THE UNIVERSITY OF MANITOBA

AN ACOUSTIC ANALYSIS OF DURATION IN SKOLT SÁMI DISYLLABICS

by

Zita Maria McRobbie

A THESIS
SUBMITTED TO THE FACULTY OF GRADUATE STUDIES
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ZITA MARIA MCROBBIE

A thesis submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfillment of the requirements of the degree of

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ABSTRACT

This dissertation provides an acoustic analysis of duration in Skolt Sámi disyllabics. Inasmuch as there exists no comprehensive analysis of duration in relation to the assumed phonological quantity degrees, the present study is to be considered a first step towards an analysis of the complex question of quantity in Skolt Sámi.

On the basis of the results of the durational measurements made, two important findings have emerged. First, it appears that durational ratios, rather than absolute durational values, are significant in the signalling of differences between the main structural types in the language. Second, it will be argued on the basis of the acoustic analysis of compensatory lengthening, that when considering the domain of quantity, as far as the distribution of duration is concerned, the syllable has to be considered as being relevant within the larger unit, i.e. the disyllabic stress group.

The theoretical implications of this experimental phonetic research are of considerable significance. An attempt to incorporate the results of the present acoustic analysis into the framework of one of the more influential prosodic phonological theories -- moraic phonology -- confirms the assumptions based upon the durational measurements of the relevant segments in the disyllabic stress-group, concerning (i) the importance of prosodic structure differences in the realization of phonological processes, and (ii) the assigning of the proper syllabic structure in conformity with predictions according to the theory concerning universal syllabification procedures.

INTRODUCTION

The Sámi (or Lappish)[1] language has long been considered to have a complex quantity system.[2] The purpose of the present research is to provide a detailed acoustic analysis of duration, the results of which may contribute to a better understanding of quantity in the language under investigation and possibly in all languages where quantity is phonologically relevant. In order to view the research undertaken here in appropriate perspective in terms of the analyzing of phonological quantity, it is essential to give a detailed survey of past and present research in Estonian and Sámi quantity. Only after gaining an understanding of the results achieved thus far may the significance of the present analysis of duration be appreciated.

1. Sámi and Estonian

Sámi and Estonian belong to the Finno-Ugric language family. There are about 30,000 Sámi speakers scattered in the northern-most parts of Sweden, Norway, Finland and the U.S.S.R.

Sámi has ten main dialects[3] and these are divided into numerous subdialects. It is customary to distinguish between

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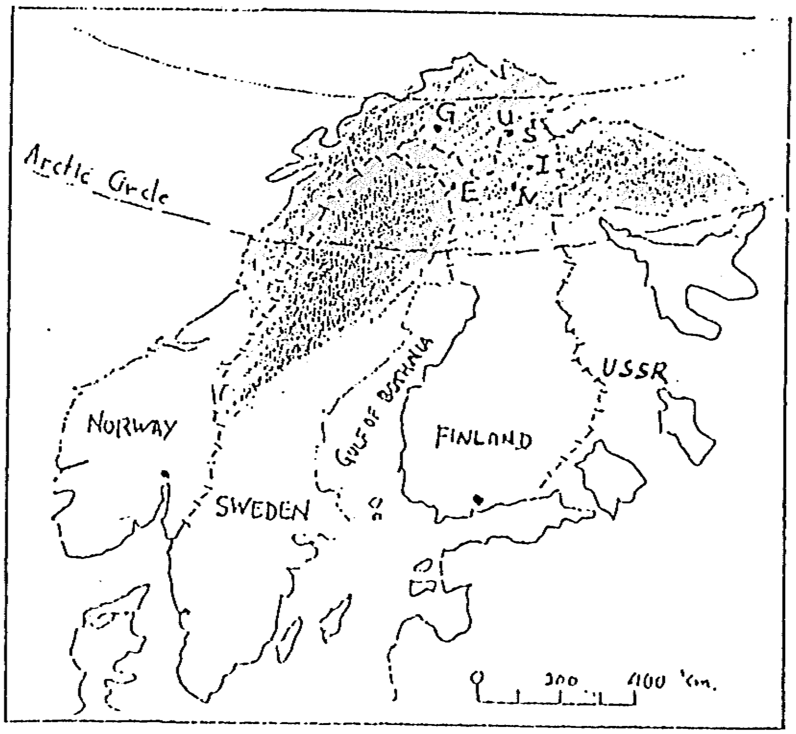
[1] In recent literature the term "Sámi" has been preferred to the former term "Lappish" (Sammallahti 1977, Korhonen et al. 1973, Engstrand 1987a, 1987b, among others). The latter has acquired a pejorative meaning in most dialects.

[2] The term "quantity" and research concerning its various aspects will be discussed in Chapter 1.

[3] It has long been agreed that it is more practical to regard these dialects as separate languages (Korhonen 1981). Differences between the various "dialects" are quite significant; speakers of two dialects are able to understand each other only with great difficulty, if at all. Thus in connection with Sámi the term "dialect" is used here in conformity with the tradition of Finno-Ugric literature, rather than to indicate the degree to which the language diverges.

Figure 1. Habitat of the Sámi



The shaded area denotes the region inhabited by the Sámi. Settlements or towns: E (Enontekiö), I (Inari), G (Guovdageaidnu), S (Sevettijärvi), Iv (Ivalo), U (Utsjoki).

