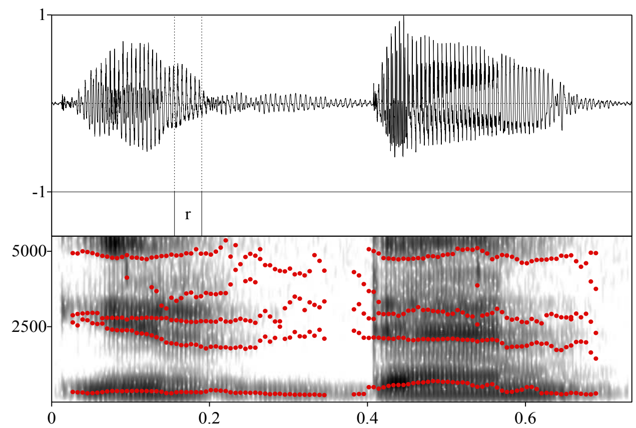
Even within the same speaker the realization of the trill sound can vary considerably. I observed a lot of instances of this variation in the position of the word medial coda. The trill sound can be produced with a portion of fricative noise instead of voiced period, as in Fig. 5.3. In comparison to Fig. 5.2, /r/ in Fig. 5.3. has a formant structure, however its formants are not very intensive and there is still fricative noise in the high frequencies.

Fig. 5.3. An example of the token [irden] ‘to be cooked’ (speaker VIA, female, 69) illustrating friction within the trill sound.



The trill sound can be produced without the characteristic closure and periodic vibration, which makes it sound similar to an approximant consonant. An example of such a realization can be found in Fig. 5.4. Unlike Fig. 5.3. the trill sound has a larger intensity in Fig. 5.4, as can be seen in the wave form. At the same time, the drop in intensity between the preceding vowel and the trill found in Fig. 5.3 is lacking in Fig. 5.4. Interestingly, the tokens in Fig. 5.3 and Fig. 5.4 represent the same word form produced by the same speaker.

Fig. 5.4. An example of the token [irden] 'to be cooked' (speaker VIA, female, 69) illustrating the trill sound realized as approximant.



The cases where /r/ is realized as an approximant are potentially difficult for the formant analysis, since F2 and F3 are very close to each other and often recognized by Praat as one formant. For example, tokens of the same word form pronounced by the same speaker (recorded under the same settings) are pronounced differently and, hence, the resulting analysis in Praat looks different, as illustrated wih Fig. 5.5 and Fig. 5.6. The trill sound in Fig. 5.5 contains several trill periods: according to the sound wave in the upper part of the plot it has a least two clear peaks and two smooth periods; the spectrogram in the bottom also reflects the rise of formant intensity corresponding to the peaks. In the formant structure F2 and F3 are shown separately. In Fig. 5.6 /r/ in the same word is realized as an approximant: there are no trill periods, the structures of both sound wave and spectrogram are homogeneous. At the same frequency where there were F2 and F3 in Fig. 5.5 (around 2400 Hz) there is only one formant contour in Fig. 5.6.

Fig. 5.5. An example of the token [irli] 'be cooked (imperative)' (speaker EIA, male, 55) illustrating a trill sound with clear F2 and F3.

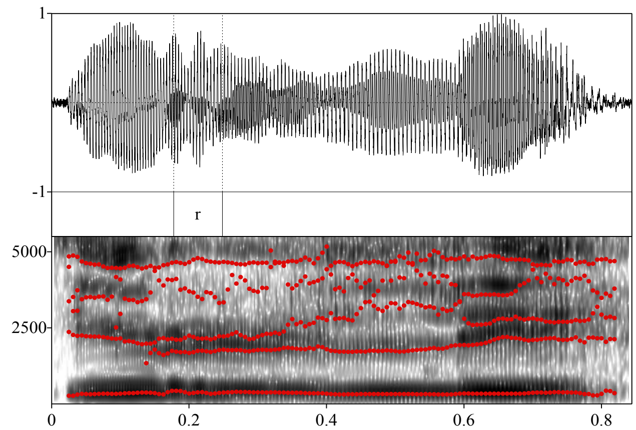
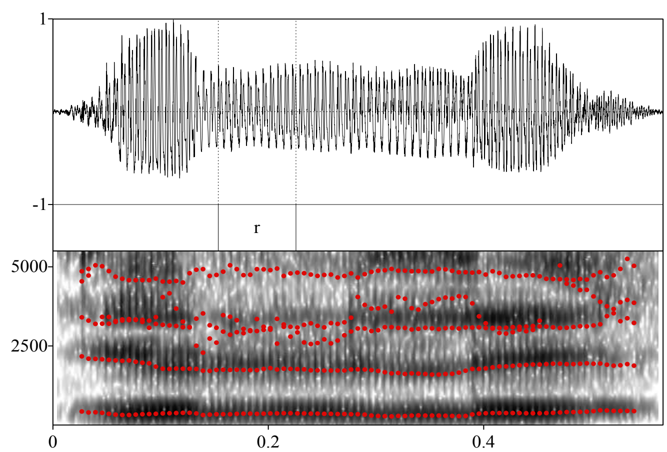


Fig. 5.6. An example of the token [irli] 'be cooked (imperative)' (speaker EIA, male, 55) illustrating a trill sound with merged F2 and F3.



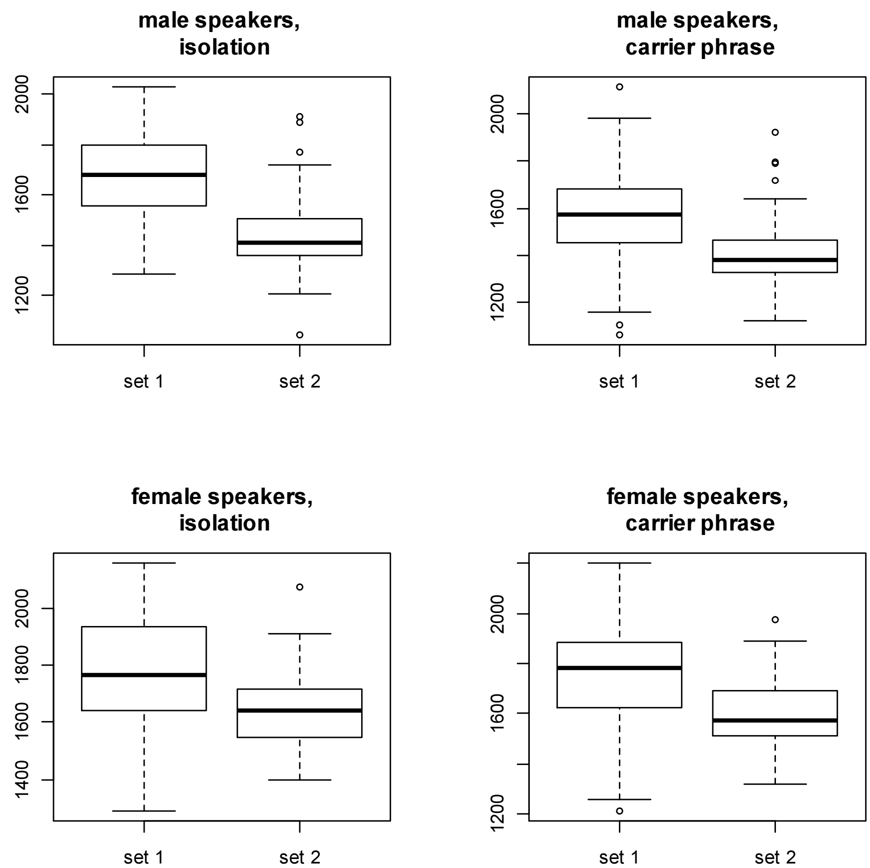
5.2.3 Results

Bystraia dialect

During the process of labeling I noticed a tendency for /r/ to have a higher F2 in the words of set 1 and a lower F2 in the words of set 2. Auditorily I can also distinguish some differences in the pronunciation of /r/ in the words of different sets. The differences can be seen most clearly in the examples with identical adjacent sounds and identical syllabic structure like /irri/ vs. /ịrrị/ and /irdej/ vs. /ịrdaj/. However, I am interested if this difference holds for the whole sample of my data (the word list in Table 5.1) and if this tendency will be confirmed with a statistical analysis.

As shown in Fig. 5.7 below, in the data plotted for all speakers and all positions, the trill consonant has a consistently higher F2 in words of set 1 than in the words of set 2. This tendency holds irrespective of the sex of the speaker and whether the words were spoken in isolation or in a carrier sentence. The female speakers have higher F2 values overall, as expected from the physiological differences between the male and female vocal tract.

Fig. 5.7. The variation of F2 of the trill sound in the words of set 1 and set 2, separated by sex of speaker and recording conditions.



The formant values of trill consonants are highly influenced by the adjacent vowel (Dhananjaya 2012). From this point of view, the word list given in Table 5.1. might look unbalanced, e.g. among the words of the category "VRC" besides the quasi-minimal pairs /irdej/ and /ịrdaj/, /irli/ and /ịrlị/, I have /urke/ and /ịrkan/. The vowels /u/ and /ị/ preceding the trill sound are expected to have a different influence on it: F2 is lowered after /u/ and raised after /i/. Moreover, the words chosen to measure F2 of /r/ in final position might cause some inadequacy in the measurements. Since /e/ and /a/ form a minimal pair in Even, I included /ereger/ and /toŋeːr/ as examples of set 1 and /ọngar/ and /aːtar/ as examples of set 2. However, /e/ and /a/ differ with respect to F2, and preceding the trill sound /e/ automatically raises F2, while /a/, on the contrary, lowers it. In the last case, context influence might have reinforced the tendency which was shown in Fig. 5.7. Unfortunately, working with a word list recorded under field conditions I am very limited in the data I have at my disposal. I therefore included the factor preceding VOWEL in the statistical analysis to account for the influence of the vowel context.

To check if the observed tendency is real, and was not just caused by an unfortunate choice of examples, I compiled a reduced subset of the list from Table 5.3. The new list has minimal differences between the vowel contexts of the trill sound. The problematic word-final position was excluded.

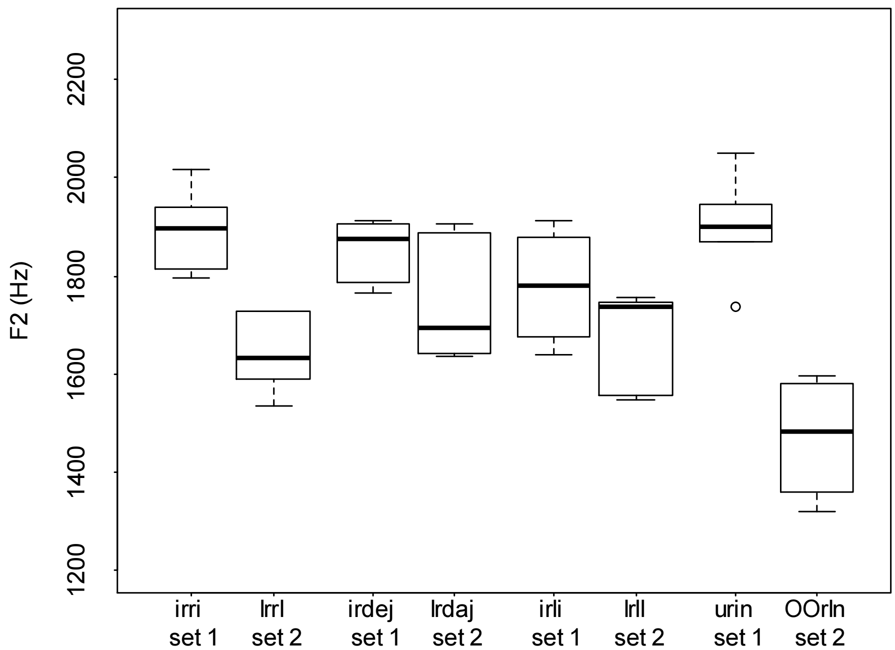
Table 5.3. The reduced word list used for the analysis of the trill sound (F2).

set 1			set 2		
Even	position	translation	Even	position	translation
irdej	VRC	to be cooked	ịrdaj	VRC	to drag
irli	VRC	be cooked (imperative)	ịrlị	VRC	drag (imperative)
irri	VRV	being cooked	ịrrị	VRV	dragging
urin	VRV	stop	ọːrịn[9]	VRV	made

In order to estimate roughly if the tendency for F2 to vary depending on the set of the word holds for this reduced sample, I checked the data distribution for each speaker, comparing the corresponding lexemes of set 1 and set 2 from Table 5.3. The results demonstrate that the tendency holds for all speakers (with just a few exceptions and several missing data points for the speakers VAC and RME). As an example, Fig. 5.8 shows the distribution of F2 for one of the speakers (VIA) for the reduced word list. This speaker has a consistent F2 difference in the trill depending on the set of the word.

[9] The pair /urin/ and /ọːrịn/ were included, since I assume that there is no striking F2 difference between /u/ and /ọ/.

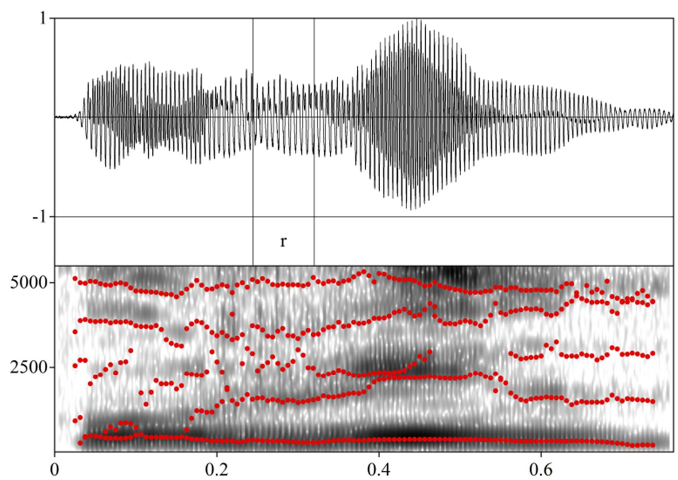
Fig. 5.8. The variation of F2 of the trill sound in the words of set 1 and set 2 pronounced by speaker VIA (female, 69).



In order to test whether the observed tendency is statistically significant I analyzed the full data set applying a General Linear Mixed Model. Composing the full model for the data of the Bystraia dialect as described above, I included the factors which might influence the distribution of F2. In comparison with the full model, the null model did not contain the factor SET. Comparison between the full and the null model did not reveal significant results (likelihood ratio test: χ^2=1.988, df=1, P=0.159), which sugests that the factor SET does not have any statistically significant influence on the distribution of F2 values. Contrary to what I expected, there is thus no statistically significant influence of set on the trill sounds. However, this result was obtained for the dataset that was not perfectly balanced with respect to the vowel context. Including words where /r/ is preceded and followed by vowels of the same quality (e.g., only /i/ and /i̧/) might change the picture. Moreover, it might be that to test such a complex statistical model I would need to include considerably more data points. I assume that increasing sample size would help to attain statistical power.

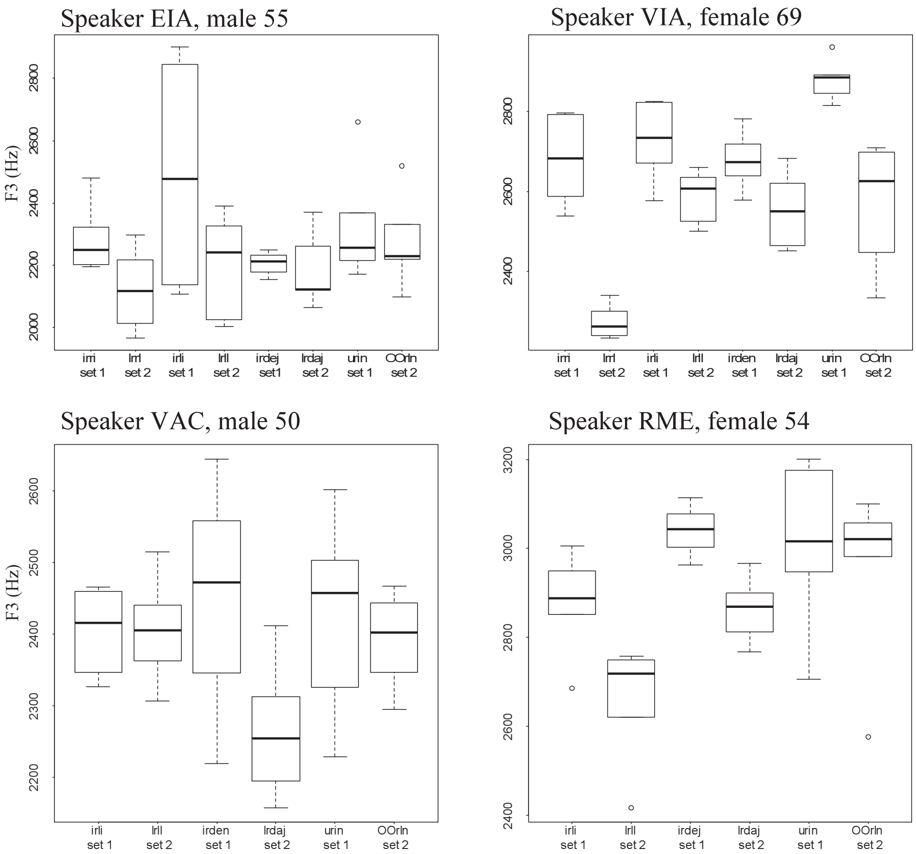
As noted above, it was not possible to measure F3 automatically in the way it was done for F2. In many cases, F3 is unsteady and has low intensity (for an example, see Fig. 5.9). The mean of F3 would thus give only a very rough and probably even erroneous estimation .

Fig. 5.9. An example of the token [urin] ‘stop during the migration’ (set 1) with unstable and low-intensity F3, speaker EIA (male, 55).



However, since the distribution of F3 of the trill sounds is interesting for my study, I measured it manually in a limited set of tokens (Table 5.3), still based on the formant structure offered by Praat, but checking visually the intensity and steadiness of F3. Cases such as that illustrated in Fig. 5.9 were excluded from further consideration. The results of this measurement, shown in Fig. 5.10, reveal the same overall tendency as for F2: in the words of set 1 the trill sound has a higher F3 than in the words of set 2.

Fig. 5.10. F3 distribution of the trill sound for 4 speakers of Bystraia.

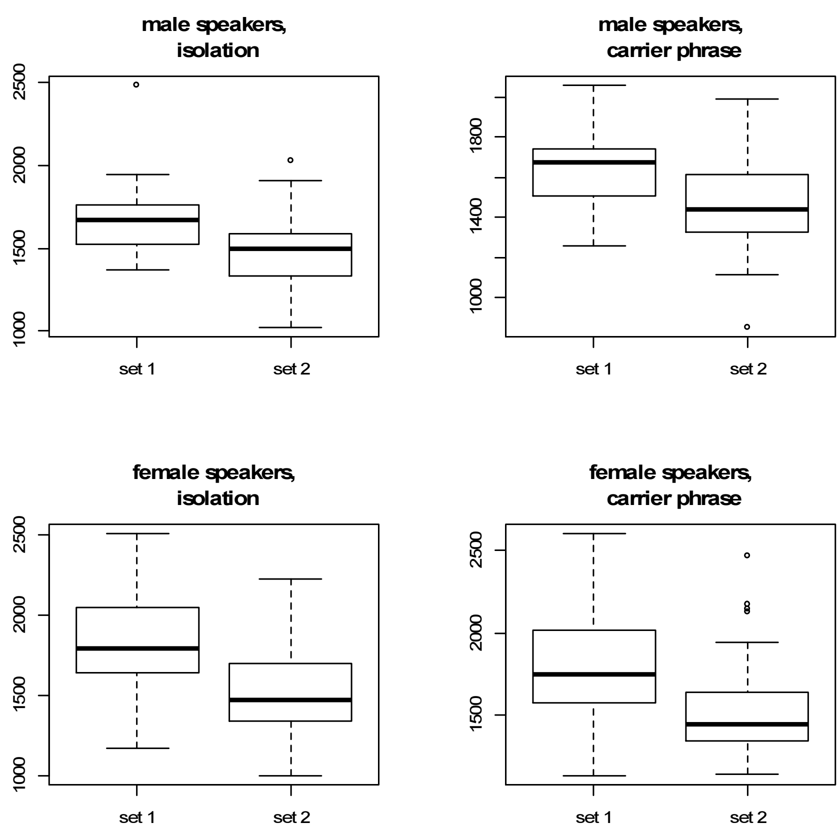


To sum up the results, despite my observation that in the Bystraia dialect F2 of the trill sound differs depending on the set of the word, both on a large scale (Fig. 5.7) and on a small scale (Fig. 5.8), this distinction was not confirmed by the statistical analysis. However, taking into account the size of my sample and the diversity of the vowel contexts, I doubt that the lack of statistical significance in this case implies a linguistically meaningless difference in trill sounds. The same tendency, although using a reduced sample, was observed for F3 as well.