The dialects under investigation in this study belong to the East Sámi group. Here the main dialects are: (i) Inari, (ii) Skolt, and (iii) Kola. I have been working on two Skolt dialects: (i) Suonikylä (or Suenjel) and (ii) Petsamo. The Suonikylä Skolts comprise the majority of all Skolt Sámi speakers (Korhonen 1981:18). The Petsamo Skolts live in North-East Finland scattered between Ivalo and the Russian border[4]. Speakers of the Suonikylä

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[4] This dialect is listed as the Paatsjoki-Petsamo dialect (Korhonen 1981:16). I shall refer to it as the Petsamo dialect in this thesis because the subject whose speech is being analyzed here is from the Petsamo area.

between Ivalo and the Russian border[4]. Speakers of the Suonikylä dialect live mainly around the Sevettijärvi community in North-East Finland, very near to the Norwegian border.

The quantity system in Estonian has received considerable attention in the past four decades.[5] Because there are many similarities between Estonian and Sámi in terms of the characteristics of phonological quantity (see below), reference to the much larger volume of research on quantity in Estonian is essential for a better understanding of quantity in Sámi.[6]

2. The scope of the dissertation

This dissertation will provide empirical evidence for an analysis of duration in the Petsamo and Suonikylä dialects of Skolt Sámi. In relation to the complex issues involved with the analysis of linguistic quantity, this work may be regarded as an essential first step towards an understanding of all aspect of Sámi quantity.

A detailed account of the durational manifestations of Skolt Sámi disyllabic structural types will be given. Inasmuch as no such account has been available as yet, it is hoped that this will contribute to a better appreciation of durational interdependencies in these structural types.

The analysis of durational interdependencies will be carried out on the basis of previous assumptions concerning the relevance of the disyllabic quantity unit. It will be argued, on the basis of

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4 This dialect is listed as the Paatsjoki-Petsamo dialect (Korhonen 1981:16). I shall refer to it as the Petsamo dialect in this thesis because the subject whose speech is being analyzed here is from the Petsamo area.

5 For example, Posti 1950, Ravila 1962, Harms 1962, 1978, Hint 1966, 1972, 1978, 1983, Tauli 1973, Eek 1983, 1987a, 1987b, 1987c, Lehiste 1960, 1965, 1966, 1978, 1983, 1989, Viitso 1979, 1986, Prince 1980, 1983.

6 Besides the obvious similarities between Estonian and Sámi quantity, there are also significant differences. Reference will be made to both throughout Chapter 1.

acoustic analysis of the compensatory lengthening phenomena, that the syllable does indeed play a more significant role in the distribution of duration within the disyllabic unit than has hitherto been assumed. Further, arguments will be presented for the significance of durational ratios.

A durational template will be presented, for the purpose of establishing those values that appear to be significant in the perceiving of phonologically relevant quantities. It will be argued, again on the basis of compensatory lengthening, that consideration of the ratios of duration of the main stress-group locations is essential to an understanding of the durational distributions of the different structural types.

Whether the proposed durational template will prove adequate for distinguishing between the different quantity degrees in Skolt Sámi (as subsequent listening tests will suggest)[7] or whether some configuration of duration with other prosodic features will become necessary (for example, stress, as put forward by Korhonen 1971, 1975),[8] are additional questions I intend to investigate following the clarification of durational relations in this thesis.

Finally, I shall indicate possible ways of incorporating the results of this acoustic analysis into the frameword of moraic phonology. This phonological analysis is intended as but a first attempt towards explaining the characteristics of compensatory lengthening as it appears in Skolt Sámi. It is hoped that even this preliminary phonological analysis will prove sufficient in determining the status of the syllable within the disyllabic stress-group in Skolt Sámi.

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[7]The testing of the validity of the model reflecting the role of duration in the perceiving of phonological quantities will be the subject of subsequent research based upon results appearing in this thesis.

[8] See pp. 175-177 for a discussion of Korhonen's assumptions in this regard.

3. The structure of the dissertation

In the course of the discussion, the role of duration in the complex of quantity analysis will be elaborated in Chapter 1. The procedures employed in the acoustic analysis will be presented in Chapter 2. There the criteria employed for segmentation will be discussed. The organization of the test material by way of grouping the disyllabics into main structural types will also be described. Tabulations of the durational measurements comprise the larger part of Chapter 3. A survey of the distribution of duration in consonant gradation will be given in Chapter 4, together with an indication of the complex interrelationship between alternating grades and the main structural types of disyllabics that comprise the majority of words in Skolt Sámi. The compensatory lengthening phenomenon apparent in the language will be examined in terms of the effects of compensatory lengthening on the duration of the relevant segments in the disyllabic unit in Chapter 5.

On the basis of the results of the durational measurements, interdependencies between these durations will be pointed out in Chapter 6. It will be argued that durational ratios, rather than absolute durational values, are significant in signalling differences between the main structural types. It will be further argued that the status of the syllable within the disyllabic unit has to be reconsidered[9]. Durational changes observed as a result of the compensatory lengthening phenomenon, imply that increases in duration are manifested in the first syllable only. As a consequence, when considering the domain of quantity, as far as the distribution of duration is concerned, the syllable has to be

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[9] In previous research on Sámi quantity the role of the syllable within the disyllabic quantity unit had been considered to be insignificant (E. Itkonen 1946, Sammallahti 1977 and Magga 1984, among others). A more detailed discussion of this view of the syllable is given in Chapters 1, 5 and 6.

considered relevant within the larger unit, i.e. the disyllabic stress-group.

A first attempt at incorporating the result of the acoustic analysis into one of the current phonological theories concerned with prosodic structure of these disyllabic will be included in the last Chapter where the theoretical implications of this experimental phonetic research is discussed.

CHAPTER 1

THE ANALYSIS OF QUANTITY: A SURVEY

This Chapter provides a summary of research into quantity in Sámi and Estonian.

Following a brief overview of the interpretation of the concept of quantity, two crucial related issues will be dealt with: (i) the domain of quantity, and (ii) two vs. three degrees of quantity. In connection with the latter, the configuration of phonetic properties in phonological quantity will be discussed. On the basis of ongoing research into quantity (especially in connection with Estonian), it will be argued here that in the phonological description of languages such as Estonian and most probably Sámi, it is essential to refer to phonetic properties -- namely duration (more specifically, ratios of duration) and pitch movement -- relevant in the perceiving of linguistic quantity.

1. The Definition of Quantity

In Jakobson, Fant and Halle (1967:13) it is claimed that quantity can be defined only with reference to time. Lehiste (1976:226) defines quantity as "the contrastive function of duration within the phonological system." This approach does not regard quantity as the durational property of the syllable only.[10]

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[10] In generative phonologies it has been customary to distinguish between length as a durational property of the segment, and quantity as a durational property of the syllable (for an overview of this approach, see Lass 1984). The numerous analyses attempting to account for phonemic duration have restricted themselves to attempts to fit the various problems in connection with length into the framework of SPE and post-SPE theories based upon attributing this feature to the segment (for example, Kenstowicz 1970, Kisseberth 1973, Pyle 1970, 1971, Guerssel 1977, 1978). As a consequence of concentrating on segmental length, generative phonology

The term quantity thus is applied to duration when it functions as an independent variable in the phonological system of a language. Establishing a deeper understanding of the concept has proved necessary, due to recognition of the fact that there are languages where perceived differences in quantity may not reflect durational differences only. Consequently, descriptions of quantity oppositions have been based on the assumption that besides durational differences, accentual differences may also have to be taken into consideration (Trubetzkoy 1936, 1939, Ravila 1962). As Lehiste has pointed out in several studies on Estonian quantity (e.g. 1975, 1983, 1989), pitch movement may also play a role in phonological quantity (for more on this see pp. 29-37). Recent research in Estonian quantity has also taken account of the role of stress in the realization of different quantity degrees (most notably Eek 1983, 1987a, 1987b, 1987c, Eek and Help 1986, 1987). Thus the determining of what constitutes the independent variable in the occurrence of different quantity degrees represents something of a challenge.

There may also be additional complications in connection with quantity. First, there are languages where it may not be sufficient to refer only to the segment in the description of quantity. It has been recognized for some time that linguistically relevant temporal patterns frequently are manifested in units larger than a segment within the word (Laziczius 1963:116-126, Lehiste 1970:157-167, Lisker 1974:2402-2403, among others). Second, there may be more than two phonologically relevant quantity degrees to account for.[11] The most thoroughly analyzed

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virtually ignores the contrastive function of duration that yields characteristic quantity patterns which have significant phonological relevance in certain languages, and which cannot be described in segmental terms (see Hint 1972).

[11] For an overview of languages with more than two phonological quantities, see Lehiste 1970:45-49.

language in which all these additional factors have to be considered as relevant in the interpreting of phonological quantity, is Estonian (an account of the analysis of all aspects of Estonian quantity will follow in this Chapter). Sámi is another language whose complex quantity patterns have to be accounted for in the phonological description. As with Estonian, in Sámi three considerations apply: (i) the domain of quantity appears to be larger than the segment (see below); (ii) there are three phonologically relevant quantities; (iii) quantity differences do not reflect durational differences only: the configuration of more than one prosodic factor in the resulting quantity degree has to be considered.

2. The Domain of Quantity

The domain of quantity signifies that independent minimal, phonologically relevant quantity unit which may range from a segment to a phonological word (Lehiste 1970:42). Thus this independent unit of quantity may be segmental, syllabic, or disyllabic.

2.1. Segmental Quantity

Two languages will be cited to illustrate segmental quantity. One of these, Finnish, has two distinctive degrees of quantity; the other, Wichita,[12] has three.

Finnish

The distinctive quantities in Finnish are short and long. Apart from some phonotactic restrictions (which are few in

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12 Wichita is a Carboloan language, indigenous to central Oklahoma, Southern Kansas and Northern Texas (Rood 1975).

number),[13] these two quantities combine freely with all consonant and vowel phonemes. Long vowels may stand in opposition to short vowels (*tule* 'come' Imp.Sg2. vs. *tulee* Prs.Sg3., *tuli* 'fire' vs. *tuuli* 'wind'); long consonants may stand in opposition to short consonants (*lippua* 'flag' Part.Sg. vs. *lipua* 'slip' Inf.).

Lehiste (1970) regards the contrast between short and long consonants in Finnish as one of opposition between single and geminate consonants. She also suggests that this kind of opposition could be looked upon as "contrast in the placement of syllable boundaries, accompanied by differences in length" (p. 157). In her view, the fact that opposition between short and long consonants occurs in intervocalic positions only, supports the single vs. geminate opposition assumption.

The contrast between short and long quantity is independent of stress, Finnish having fixed stress on the first syllable. As the above examples show, quantity is distinctive in both stressed and unstressed syllables. Thus it can safely be stated that in Finnish quantity has to be assigned to the segment, to either the vowel or the consonant phoneme. Syllabic quantity in Finnish does not allow for 3-moraic sequences (*tuuuli).[14] Finnish is customarily referred to as a "pure quantitative language", with the segment as the domain of quantity.[15]

Wichita

Rood (1975) argues that Wichita has three degrees of phonological length. The three-way distinction is characteristic, however, only of vowel segments. Thus, in the language

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13 See Lehiste 1965:448-449.