Sebian-Küöl dialect

The data of Sebian-Küöl reveal the same tendency for /r/ in the set 1 words to have a higher F2 than in the set 2 words as observed in Bystraia Even (cf. Fig. 5.11 below and Fig. 5.7).

Fig. 5.11. The variation of F2 of the trill sound in the words of set 1 and set 2, separated by sex of the speakers and recording conditions.



During the process of labeling I noticed some variation in the speakers' speech rate: the male speakers had a higher speech rate than the female speakers[10]. This leads to

[10] This variation might be also caused by the generation differences, since the male speakers (17 and 23) were younger than the females (38 and 46).

the shorter length of each segment, the trill sound amongst them. In order to obtain reliable acoustic measurements for the male speakers, I had to leave out of the analysis a number of tokens in which the formant structure was unclear due to these factors.

Statistical analysis was performed using a General Linear Mixed Model. The model included the same factors as described in section 5.2.1 for the analysis of the Bystraia data. The only difference is that it was technically not possible to include simultaneously into the model random factors corresponding to the preceding vowel and to minimal pairs as was done for the data of Bystraia. But when including them separately I received very similar statistically significant results, which means that these factors give a comparably good sub-categorization of the words in the list. Thus, when including the factor of preceding vowel (VOWEL), the comparison between the full model containing the factor SET and the reduced one reveals significant results (likelihood ratio test: χ^2=9.213, df=1, P=2.4e-03). The same comparison with both the full and the reduced model containing the factor of the minimal pair also gives statistically significant results (likelihood ratio test: χ^2=9.904, df=1, P=1.64e-03). Thus, in both cases the F2 value of the trill consonant depended on the set of the word.

These results differ from the the results obtained in the analysis of the data from Bystraia, where the factor SET did not have a significant influence on F2 of the trill consonant. It might seem somewhat surprising that the perception data in Bystraia Even suggested differences in the trill sound, which were not confirmed statistically in the acoustic analysis of the trills, whereas in the data from Sebian, where liquids did not influence perception, the acoustic data reveal a statistically significant difference. To explain this statistical difference one has to remember the word list used for the accoustic analysis of the Sebian data (Table 5.2). In most cases, the trill sound follows /e/, /a/, /o/ and /ọ/ which according to my acoustic investigation (cf. Chapter 3) differ in frontness, i.e. F2. In Bystraia, /o/ and /ọ/ are not different with respect to frontness. Thus, the differences in F2 of the trill sounds following one of these vowels can be explained by the effect of co-articulation. However, it is interesting to see if the same tendency for /r/ holds in the context of high vowels (with a likely merger of /i/ vs. /ị/ and and /u/ vs. /ụ/). If these vowels are not opposed by set, one should not find any co-articulation effect in the acoustic properties of the trill sound. Unfortunately, in my sample from Sebian I lack comparative data for /r/ adjacent to /i/ and /ị/. But I can still present the data of /r/ adjacent to /u/ and /ụ/ from individual speakers.

In my sample (Table 5.2) I have three pairs of words with very similar contexts of /r/ preceded by /u/ or /ụ/: /turkutej/ 'not be able' and /tụrkịdadaj/ 'go by sled', /urke/ 'door' and /ụrdaj/ 'revive', /ure:kčen/ 'mountain' and /tụrakị/ 'crow'. However, the measurements of F2 in the trill consonants are not available for all speakers for all of these items. Some words of set 2 are missing for the male speakers either because they were missing in the recordings (the speakers did not know the word) or because the formant structure was unclear. The available data are clearly not sufficient to make a strong statement. The data from the four speakers do not reveal a consistent pattern with respect to set 1 and set 2 words. For the pair /urke/ and /ụrdaj/, for instance, the speakers KKK and TPK show opposite tendencies. In the other cases, there is a strong overlap in the values corresponding to set 1 and set 2 words.

Fig. 5.12 The variation of F2 of the trill sound following /u/ and /ụ/ in four speakers.

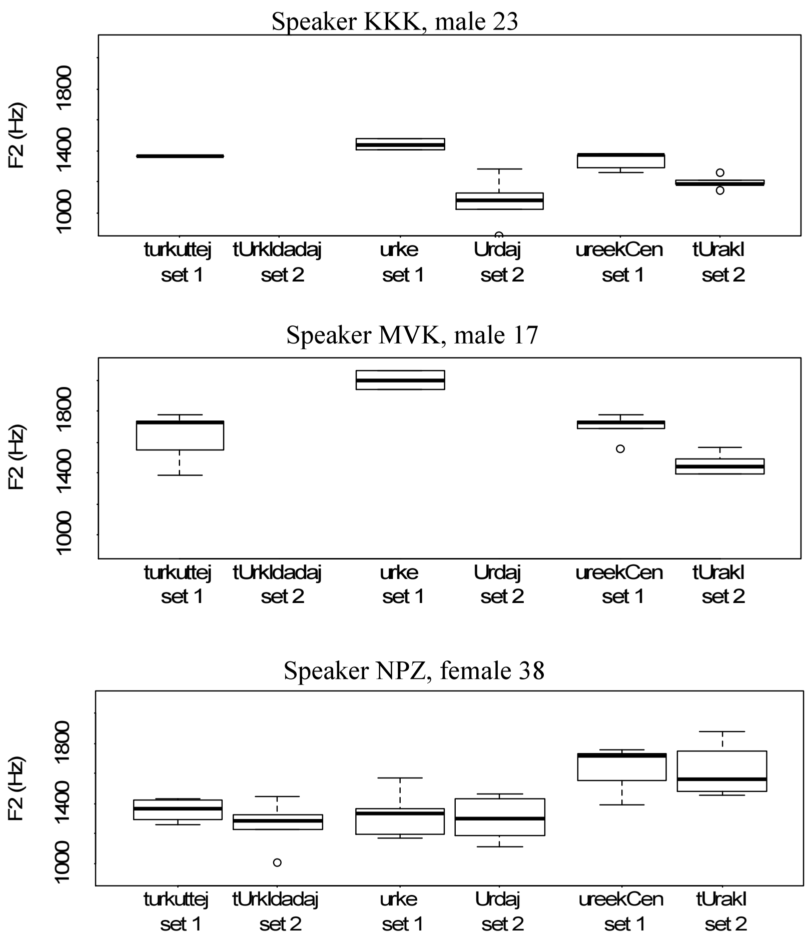
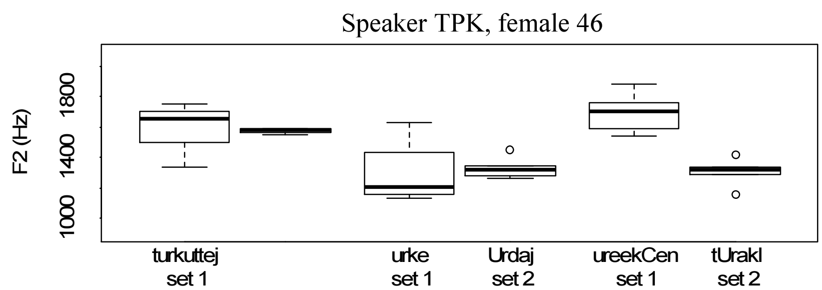


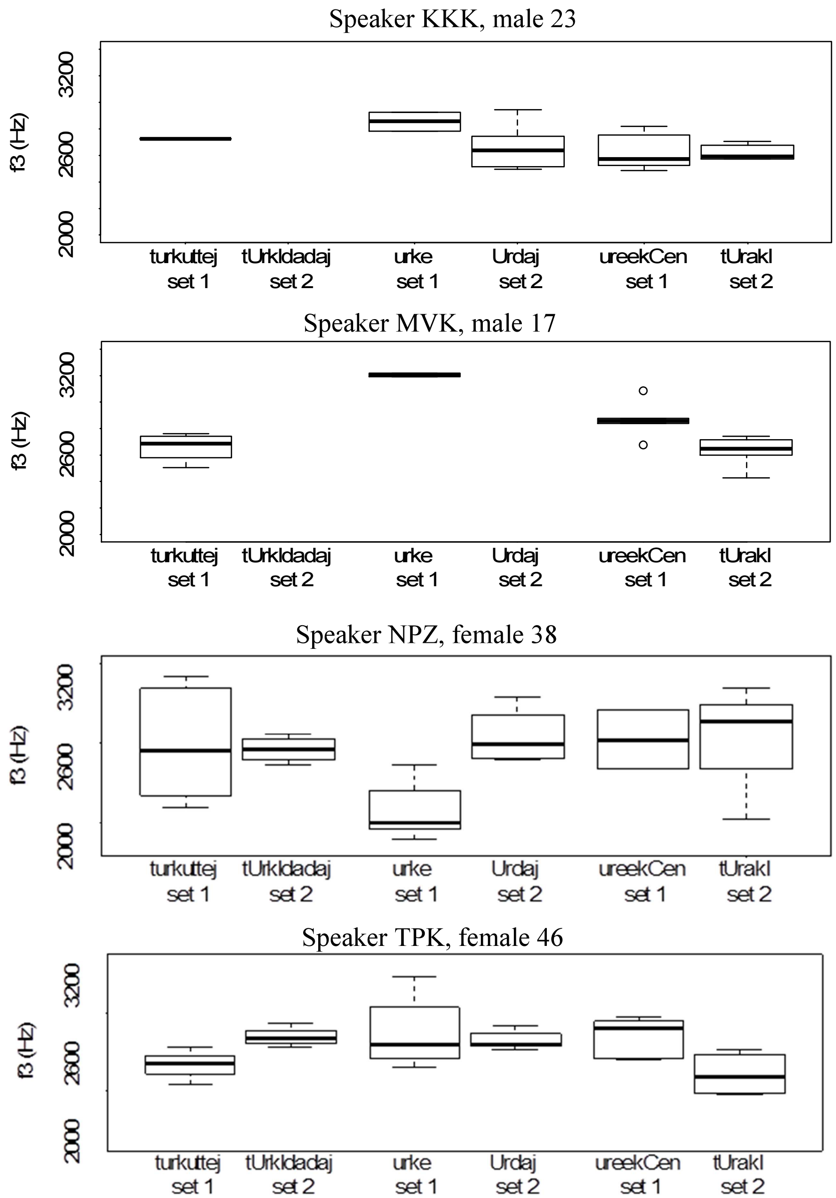
Fig. 5.12 The variation of F2 of the trill sound following /u/ and /ụ/ in four speakers (cont).



The only pair for which the data are available from all four speakers and which reveals the same pattern is /ure:kčen/ and /tụrakị/. All four speakers show a higher F2 in the trill of the set 1 word than of the set 2 word. However, this might be caused by the effect of co-articulation with the following vowel, which I do not account for in my model. The remaining data are too sparse and contradictory, so I cannot trace any clear pattern of variation of the trill following /u/ and /ụ/ in set 1 words and set 2 words, respectively. This might simply reflect the absence of such a pattern, because of no influence of the preceding /u/-vowel in case of a merger of /u/ and /ụ/. On the other hand, given the very limited data this is rather an observation supporting the hypothesis about the merger than a strong argument for it.

As for Bystraia Even, the data on F3 in Sebian had to be obtained primarily manually: automatic measurement would have given too many erroneous results. For this reason, I restrict myself to the sample of three comparable pairs where /r/ is preceded by /u/ or /ụ/, which were investigated above with respect to F2. These F3 data do not reveal any specific pattern as can be seen in Fig. 5.13. Even though the mean values of F3 sometimes differ between words of a pair produced by an individual speaker, there is no consistent pattern of this difference. For instance, for the speaker KKK the mean of F3 of the trill in the set 1 word /urke/ is higher than the one in the set 2 word /ụrdaj/ (however the values themselves are fully overlapping). The picture is the opposite in the data of the speaker NPZ. In the same pair of words for the speaker TPK these values are roughly equal. Generally, taking into account the inter-speaker variation and the overlap of the values from set 1 and set 2 words within one speaker, I conclude that in the dialect of Sebian the F3 of the trill consonant is not influenced by the set of the word.

Fig. 5.13. The variation of F3 of the trill sound following /u/ and /ụ/ in four speakers.



5.3 Acoustic variation of /l/ in Even

As mentioned in section 5.1, allophonic variation of the lateral approximant with respect to different degrees of palatalization and velarization is commonly described for Even dialects. However, from the descriptions it is not clear if the distribution of these allophones depends on the harmonic set of the words or some other positional constraints. This might also differ in different dialects. Nevertheless, the perception study described in Chapter 4 revealed that at least in Bystraia Even this allophonic variation plays an important role for the correct recognition of words. For this reason, it is especially interesting to see how this variation is reflected in the acoustic properties of Even laterals and if there are any differences between the dialects of Bystraia and Sebian-Küöl.

In acoustic studies, the difference between palatalized and velarized laterals is connected to F2. Such a distinction in Russian was described by Zinder et al. (1964: 31), who demonstrated a large difference in F2 between the velarized lateral (900 Hz) and the palatalized one (2200 Hz). A similar tendency is also observed in Bulgarian and Albanian, as reported by Ladefoged and Maddieson (1996: 197). Another method of acoustic measurement which is often applied to laterals is to measure the difference between F1 and F2 (Yuan & Liberman 2011, Oliveira et al. 2013). This method is used to define the degree of darkness of the lateral, cf. English *leap* (light [l]) and *heal* (dark [ɫ]). In the received pronunciation of British English, F2-F1 is higher for the light [l] and lower for the dark [ɫ]. Bladon (1979: 502) also noticed that the dark velar [ɫ] has a very low F2 which "seems to be related to the uvular or pharyngeal constriction which it shares with the back vowels". However, the first formant alone might also be a meaningful measure to distinguish between these two types of laterals. Bladon also mentions high F1 for the velar [ɫ], though he observes less variation for F1 than for F2. Data from Russian in Fant (1960) show the same distinction in F1 for palatalized and velarized lateral phonemes (F1=230 Hz for [l^j] and F1=350 Hz for [ɫ]). A high F1 is also observed in Mid-Waghi and Melpa by Ladefoged and Maddieson (1996), where the highest F1 is observed in the velar laterals. Thus, both F1 and F2 provide some important information about lateral consonants which are opposed by the degree of velarization. I therefore analyse both F1 and F2 in the Even data.

5.3.1 Methods

For the acoustic analysis of the lateral consonants I used the data recorded during my field trips to the Bystraia district (2009; 2011) and to the village of Sebian-Küöl (2010). As was done for the measurements of the trill consonant, for the measurements of the lateral I compiled a separate set of words for each dialect (Table 5.4 and Table 5.5, respectively, for the Bystraia dialect and for the Sebian-Küöl dialect). Moreover, as in the case of the trill consonant, I paid attention to the vocalic environment and position of the lateral consonant in the word. Therefore, I included in the data set comparable pairs of set 1 and set 2 words and labeled the position of /l/, in order to be able to include this information in the following statistical analysis. With respect to the positional distribution, /l/ never occurs in word-initial position. In the dialect of the Bystraia district, there is a tendency towards open syllables, which leads to vowel epenthesis at the end of the monosyllabic words ([e] or [ə]-like, depending on the harmonical set), see section 2.3.1. This additional vowel can be omitted in connected speech, for instance in the context of the carrier phrase. For this reason, I have a very restricted set of words with /l/ in the final position. This variability can be seen in Table 5.4 for the words [il] ~ [ile] 'soup', [neːl] ~ [neːle] 'apron', [di̞l] ~ [di̞lə] 'head', [al] ~ [alə] 'harness' and [dʒu̞ːl] ~ [dʒuːlə] 'houses'.

Table 5.4. Words used for the analysis of the lateral consonant, Bystraia dialect.

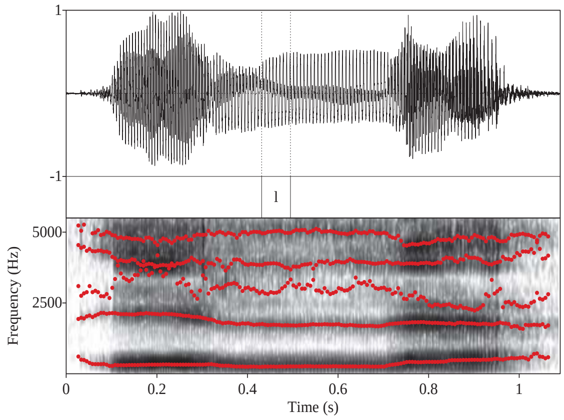
	set 1			set 2		
#	Even	position	translation	Even	position	translation
1	ileŋ	VLV	dry	i̞lan	VLV	three
2	ulle	VLV	meat	u̞lla	VLV	cover
3	iːlle	VLV	come in (imperative 2PL)	i̞ːllam	VLV	I suffer
4	irli	CLV	be cooked (imperative 2SG)	i̞rli̞	CLV	drag (imperative 2SG)
5	iːldej	VLC	to grill meat; to appear	i̞ːldaj	VLC	to suffer
6	uldej	VLC	dig	dʒu̞ːl/dʒuːlə	VL / VLV	houses
7	il/ile	VL / VLV	soup	di̞l/di̞lə	VL / VLV	head
8	eŋeńil	VL	waists	o̞kaji̞l	VL	fly agarics
9	neːl/neːle	VL / VLV	apron	al/alə	VL / VLV	harness

Table 5.5. Words used for the analysis of the lateral consonant, Sebian dialect.

	set 1			set 2		
#	Even	position	translation	Even	position	translation
1	ileŋ	VLV	dry	ịlan	VLV	three
2	uːllen	VLV	started to melt	ụːlan	VLV	person who is skilled at mounting a reindeer
3	illi	VLV	remove the bark (imperative 2SG)	ịllị	VLV	stand up (imperative 2SG)
4	isli/ihli	CLV	tear away (imperative 2SG)	ịslị/ịhlị	CLV	reach (imperative 2SG)
5	ildej	VLC	remove the bark	ịldaj	VLC	stand up
6	ulden	VLC	its meat	ụldan	VLC	has been heard
7	ulde	VLC	meat	hụlda	VLC	cover
8	hil	VL	soup	dịl	VL	head
9	neːl	VL	apron	adal	VL	net

The parts of these words corresponding to the intervals with the most stable F1 and F2 in the lateral consonants were labeled in Praat (see Fig. 5.14 for an example). The length of the labeled intervals varies between 28 ms and 118 ms, but about 80% of the intervals are between 40 ms and 80 ms. The formant measurements (F1 and F2) were automatically obtained with a script using Praat. The main settings were the same as in the measurements of the trill (see section 5.2.1).

Fig. 5.14. An example of the labeled token [iːlle] 'come in' (set 1), speaker EIA (male, 55).



Using a General Linear Mixed Model (Baayen 2008), I checked the statistical probability that the factor SET influences the distribution of F1 and F2 (for the Bystraia district only F1, as will be explained in detail below) of the lateral consonant. As in section 5.2, the following fixed effects were taken into account: SET of the word, the CONTEXT of the word ("isolation" or "carrier phrase"), and SEX of speakers. The random effect factors were also the same, excluding the factor VOWEL: recorded words, position in the word ("VLV", "VLC", "CLV" and "VL"), the speakers and the information about which words compose minimal pairs or contain a similar context for /l/ (factor PAIR with numeric values assigned to the words as in Table 5.4 and Table 5.5). I also included into the model random slopes of SET and CONTEXT within speakers, random slopes of SEX and CONTEXT within recorded words, random slopes of SEX, SET and CONTEXT within position in the word, random slopes of SEX and CONTEXT within PAIR. This was done since, theoretically, formant values can pattern differently with respect to these parameters within the data of each speaker, each recorded word, each position or each compared pair.

5.3.2 Results

Bystraia dialect

The acoustic analysis of the first two formants of the lateral consonant in the dialect of the Bystraia district shows a striking difference between set 1 and set 2 words.

The lateral consonant in the words of set 1 reveals a clear formant structure as in Fig. 5.14 (the arrow stands for the whole lateral segment, but for the measurements only the portion labelled in the TextGrid was used). The measurements of both F1 and F2 within one and the same set 1 word within a speaker do not vary a lot and show a rather stable pattern. However, the formant structure of set 2 words is very unclear. This especially concerns F2, which often lies very close to F1 and can partly or completely coincide with F1. This low F2 is probably related to a high degree of velarization, but it is problematic to obtain plausible F2 measurements. Accordingly, the first results of the measurements in the set 2 words show a large variation in the data, but these results do not correspond to reality. If F2 has very low values, the automatic algorithms of Praat recognize only one formant in the low frequencies and misinterpret F3 as F2. In addition to the problem of formant merging, there is another issue caused by the unstable F2: in the cases where F2 is not merged with F1 it is still very unstable and there is no general way to define where to measure F2. Examples in Fig. 5.15 and Fig. 5.16 below demonstrate the flow of F2 and the tendency for F1 and F2 to be merged (Fig. 5.16).

Fig. 5.15 An example of the token [ịlan] 'three' (set 2), speaker EIA (male, 55), recording # 1; F1=442 Hz, F2=531 Hz.

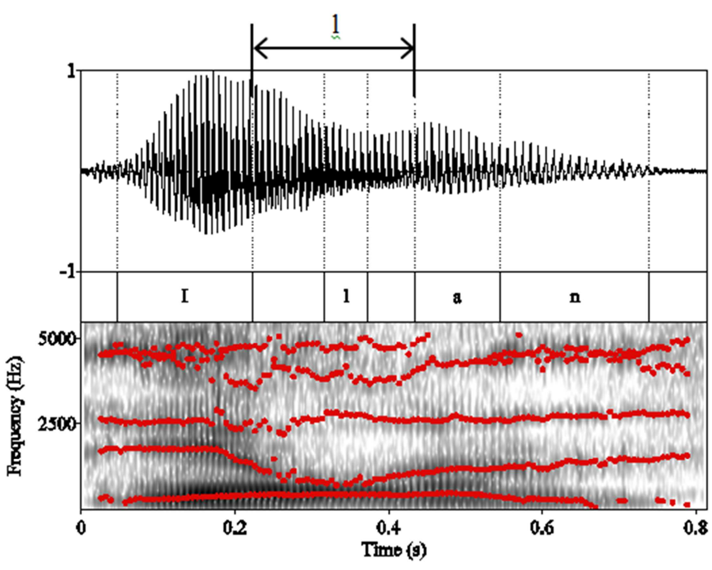
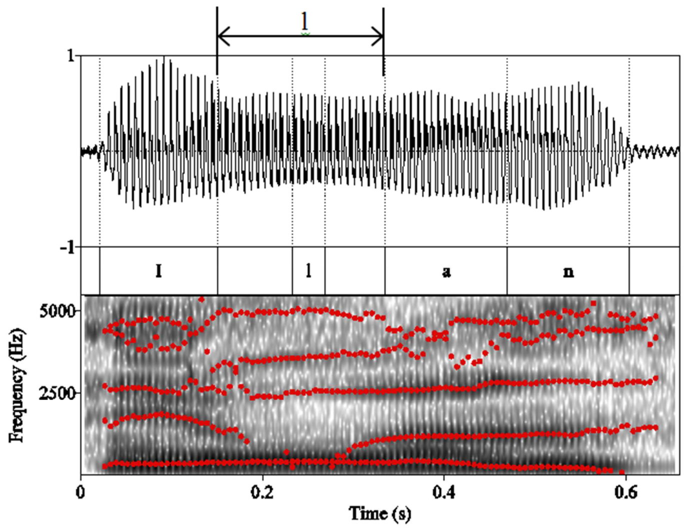


Fig. 5.16. An example of the token [ị̣lan] 'three' (set 2), speaker EIA (male, 55), recording # 2; F1=402 Hz, F2=2430 Hz.

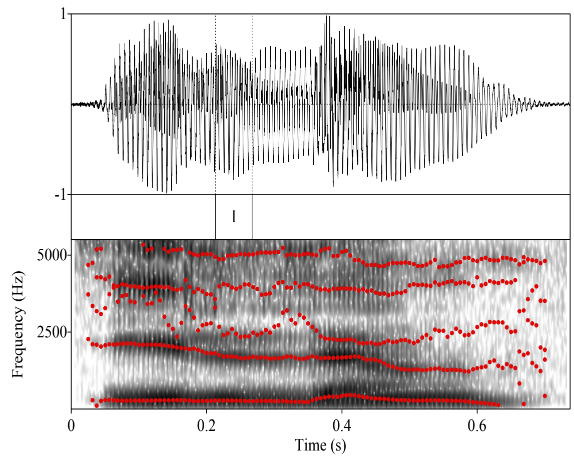


In Fig. 5.15, F2 can be recognized as a separate formant lying very close to F1. In Fig. 5.16 (a recording of the same word by the same speaker several seconds later), the formant structure is slightly different: F2 is almost absent in the spectrogram, being merged with F1. The results of the automatic algorithms are given in the figure legends. It is clear that the value F2=2430 Hz in Fig. 5.16 cannot be correct and most probably corresponds to F3 and was obtained only because F1 and F2 are indistinguishable. It is also noteworthy that the tendency for F2 to drop down towards F1 can be seen in the transition areas both in Fig. 5.15 and in Fig. 5.16. First, F2 drops in the transition between [ị] and [l], then it rises again to the level of F2 characteristic for [a].

Since F1 and F2 are often merged, or the position of F2 is unclear in most set 2 words[11], I decided to use only the F1 data to estimate the difference in the degree of velarization. As mentioned in the beginning of section 5.3, F1 is reported to be different for velar and non-velar laterals cross-linguistically. This tendency is also found in the data of Bystraia Even. If one compares F1 in the set 1 word /ileŋ/ 'dry' (Fig. 5.17) with F1 in the set 2 word /ịlan/ 'three' (Fig. 5.15 and Fig. 5.16), it is clear that F1 in the set 1 word is lower than F1 in the set 2 word both where F1 and F2 are recognized as two separate formants and where F1 and F2 coincide.

[11] In the data of the female speakers a complete merger is not as common as in the data of the male speakers, but F2 is still often unclear, and this leads to erroneous measurements.

Fig. 5.17 An example of the token [ileŋ] ‘dry’ (set 1), speaker EIA (male, 55) F1=272 Hz, F2=1701 Hz.



However, it should be kept in mind that the F1 data for set 2 words are what Praat took to be F1 and thus measured. Consequently, in some cases it is the actual frequency of F1, in the other cases it is the frequency of the formant which is the result of the F1/F2 merger. Theoretically, this might cause a problem, since this kind of data is not consistent any more. On the other hand, a visual check of the data showed that F1 is always higher in set 2 words without the merger than in set 1 words when comparing corresponding word pairs. The merger of F1 and F2 would only raise the frequency of the resulting formant, i.e. just intensify the tendency that is observed in the cases without the merger. The strong tendency for F1 (or the formant resulting from the F1/F2 merger) in the lateral consonant of set 2 words to be higher than F1 in the lateral consonant of set 1 words can be seen in the results in Fig. 5.18.

Fig. 5.18. Variation of F1 in laterals in set 1 and set 2 words, data of Bystraia.

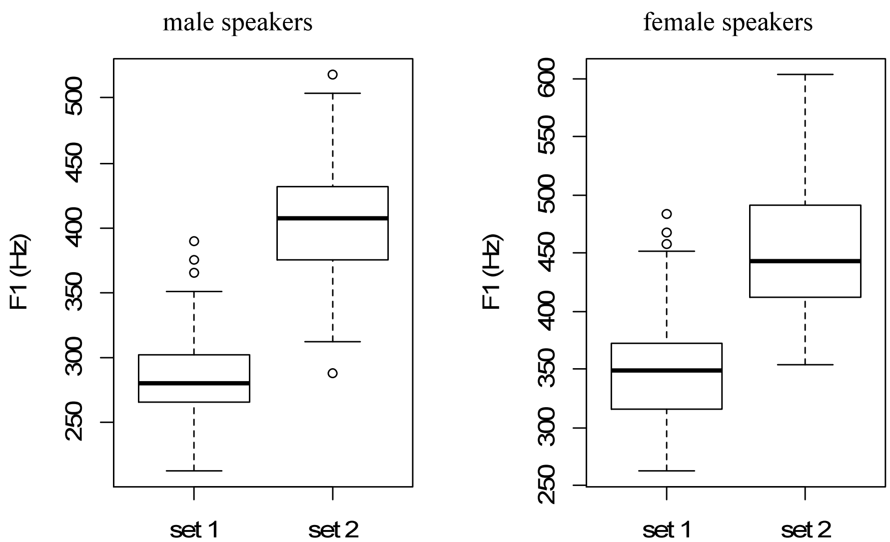


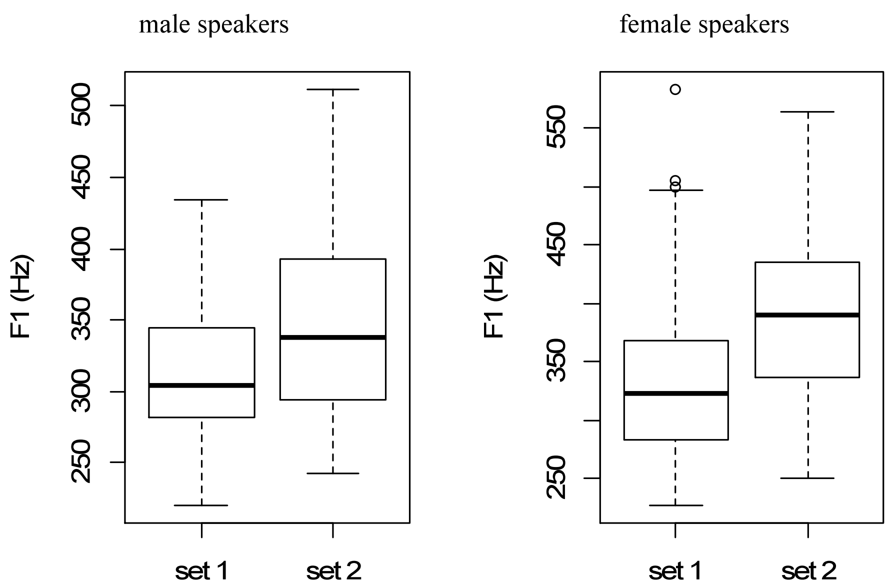
Fig. 5.18 shows that F1 of the lateral consonant is higher for set 2 words than for set 1 words in the data of both male and female speakers. This tendency holds irrespective of the preceding vowel. In Fig. 5.18 I did not depict the differences coming from the context of recording (isolation or carrier phrase) and position in the word, as they had no effect. Fig. 5.18 also clearly shows a gender difference: the mean values of F1 in the data of female speakers are always slightly higher than the corresponding values in the data of male speakers.

The statistical analysis described in 5.3.1 revealed that the difference between the full model containing the factor SET and the reduced model lacking this factor is highly significant (likelihood ratio test: χ^2=17.321, df=1, P=3.157e-05). Thus, the results of the statistical test support the observed tendency to distinguish lateral consonants with the mean of F1 depending on the set of the word in which this consonant occurs. These results also match the data of the perception study.

Sebian-Küöl dialect

At first sight, the results of the measurements of F1 in the dialect of Sebian-Küöl seem to resemble the data from Bystraia. The overall plot in Fig. 5.19 shows the tendency for F1 to be slightly higher in set 2 words than in set 1 words.

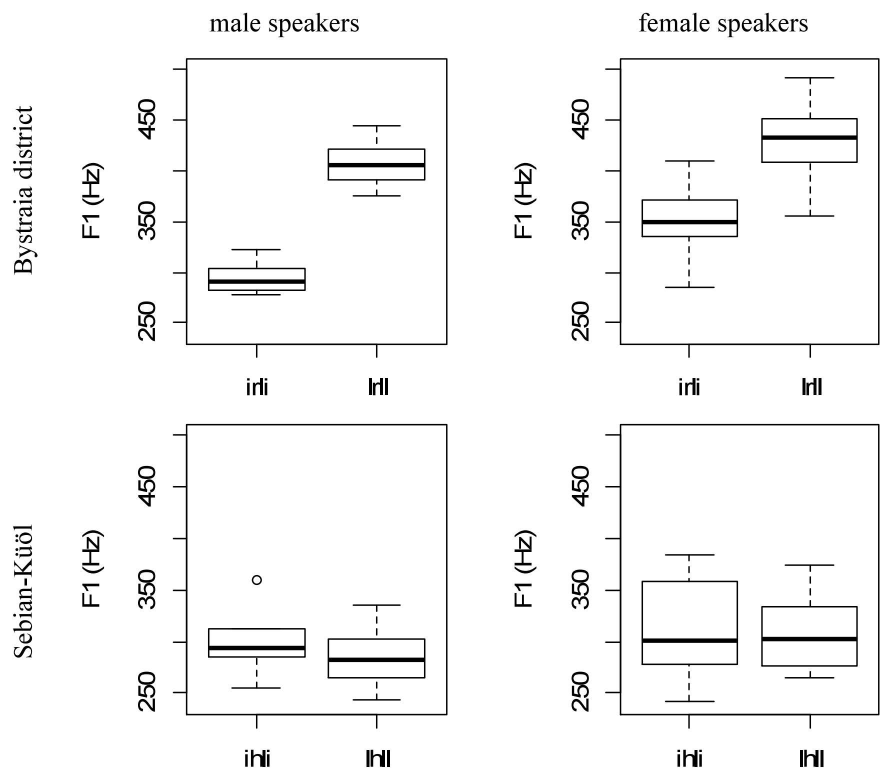
Fig. 5.19 Variation of F1 in laterals in set 1 and set 2 words, data of Sebian-Küöl.



However, statistical analysis does not reveal any significant difference with respect to the parameter SET (likelihood ratio test: χ^2=0.829, df=1, P=0.363). This fact can be explained if one looks more closely into the data. In fact, the tendency is consistent only for the words containing /e/ or /a/. In the word pairs /hil/ and /dịl/, /isli/ and /ịslị/, /illi/ and /ịllị/, on the other hand, F1 is very similar for both sets. As can be seen from this list, the similarity in F1 does not depend on the position in the word: the similarity remains in the word-final position, in the syllable-initial position and in the intervocalic position. The opposition between words containing the vowels /e/ and /a/ and those not containing them is reminiscent of the results of the perception study. Thus, it seems that the presence of these vowels in the word influences the pronunciation of /l/: F1 is lowered in the words containing /e/ and it is raised in the words containing /a/. However, the factor SET in the words without /a/ or /e/ does not influence the pronunciation of /l/. This matches the results of the perception study that /l/ in the Sebian dialect does not function as a perception cue. Unfortunately, in my sample from Sebian-Küöl I lack examples not containing /e/ or /a/ where /l/ is adjacent to /u/ or /ụ/. Examples like this would complete the picture.

Fig. 5.20 shows the difference in the dialects with respect to the distribution of F1 in the lateral consonant in the comparable word pairs: /irli/ and /ịrlị/ in the Bystraia district and /isli/ and /ịslị/ in Sebian-Küöl[12]. While in Bystraia set 1 and set 2 words have clearly distinct laterals, in Sebian-Küöl the mean values of F1 in the laterals are very close in set 1 and set 2 words. They are slightly different for the male speakers (and this difference goes in the opposite direction compared to Bystraia Even).

Fig. 5.20 Variation of F1 in laterals in words /irli/ and /ịrlị/ (Bystraia) and /isli/ and /ịslị/ (Sebian-Küöl).



With respect to F2 in the dialect of Sebian-Küöl I cannot report as many cases of F1/F2 mergers as in the Bystraia dialect. However, the data of F2 are very much dispersed both for set 1 words and set 2 words. This variation might be explained by the

[12] Probably the pair from the Bystraia district /irli/ vs. /ịrlị/ is not the best candidate for the comparison, since these words contain /r/ which also serves as a perception cue. But from my sample this is the only comparable word pair which has the same syllabic and morphological structure as /isli/ in Sebian-Küöl.

factors of perception. If the lateral consonant is not used as a cue for SET, the speakers do not have to keep two allophones so strictly apart in the production.

5.4 Allophonic variation between velar and uvular voiceless stops

As discussed in 5.1 the allophonic distribution between velar and uvular voiceless stops is found in a number of languages with vowel harmony. Some Even dialects are also reported to have this feature, but dialects with and dialects without this phonetic peculiarity do not pattern geographically. According to my observations, this variation is quite strong in the Bystraia dialect and less striking in the Sebian dialect.

Trying to analyse the data of the Even velar/uvular stop I encountered a problem: there is hardly any objective measurement which could be used to distinguish velars and uvulars based on acoustic data. One of the most commonly used measures for stop consonants is Voice Onset Time (VOT). Typologically it was noticed that there is a general tendency for VOT to be longer when the stop closure is articulated further back in the vocal tract (Fischer-Jørgensen 1954, Chen 2006). This suggests that uvular stops have a longer VOT than velar stops. However, the data from 18 languages in Cho & Ladefoged (1999) show little consistency for velar/uvular stops with respect to VOT. Below I describe the variation of VOT in the dialects of the Bystraia district and of Sebian-Küöl. For the data of the Bystraia dialect, I provide the results of VOT measurements. However, it should be noted that they do not show any clear tendency. The data of Sebian-Küöl will be presented only descriptively, but this seems to be sufficient to show inter-dialectal difference. There were no measurements done for the data of Sebian-Küöl, since measuring VOT for Bystraia turned out to be inappropriate to account for the variation in velar/uvular stops.

Bystraia dialect

My auditory impression was that in the dialect of the Bystraia district the velar voiceless stop has a clear silent closure in the words of set 1. The corresponding sound in the words of set 2 is in most cases pronounced as a uvular with additional fricative noise in the closure, whereas in some cases its articulation is perceived auditorily as a more back velar stop relatively to the velar stop in set 1 words. In segments that precede /i/ or /ị/ this difference is neutralized through the palatalization of the stop consonants.

This impression was also supported by the acoustic data in the most similar examples from the different sets. For instance, comparing Fig. 5.21 and Fig. 5.22 one can see the difference in the closure. In the set 1 word /eken/ ‘older sister’ the closure in /k/ is rather clear (with some remnant voicing in the beginning). In the set 2 word /akan/

‘older brother’ there is some noise typical for fricative consonants in the beginning of the closure in the sound wave and strengthening in the high frequencies in the spectrogram. The articulation of the stop sounds to me rather uvular, and it was labelled as “q”.

Fig. 5.21. An example of the token /eken/ ‘older sister’ (set 1), speaker EIA (male, 55), VOT=47 ms.

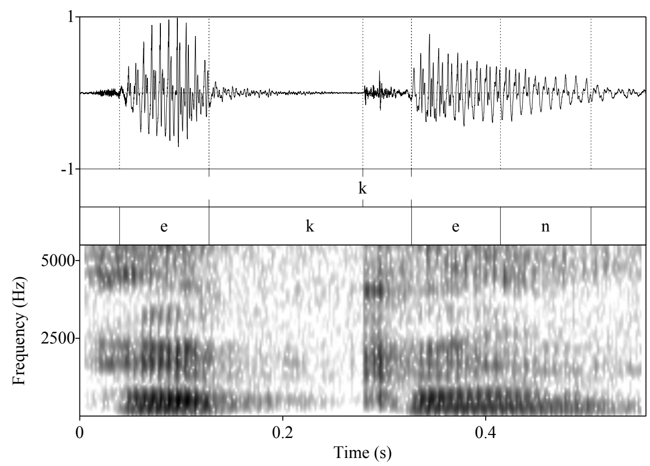
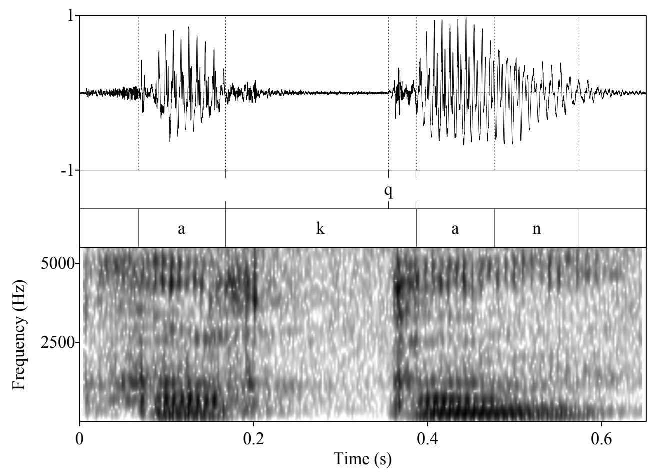


Fig. 5.22. An example of the token /akan/ ‘older brother’ (set 2), speaker EIA (male, 55), VOT=31 ms.