14 A summary of Finnish syllable structure can be found in Karlsson 1983.

15 See Ravila 1962:491.

/V/~/VV/~/V:V/ alternations are attested. Rood claims that these length alternations may occur in any syllable, length being independent of stress. Whether these quantity differences are indeed differences in duration only, with no other prosodic factors playing a role, is a question still to be answered.[16] It seems clear, however, that in Wichita quantity is to be regarded as a property of the segment.

2.2. Syllabic quantity

In languages such as Swedish, Icelandic and Norwegian the domain of quantity clearly is the syllable. The durational relationship is inverse between the vowel and the consonant following it (Lehiste 1970:42). In the configuration of quantity distributions, stress does not affect this compensatory relationship between vowel length and consonant length. As illustration, consider the following example from Swedish: *vi:t* vs. *vit:* 'white' (common and neuter forms). Syllable constraints here do not allow a long vowel followed by a long consonant, nor a short consonant preceded by a short vowel. Thus the sum of quantities in the V:C sequence equals the sum of quantities in the VC: sequence. In Swedish the inverse relationship of quantities in the syllable is compensatory in nature. The total sum of syllable quantities is stable.[17]

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16 Rood (personal communication) did not consider his statement in 1975 regarding the three degrees of length as final. He agreed that further research is essential before the attempting of a final analysis of the characteristics of the quantity system in Wichita.

17 For a comprehensive analysis of quantity patterns in Swedish, see Elert 1964.

2.3. The domain of quantity is the disyllabic unit

The languages where disyllabic quantity units are most thoroughly studied and best known are Estonian and Sámi. Both languages have three distinctive degrees of quantity.

Estonian

Lehiste has argued in a number of publications (1960, 1965, 1966, 1970, 1978 and most recently 1987 and 1989) that Estonian phonology cannot be adequately described without reference to disyllabic "building blocks". Establishing the phonological hierarchy of segment, syllable and disyllabic unit is essential for an understanding of quantity patterns in Estonian.

The three-way contrast can clearly be seen from the following examples:[18] (i) *sage* 'frequent' /Q1/, *saage* 'get' [a:] Imp.Pl2. /Q2/, *saage* [a:a] 'saw' Part.Pl. /Q3/; (ii) *lage* 'bare' /Q1/, *lake* 'thin gruel' /Q2/, *lakke* 'ceiling' Ill.Sg. /Q3/.[19]

In a monosyllabic word in Estonian, quantity appears always in the third degree.[20] Here the vowel can be either long or short, a short being followed always by a long consonant. In polysyllabic words all vowel phonemes (nine in number) may occur in three contrastive quantities in the first syllable. Nine out of the twenty-three diphthongs may occur in two contrastive quantities. In consequent syllables the duration of the occurring diphthong is

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18 The examples here are from Lehiste 1965:449. Q1=quantity one, Q2= quantity two, and Q3=quantity three.

19 In standard Estonian orthography, the characters *b d g* stand for voiceless lenis consonants, intervocalic *p t k* indicate short geminates, *pp tt kk* stand for long geminates. Both long and overlong vowels are symbolized by two-vowel characters.

20 Exceptions are a handful of monosyllabics, including certain pronouns, conjunctions and clitics.

determined by the quantity of the preceding syllable. Monophthongs in non-first syllables are of short duration.

Consonants may occur in three contrastive quantities between odd- and even-numbered syllables. The three-way quantity opposition may also occur between even- and odd-numbered syllables, but only if the preceding syllable is overlong. In cases when the preceding syllable is not overlong, a two-way contrast may be realized between even- and odd-numbered syllables.

When accounting for the distribution of quantity in Estonian, in addition to segmental quantity one must consider syllabic quantity as well. In connection with syllabic quantity, the following points have to be mentioned:[21] (i) three contrastive quantities may occur in the first syllable of a polysyllabic word; (ii) the number of possible contrasts in consequent syllables is determined by the quantity of the odd-numbered syllable[22] (when the odd-numbered syllable is in quantity three, the syllable following it may be in quantity three as well; after a Q1 or Q2 syllable short or non-contrastive long syllables may occur); (iii) syllable quantity is not the sum of its components:[23]

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21 Here I follow Lehiste's method (1965, 1966, 1970, 1978), which is in accordance with that of traditional Finno-Ugric usage, describing the distribution of quantity in relation to the ordered number of syllables. The counting of syllables always proceeds from left to right.

22 A survey of segmental quantity in relation to syllabic quantity can be found in Lehiste (1960, 1965, 1976) and Posti (1950).