As can be seen in the captions of Fig. 5.21 and Fig. 5.22, the VOT of these examples does not follow the pattern predicted for uvular and velar stops. However, it is possible that in Even the VOT for velar stops is longer than for uvular stops. Although there are no general cross-linguistic tendencies concerning VOT of velar and uvular consonants (Cho & Ladefoged 1999), in individual languages, striking differences in VOT between velar and uvular plosives have been described. For instance, in the Athabaskan language Hupa the mean value of VOT for velars and uvulars is 44 ms and 27 ms, respectively (ibid.).

To measure the VOT in words of different sets I used the words shown in Table 5.6. These data were recorded from four speakers in 2009 in isolation and in a carrier phrase, but not with the special purpose to analyse VOT. Thus, this list is not balanced with respect to vowel qualities, but includes all words from the phonetic list containing velar/uvular stops (excluding clusters).

Table. 5.6. Words used for the analysis of VOT, Bystraia dialect.

set 1			set 2		
Even	position	translation	Even	position	translation
ko:je	KV	horns	kam	KV	dried fish
kewe	KV	jaw	kabanụkannị	KV	he crunches
koje:dej	KV	watch	kabịaw	KV	ptarmigan
			kịata	KV	salmon
eken	VKV	older sister	akan	VKV	older brother
bukes	VKV	ice	ọrantakị	VKV	to the reindeer
ieke	VKV	pot	ọrọččakan	VKV	like Even
eriki	VKV	newt	tụrakị	VKV	crow
ńi:kičen	VKV	duck	nọkọttaj	VKV	hang up
ukuń	VKV	milk	ịakịta	VKV	larch
uliki	VKV	squirrel	giaki	VKV	friend
ŋe:luki	VKV	wolf	ọsịkat	VKV	star
ekič	VKV	very	ọkat	VKV	river
esseki	VKV	down the river	bassakị	VKV	on the opposite side
nekottem	VKV	I do	ọ:kaj	VKV	fly agaric
ike:dej	VKV	sing	ụtakan	VKV	witch
uteken	VKV	child	ọrjakan	VKV	little reindeer
nimek-u	VKV	neighbour-ACC	čakabdaj	VKV	gather
i:-reku	VKV	come-CVB	nakat	VKV	bear hide
			dʒọ:-kan	VKV	remember-CVB
ti:k	VK	now	ačịk	VK	hole
nimek	VK	neighbour	awak/awadʒak	VK	towel
ejek	VK	settled Koryak / non-Even?	tak	VK	salt
			ịak/ịaka	VK/VKV	what

I distinguished between velar /k/ and uvular /q/ during labeling, but this was based only on my auditory impression. Moreover, all palatalized velar stops were labeled differently ("kj").

The results of labeling based on my auditory impression are following. As expected, within the non-palatalized stops the uvular realizations occur only in set 2 words. Uvular stops are much more frequent in set 2 words than velar stops. However, not all of the stops in set 2 words were uvular. Table 5.7 shows that all speakers prefer the uvular articulation over the velar one. There are no special constraints on the use of the velar allophone in set 2 words: it appears in the data from all speakers irrespective of position in the word and quality of the adjacent vowels. The velar stop is just one of many possible realizations, some of which are described further below.

Table 5.7. Distribution of uvular and velar stops in the words of set 2 as pronounced by different speakers based on auditory judgement.

label	RME, female, 54	VIA, female, 69	EIA, male, 55	VAC, male, 50
k	8	21	24	6
q	112	93	86	100

However, if one considers the duration of VOT irrespectively from labeling, the results do not differ so much between the words of set 1 and set 2. Statistical analysis of the VOT does not reveal any influence of the harmonical set. As previously, I used a Generalized Linear Mixed Model with factors SET, SEX and CONTEXT as fixed effects, LEXEME, POSITION in the word (initial, intervocalic or final) and SPEAKER as random effects, and random slopes of SET, SEX and CONTEXT within speakers. A comparison with the reduced model not containing the factor SET does not reveal significant results (χ^2=0.012, df=1, p=0.91).

Fig. 5.23 illustrates that the VOT values of velar/uvular stops are not influenced by the set of the words. Fig. 5.24 shows that the VOT of palatalized velar stops does not depend on the set of the word, either. Both in non-palatalized and in palatalized cases the mean values of VOT are practically equal for set 1 and set 2 words. The picture in Fig. 5.23 and Fig. 5. 24 is very simplified, since these figures do not show the data distribution per speaker or for the different positions. But the absence of the influence of set is also found for each speaker and for each position in the word. In absolute numbers, the VOT of the palatalized stops is slightly lower (45 ms and 43 ms for set 1 and set 2, respectively) than the VOT of the non-palatalized stops (46 ms and 47 ms for set 1 and set 2, respectively). This difference is so minor that the only conclusion that can be drawn from these data is that VOT is not an adequate measure for the differences in stop consonants which can be perceived auditorily (velar vs. uvular and palatalized vs. non-palatalized).

Fig. 5.23 VOT of non-palatalized stops in set 1 and set 2 words (averaged over speakers).

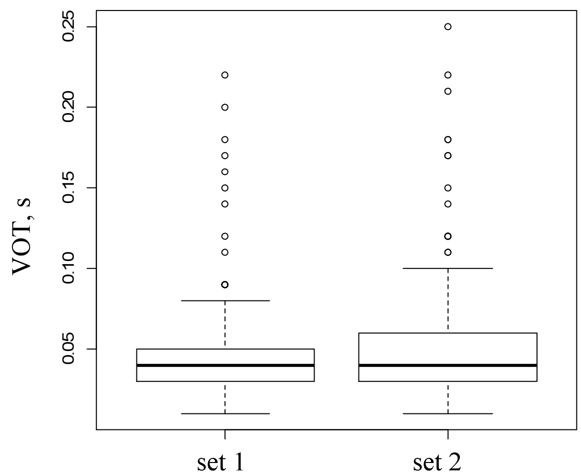
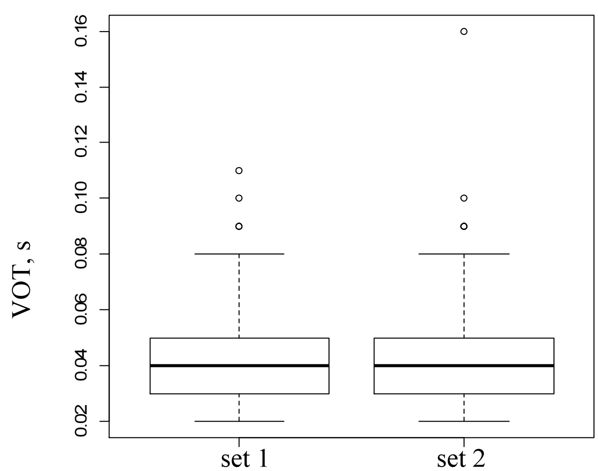


Fig. 5.24. VOT of palatalized stops in set 1 and set 2 words (averaged over speakers).

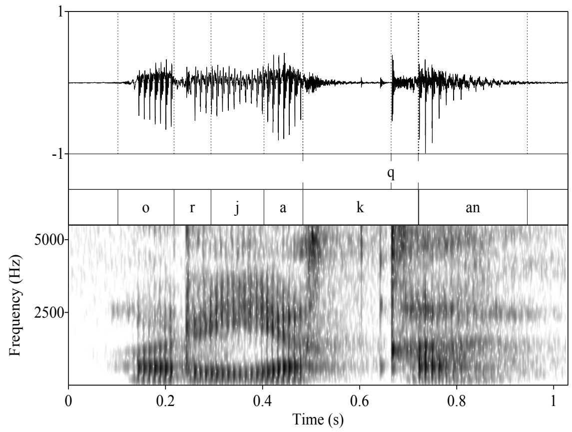


VOT is not the only measurement I applied to study the difference between velar and uvular stops in set 1 and set 2 words. Taking into account the articulatory differences of uvular and velar stops, one would assume that it takes longer to make a constriction between the dorsum of the tongue and the uvula than between the dorsum of the tongue and the velum. However, the analysis of the closure time does not reveal any significant difference between set 1 and set 2 words. I also analyzed the intensity within the closure, since fricative noise in the initial part of the closure appears in many instances of set 2 stops. In order to account for speaker differences in loudness (and possible differences in recording conditions) I divided the value of the intensity in the closure by the intensity of the whole word. Unfortunately, this method does not show any difference either, because a potential increase in the intensity of the closure in set 2 stops is neutralized by the overall intensity of set 2 words, which are louder in most cases. Probably this is related to the prevalence of the examples of set 2 containing the vowel /a/, which is typically louder than the corresponding set 1 vowel /e/. It seems that to perform an analysis like this, it is necessary to have a very balanced set of examples of the same length and potentially containing only high vowels. Thus, there is no suitable measure with which to assess the acoustic difference between velars and uvulars in my data.

However, despite the absence of significant differences in VOT and the other measures, it seems that the set of the word still influences the choice of the stop. While velar stops in set 1 words do not show much variation (other than the palatalized vs. non-palatalized allophones), their variants in set 2 words vary considerably both in the manner of articulation and, to a lesser degree, in place of articulation. The latter concerns only the variation between velar and uvular articulation (see Table 5.7). The variation in the manner of articulation covers the whole range of possibilities: additional fricative noise at the beginning of the closure, multiple bursts, fricative noise after the burst before the voicing, or the change of the stop into a uvular fricative consonant. It is not possible to provide a full classifiation of the variants occuring within set 2 words, since some of the mentioned features can be expressed simultaneously or less prominently; nevertheless, below I provide a description of several examples to show the variation.

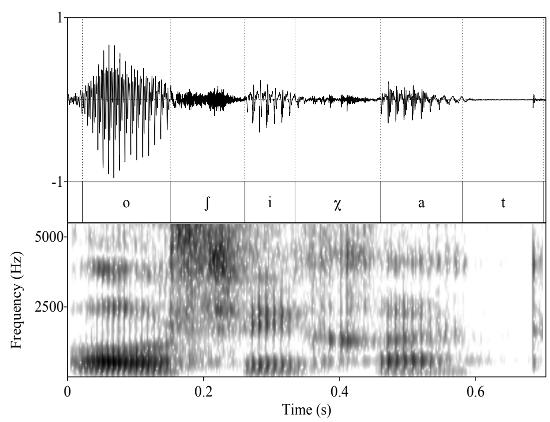
One of the most frequent supplements to a uvular stop is fricative noise at the beginning of the closure (this was also pointed out in conjunction with Fig. 5.22). From an articulatory perspective, this can probably be explained by the movement of the tongue towards the uvula before the constriction is created. Fig. 5.25 shows this phenomenon: an intense fricative noise can be observed in the initial part of the closure, both in the sound wave and in the spectrogram. Moreover, in this picture one can observe another fricative portion, namely after the burst of the stop. The spectrogram also shows multiple bursts before the main burst (labelled).

Fig. 5.25. An example of the token /ọrjakan/ [or^{j}ja^{χ}q^{χ}ã] ‘little reindeer’, speaker VAC.



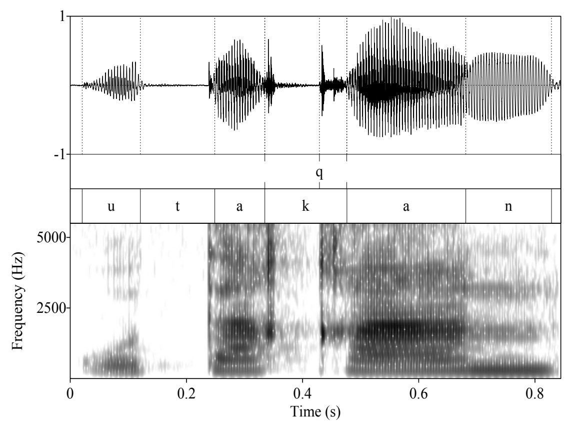
Another variant of this stop consonant can be a pure fricative uvular, which lacks both closure phase and release. Fig. 5.26 shows an instance of this type. In this case, the articulators do not create a complete closure at all. For this reason, it was not possible to mark any release and thus calculate a VOT value, and cases like this were not included in the measurements reported above. However, these variants do not occur very frequently.

Fig. 5.26. An example of the token /ọsịkat/ [oʃɪ̆χat] ‘star’, speaker VAC.



The last variant I am going to illustrate here is a stop with multiple (usually double) bursts. Fig. 5.27 shows an example of such a realization. An extra-burst is produced before the closure – where a fricative noise can be found in the other examples. It is also possible to have a double burst after the closure. In the latter case the first burst is not fully released and followed by a short closure.

Fig. 5.27. An example of the token /ụtakan/ [utaqan] ‘witch’, speaker RME.



<u>Sebian dialect</u>

In the Sebian dialect, I could not auditorily distinguish any uvular stops: both set 1 and set 2 stops appear to be classical velar stops. Furthermore, in contrast to the Bystraja dialect, there does not seem to be any discernible allophonic variation among the velar stops in set 2 words. I did not perform any measurements of the Sebian data, since even in the Bystraia district, where the data for set 1 and set 2 clearly differ auditorily, acoustic methods were not adequate. Here I restrict myself to illustrating several examples.

The velar stops in Fig. 5.28 (set 1) and Fig. 5.29 (set 2) are very similar: in both examples the closure is clear and does not contain any friction noise. Fig. 5.28 and Fig. 5.29 illustrate the production of the stop of only one speaker, but there is no big inter-speaker variation with respect to velar stops. If one compares the spectrograms in Fig. 5.29 and Fig. 5.22 (the same example recorded in the Bystraia dialect), one can notice that there is no strengthening in the high frequencies in the example from Sebian.

Fig. 5.28. An example of the token /eken/ ‘older sister’ (set 1), speaker TPK (female, 46).

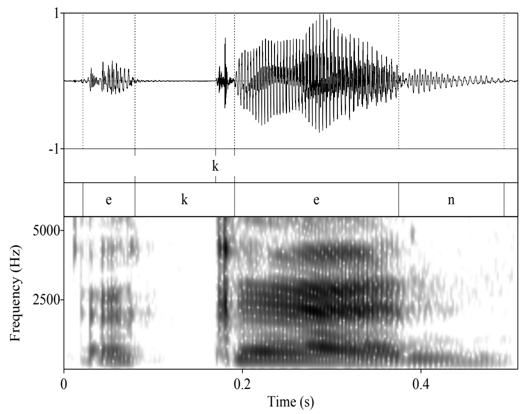
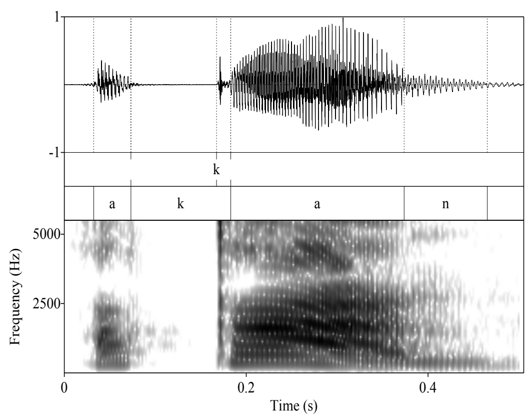


Fig. 5.29. An example of the token /akan/ ‘older brother’ (set 2), speaker TPK (female, 46).



The only variation which occurs in the Sebian data is intensive aspiration accompanying the burst if the stop is in final position, illustrated in Fig. 5.30 and Fig. 5.31. As can be seen, such aspiration occurs in both set 1 and set 2 words. The distribution of these variants is not strict: it varies both between different speakers and within the speech of one speaker (for instance, in the data of the speaker NPZ, from which Fig. 5.30 and 5.31 were taken, we also find unaspirated variants of the same tokens).

Fig. 5.30. An example of the token /nimek/ ‘neighbor’ (set 1), speaker NPZ (female, 38).

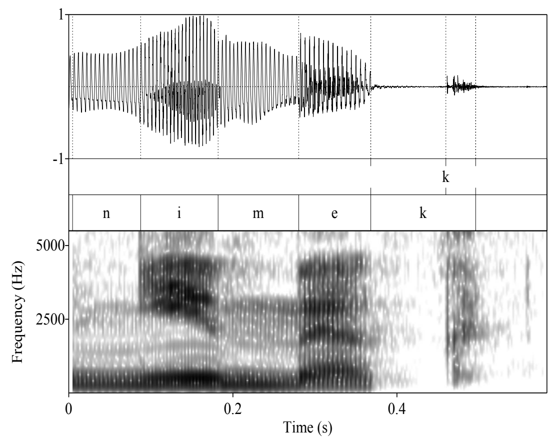
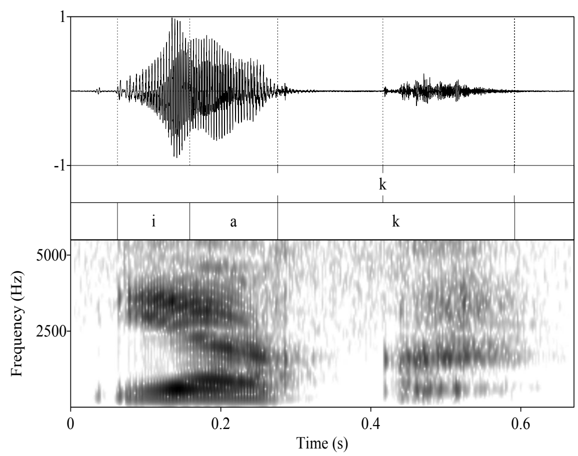


Fig. 5.31. An example of the token /ịak/ ‘what’ (set 2), speaker NPZ (female, 38).



5.5 Discussion

In this section I am going to highlight the differences in consonantal variation between the Bystraia and Sebian dialects. The analysis of the liquid consonants and the voiceless velar plosives shows that in the Bystraia dialect the set of the words influences the allophonic distribution of these consonants, whereas the data of Sebian-Küöl do not demonstrate such an influence. Before I proceed to the discussion of the arguments, I would like to give a short reminder of the methodological issues I encountered and the solutions I chose.

Initially, in order to analyze the liquid consonants I planned to measure F2 and F3. But it turned out that neither for /r/ nor for /l/ was it possible to provide such an analysis in a fully automated way. The reason for this is the phenomenon of merged formants which impedes the correct detection of formants in the Praat algorithms. In case of /r/, it was F2 and F3 which overlapped or lay too close to one another and consequently were recognized as one formant. Thus, for /r/ I measured only F2 automatically (with an additional visual check). F3 was measured mostly manually and only for a restricted sample of examples. For the lateral consonant /l/, I was able to measure automatically only F1, since there was a large amount of cases with merged F1 and F2 (due to velarization of /l/ in set 2 words). Even though it is F2 and F3 which are usually used in acoustic studies of laterals, the measurements of F1 showed a difference between set 1 and set 2 words for the Even data.

To analyze the variation in velar and uvular stops in Bystraia Even I used VOT, but this measure does not seem to be adequate to capture the difference between the two variants. Both for the Bystraia and Sebian-Küöl dialects, I restricted myself to a descriptive approach, simply illustrating the most interesting cases of allophonic variation.

As expected from the perception study, Bystraia and Sebian show different tendencies with respect to vowel-consonant interactions. The trill sound in Bystraia differs depending on the set of the word: this is supported by the data of both F2 and F3, which are higher in set 1 words than in set 2 words. However, this tendency was not statistically significant. In the Sebian dialect, F2 has a similar tendency to the Bystraia dialect for the whole set of examples, but it seems to be the result of the co-articulation effect caused by adjacent vowels that differ in frontness. In a restricted subset of examples (where /r/ is adjacent to /u/ and /ụ/) this tendency was absent. F3 did not show any tendency for /r/ to vary depending on the set of the word, either.

The lateral consonant in Bystraia shows consistent and statistically significant variation between palatalized [l^j] in set 1 words and velarized [ɫ] in set 2 words. In contrast, in the data from Sebian the values of F1 in /l/ are overlapping for set 1 and set 2 (when these words do not contain /a/ or /e/). This suggests that /l/ in Sebian is not sensitive to the set of the word.

The auditory analysis of the variation in velar and uvular stops in Bystraia shows that while the velar stop is consistently realized as such in set 1 words, a whole range of realizations including velars, uvulars and even fricatives can be found in set 2 words. As in the case of the liquid consonants, the velar/uvular distribution shows a clear pattern of opposition between set 1 and set 2 in the dialect of Bystraia. In Sebian, the velar stops sound very similar in set 1 and set 2 words, no uvular stops were found, and there is minimal variation of velar stops even in set 2 words.

Overall, the distribution of consonantal allophones in Bystraia depends on the set of the word. A consonant can potentially become a signal for the set of the word if the set is not clear on the basis of the vowels. The data from Sebian show that the consonants do not support the distinction between set 1 and set 2 words. Thus, these results mirror the results of my perception study both for the Bystraia district and for Sebian-Küöl.