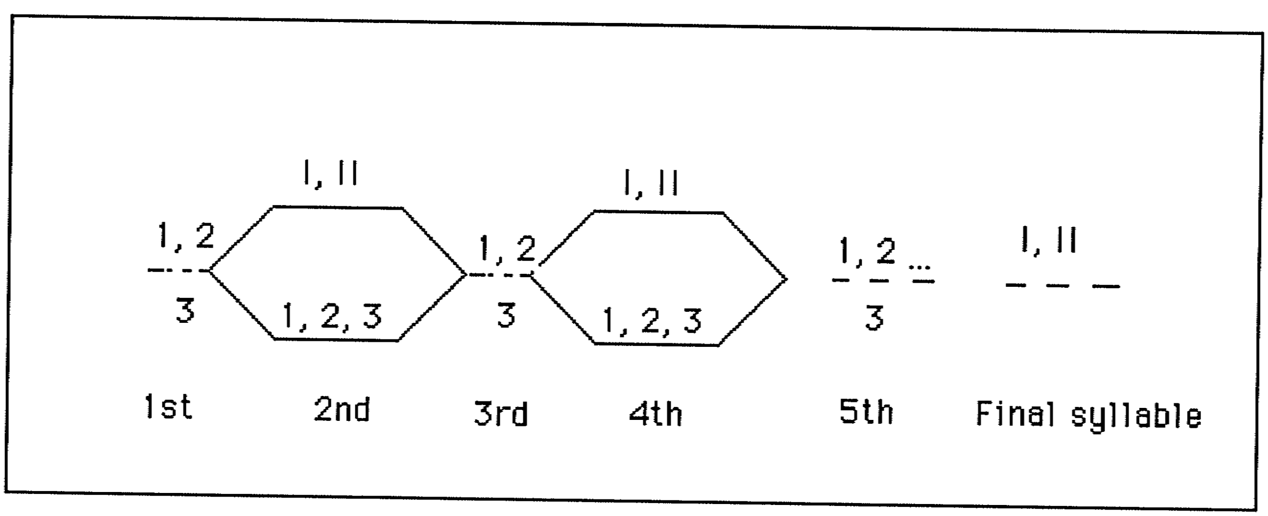
23 The examples cited here were suggested by Lehiste (personal communication).

V/Q2/+C/Q1/ syllable quantity:	/Q2/	*saade* 'sending'	
V/Q2/+C/Q2/	/Q2/	*saate* 'get' Pl2.	
V/Q3/+C/Q3/	/Q3/	*saate* 'sending' Gen.Sg.	
V/Q3/+C/Q1/	/Q3/	*saade* 'hayrick' Part.Pl.	

As may be seen from the above examples, even though the sums of segmental quantities may be the same, as in *saate* and *saade* (2 + 2 in *saate* and 3 + 1 in *saade*), nevertheless syllabic quantities are different (Q2 and Q3 respectively).

In the diagram below (Lehiste 1965) reveals the existence of disyllabic sequences in Estonian emerging on the basis of quantity distribution. (The numbers 1, 2 and 3 refer to syllabic quantities in positions where they are contrastive, the Roman numerals I and II to positions where two-way contrast may occur).

Figure 2. Syllabic Quantity in Estonian



On the basis of the above, one must recognize that segmental quantity cannot be described without reference to the syllable and its position within the word. Thus it may be said that, in order to determine the domain of quantity, a segmental approach does not seem to be a workable strategy. Quantity alternations, which play an essential role in Estonian phonology, must be described by referring to units larger than the segment (such as syllables which are constituents of disyllabic units).

Degree change in Estonian also provides evidence of the phonological relevance of disyllabic units. Lehiste (1978) argues that the factors conditioning degree change cannot be described by referring to segments only. She elaborates what seems to be a crucial argument for rejecting an explanation of degree change solely in segmental terms. Segmentally identical sequences may or may not undergo degree change, depending on their position in the word. For example, the disyllabic word *suka* 'stocking' Gen.Sg. undergoes degree change: *sukka* Part.Sg. However, the same sequence /suka/, when it appears as part of a trisyllabic word -- *kasuka* 'fur coat' -- will not undergo degree change (Lehiste 1978:77).

Sámi

Previous researches (in particular, E. Itkonen's 1946 dissertation on East Lappish quantity, and Bergsland's 1946 grammar of Røros Lappish) have established that in analyzing quantity in Lappish, one must regard disyllabic units -- stress-groups -- as the domain of quantity. There appear to be two reasons for justifying the existence of disyllabic stress-groups in Sámi. First, gradational phenomena are manifested similarly to what was described above regarding Estonian gradation: i.e. identical sequences behave differently and may or may not undergo gradation, depending on the position in the word of the consonants in question.[24] This may be seen, for example, in connection with the so-called subradical gradation, i.e. in the case of suffixal gradation. Here occurrences of the strong vs. weak grade depend on whether the suffix follows an odd- or even-numbered syllable (e.g. *læǯ'ǯap* 'be' Pot.Pl1. vs. *mânâǯæp* 'go' id.)[25] Second, as early as the beginning of this century,[26] experimental analysis of duration within the disyllabic stress-group established the existence of durational interdependencies between the first syllabic vowel, the intervocalic consonant(s) and the second syllabic vowel. Modern acoustic analysis has confirmed the results of this earlier research.[27]

Although the concept of the stress-group as the domain of quantity has proved to be valid in earlier as well as more recent research, it is still far from clear that phonological quantity has its domain in this disyllabic unit. In one of the most recent analyses of a Sámi dialect (the Guovdageaidnu dialect of North Sámi), an attempt was made to confirm the relevance of the disyllabic stress-group experimentally through demonstrating the existence of durational interdependencies within the disyllabic stress-group (Magga 1984). Magga assumes (p. 14) the validity of Sammallahti's analysis (1975), according to which vowels in the first syllable have three quantities, intervocalic consonants also have three quantities, and second syllabic vowels have two

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[24] See Korhonen 1981:149-153.

[25] The examples are from North Sámi (Korhonen 1981:149). In North Sámi orthography *â* = IPA [ɔ]. ['] indicates the strong grade of consonants.

[26] Äimä 1918, Lagercrantz 1927, E. Itkonen 1946.

[27] Most notably Magga 1984.

quantities.[28] However, from Magga's examination of Guovdageaidnu disyllabics, it is not at all evident that contrastive quantities actually do have their domain beyond the segment. Further, there is no indication that in consequent syllables the third quantity degree occurs in such a regular fashion as can be shown to be the case in Estonian quantity.