6 Discussion and conclusions

In this chapter I summarize the findings of the analyses described in chapters 3, 4 and 5. I present the phonetic data of the dialects of the Bystraia district and Sebian-Küöl as two phonological systems, highlight different processes occurring in these dialects and compare these processes to those found in other languages. Moreover, I pay special attention to the question of the feature that underlies the harmonic opposition between the two vowel sets, considering arguments for the existence of an ATR/RTR distinction in the dialects under examination.

Section 6.1 is devoted to the analysis of the ATR-hypothesis. In section 6.2, I summarize the results of the acoustic and perception studies and present the systems based on the statistical significance of the acoustic measurements together with the systems based on vowel discrimination by the speakers of the two dialects of Even. In section 6.3 I discuss the nature of mergers and "near-mergers" as they are defined by the representatives of the variationist approach to sound change, since this approach might explain some contradictions in my results. In section 6.4 I will illustrate how the concept of near-merger can account for the Even data. Furthermore in section 6.5 I discuss the role of consonantal cues in the dialect of Bystraia and its potential role in the change of the phonological system. Finally, in section 6.6 I summarize the conclusions of the whole dissertation.

6.1 The question of the feature underlying vowel harmony

The acoustic characteristics which are typical for the vowels in an ATR language are discussed in detail in Chapter 3, section 3.1.3, based on data from West African languages. Even though the evidence from these data is sometimes equivocal, e.g. the characteristics of [+ATR] vowels in one language correspond to the characteristics of [-ATR] vowels in another language, there is a consensus that at least two acoustic parameters are typical for the [±ATR] distinction. These parameters are F1, which is lower for [+ATR] vowels than for [-ATR], and spectral slope, which is higher for [+ATR] vowels than for [-ATR]. Spectral slope is associated with some properties of voice quality which arise due to the change in the size of the pharyngeal cavity caused by the retraction or advancement of the tongue root. It is important to keep in mind that one of the main arguments of Ard (1980) for considering the vowel opposition in Even to be based on tongue root position was the pharyngealization found in the dialect of Ola. For this reason, evidence for differences in voice quality between vowels of different sets would be of importance for Even. Acoustically, spectral slope, also known as spectral tilt or the degree of spectral flatness, is a measure of steepness of the fall of amplitudes of the formants. There are several slightly different methods to measure this parameter. The one applied in the present dissertation is A1-A2.

However, there is no agreement on how to interpret the difference in spectral slope regarding the articulation associated with it. First, some confusion is observed in the values of spectral slope characteristic for [+ATR] and [-ATR] vowels. For instance, in section 3.1.4, I discuss the results that Lulich and Whaley (2012) obtained in their acoustic study of vowels in Oroqen, a Northern Tungusic language genetically close to Even. The overall conclusion of the authors is that the data confirm the hypothesis of an ATR opposition in Oroqen. However, if one compares their results with the African data, the comparison would rather indicate the opposite: two of three speakers showed a lower spectral tilt for [+ATR] vowels. Thus, taking into account the inter-speaker variation and, hence, no clear pattern of parameters, one can assume that the support for the [±ATR] distinction in Oroqen is weak. Secondly, this parameter might have some language-specific values, as was shown in Ikposo, where high vowels demonstrate the opposite pattern to what was predicted for ATR-systems (see the discussion of Anderson (2003) in Chapter 3, section 3.1.3). Thirdly, the parameter of spectral slope seems to be generally rather understudied. Jessen (1999: 332) notes that differences in spectral slope are found between tense and lax vowels in English, which are assumed to be different in length and height, but not in tongue root position.

The results of my acoustic investigation of Even vowels were presented in section 3.2.2, and the discussion of the results in the context of what has been found for the ATR languages of Africa is in section 3.3. In general, there is very little evidence for a [±ATR] distinction from the acoustic analysis, and it is present only in the Sebian dialect for back vowels. Acoustic analysis of the data from the dialect of the **Bystraia** district shows a consistent difference in F1 between vowels of the two harmonic sets, namely /e i o u/ have a lower F1 than /a ị ọ ụ/. Neither spectral slope nor the other parameters show a consistent pattern. However, it is clear that the acoustic data do not provide robust evidence for ATR in the Bystraia dialect. The data of the **Sebian** dialect lack a unified pattern: the acoustic data indicate a merger of /i/ and /ị/, whereas the back vowels /o u/ and /ọ ụ/ can be differentiated by F1 and spectral slope. In addition, the back mid vowels /o/ vs. /ọ/ are clearly opposed by frontness (F2). On the other hand, one could also look at this system as a system of vowels primarily opposed by F1 (as in the Bystraia dialect, but excluding /i/), /e o u/ vs. /a ọ ụ/, with additional differentiation by spectral tilt for /o u/ vs. /ọ ụ/ and frontness for /o/ vs. /ọ/. From this point of view F1, i.e. height, is a common feature in both dialects. But it is hard to make generalizations about both dialects, since in Sebian the other parameters seem to be important for the vowel opposition too: the sets of back vowels are opposed by F1 together with spectral slope, which can be an indication for a [±ATR] distinction. However, taking into account the absence of a direct mapping between spectral slope and a specific type of articulation, even supported by spectral slope the difference between /o u/ and /ọ ụ/ cannot be attributed to a differences in tongue root position with certainty.

Thus, the overall conclusion regarding the feature underlying vowel harmony in Even is that the main vowel opposition is based on relative height. But while in the Bystraia district this seems to be the single opposition for all vowels, in the Sebian dialect the system is more complex, including differences in spectral slope for back vowels and in frontness for mid back vowels. Auditorily, there were no observed phonation differences which could indicate some degree of pharyngealization. The absence of F3 differences between the harmonical sets justifies this auditory impression.

In general, including Even and the other Tungusic languages into the set of languages having ATR vowel harmony seems to be thus inappropriate. Comparing Tungusic vowel systems with the vowel systems of African languages, where the differences in tongue root position were proved experimentally, one can see that the Tungusic type of vowel harmony is rather different. First, it is the configuration of oppositions which differs from African languages (see the discussion of the typology of ATR systems by Casali (2008) in section 3.1.2). Secondly, Tungusic languages (as well as all the Altaic languages) have a root-to-suffixes spread of vowel harmony, whereas in an Afrikan language like Akan or Kalenjin vowel harmony spreads from the element containing the dominant vowel to the rest of the word, i.e. it is of the dominant type.

In general, the term "ATR vowel harmony" is very widespread in phonological studies. This term, which initially referred to a specific articulatory configuration only, is now more often used as an abstract phonological label. With respect to the classificatory parameters of vowel harmony types, phonologists distinguish between palatal and labial harmony systems (in Turkic languages they function within one system of vowel harmony). In these cases, a phonological feature is directly associated with the corresponding articulation. After the discovery of the ATR vowel harmony systems in the languages of West Africa, ATR was postulated as an underlying feature of vowel harmony in many other languages of the world, even outside Africa (various Tungusic languages and Chukchee in Siberia, Palestinian Arabic, Catalan, Sicilian and others, see the summary in Casali (2008: 505)). In a number of cases there is no articulatory or phonetic evidence for this label. Often, it is vowel harmony types based on some parameter other than a clear palatal or labial feature which are labelled "ATR". In cases like that the term "ATR" does not refer to any phonetically grounded evidence, but is used as a purely abstract phonological feature. From a typological point of view, such usage is rather unfortunate because it obscures the phonetic characteristics associated with it, if one assumes a direct mapping between phonological feature and its phonetic implementation. If the term "ATR" is used as a language-specific phonological label, it does not lead to any problems. However, once it becomes a comparative concept, there is a danger that this label covers phonological systems which differ from each other to a large degree, both in terms of phonological oppositions and in terms of their phonetic realization.

6.2 Disagreement between the results of the acoustic and the perception study

One of the advantages of the layout of my research was the possibility to perform the same acoustic recordings and perception experiments in two geographically remote dialects. The results show some expected dialectal differences. However, the data from both dialects reveal a certain contradiction between the results of the acoustic and perception study. In particular, the number of vowel pairs based on statistically significant acoustic differences does not reflect the vowel oppositions based on speakers' recognition. Thus, one can postulate two systems for each dialect, one based on the acoustic measurements (speech production) and one on the data of vowel perception. I present these two systems in Table 6.1 (in the part concerning the acoustic oppositions, it overlaps with Table 3.4 in Chapter 3). Table 6.1 contains only the vowel qualities, since the question whether length is phonemic or not requires further investigation.

Table 6.1. Systems of monophthongs in the Bystraia and Sebian dialects.

		Bystraia dialect			Sebian dialect		
		front	mid	back	front	mid	back
acoustic study	high	i		u	i		u
		ị		ụ			ụ
	mid	e		o	e	o	ọ
				ọ			
	low		a			a	
perception study	high	i		u	i		u
	mid	e		o/ọ	e	o	ọ
	low		a			a	

As can be seen from Table 6.1, the number of vowel oppositions in the upper part of the table (based on acoustic measurements) differs from the lower part of the table (based on the analysis of perception data) both for the dialect of the Bystraia district and for the Sebian-Küöl dialect. The main difference between the upper and lower parts is the reduction of the opposition between set 1 and set 2 vowels in perception. In the lower part for the Bystraia dialect all set 1/set 2 vowel oppositions are absent except for /a/ vs. /e/, and in the lower part for Sebian-Küöl the oppositions /a/ vs. /e/ and /o/ vs. /ọ/ are kept, which means they are supported by the perception study. The choice of the set 1 symbol for the merged vowels in the lower part of Table 1 does not refer to any specific phonetic property: when the vowels of two sets have merged, the set property becomes irrelevant. Below I summarize the arguments for such a split between the acoustic and perception data for each case of disagreement.

The analysis of the perception data from the dialect of the **Bystraia** district reveals three cases of merger between set 1 and set 2 vowels. I start with the opposition of the high front vowels /i/ vs. /ị/. In the acoustic data, these vowels are significantly different with respect to two parameters: first, set 1 /i/ has a lower F1 than set 2 /ị/ (especially prominent for the short vowels); secondly, set 1 /i/ and set 2 /ị/ differ in spectral slope (however, the distinction is not consistent among short and long vowels). Perceptually, these vowels do not seem to be distinguished on their own. The words containing /i/ and /ị/ can be translated correctly only if they also contain certain consonants and the vowels /e/ or /a/ in the suffix, which function as the necessary cues for the speakers.

The analysis of the opposition /u/ vs. /ụ/ remains ambiguous, since the data of vowel perception is open to various interpretations. The acoustic data indicate a clear distinction of these vowels in speech production: set 1 vowels have a lower F1 than set 2 vowels and spectral slope is significantly different for set 1 and set 2 vowels, although as in the case of /i/ vs. /ị/, the difference is not the same for short and long vowels. The perception data show neither clear evidence for the distinction nor convincing facts for a merger. As discussed in Chapter 4, section 4.3, this is partly due to the unfortunate choice of recordings for the stimuli. But the largest difficulty for interpretation is the following unexpected pattern: set 1 words are systematically recognized worse than set 2 words. This can be seen in the results of all three perception experiments: for Experiment 1 in Fig. 4.8 and, especially, in Fig. 4.11, for Experiment 2 in Fig. 4.18, and for Experiment 3 in Fig. 4.22 of Chapter 4. However, despite the lack of an explanation for this pattern, it seems that the distinction between the two vowels is not so clear for the speakers. Otherwise, one would expect the words with both set 1 vowel /u/ and with set 2 vowel /ụ/ to be recognized equally well. The fact that the words with set 1 vowel are systematically associated with set 2 means that the speakers cannot fully make this distinction. Thus, my tentative analysis of this case would be to rather assume a merger between these two vowels, as specified in Table 6.1.

The vowel opposition which remains to be discussed is /o/ vs. /ọ/. Acoustic analysis shows a significant difference between these vowels with respect to both F1 and F2. Unfortunately, my perception study cannot illuminate if these vowels are discriminated per se, or if the recognition of the words is done on the basis of other cues.

All words containing set 1 /o/ contain /e/ as well. The attempt to mask /e/ in the suffix (Experiment 3) in words /moːle/ vs. /mọːla/ was not sufficient, since apparently /l/ is an important cue for the set difference as well (as shown in section 5.3). However, there is some evidence that these vowels are not opposed phonologically any more. The evidence comes not from the perception data, but from the distribution of set 1 /o/, which is quite restricted due to the change /o/ ⟶ /u/ in most contexts. Set 1 /o/ never occurs in monosyllabic words, and in polysyllabic words it is always followed by a syllable with /e/, whereas set 2 /ọ/ may occur both in mono- and polysyllabic words; in the latter case it requires suffixes containing /a/. The lack of monosyllabic words with /o/ results in a lack of minimal pairs which could support the opposition /o/ vs. /ọ/. Thus, these vowels are in complementary distribution and, hence, they are two allophones of one phoneme. Obviously, this conclusion is based only on the distributional properties of /o/ and /ọ/ and not on the ability of the speakers to recognize the words by the presence of one of these vowels. But it seems that for the perception of the words with /o/ and /ọ/ it cannot be the set distinction of the two vowels which plays a decisive role for the correct recognition, but other cues like /e/ and /a/ in the suffixes and certain consonants. For this reason, the pair /o/ and /oː/ is given with a slash in Table 6.1: on the one hand, I do not have evidence for a merger of set 1 /o/ and set 2 /ọ/ in the perception data, but on the other hand, from the distributional properties of these vowels it seems that the set distinction is no longer relevant for the recognition of the words containing these vowels.

In addition to the questionable status of the set opposition for monophthongs, I would like to mention here the “confusion” of diphthongoid vowels observed in the Bystraia dialect. As discussed in Chapter 2 (section 2.2.2), the diphthongoid vowels /ie/ and /ịa/, which consistently support lexeme distinctions in the Ola dialect, show a lot of variation in the dialect of the Bystraia district. This confusion reveals itself in the fact that the same lexemes can be used either with set 1 or with set 2 diphthongoid vowels. For some lexemes, this is observed only as inter-speaker variation, but for others this “confusion” occurs in the speech of one and the same speaker. Thus, in those cases where the diphthongoid vowel is kept, its set property seems to be of secondary importance: both [iet] and [ịat] for ‘willow’, both [ieke] and [ịaka]~[ịaqa] for ‘pot’ are documented. Thus, in monophthongs the data of speech production still show the distinction between vowel sets, and evidence for the confusion of the vowel sets comes rather from speech perception. The diphthongoid vowels reveal the lack of distinction on the level of speech production as well.

The data for **Sebian-Küöl** are less complicated. The contradiction between the upper and lower parts of Table 1 for the Sebian-Küöl dialect is present only for the opposition /u/ vs /ụ/. The opposition for /i/ vs. /ị/ was supported neither by the acoustic analysis (no parameter reveals a difference between the two sets) nor by the perception data. On the other hand, the opposition of /o/ vs. /ọ/ was proved beyond doubt by the acoustic investigation (F1, F2, and spectral slope all support the distinction) and by the perception data. The situation with regards to the opposition /u/ vs. /ụ/ is similar to the data for the same vowel set in the Bystraia dialect. The acoustic data reveal a significant difference between /u/ and /ụ/ with respect to F1 and spectral slope. The stimuli in the perception data were not balanced for lexical frequency (which became evident only at the stage of data analysis). This fact explains some asymmetry in the figures with responses (Fig. 4.16 and Fig. 4.24 in Chapter 4). My conclusion about the recognition of words containing high vowels is that during the experiments the speakers were relying more on word frequency than on the set of the vowels, which indicates their inability to discriminate between the two sets. Thus, as in the case of /i/ and /ị/, the opposition of /u/ vs. /ụ/ is not supported by the perception data.

6.3 Near-mergers in Labov's paradigm

To explain the results of my acoustic and perception analyses, which look rather conflicting at the moment, it is helpful to introduce some concepts from the variationist approach to language change. As noted by Gordon (2003: 245), while the traditional Saussurean approach deals with linguistic changes which can be observed after they become part of the system, within the variationist approach the research is focused on language change in progress, on discerning the patterns of variation in the speech of individual speakers and following the scenarios of each particular change. This paradigm was elaborated primarily by William Labov. One of the central questions of his work was the mechanism of phonological change, namely shifts, mergers and splits, which he studied using data of various English dialects.

Studying the phenomenon of vowel mergers, Labov et al. (1972) discovered an unexpected situation in a number of American English dialects: words perceived as the same showed a statistically significant difference in the pronunciation of their vowels. These kind of perceptual vowel mergers without full acoustic overlap were called "false reported" mergers by Labov et al. (1972); later the term "near-merger" became more common. The first case of this phenomenon was found in 1969 in data obtained from a teenager whose origin was Albuquerque, New Mexico. The minimal pair (identification) test showed that this speaker of English categorized words like *fool* and *full* as the same; however, the acoustic analysis of his speech showed that the realizations of /u/ and /ʊ/ were quite separate in the F1/F2 space. Labov et al. (1972: 236-257) described the same "false reported" merger also for other vocalic oppositions: *source* vs. *sauce* in New York City, *hock* vs. *hawk* in Pennsylvania and others. Later, more cases were reported by other scholars, e.g. Trudgill (1974) provided an example of the same nature in Norwich English for *beer* vs. *bear*.

To investigate the oppositions/mergers in perception, Labov (1972, 1994) designed two experiments: the minimal pair test and the commutation test[1], which became the prototypes of the modern discrimination and categorization tests. In the minimal pair test, words with the opposition under investigation are recorded from a speaker and at that time the speaker is asked if these words sound different or the same to him or her. In this way, both speech production and speaker's intuition can be tested. In the commutation test, the speaker who is supposed to have a merger listens to his or her own recordings in a randomized order and is asked to identify each word. Unlike the minimal pair test, the commutation test does not have the problem that orthography can potentially influence the speaker's intuition. More subjects can be involved in judging the recordings (as in Di Paolo & Faber 1990). Thus the acoustic data obtained in the minimal pair test and the results of the commuation test from one or more speakers can provide evidence for an opposition, a merger, or a near-merger.

The emergence and the linguistic distribution of near-mergers (i.e. the frequency of this phenomenon in the languages of the world) are not entirely clear. On the one hand, near-mergers were observed in younger speakers in Albuquerque and Norwich. On the other hand, in Pennsylvania, a region known for the complete merger of vowels of the type *caught* and *cot*, a near-merger was attested in the speech of an 80-year-old man. According to Labov (1994: 363, who called it the "Bill Peters effect"), this man "unconsciously adopted the incoming merged norm as a guide in the minimal pair test, but not for speech". Later investigation focused on the possible social conditions enabling the merger in perception. In a recent paper Hay et al. (2006) designed an experiment to test the influence of social factors on the perception of the diphthongs in *near* and *square* in New Zealand English. In this variety of English, an ongoing merger of /iə/ and /eə/ is observed. Using both visual and audio stimuli the authors aimed to investigate whether the age and social class associated with the stimuli can influence perception. The results showed that the subjects tended to be more accurate in their perception when they were presented with stimuli associated with an older speaker, and tended to have a merger in their perception when they assumed the speaker was young.

Despite the clear evidence for the existence of near-mergers, there is no definite understanding how they develop further in the process of sound change. Boersma (1998: 388) sees a near-merger as one of the intermediate stages between a full contrast and a complete merger. However, there are two possibilities: a situation when a near-merger can lead to a full merger, and a situation when after the existence of a near-merger for a certain time, two phonemes drift apart in their phonetic realization and are not perceived as the same any more. The first situation can be observed in New Zealand English where a near-merger of the diphthongs appears to be a step towards a complete merger of

[1] The term was proposed by Hjelmslev in 1938 (see Garvin 1954).

diphthongs. The second possibility was proposed by Labov et al. (1972: 253, 296) for the Tillingham English diphthongs /aɪ/ and /oɪ/ (*isle*, *tile* vs. *oil*, *toil*), which after being very close acoustically for several hundred years are "re-separating" in the speech of younger speakers. These vowels are still perceived as the same in the region and show only slight differences in the acoustic measurements of the speech of older speakers, but adolescent speakers show a much greater difference in production. The other situation discussed in Labov et al. (1972: 277-297) is the scenario for the vowels in words like *meat* and *mate*. Using historical data, Labov shows that in the sixteenth century the words with these vowels were heard as the same, but later history showed that they did not merge entirely, but became independent phonemes again in the seventeenth century. According to Guy (2003: 379), in the sixteenth century "some words turned out to have changed their class membership, suggesting that during the period of close approximation, they were so close phonetically to the other class as to be reinterpreted phonemically." One of the examples illustrating this process is the pair of words *speak* and *break*, both of which belonged to the same class as *meat* in the sixteenth century and were reported to sound the same as *mate*. Later on, when the (near-)merger *meat*/*mate* split apart, *speak* like *meat* (as well as *flea*, *sea*, *seat*, *eat* etc.) followed the vowel change to /iː/, whereas *break* remained in the same class as *mate*, having the diphthong /eɪ/ in Modern English (Labov 1994: 296-297, Hickey 2004). So it seems that sometimes near-mergers may leave some trace in the history of a language, even if later on they develop into separate phonemes. The case of *meat* vs. *mate* appears to be a complete merger followed by complete separation. Thus, as Hamann (2015: 251) puts it, near-mergers represent "a riddle for many phonologists and phoneticians: if there is a contrast in the underlying forms, why is it observable in production but not in perception?"