Another essential difference between Estonian and Sámi disyllabic units is that, while in Estonian the syllable is clearly recognized as an essential constituent of the disyllabic quantity unit, this is not so in Sámi. In fact, it has been a generally held view among Lappologists that the syllable plays no role in the distribution of quantity. This is the approach taken in E. Itkonen's analysis of East Sámi structural types (1946). He rejects Lagencrantz's earlier thesis of the crucial role played by the first syllabic vowel and the consonant(s) following it in the distribution of quantity within the syllable, and criticizes Lagencratz for failing to attribute importance to the quantity apparent in the second syllable.[29] Itkonen (following Äimä's approach)[30] states:

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28 Magga's analysis does not consider the phonological relevance of these quantities; thus the quantity degrees he referred to are to be interpreted as phonetic quantities.

29 Lagercrantz 1927.

30 It was Äimä (1918) who first stated explicitly that the duration of the first syllable is not independent of the duration of the second syllable. Previously, Genetz (1896) had pointed out the effect of second syllabic vowel quality on the vowel in the first syllable. This effect is the well known metaphony (or umlaut) phenomenon found in Sámi (Korhonen 1967, 1969, McRobbie 1981). In my opinion, Magga's reference to Genetz, when the former seeks to establish the interdependency of the two syllables, is not convincing. Magga states: "Genetz showed in 1896 that the quality of the first syllable vowels in bisyllabics is dependent on the quality of the second syllable vowel. This might indicate that also quantitatively Lappish bisyllabics form a unit themselves which is not to be split in smaller independent quantitative particles." (p.13) This assumes that interdependencies of quantity may cooccur with other interdependencies (i.e. quality of vowels). This claim needs substantiation. Such substantiation, however, is not provided in Magga's analysis; thus the

> Der Strukturtypus wird nicht nur durch die gegenseitigen Verhältnisse des Stammvokalismus (d.h. des Vokalismus der ersten Silbe) und -konsonantismus bestimmt, wie Lagercrantz meint, sondern man muss ihm den Lautkomplex zurechnen, der vom Beginn des haupt- oder stark nebenbetonten Vokals bis an das Ende des folgenden, schwachbetonten Vokals reicht. (p. viii)

He also makes it clear that the syllable has no significance within the stress-group (= Sprechtakt):

> Heute ist man vollkommen im klaren darüber, dass die Grundelemente im Sprachrhythmus die vom Anfang eines Vokals - des Trägers des Intensitätsgipfels - bis zum Anfang des folgenden Vokals reichenden Lautkomplexe sind. Die Silbe dagegen ist kein rhythmisches Element. (p.14)

To regard the syllable as significant in terms of the domain of quantity, has not been considered plausible in more recent research either. Sammallahti (1977) clearly states that because all structural restrictions seem to centre in syllable boundaries, syllables play no role in the stress-group (p. 109). Magga also downplays the syllable as a possible candidate for quantity research, on the grounds that locating the exact boundaries would be, at least from the point of view of his particular study, of but minor importance in explaining the quantity system of disyllabic words in the Guovdagaeidnu dialect (1984:13). However, in this dissertation it will be demonstrated (through analysing durational interdependencies within the disyllabic stress-group) that, at least where such relationships are concerned, the syllable indeed does have a significant role within the disyllabic stress-group.

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assumption, a not very plausible one in any case, needs further evidence before it could be considered as valid.

It is not obvious on the basis of research to date which unit (segment, syllable or disyllabic stress-group) may be considered to be the domain of the phonologically relevant quantity, despite the extensive and valuable work done on Sámi quantity. To illustrate the difficulties, I shall give a brief summary of the most important facts concerning phonological quantity in Sámi.

In Sámi three-way quantity opposition is characterized only in connection with the syllable carrying the main stress. The following illustrate this: *goaro* 'sew' Imp.Sg2. /Q1/, *goarro* [r'r] Prs.Sg3. /Q2/, and *goar'ro* [r:r] Prs.Part. /Q3/.[31] Two-way distinctions may occur in connection with odd-numbered syllables: e.g. *vânâtallat* 'stretch' Inf. /Q2/, *vânâtalam* Sg1. /Q1/.

The concept of the disyllabic stress-group as the domain of quantity (see above) was not explicitly employed in phonological analyses of Sámi until 1977, when Sammallahti applied it in the phonological description of a North Sámi dialect (East-Enontekiö dialect). He refined the stress-group concept, pointing out the need to examine the durational values of the crucial segments (i.e. main stress-group locations)[32] in the stress-group: that is, the durational values of the vowel centre, consonant centre and latus:[33]

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31 The examples here are from North Sámi. In indicating length, throughout the text I shall follow the IPA conventions rather than the Finno-Ugric. Thus half-long segments are represented by the diacritics ['] after the relevant characters, long segments by the diacritic [:].

32 The term "stress-group location" though extensively used in recent research on Sámi quantity is not considered an appropriate one by Lehiste (personal communication). She points out possible ambiguities associated with this term, i.e. "a stress group location is the location of the stress-group" -- an interpretation not intended by Magga (1984) and Sammallahti (1977). On the basis of the present analysis the relevance of the "stress-group location" concept will be questioned and argued against (Chapter 6). See also fn. 33.

33 In his analysis, the first syllabic vowel is referred to as "vowel centre", intervocalic consonant(s) as "consonant centre", and the vowel in the

(initium)	Vowel Centre	Consonant Centre	Latus	(finis)	
p	*aa*	*hk*	*a*	*s*	
					'hot'

Both Sammallahti and Magga (who followed the former's approach in his experimental study referred to earlier) restrict their investigations to the first stress-group of the word. Their concern was to relate durational values of the relevant stress-group location to the surfacing three-way quantity degrees. In order to determine the degrees of the key stress-group locations, according to Sammallahti, it is necessary to assume the following:

(i) Consonants in the consonant centre may represent three different subglottal arrangements:[34]

a. a single subglottal stretch or pulse (C)

b. two subglottal stretches (C˙C)

c. three subglottal stretches (C:C)

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second syllable as "latus". This terminology indicates that syllables have no relevance in quantity distribution within the stress-group. In Chapter 6 the validity of this terminology will be challenged.

34 Sammallahti's aim is ..."to reduce the quantity relations of the consonants to syntagmatic properties to such an extent that in the series *l* - *l̆l* - *l̄l* for example, we will be faced with a subglottal arrangement of the consonantal sequence. Thus, *l* stands for a phonetic segment belonging to a single subglottal stretch or pulse, *l̆l* extends over two stretches (a geminate consonant), and *l̄l* correspondingly, over three subglottal stretches." (1977:265).

Examples: (C) *pala:ht* 'fear' Prs.Sg2.

(C˙C) *pal˙a˙ht* Inf.

(C:C) *pal:la:ht* Incoat.

(ii) Vowels in the vowel centre may be distinguished by the peak of intensity. Only the vowel /a/ in the vowel centre may have contrastive quantities in front of three-pulsed consonants; all the other vowels, monophthongs and also diphthongs, are short in front of three-pulsed[35] consonants (Magga 1984:16). Long vowels or diphthongs may be of three types:

a. initially stressed long vowels (VV)

b. evenly stressed long vowels (V'V)

c. finally stressed long vowels (VV')

In justifying the dividing of consonants into three groups as indicated above, Sammallahti refers to Harms's spectrographic analysis of data (Harms 1975) from Utsjoki (another North Sámi dialect) where the existence of the extra syllabic pulse in C'C was shown.[36]

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35 Harms (1975) claims that there is an extra pulse associated with consonants observable in the spectrograms of Utsjoki (North Sámi dialect) data. So far as I am aware, there is no evidence of the existence of this extra pulse other than that presented by Harms. However, it is my view that his spectrographic data have not been interpreted convincingly. His claim that an additional increase in amplitude is clearly discernible in the spectrograms (1975:436), is hard to accept especially in connection with plosives (doubts were expressed in this respect also by Lehiste, in a personal communication).

36 See Sammallahti 1982:111.

To conclude this section on the domain of quantity in Sámi, it can be stated that so far there has been found no convincing evidence for the stress-group being the domain of linguistically relevant quantity. That the stress-group does indeed play an important role in the distribution of duration is clear from both earlier and more recent research (E. Itkonen 1946, Magga 1984). The relationship of phonological quantity to this rhythmic unit, however, has not yet been clarified.

3. Analysis of quantity: a survey of previous and current research.

In this section two issues will be reviewed on the basis of earlier and current research on quantity. These are: (i) two vs. three-way quantity contrast, and (ii) the configuration of phonetic (suprasegmental) properties in the perceiving of phonological quantity. Available findings and perspectives on future research in connection with Estonian and Sámi quantity will also be discussed.

Whether there exists a binary or ternary quantity system in Estonian and Sámi has been extensively debated for many decades. The difficulty of relating the apparent three-way contrast to the binary opposition assumption of phonological theories has posed a considerable challenge for phonologists up to the present.[37]

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[37] In connection with incorporating the Estonian three-way quantity system into recent phonological frameworks, I may refer to Prince (1980, 1983) and Hayes (1989). For an evaluation of Prince's study, see Lehiste (to appear). For Sámi, Itkonen et al. (1971) provide phonological analyses of several Sámi dialects. A critical evaluation of these studies may be found in Viitso (1974). Because this Chapter seeks to provide no more than an overview of the characteristics of the apparent quantity manifestations and of the research on what constitutes quantity in these languages, it is beyond the scope of this introduction to try to account for the possible limitations of recent phonological theories with regard to quantity analysis. In Chapter 6 a survey and evaluation of ongoing research in this respect will be given.

That Finno-Ugric linguistics has a long tradition of approaching languages from a strictly phonetic perspective has not exactly helped in resolving the problem of incorporating quantity into the framework of available phonological theories. Formerly, Finno-Ugrists were mainly concerned with analysing data with a view to facilitating historical linguistic analysis. Trubetzkoy was one of the first to try to provide an answer to the binary vs. ternary dilemma (1939). His arguments were based on data from Estonian as presented by Polivanov (1928),[38] and from Sámi by Ravila (1932). Trubetzkoy's claim was that both Estonian and Sámi have two distinctive degrees of quantity. He asserted that no language can have more than two phonologically relevant quantities. Where more than two phonological degrees are apparent in a language, the question becomes one of dependent quantities. Trubetzkoy was certainly aware of the existence of three degrees of quantity in both Estonian and Sámi. But he argues that quantity as a distinctive feature is not really relevant in the phonology of these languages; rather, what is involved is a bundle of intensity correlations. Trubetzkoy considers quantity opposition only as a contrast of short vs. long; otherwise he identifies differences in intonation to which quantity is attached as only an accompanying phenomenon. Concerning Estonian, Trubetzkoy concludes that tonal distinction is the essential factor in the phonological system of the language.[39]

Finno-Ugrists generally have been reluctant to accept Trubetzkoy's theory of binary contrast. A typical refutation of his

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[38] It is unfortunate that Trubetzkoy had to rely on Polivanov's work on Estonian. Polivanov's description of Estonian length-alternation is characterized by the introduction of length-intonation types. However, the types he posits are not to be found in any of the Estonian dialects. For an evaluation of Polivanov's analysis, see Harms (1962) or Lehiste (1983).