Finally, I would like to draw attention to the fact that it is still not clear how frequent this phenomenon is, especially how widely it is found in languages other than English. In the paradigm of the variationist approach it is mostly English dialects which were studied and where near-mergers were discovered. A rare exception is the study by Yu (2007), who suggests that near-mergers can also affect tones, as he demonstrates with Cantonese data.

6.4 Near-mergers as an explanation for the Even data

In light of what has been attested for near-mergers, the data of Even do not look so contradictory any more. The consistent acoustic differences between the vowels of harmonic pairs discussed in Chapter 3, on the one hand, and the inability of perceptual discrimination shown in Chapter 4, on the other hand, pattern with the description of near-mergers. However, the procedure I performed in the field to collect acoustic and perception data differs from the minimal pair test and commutation test described by Labov (1994: 353-357). While in Labov's tradition it is the same lexical items which were used for the acoustic analysis and to test the speakers' ability of perceptual discrimination, I used a large set of lexemes for the acoustic analysis (see Appendix 1 for the Bystraia district and Appendix 2 for Sebjan-Küöl) and only a subset of this[2] for the perception experiments (the stimuli for the perception sets are given in Appendices 3, 5 and 6 for the Bystraia district and 4, 5 and 7 for Sebjan-Küöl). In Chapter 4, I treated each minimal pair included in the stimuli individually, discussing possible factors which might have influenced the distribution of correct and incorrect responses. But in Chapter 3, to measure the statistical significance of acoustic differences between set 1 and set 2 vowels, I use either the full set of lexemes or a subset of lexemes representing the same vowel quality, without comparing vowels in individual minimal pairs. Thus, to be able to compare my results with the near-mergers described by variationists, I have to look at individual minimal pairs both from the point of view of perception and from the point of view of acoustic measurements.

There are some other important distinctions between Labov's tests and the perception experiments I conducted in the field. In fact, I did not conduct the minimal pair test as such with the Even speakers: I did not ask them directly if they hear a difference between two words which presumably compose a minimal pair. However, I believe I have the same kind of information as that which can be collected from the minimal pair test in the proper sense. At least some speakers from whom I recorded the stimuli for the perception experiments were also included in this experiment as listeners, which means that I can judge their ability to recognize words of different sets, including the cases when they listened to their own pronunciation. The acoustic analysis of these stimuli can either be extracted from the results of the measurements I presented in Chapter 3, or added for the stimuli recorded specially for the perception experiment (Bystraia). Thus, I can match this information with the results of Labov's minimal pair test. As for the commutation test, the main difference between Labov's design and mine is that the subjects of Labov's test listened to several recordings of the same words, and in my study each subject was presented with each stimulus only once. Thus, the percentage of the correct responses in Labov (1994) refers to the responses of one and the same subject listening to a number of randomized recordings of two words composing a minimal pair (or "supposed" minimal pair). The percentage I provide for the recognition rate of the members of minimal pairs (Chapter 4) refers to the number of speakers who gave correct or incorrect answers for that particular word only once during the experiment.

Below I present some data which can be compared to near-mergers in Labov's understanding: together with the acoustic plots for the vowels of different sets I provide

[2] In the Bystraia district some stimuli for the perception experiments were recorded in addition, but the conditions and equipment of recording were the same as for the stimuli coming from the set for the acoustic measurements.

the data from the perception experiment. For this demonstration I use the original non-modified recordings from Experiment 2 (see Chapter 4) in order to have words with vowels of the same quality: /ujun/ 'nine' and / ụjụn / 'ford a river' (Bystraia district and Sebian-Küöl), /issi/ 'pulling out' and /ịssị/ 'reaching' (Bystraia district), /hiwli/ 'go out, extinguish' and / hịwlị / 'turn inside out' (Sebian-Küöl).

<u>Bystraia district</u>

The data of the Bystraia district do not show a uniform picture. The stimuli containing /u/ and /ụ/ and the stimuli containing /i/ and /ị/ do not show the same pattern. The data for the lexemes /ujun/ and /ụjụn/ show the expected results for a near-merger: separation in the acoustic measurements and confusion in the perception test. The results of the measurements of the initial vowels in the words /issi/ and /ịssị/ do not show such a separation and, therefore, together with the confusion in the perception test rather indicate a complete merger.

Figure 6.1 shows the F1/F2 distribution of the initial vowels in the words /ujun/ and /ụjụn/ (six instances of each word) pronounced by one male and one female speaker. Despite a small overlap (around 3.75 Barks for the male speaker and 4 Barks for the female speaker), there is clear separation along F1, with set 1 /u/ being lower than set 2 /ụ/.

Fig. 6.1. F1/F2 distribution for the first vowel in the words /ujun/ and /ụjụn/, pronounced by the male speaker EIA (left) and female speaker VIA (right)

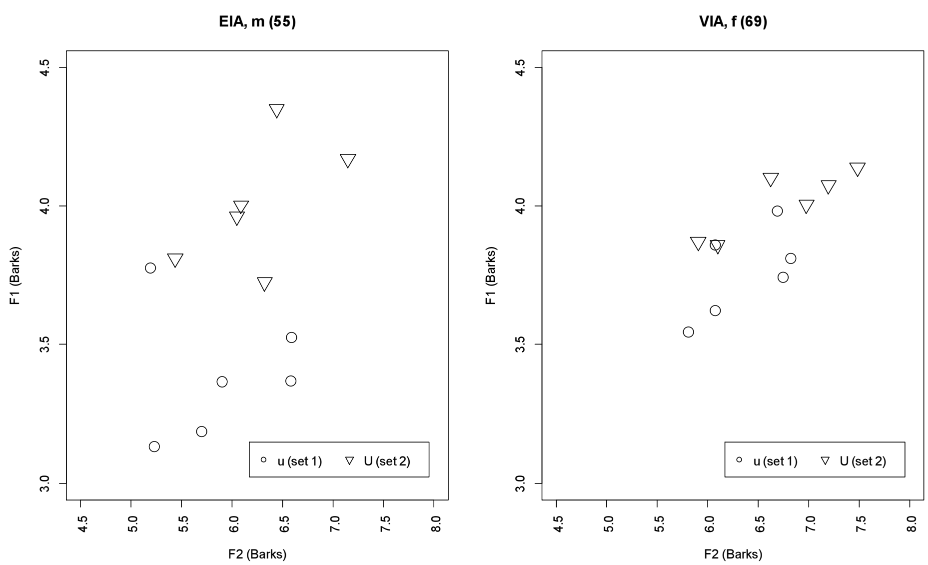


Table 6.2 shows the responses of the same subjects (EIA and VIA) to their own stimuli, the responses of the other subjects, and their responses to each other's stimuli:

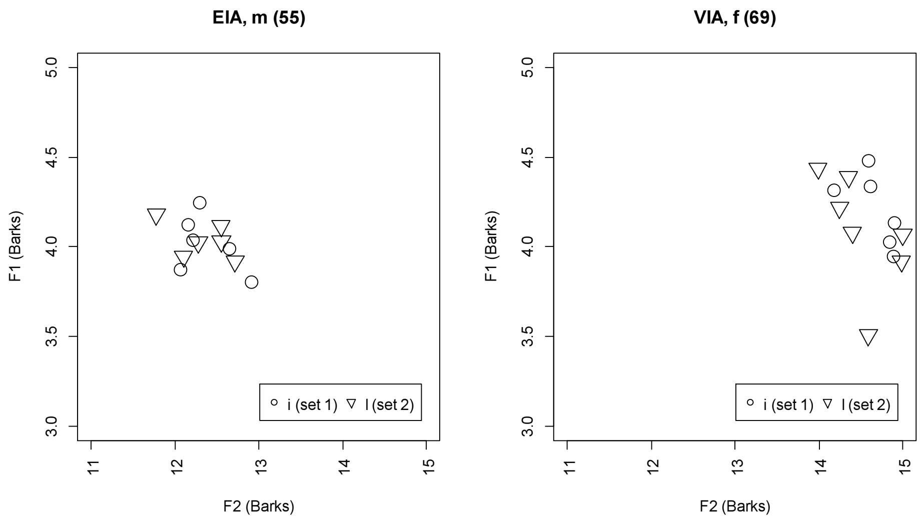
Table 6.2. The distribution of correct and incorrect responses to the stimuli /ujun/ (set 1) and /ụjụn/ (set 2).

	EIA's responses to his own stimuli		VIA's responses to her own stimuli	
	correct	incorrect	correct	incorrect
set 1 ujun	0	1	0	1
set 2 ụjụn	1	0	1	0
	responses of the others to EIA's stimuli		responses of the others to VIA's stimuli	
set 1 ujun	7	10	9	8
set 2 ụjụn	16	1	12	5
	EIA's responses to VIA's stimuli		VIA's responses to EIA's stimuli	
set 1 ujun	1	0	1	0
set 2 ụjụn	1	0	1	0

Both speakers experience difficulties when they judge their own production. At the same time they show the same pattern, assigning set 2 to both words. The same tendency can be seen in the responses of the other subjects to EIA's data: ten out of seventeen subjects assign /ujun/ 'nine' to set 2. But the guesses about this word produced by VIA are divided almost equally. Interestingly, the responses of EIA and VIA to each other's stimuli are correct. But the overall impression is that these two words are strongly confused by Even speakers, which together with the acoustic opposition suggests a near-merger.

However, the situation with the high front vowels /i/ and /ị/ in the words /issi/ and /ịssị/ resembles a complete merger. The plots based on the acoustic analysis of the stimuli recorded for the perception experiments are shown in Figure 6.2. The data of both speakers reveal a strong overlap with respect to F1 and F2, though the individual speakers' properties are quite striking as well, namely the difference in F2 between the speakers (around 12.5 Barks for the male speaker and around 14.5 Barks for the female speaker) and the range of F1.

Fig. 6.2. F1/F2 distribution for the first vowel in the words /issi/ and /ịssị/, pronounced by the male speaker EIA (left) and female speaker VIA (right)



The responses in the perception experiment also show a strong confusion between set 1 and set 2 words. The distribution of the responses to the stimuli recorded from the speakers EIA and VIA are given in Table 6.3.

Table 6.3. The distribution of correct and incorrect responses to the stimuli set 1 /issi/ and set 2 /ịssị/.

	EIA's responses to his own stimuli		VIA's responses to her own stimuli	
	correct	incorrect	correct	incorrect
set 1 issi	0	1	0	1
set 2 ịssị	0	1	0	1
	responses of the others to EIA's stimuli		responses of the others to VIA's stimuli	
set 1 issi	5	12	4	13
set 2 ịssị	13	4	2	15
	EIA's responses to VIA's stimuli		VIA's responses to EIA's stimuli	
set 1 issi	0	1	0	1
set 2 ịssị	1	0	1	0

Interestingly, both speakers give incorrect responses to their own stimuli. Otherwise, for EIA's stimuli the other speakers give more set 2 responses, as was observed with respect to the stimuli /ujun/ and /ụjụn/. Among the responses to VIA's stimuli there are more incorrect than correct responses for both words. Giving responses to each other's stimuli, both speakers assign set 2 to both words (resulting in the incorrect response to the set 1 stimulus and the correct one for the set 2 stimulus). Even though the results of the perception test look rather unexpected (the expected scenario for a merger would be an equal number of correct and incorrect responses), it is clear that the speakers are not able to distinguish between set 1 and set 2 words. Taking into account the overlap in acoustic space (Fig. 6.2), the example of /issi/ and /ịssị/ provides strong evidence not just for a near-merger, but for a complete merger between /i/ and /ị/.

It might seem that the acoustic merger of vowels in this example contradicts my findings in Chapter 3, where I showed that set 1 /i/ and set 2 /ị/ are significantly different, with set 1 vowels having lower F1 values. However, Fig. 3.16 from Chapter 3 suggests strong inter-speaker variation: EIA and VIA have a similar distribution of /i/ and /ị/ and /u/ and /ụ/, with a partial overlap between the vowels of the same quality, VAC shows the most overlap, whereas RME, in contrast, has distinct values for all vowels (except for the pair /o/ and /ọ/). Thus, the difference between set 1 /i/ and set 2 /ị/, which was proven to be statistically significant in Chapter 3, might be due to the influence of RME's data.

The variation between speakers is also interesting in itself. Unfortunately, in the perception test I did not use stimuli produced by all four speakers whom I recorded for the acoustic study, but only by two of them. It would be interesting to see a similar set of responses as in Tables 6.2 and 6.3 to RME's stimuli, since it appears that this speaker makes a stronger acoustic distinction. This would be especially helpful for the perception analysis of /i/ and /ị/. As I show above, the data of EIA and VIA included in the perception test show an acoustic merger with respect to /i/ and /ị/. The confusion in the responses of the other subjects who participated in the perception test to these stimuli might therefore be explained by an acoustic merger: all 18 subjects are unable to perceive the difference because the difference is absent in the stimuli. So this vowel pair cannot be a near-merger in the strict Labovian sense, but appears rather to be a complete merger. The picture might have been different if I had included the data recorded from RME. Presumably the acoustic analysis of /issi/ and /ịssị/ would show a distinction between /i/ and /ị/ in RME's data. If the subjects still gave responses with a high degree of confusion, it would be possible to postulate a near-merger for RME's data. But it could also be the case that the subjects (or at least a subgroup of the 18 subjects) would be able to perceive the available acoustic differences. In this case, one would have to postulate that some speakers, such as RME, have kept the vowels distinct, whereas others have developed a merger, and differences in the production would directly correlate with perception.

It seems that the vowel system in Bystraia is undergoing a structural change towards a merger of harmonic pairs of high vowels. As is characteristic for an ongoing change (McMahon, 1994: Chapter 9), there is strong inter-speaker variation, which is why it is hard to make a generalization at the dialectal level.

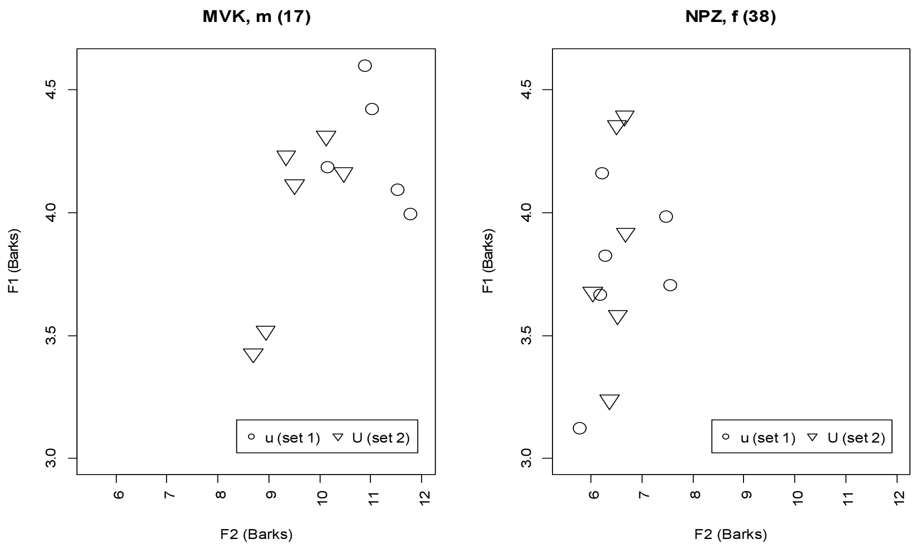
<u>Sebian-Küöl</u>

The data from Sebian-Küöl show a similar pattern to the one in the Bystraia district. However, here the acoustic merger is found even for /u/ and /ụ/ in the data of one of the two speakers, but not in the data of the other one. The merger in the acoustic data for /i/ and /ị/ is found in the data of both speakers, in line with the findings presented in Chapter 3.

Fig. 6.3 shows the F1/F2 distribution for the initial vowels /u/ and /ụ/ in the minimal pair /ujun/ and /ụjụn/. The two sets of vowels are not separated in the speech of the female speaker (right). In contrast, in the speech of the male speaker (left) the data points for set 1 and set 2 are completely separate on the plot with one exception. Unexpectedly, this distinction is observed along the F2-axis, even though the distinction would be expected in F1 based on my acoustic study in Chapter 3.

An additional interesting observation is that the male speaker has generally rather high values of F2 for an u-vowel. In Fig. 3.17 in Chapter 3 the mean values of F2 for /u/ and /ụ/, which show a strong overlap in the data of MVK, are between eight and ten Barks. In Fig. 6.3 below the range of F2 varies between eight and twelve Barks.

Fig. 6.3. F1/F2 distribution for the first vowel in the words /ujun/ and /u̯ju̯n/, pronounced by the male speaker MVK (left) and female speaker NPZ (right).



However, the responses to the stimuli in the perception test do not indicate any distinction among these two words (see Table 6.4). Since MVK was not available for the perception test, Table 4 only shows responses to his stimuli of the other subjects, not his responses to NPZ's or his own stimuli. In this, Table 6.4 differs from the corresponding Tables 6.2 and 6.3 for the Bystraia district.

Table 6.4. The distribution of correct and incorrect responses to the stimuli set 1 /ujun/ and set 2 /ụjụn/.

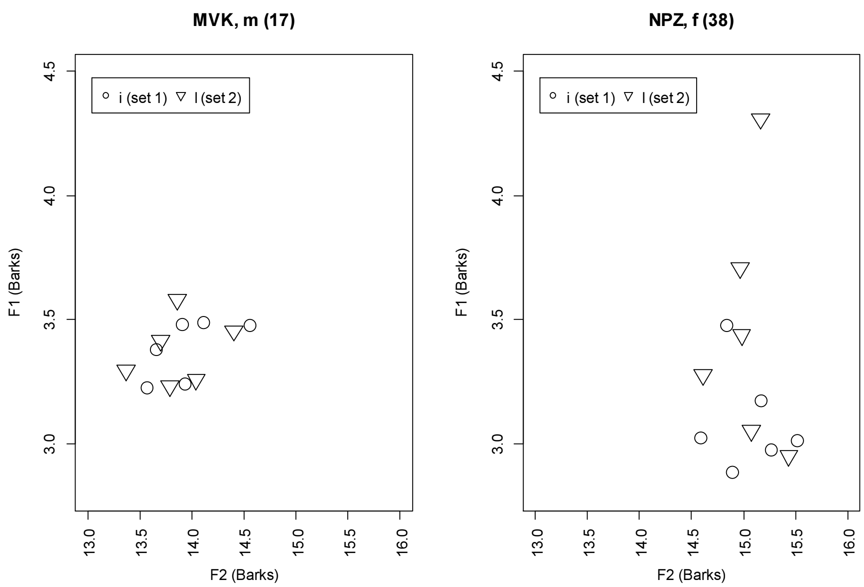
	correct	incorrect
	NPZ's responses to her own stimuli	
set 1 ujun	1	0
set 2 ụjụn	0	1
	NPZ's responses to MVK's stimuli	
set 1 ujun	0	1
set 2 ụjụn	0	1
	responses of the others to NPZ's stimuli	
set 1 ujun	5	3
set 2 ụjụn	3	5
	responses of the others to MVK's stimuli	
set 1 ujun	8	1
set 2 ụjụn	0	9

The speaker NPZ gives a correct response to her own set 1 stimulus with the meaning 'nine' and gives incorrect responses to both the set 1 and set 2 stimuli of MVK. The reaction of the other subjects to MVK's and NPZ's stimuli is different. Whereas the responses to NPZ's stimuli show considerable confusion (even though the response corresponding to the set 1 stimulus 'nine' is given more often), the responses to MVK's stimuli are almost entirely consistent with the response translated as 'nine' (set 1). As discussed in Chapter 4 with respect to the results of Experiment 1 in Sebian-Küöl, this effect might be explained by the fact that the set 1 word 'nine' is more frequent than the set 2 word 'ford a river'. During the experiment some of the speakers gave only this response, even though they claimed to know the corresponding set 2 word /ụjụn/ 'ford a river' when they were asked separately from the experiment. Hypothetically, another explanation for the prevailing number of the responses 'nine' might be the fronted pronunciation of both /u/ and /ụ/ by the speaker MVK. F2 is not supposed to be a cue for the discrimination between set 1 /u/ and set 2 /ụ/, but in Sebian it differs significantly between set 1 /o/ and set 2 /ọ/ in such a way that set 1 /o/ is more fronted (has a higher F2) than set 2 /ọ/. Maybe this cue has extended or has been generalized by the listeners to the distinction between /u/ and /ụ/, and since the production of MVK shows higher than average F2 values, most subjects may have identified MVK's stimuli as a set 1 word.

Thus, the comparison between the acoustic and the perception data with respect to /ujun/ and /ụjụn/ shows the intermediate status of this merger between a complete merger (the data of NPZ, where acoustics agrees with perception) and a near-merger (the data of MVK, where a separation in the acoustic data is not reflected in the perception results). However, the acoustic analysis in Chapter 3 showed a statistically significant difference between /u/ and /ụ/ with respect to F1 and spectral slope, and it is the speaker NPZ who has distinct mean values for these vowels in Fig 3.17 (Chapter 3). This discrepancy needs further investigation, which would involve more stimuli from a wider set of speakers and more subjects for the perception test.

The analysis of the minimal pair /hiwli/ and /hịwlị/ confirms the results of the acoustic study in that it shows a complete merger of /i/ and /ị/ both in acoustics and perception. In Fig 6.4 I provide the F1/F2 distribution for the first syllable vowels in the words /hiwli/ and /hịwlị/ for two speakers. Both of them show a strong overlap between the set 1 and set 2 vowels.

Fig. 6.4. F1/F2 distribution for the first vowel in the words /hiwli/ and /hịwlị/, pronounced by the male speaker MVK (left) and female speaker NPZ (right).



The responses to these stimuli are given in Table 6.5. As is evident from the table, the subjects were not able to identify the words containing the vowels /i/ and /ị/. It is important to note that even though the proportion of correct responses to NPZ's /hiwli/ and MVK's /hiwli/ is the same (three correct responses to 5 incorrect ones), the subjects who gave correct responses to NPZ's stimulus are not the same as those who gave correct responses to MVK's stimulus. If one looks closely at who exactly gave correct or incorrect answers to particular stimuli, the distribution of the responses is still close to random: none of the subjects gave more than two correct responses to these four stimuli. Thus, there is no subject who can identify all these words correctly.

Table 6.5. The distribution of correct and incorrect responses to the stimulus of set 1 /hiwli/ and of set 2 /hịwlị/.

	correct	incorrect
	NPZ's responses to her own stimuli	
set 1 hiwli	0	1
set 2 hịwlị	1	0
	NPZ's responses to MVK's stimuli	
set 1 hiwli	1	0
set 2 hịwlị	0	1
	responses of the others to NPZ's stimuli	
set 1 hiwli	3	5
set 2 hịwlị	2	6
	responses of the others to MVK's stimuli	
set 1 hiwli	3	5
set 2 hịwlị	4	4

With respect to the differentiation between vowels of the two harmonic sets in written speech, there is some asymmetry: unlike the other vowels, in the standard Even orthography high vowels are not opposed. So one might assume that it is the knowledge of the orthographical representation which has influenced the phonemic boundaries and made two distinct phonemes so similar in production – or even caused a merger – that they are not even identifiable perceptually anymore. However, from what I know about the usage of Even as a written language, it has always been very limited and thus could not have been so influential. The contemporary situation concerning the written form of Even, as well as the factors which led to its development are described by Burykin (2004). As I mentioned in Chapter 1, most Even speakers of Sebian-Küöl are trilingual in Russian, Even and Sakha. Despite the fact that they are literate in Even, this is the language they use least of all in its written form. The only exceptions are those who use it professionally as Even scholars or teachers of Even language and literature. Interestingly, one of my language consultants, who received a diploma degree in Even philology at the Yakutsk State University (now North-Eastern Federal University) and who was one of the main collaborators during the DoBeS project, tends to differentiate set 1 and set 2 high vowels in her transcriptions of the narratives for the project. She uses the Latin character <i> for the set 2 vowel /ị/ (as opposed to the Cyrillic <и> for set 1 /i/) and the Sakha character <γ> for set 1/u/ (as opposed to the Cyrillic <у> for set 2 /ụ/).

However, as the perception test shows, she cannot differentiate the two forms of the high vowels. It would seem that during her studies at the university this speaker was acquainted with the descriptions of Novikova (1960), Lebedev (1978, 1982) and the other classics of Even studies and extended their description of Even vowels to her native dialect. Theoretically, this style of writing might support the separation of the phonemes in the future, but, as I said above, the impact of the written language on the everyday usage of spoken language seems to be minimal.

Interestingly, in her phonetic description of the Sebian-Küöl dialect Kuz'mina (2010: 15-19) makes a distinction between set 1 /u/ and set 2 /ụ/, but not between i-vowels. This reflects the findings of my acoustic study in Chapter 3. However, Kuz'mina herself was a subject for the perception test and, like the other subjects, was not able to identify the stimuli with the vowel /u/ correctly.

Another interesting phenomenon, which is in line with the discussion of the near-mergers and mergers in section 6.3, is the change of class membership between harmonic sets. In the corpus of the narratives recorded in Sebian-Küöl I found an example of a set 1 word /čupter-/ 'slide.backwards' which corresponds to the set 2 word /čụptar-/ as it is found in the dictionaries (Cincius & Rishes 1952, Robbek & Robbek 2005). Unfortunately, it occurs only once in the corpus and it is impossible to say if it is a feature of this particular speaker or a dialectal trait. Nevertheless, its presence in the dictionaries as a set 2 word certainly shows that a change of set membership is also possible. The prerequisites for such a change must have been the considerable perceptive proximity of set 1 /u/ and set 2 /ụ/ as well as the unclear quality of the reduced vowel in the second syllable. This is not the only example of such a change, though apparently the change of set membership does not happen frequently. Another example found in Sebian-Küöl in the narratives of two other speakers is the set 1 word /hiekite/ for 'larch', which is found in the dictionaries as well as in the speech of other speakers from the same dialect as the set 2 word /hịakịta/. (The corresponding form in the Bystraia dialect is /ịakịta/ with the loss of initial /h/). The opposite change from set 1 to set 2 is observed in the Bystraia dialect: the stem of the verb /oːsej-/ 'tease' (set 1) has changed into /ọːsaj-/ (set 2), at least in the speech of two speakers. However, it seems that this phenomenon might be even more widespread in the Bystraia dialect, since this dialect has a tendency to reduce vowels of the suffixes both quantitatively and qualitatively, so that they hardly differ (and are orthographically represented with one and the same Cyrillic character <ы>, see below).

6.5 Consonantal cues in the dialect of the Bystraia district: possible change of the whole phonological system

Chapter 5 was devoted to the acoustic analysis of the three consonants /l/, /r/ and /k/, which have different realizations depending on the harmonic set of the word. This feature was not found in the Sebian dialect. The perception analysis in Chapter 4 is consistent with these results: it was shown that the presence of these consonants in the word helps the speakers of the Bystraia dialect to recognize the stimuli correctly, whereas there was no such effect for the speakers from Sebian-Küöl. On the other hand, the change in the vowel systems, namely the tendency to merge the harmonic pairs of high vowels, is observed in both dialects (with respect to the i-vowel in Sebian-Küöl one should rather speak about a completed merger). Thus, the Bystraia dialect reveals changes in both the vowel and the consonantal system.

As was briefly discussed in section 5.1, a similar change was observed in the phonological system of the Turkic language Western Karaim (Stachowski 2009). In this language, a series of palatalized consonants was developed at the same time as the classical Turkic eight-vowel system was restructured: non-initial front vowels changed into corresponding back vowels. Nowadays, initial front vowels do not trigger the use of front vowels in the following syllables, but they trigger the use of the palatalized consonants instead. For example, initial /e/ does not trigger a front vowel in the next syllable, as previously; however, the consonants are now palatalized: **emen* > *eḿań* 'oak' (Stachowski 2009: 160). In this way, the harmony system, which was previously based on vowels, is transferred to the consonant opposition. In my opinion, the phonological system in the Bystraia dialect is changing in the same direction, though it is still far from being completely restructured. According to my hypothesis, the Bystraia dialect is losing the harmonic opposition expressed by vowels. The evidence for this hypothesis consists of several facts. With respect to the vowel system, I observe a tendency for the merger of the harmonic pairs of high vowels in the roots. As was shown above, some speakers keep the vowels distinct acoustically (in their production), but these vowels are not recognized correctly by the other speakers, which is a condition for the near-merger. Near-mergers of /i/ ~ /i̯/ and /u/ ~ /u̯/ seem to be a transitional phase to the complete merger of high vowels. The use of the mid back set 1 /o/ in roots is restricted to a very limited context (it has to precede certain suffixes with /e/, otherwise it is changed into /u/). The diphthongoid vowels are not strictly opposed in the Bystraia dialect either: in section 2.2.1 I provide several examples of the confusion between set 1 and set 2 diphthongoid vowels, as well as examples of the monophthongization of set 1 /ie/. The other process which might affect the system of vowel harmony is the process of vowel reduction in the suffixes. Actually, this process is so strong in the Bystraia dialect that it can affect even the root-vowels (e.g. /ereger/ [ɨrəgər] 'always'). This process becomes evident in the analysis of written texts in Bystraia Even (e.g. the speakers' transcriptions of their own narratives): schwa-like reduced vowels are designated with the Cyrillic <ы>, which can replace different full vowels such as /e/, /a/, /u/, /u̜/, /i/, /i̜/ independently of their set, which is not marked orthographically in this case. These arguments stand for the tendency to lose the vowel opposition in set. On the other hand, the results of the perception and acoustic studies reveal that the consonants play an important role in those cases where the vowel opposition is not helpful any more. The variants which were merely allophonic depending on the vowel set have become phonemes, since they are used for word discrimination by the speakers.

It is beyond any doubt that further acoustic and perception studies of the other consonants would be helpful. It seems that not the entire consonantal system is involved in this process, but only a subset. For example, as shown in the perception study (Chapter 4) /j/, /s/ and nasal consonants do not serve as such perceptual cues: their presence in the stimuli did not help the speakers to give correct responses. Moreover, an additional acoustic study might elucidate if the reduced vowels still follow the rule of vowel harmony, or if they are all just schwa-like vowels which do not differ depending on the set of the word. One possibility would be to compare the acoustic properties of reduced vowels of suffixes in quasi-minimal pairs of different sets. Another option for such an analysis would be to trace the change of one parameter (e.g. F1) within all the vowels of a word to see if the root vowel can possibly influence the following vowels.

The restructured phonological system of Bystraia Even as described above resembles the phonological system of Russian in several ways (e.g. Kodzasov & Krivnova, 2001: 359-367). First, the reduction of suffix vowels in Bystraia is similar to neutralization of reduced vowels in non-stressed positions in Russian. Secondly, the opposition of the velarized and palatalized lateral in Bystraia is reminiscent of the two series of palatalized and non-palatalized consonants in Russian. Thirdly, the overall vowel configuration of Bystraia, if one considers the mergers of the high vowels and the questionable status of the diphthongoid vowels, is similar to the Russian vowel inventory: /i e a o u/. However, it is rather improbable that this resemblance was caused by contact with Russian. Despite a century of Even-Russian contact on Kamchatka, the contact situation differs from gradual language death which would be rather expected[3]. Campbell & Muntzel (1989: 185) note, "this situation [the situation of gradual death – N.A.] is characterized by a proficiency continuum determined principally by age". However, proficiency level in Bystraia Even is determined rather by personal history of particular speakers, not the age. As discussed in 3.2.1.1, the Even speakers I had a chance to work with for my dissertation are highly proficient in their native language, had a full command of both Even and Russian and did not have code-switching in their narratives. But within the DoBeS project we also collected data from some other

[3] I thank Brigitte Pakendorf for this observation.

speakers who experienced difficulties in remembering Even words and controlling code switching. Some of them were older than the speakers I used to work with for my dissertation. So, the age is not a decisive factor. At the same time, with a high degree of confidence one can say that the tendencies described above will not continue in the following generations, since at the moment there are only some elderly speakers who have a good command of the language and there are no Even adolescents or children in the Bystraia district for whom Even is the mother tongue.

With respect to the vowel mergers I observed similar tendencies in the Bystraia district and in Sebian-Küöl. This fact suggests that the process of the mergers in the harmonic pairs of high vowels could have started a long time before the contact with Russian and independently from it. From what is known about the variation in Even dialects, it might be that this process was slower in some dialects than in others. Probably in the Ola dialect, the phonology of which was described by Novikova (1960), the vowel opposition was more pronounced. Unfortunately, there are no contemporary recordings of this dialect, as far as I am aware.

Unlike the Bystraia dialect, in the dialect of Sebian-Küöl the set distinction seems to be lost only for the high vowels. The consistent use of /e/ ~ /a/, set 1 /o/ ~ set 2 /ọ/, and the diphthongoid vowels supports the existence of vowel harmony in Sebian-Küöl. However, for the roots containing only high vowels, e.g. /is-/ 'to tear off' and /ịs-/ 'to reach', /hut-/ 'to pierce' and /hụt-/ 'to tear itself loose and run off', it cannot be vowel harmony in its pure form that determines the suffix vowels. For roots containing only high vowels it is not the phonetic properties of the vowels that determine the suffix vowels, since set 1 /i/ and set 2 /ị/ are merged completely and set 1 /u/ and set 2 /ụ/ are indistinguishable for the listeners. In Sebian-Küöl, the set distinction for the roots containing high vowels has become a lexical specification (as was proposed for Evenki by Bulatova & Grenoble 1999). One can speak about it as two lexical classes. In the words of one class, roots with high vowels are combined with suffixes containing /e/, set 1 /o/ and /ie/, whereas in the words of the other class, roots with high vowels can take only suffixes with /a/, set 2 /ọ/ and /ịa/. However, for the roots containing non-high vowels vowel harmony is kept in its proper sense, allowing the combinations of vowels from only one and the same set in one word.

Thus, it seems that the Bystraia and Sebian-Küöl dialects of Even are at different stages of language change. Phonetically, the dialect of Sebian-Küöl has lost the set distinction for the high vowels. The dialect of the Bystraia district has gone one step further in this development: in this dialect I observe a tendency to eliminate the set distinction completely. The factors which indicate this tendency were given above.

6.6 Conclusions

The main question of this dissertation was the organization of the vowel system in two Even dialects, the dialect of the Bystraia district and the dialect of Sebian-Küöl. Taking into account the place of Even in the phonological studies of ATR systems (section 3.1.4), a special focus was on the phonetics of the underlying harmonic distinction. In particular, I was interested in the number of vowel phonemes and their role in the process of vowel harmony, i.e. the number of harmonic oppositions. Another interesting phenomenon investigated here was the contribution of the consonantal elements in supporting the system of vowel harmony.

With respect to the underlying harmonic feature, the acoustic analysis showed no consistent pattern which could confirm the ATR-hypothesis (Chapter 3). The only support for the [±ATR] distinction was observed for the back vowels of the Sebian-Küöl dialect: it is based on the combination of differences in F1 and spectral slope. However, the mid back vowels have a significant difference in F2 as well. So, despite the fact that acoustically back vowels in Sebian-Küöl show some features of the [±ATR] distinction, there are different mechanisms supporting the opposition in high and mid back vowels. So the [±ATR] distinction cannot be treated as a single underlying feature for the harmonic opposition even for the back vowels in Sebian-Küöl. The only parameter showing a consistent pattern in both dialects is F1. It is significantly different across all vowel pairs (excluding the i-vowel in Sebian, which shows a clear merger in the acoustic data). For this reason, I see stronger evidence for a distinction in relative height (F1) than for a [±ATR] distinction. Thus, contrary to what was proposed by Ard (1980), Even does not represent an instance of an ATR language. At the same time the [±ATR] distinction in Tungusic languages was largely reconstructed on the basis of Even. Consequently, since Even does not have ATR vowel harmony, the existence of this feature in Tungusic is questionable.

In order to investigate the number of vowel oppositions, I supplemented the acoustic study with three perception experiments (Chapter 4). The results of the perception experiments showed a merger of the harmonic pairs of high vowels both in the dialect of the Bystraia district and in the dialect of Sebian-Küöl. At first glance, these results seem to contradict the results of the acoustic study, which show a consistent difference for most vowel pairs. However, as discussed in sections 6.3 and 6.4, this apparent contradiction can be explained if one assumes a re-structuring of the vowel systems via near-mergers. Thus, I propose to describe the high vowels in the Bystraia dialect and the high back u-vowels in the Sebian dialect in terms of near-mergers. As shown in section 6.4 there is some inter-speaker variation between near-mergers and complete mergers.

The judgments regarding the number of vowel phonemes in the dialects under consideration are based on the perception study, since, by definition, two phonemes are opposed if they are used to distinguish two words (Ladefoged & Johnson 2010: 34). Thus, the number of monophthongs in Table 6.6, which gives the vowel inventories for the Bystraia and Sebian dialects, agrees with the number of monophthongs given in the lower part of Table 6.1, which showed the results of the perception study. As for the diphthongoid vowels in the Bystraia district, due to strong variation both in and among speakers, it is difficult to tell whether they are two distinct phonemes or variants of one and the same phoneme. In the dialect of Sebian, they are consistently used as two opposed phonemes. As in Table 6.1, in Table 6.6 I provide information only on vowel qualities, not on vowel quantity, since it is not yet clear whether there is a phonological length opposition.

Table 6.6. Vowel systems in the dialects of the Bystraia district and of Sebian-Küöl.

	Bystraia dialect			Sebian dialect		
	front	mid	back	front	mid	back
high	i		u	i		u
mid	e		o	e	o	ọ
low	ie/i̯a	a		ie i̯a	a	

Together with similar processes of merging the harmonic pairs of high vowels, I also observed considerable differences in the development of these dialects, with processes occurring in Bystraia that are not taking place in Sebian-Küöl. These include vowel reduction, vowel change (/o/ → /u/ in the majority of contexts), and confusion of the diphthongoid vowels. Moreover, in the Bystraia dialect I discovered that some consonantal cues play an important role for the discrimination between words. It seems that in this dialect variants of liquid consonants and velar/uvular realizations of voiceless stops that were previously allophonic now discriminate members of minimal pairs, i.e. they have acquired phonemic status. The changes observed in the Bystraia dialect point to an ongoing loss of vowel harmony as a consequence of the reduction in vowel oppositions. On the other hand, several new consonantal phonemes are being developed. In the dialect of Sebian-Küöl, in contrast, the vowel changes do not affect the system of consonants, resulting in some ambiguity for words containing only high vowels.

The work on the sound system of Even is still far from complete. There are a number of questions which have to be addressed in the future, such as the role of vowel length, the acoustic properties of the reduced vowels and, especially in the dialect of the Bystraia district, other possible changes in the consonant system. It would also be very helpful to study vowel articulation using advanced techniques like ultrasound analysis in order to confirm the results of my acoustic study. However, through the acoustic measurements and the data gathered in the perception experiments, I hope to have shed more light on the current state of Even dialects and to have introduced new aspects into the discussion of Even phonetics and phonology.

Appendix 1

List of stimuli used for the acoustic analysis (Bystraia dialect)

short			long		
a	asị	‘woman’	aː	baːn	‘lazy’
	tak	‘salt’		gaːd	‘half’
	adal	‘net’		maː-da-j	‘kill-PURP.CVB-PRFL.SG’
	nakat	‘bear.skin’		ọkaːt	‘river’
	akan	‘father’		aːtar	‘dark’
e	kewe	‘jaw’	eː	teːw-ri-n	‘put-PST-POSS.3SG’
	teg-de-j	‘sit-PURP.CVB-PRFL.SG’		toŋeːr	‘lake’
	teti	‘coat’		teːleŋ	‘story’
	tet-če	‘dress.up-PF.PTC’		ikeː-de-j	‘sing-PURP.CVB-PRFL.SG’
	eken	‘mother’		oleː-t-te-j	‘cook-RES-PURP.CVB-PRFL.SG’
				oleː-d-de-j	‘cook-PROGR-PURP.CVB-PRFL.SG’
				ekeː	‘older.sister’
ị	dịl	‘head’	ịː	ịːr-da-j	‘be.angry-PURP.CVB-PRFL.SG’
	ịr-da-j	‘carry-PURP.CVB-PRFL.SG’		ịː-da-j	‘rub-PURP.CVB-PRFL.SG’
	ịgị	‘forest’		ịː-d-da-n	‘rub-PROGR-NONFUT-3SG
	gịd	‘spear’			
	asị	‘woman’			
i	digen	‘four’	iː	biː	‘I’
	il	‘soup’		iː	‘you’
	ekič	‘very’		tiːniw	‘tomorrow’
	tik-re-n	‘fall-NONFUT-3SG’		iːt	‘tooth’
	tik-ri-n	‘fall-PST-POSS.3SG’		iː-de-j	‘come-PURP.CVB-PRFL.SG’
	teti	‘coat’			
ụ	ụt-ta-j	‘twist-PURP.CVB-PRFL.SG’	ụː	ụːnadʒ	‘daughter’
	ụt-ča/ụč-ča	‘twist-PF.PTC’		ụːnadʒ-ị	‘daughter-PRFL.SG’

	tụrakị	'crow'		dʒụ:-la	'house-LOC'
	ụdan	'rain'		ụ:na-mŋa	'saw-AGNR'
	ụtakan	'farm.woman'		gụ:d	'high'
u	**u**rke	'door'	u:	b**u:**	'1PL.EX'
	ut	'child'		**u:**-n	'blow-NONFUT.3SG'
	ut-e-s	'child-EP-POSS.2SG'		**u:**-de-j	'blow-PURP.CVB-PRFL.SG'
	turk**u**-de-j	'not.be.able-PURP.CVB-PRFL.SG'			
	turk**u**-t-te-j	'not.be.able-RES-PURP.CVB-PRFL.SG'			
	ekm**u**	'mother.POSS.1SG'			
ọ	ọran	'reindeer'	ọ:	mọ:	'wood'
	ọd-da-j	'finish-PURP.CVB-PRFL.SG'		mọ:-la	'wood-LOC'
	ọd-da-n	'finish-NONFUT-3SG'		ọ:kaj	'agaric'
	čọg	'bell'		dʒọ:n-ča	'remember-PF.PTC'
	ọńa-da-j	'write-PURP.CVB-PRFL.SG'			
o	or-de-j	'go-PURP.CVB-PRFL.SG'[1]	o:	ko:je	'horns'
	koje:-de-j	'look-PURP.CVB-PRFL.SG'		mo:-le	'water-LOC'
	toŋe:r	'lake'		go:n-de-j	'say-PURP.CVB-PRFL.SG'
	ole:-t-te-j	'cook-RES-PURP.CVB-PRFL.SG'		o:ńe-d-de-n	'tie.up-PROGR-PURP.CVB-POSS.3SG'
	ole:-d-de-j	'cook-PROGR-PURP.CVB-PRFL.SG'			

[1] present in the sample of only one speaker (EIA)

Appendix 2

List of stimuli used for vowel analysis (Sebian dialect)

short			long		
a	tak	‘salt’	aː	baːn	‘lazy’
	adal	‘net’		gaːd	‘half’
	abaga	‘grandfather’		maː-ča	‘kill-PF.PTC’
	nakat	‘bear’		ọkaːt	‘river’
	akan	‘older.brother’		haːtar	‘dark’
				họlaːkị	‘downstream’
e	degen	‘flight’	eː	neː-ri-n	‘put-PST-POSS.3SG’
	urge	‘heavy’		neː-re-n	‘put-NONFUT-3SG’
	tet-če	‘dress.up-PF.PTC’		keːńeli	‘bad’
	erte	‘skin’		toŋeːr	‘lake’
	bulde	‘tendons’		ebeː	‘urine’
				ikeː-de-j	‘sing-PURP.CVB-PRFL.SG’
ị	ịbga	‘good’	ịː	hịːr-da-j	‘be.angry-PURP.CVB-PRFL.SG’
	hịgị	‘forest’		hịː-da-j	‘rub-PURP.CVB-PRFL.SG’
	ịs-lị/ịh-lị	‘reach-IMP.2SG’			
	ịd-ča	‘comb-PF.PTC’			
	gịd	‘spear’			
i	teti	‘coat’	iː	iːje	‘horns’
	ewe-di	‘Even-ADJR’		hiː	‘you’
	tik-re-n	‘fall-NONFUT-3SG’		biː	‘I’
	is-te-j	‘tear.away-PURP.CVB-PRFL.SG’		iːt	‘tooth’
	ih-li/is-li	‘tear.away-IMP.2SG’		iː-de-j	‘come-PURP.CVB-PRFL.SG’
				iː-če	‘come-PF.PTC’

ụ	ụč-ča/ụt-ča ‘twist-PF.PTC’ ụ-ča-n ‘twist-PF.PTC-POSS.3SG’ dụk-ta-j ‘write-PURP.CVB-PRFL.SG’ dụk-lị ‘write-IMP.2SG’ bụg ‘nature’ bụg-la ‘nature-LOC’ tụdʒ-la/tụd-la ‘tin-LOC’	ụː	hụːna-da-j ‘saw-PURP.CVB-PRFL.SG’ čụːrịt ‘beads’ gụːd ‘high’ ụː-da-j ‘mount.a.reindeer-PURP.CVB-PRFL.SG’ ụː-d-da-n ‘mount.a.reindeer-PROGR-NONFUT-3SG’ dʒụː-la ‘house-LOC’
u	mut ‘we’ hut-ti-n ‘punch-PST-POSS.3SG’ tut-ti-n ‘run.away-PST-POSS.3SG’ hut ‘child’ hut-e-n ‘child-EP-POSS.3SG’ ekmu/ejmu ‘mother.POSS.1SG’ irel-du ‘summer-DAT’ ur ‘belly’	uː	uːr ‘recent’ huː-de-j ‘blow-PURP.CVB-PRFL.SG’ huː-n ‘blow-NONFUT.3SG’ huː-d-de-j ‘blow-PROGR-PURP.CVB-PRFL.SG’ huː-d-de-n ‘blow-PROGR-NONFUT-3SG’
ọ	ọran ‘reindeer’ ọd-da-j ‘finish-PURP.CVB-PRFL.SG’ ọd-da-n ‘finish-NONFUT-3SG’ gọr ‘far’ čọg ‘bell’	ọː	mọːkịŋa ‘nature’ mọː ‘wood’ ọː-lị ‘make-IMP.2SG’ ọː-ča ‘make-PF.PTC’
o	omen ‘one’ ogin ‘top’ bohke ‘ice’ hor-de-j ‘go-PURP.CVB-PRFL.SG’ noste ‘young’	oː	moː ‘water’ toːr ‘earth’ oː-de-j ‘scrape-PURP.CVB-PRFL.SG’ oː-če ‘scrape-PF.PTC’ oːs ‘sleeve’ oːh-e-s ‘sleeve-EP- POSS.2SG’

Appendix 3

List of stimuli used for the perception experiment 1 in the dialect of the Bystraia district

set 1	recorded from	set 2	recorded from
moːle ‘on the tree’	VIA	mọːla ‘in the water’	VIA, EIA
ojle ‘on the top’	VIA, EIA	ọjla ‘on the clothes’	VIA, EIA
istej ‘tear away’	VIA, EIA	ịstaj ‘reach’	VIA, EIA
irli ‘be cooked’	VIA, EIA	ịrlị ‘drag’	VIA, VAC
irden ‘to be cooked’	VIA, EIA	ịrdan ‘to drag’	EIA
ussin ‘splashed’	VIA, EIA	ụssịn ‘cut off’	VIA, EIA
ussin ‘pulled out’	VIA, EIA		
ustej ‘splash’	VIA, EIA	ụstaj ‘cut off’	VIA, EIA
ustej ‘pull out’	VIA		
uttin ‘pierced’	VIA, EIA		
uttin ‘fixed’	VIA, EIA		
uttin ‘had a rest’	VIA, EIA		
udej ‘scrape reindeer hide’	VIA, EIA	ụːdaj ‘to mount a reindeer’	VIA, EIA
uːnte ‘different’	VIA, EIA	ụːnta ‘deep’	VIA, EIA
		ụkrịn ‘removed the bark’	VIA, EIA

Appendix 4

List of stimuli used for the perception experiment 1 in the dialect of Sebian-Küöl

set 1	recorded from	set 2	recorded from
ildej 'remove the bark'	MVK, NPZ	ịldaj 'get up'	MVK, NPZ
okeldej 'suck'	MVK, NPZ	ọkaldaj 'eat berries'	NPZ
mo:le 'on the tree'	MVK, NPZ	mọ:la 'in the water'	MVK, NPZ
ulden 'its meat'	MVK, NPZ	ụldan 'has been heard'	NPZ
u:llen 'started to melt'	MVK, NPZ	ụ:llan 'person who is skilled at mounting a reindeer'	NPZ
istej 'tear off'	NPZ	ịstaj 'reach'	MVK, NPZ
o:če 'scraped reindeer hide'	MVK, NPZ	ọ:ča 'made, finished'	MVK, NPZ
hutten 'pierced'	MVK, NPZ	hụttan 'tore itself loose and ran off'	NPZ
hiwdej 'extinguish'	MVK, NPZ	hịwdaj 'turn inside out'	MVK, NPZ
ujun 'nine'	MVK, NPZ	ụjụn 'ford a river'	MVK, NPZ
illi 'remove the bark'	MVK, NPZ	ịllị 'get up'	MVK, NPZ
huttin 'pierced'	MVK, NPZ	hụttịn 'tore itself loose and ran off'	NPZ
hiwli 'extinguish'	MVK, NPZ	hịwlị 'turn inside out'	MVK, NPZ
isli 'tear off'	NPZ	ịslị 'reach'	MVK, NPZ

Appendix 5

List of original (non-modified) stimuli used for the perception experiment 2 in the dialect of the Bystraia district

set 1	recorded from	set 2	recorded from
irri 'being cooked'	VIA, EIA	ịrrị 'dragging'	VIA, EIA
issi 'tearing away'	VIA, EIA	ịssị 'reaching'	VIA, EIA
ujun 'nine'	VIA, EIA	ụjụn 'ford a river'	VIA, EIA
unŋi 'yours'	VIA, EIA	ụnŋị 'owner'	VIA, EIA

List of original (non-modified) stimuli used for the perception experiment 2 in the dialect of Sebian-Küöl

set 1	recorded from	set 2	recorded from
isli 'tear off'	NPZ	ịslị 'reach'	MVK, NPZ
hiwli 'extinguish'	MVK, NPZ	hịwlị 'turn inside out'	MVK, NPZ
ujun 'nine'	MVK, NPZ	ụjụn 'ford a river'	MVK, NPZ
illi 'remove the bark'	MVK, NPZ	ịllị 'get up'	MVK, NPZ
huttin 'pierced'	MVK, NPZ	hụttịn 'tore itself loose and ran off'	NPZ

Appendix 6

List of stimuli used for the perception experiment 3 in the dialect of the Bystraia district

set 1	recorded from	suffix consonant
irden ‘to be cooked’	EIA	original
irden ‘to be cooked’	EIA	from set 2 word
istej ‘tear away’	VIA, EIA	original
istej ‘tear away’	VIA, EIA	from set 2 word
ustej ‘splash’	VIA, EIA	original
ustej ‘splash’	VIA, EIA	from set 2 word
u:dej ‘scrape the reindeer skin’	VIA, EIA	original
u:dej ‘scrape the reindeer skin’	VIA, EIA	from set 2 word
mo:le ‘in the water’	VIA, EIA	
u:nte ‘different’	VIA	
set 2	recorded from	suffix consonant
ịrdan ‘to drag’	EIA	original
ịrdan ‘to drag’	EIA	from set 1 word
ịstaj ‘reach’	VIA, EIA	original
ịstaj ‘reach’	VIA, EIA	from set 1 word
ụstaj ‘cut off’	VIA, EIA	original
ụstaj ‘cut off’	VIA, EIA	from set 1 word
ụ:daj ‘to mount a reindeer’	VIA, EIA	original
ụ:daj ‘to mount a reindeer’	VIA, EIA	from set 1 word
mọ:la ‘in the water’	VIA, EIA	
ụ:nta ‘deep’	VIA, EIA	

Appendix 7

List of stimuli used for the perception experiment 3 in the dialect of Sebian-Küöl

set 1	recorded from	suffix consonant
ildej 'remove the bark'	MVK, NPZ	original
ildej 'remove the bark'	MVK	from set 2 word
istej 'tear off'	NPZ	original
istej 'tear off'	NPZ	from set 2 word
hutten 'pierced'	MVK, NPZ	original
hutten 'pierced'	NPZ	from set 2 word
huttin 'pierced'	MVK, NPZ	original
huttin 'pierced'	NPZ	from set 2 word
hiwdej 'extinguish'	MVK, NPZ	original
hiwdej 'extinguish'	MVK, NPZ	from set 2 word
ulden 'its meat'	MVK, NPZ	original
ulden 'its meat'	NPZ	from set 2 word
set 2	recorded from	suffix consonant
ịldaj 'get up'	MVK, NPZ	original
ịldaj 'get up'	MVK, NPZ	from set 1 word
ịstaj 'reach'	MVK, NPZ	original
ịstaj 'reach'	NPZ	from set 1 word
hụttan 'tore itself loose and ran off'	NPZ	original
hụttan 'tore itself loose and ran off'	NPZ	from set 1 word
hụttịn 'tore itself loose and ran off'	NPZ	original
hụttịn 'tore itself loose and ran off'	NPZ	from set 1 word
hịwdaj 'turn inside out'	MVK, NPZ	original

hịwdaj ‘turn inside out’	MVK, NPZ	from set 1 word
ụldan ‘has been heard’	NPZ	original
ụldan ‘has been heard’	NPZ	from set 1 word

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Summary

Vowel harmony in two Even dialects: Production and perception

The topic of this dissertation is the analysis of vowel systems in two dialects of Even, an endangered Northern Tungusic language spoken in Eastern Siberia. Included in the dissertation are analyses of both acoustic and perception data. The data were collected during fieldwork in the Bystraia district of Central Kamchatka and in the village of Sebian-Küöl in Yakutia. The Bystraia and Sebian dialects are spoken on the periphery of the Even-speaking area separated by almost two thousand kilometers and are undergoing contact influence from neighboring languages. The dialects under examination exhibit some common tendencies in the development of vowel mergers, but at the same time there are salient differences with respect to the role of consonants in vowel harmony.

Even is known as a Tungusic language with a robust system of vowel harmony. The central question of my dissertation is the number of vowel oppositions and the nature of the feature underlying the opposition between harmonic sets. In previous research, this feature was analyzed as pharyngealization, and, later, as [±ATR]. The acoustic data of Bystraia and Sebian Even do not provide evidence for any of these analyses. The data show a consistent pattern for only one acoustic parameter, namely F1, which can be phonologically interpreted as a feature [±height]. Thus, the distinction between the harmonic vowel sets is relative height (with vowels previously analyzed as pharyngealized or [-ATR] being the lower ones). There is only one exception to this pattern: in the acoustic data of Sebian dialect I observe a clear merger of the high front vowels of different sets into a single phoneme /i/.

The acoustic study is supplemented by perceptual data. The results of the perception experiments, which were based on minimal or quasi-minimal pairs, show that in both dialects stimuli containing high vowels are recognized with a low success rate, whereas the presence of /e/ and /a/ in the suffix of a word favors correct recognition. These results suggest that perceptually there is no harmonic opposition for high vowels, i.e., the harmonic pairs of high vowels have merged. Moreover, in the dialect of the Bystraia district certain consonants function as perceptual cues for the harmonic set of a word: words containing liquids or velar/uvular voiceless stops were recognized considerably better than words containing other consonants. In other words, the Bystraia Even harmony system, which was previously based on vowels, is being transferred to the consonant opposition.

At first glance, the results of the perception experiments seem to contradict the results of the acoustic study, which show a consistent difference for most vowel pairs. However, this apparent contradiction can be explained if one assumes a re-structuring of

the vowel systems via near-mergers. Thus, I propose to describe the high vowels in the Bystraia dialect and the high back u-vowels in the Sebian dialect in terms of near-mergers. I also show that there is some inter-speaker variation between near-mergers and complete mergers in the data of both dialects.

Samenvatting

Klinkerharmonie in twee dialecten van het Even: productie en perceptie

Het onderwerp van dit proefschrift is de analyse van de klinkersystemen van twee dialecten van het Even, een bedreigde Noord-Toengoezische taal die gesproken wordt in Oost-Siberië. Het onderzoek is gebaseerd op analyses van zowel akoestische data als perceptie-experimenten. De data werden verzameld tijdens veldwerk in het Bystraja-district in Centraal-Kamchatka, en in het dorp Sebjan Küöl in Jakoetië. De dialecten van Bystraja en Sebjan worden gesproken in de periferie van het Even-sprekende gebied, en liggen bijna tweeduizend kilometer van elkaar vandaan. Beide worden beïnvloed door contact met de aangrenzende talen. In de dialecten die hier onderzocht worden, zijn gemeenschappelijke tendensen waarneembaar in de historische samenval van klinkers maar tegelijkertijd zijn er duidelijke verschillen in de rol die medeklinkers spelen bij klinkerharmonie.

Even staat bekend als een Toengoezische taal met een robuust systeem van klinkerharmonie. De centrale vraag van mijn proefschrift is hoeveel klinkeropposities er zijn in deze dialecten, en wat de aard is van het kenmerk dat ten grondslag ligt aan de oppositie tussen de harmonische sets. In eerder onderzoek werd dit kenmerk geanalyseerd als faryngalisering, en later als [±ATR]. De akoestische data van het Even van Bystraja en Sebjan ondersteunen echter geen van beide analyses. Op basis van de data kan voor slechts één akoestische parameter een consistent patroon worden vastgesteld, namelijk voor F1, die fonologisch geïnterpreteerd kan worden als [±hoogte]. Relatieve hoogte is daarom de belangrijkste onderscheidende factor voor de harmonische klinkersets (waarbij de lage klinkers eerder geanalyseerd werden als gefaryngaliseerd of [-ATR]). Er is slechts een uitzondering op dit patroon: in de akoestische data van het Sebjan-dialect neem ik een duidelijke samenval (*merger*) waar van de hoge voorklinkers van de verschillende sets tot een enkel foneem /i/.

Het akoestische onderzoek wordt aangevuld door perceptiedata. De resultaten van de perceptie-experimenten, die gebaseerd waren op minimale paren of op quasi-minimale paren, laten in beide dialecten een lage herkenningsscore zien voor de stimuli die een hoge klinker bevatten, terwijl de aanwezigheid van /e/ en /a/ in het suffix van een woord een correcte herkenning bevordert. Dit geeft aan dat er perceptief voor de hoge klinkers geen harmonische oppositie is, d.w.z. de harmonische paren van hoge klinkers zijn samengevallen. Bovendien zijn er in het dialect van het Bystraja district bepaalde medeklinkers die functioneren als perceptief signaal om de harmonische set van een woord te bepalen: woorden waarin liquidae of velaire/uvulaire stemloze obstruenten voorkomen, werden aanzienlijk beter herkend dan woorden die andere medeklinkers bevatten. Met andere woorden, het systeem van klankharmonie in het Bystraja Even dat voorheen gebaseerd was op klinkers, verandert langzaam in een systeem dat gebaseerd is op de oppositie van medeklinkers.

Op het eerste gezicht lijken de resultaten van de perceptie-experimenten in tegenspraak te zijn met de resultaten van het akoestische onderzoek. Deze schijnbare contradictie kan echter worden verklaard door de aanname, dat de klinkersystemen geherstructureerd zijn doordat bepaalde klanken bijna zijn samengevallen (*near-mergers*). Daarom stel ik voor om de hoge klinkers het dialect van Bystraja en de hoge achterklinkers in het dialect van Sebjan te beschrijven als bijna-samengevallen klanken. Ook toon ik aan dat er een zekere variatie bestaat tussen sprekers in het gebruik van deze bijna-samengevallen klanken en volledig-samengevallen klanken in de data van beide dialecten.

Curriculum Vitae

Natalia Aralova was born in Mytishchi, Moscow Region (Russia) on May 12th, 1985. She studied linguistics at Moscow State University in the Department for Theoretical and Applied Linguistics, Faculty of Philology from 2002 to 2007. In 2006 she spent one semester in Berlin, attending linguistics courses at Humboldt University. Upon graduation from Moscow State University in 2007 she finished her M.A. equivalent cum laude.

From 2007 to 2009 Aralova worked for a commercial company in the field of computational linguistics (data mining) in Moscow. In 2009 she started a Ph.D. position at Max Planck Institute for Evolutionary Anthropology in Leipzig within the project “Documentation of the dialectal and cultural diversity among Evens in Siberia” funded by VolkswagenStiftung. Since 2012 she has been enrolled as an external doctoral student at University of Amsterdam in Amsterdam Center for Language and Communication.