[39] He was wrong to claim that Q2 has a falling tone and that Q3 is level. In fact falling contour is characteristic for Q3, whereas Q2 is level (Lehiste 1980:198).

argument can be found in Collinder (1951), who points out that in both Estonian and Sámi there are three degrees of quantity, and that Trubetzkoy's distinguishing between only two is misleading.

3.1. Estonian

Since the early thirties, important progress has been made in assembling evidence supporting the binary system theory. Attempts were directed towards separating length from intensity and pitch, arriving at the short vs. long phonological length opposition, and attributing the third quantity to stress or pitch differences in addition to durational contrasts. Three such studies must be mentioned which deal with Estonian quantity relations: Ariste (1933), Põldre (1937) and Sõster (1938). These relate length to intensity, and adopt a segmental approach. The analysis applied in each is based on durational measurement of segments. While they usefully point to correlation between stress and longer duration, they do not relate this to all phonological quantity alternations. They consider stress important only in connection with Q1 and Q2 alternations. All three studies seem to agree that duration is the sole distinguishing factor in the Q2 and Q3 contrast.

It was Posti (1950) who first suggested that opposition between Q2 and Q3 in Estonian is not a segmental but syllabic feature. Although his argument was rejected by some scholars, most notably by Collinder (1951),[40] the concept of syllabic quantity was later adopted and developed in most detail by Tauli (1973). Tauli argues that Estonian quantity phenomena should be interpreted as realizations of two binary prosodic oppositions: (i) phonemic quantity (short vs. long), and (ii) syllabic opposition, or weight of stress (the light stressed syllable vs. the heavy stressed

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40 Collinder points out that Posti's synchronic data are too restricted in scope: "...however, we must admit that he has cleared the way of the only-two-degrees theory of Trubetzkoy by showing that it is not necessary to assume three distinctive degrees in this language." (pp. 31-32)

syllable, corresponding to Q2 and Q3). Tauli refers to Harms (1962) and to Lehiste (1965) who both recognize that Q3 occurs only in a stressed syllable. He also notes that only Q3 may be followed by secondary stress, a fact acknowledged first by Hint (1966).

In connection with the number of quantity degrees in Estonian, a further point must be mentioned here. Several scholars have argued that Estonian has four, not three, distinctive quantities.[41] However, the most recent research shows a trend towards accepting only three quantities. One of the most prominent advocates of the four-way quantity contrast seems to have abandoned his claim (Viitso 1986); another former proponent, Eek (1987b) has reinterpreted the phonetic manifestations that previously were viewed as constituting a fourth degree. In as much as the question has been a major issue in Estonian phonological research it is deserving of a brief summary.[42]

It has for some time been claimed[43] that distinctions can actually be heard between certain words when they appear in the Part.Sg. as against when they appear in the short form of the Ill.Sg. Such distinctions were claimed to be *heard*[44] also in certain words which have the *-da* Infinitive, but not in the Abessive forms of nouns and adjectives, nor as indicated above

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41 Remmel 1975, Eek 1977, 1980a, 1980b, Viitso 1979, 1981, among others.

42 For a more detailed account of the three vs. four phonological quantity theories, see Lehiste 1980, 1989.

43 Lehiste (1980) refers to Mihkel Veske (1879) who reported that he heard an extra overlength in connection with words containing the emphatic particle *-ki*.

44 Lehiste's emphasis (1989:78).

(fn. 43) in words with the emphatic particle *-ki*. Examples to illustrate this are as follows:

a. *linn* 'town' *linna* Gen.Sg. /Q2/ *linna* Part.Sg. /Q3/ *linna* Ill.Sg. /Q4???/

b. *võita* 'to win' /Q3/ *võita* 'butter' Abess.Sg. /Q4??/

c. *saaki* 'prey' Part.Sg. /Q3/ *saakki* 'even the prey' Nom.Sg. /Q4??/

Proponents of the four quantity degree theory approach this question from two different points of view.[45] The first approach argues that there are four different degrees of stress, and that they are contrastive (Eek 1977, Viitso 1981). According to Viitso, for example, monosyllabics may appear in two contrastive degrees Q3 and Q4 due to differences in stress (e.g. <u>suu</u> 'mouth' /Q3/ and <u>suu</u> Gen.Sg. /Q4/). Differences between Q3 and Q4 such as in (a) are also explained by different degrees of stress (Eek 1980b, Remmel 1975). The second approach recognizes word-level tonal differences as contrastive (Lippus, Niit and Remmel 1977), its proponents arguing for the existence of four different contrasting tones also in monosyllables (Helimski 1977).

Hint (1983) rejects the case for there being four contrastive quantities, on the grounds of methodological inconsistencies. Lehiste has examined the analyses of Eek and Remmel, and also questions the validity of the fourth phonological degree; similarly, she expresses doubts concerning the validity of Viitso's and Helimski's phonologically based arguments (Lehiste 1980, 1983).

Lehiste has carried out extensive research aimed at defining exactly what constitutes the independent variable in the perceiving of different quantities. She has conducted several

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[45] For a detailed evaluation of these trends, see Hint 1983.

experiments[46] whose purpose is to define the proportion of phonetic properties relevant in the distinguishing of quantity degrees. One of the most important experiments was carried out during 1970-1975.[47] She prepared test tapes which consisted of synthetically produced acoustic stimuli, designed to pattern the three different degrees in Estonian. These tapes, each containing 252 stimuli, were used to test 26 native speakers of Estonian. Evaluation of the 6552 responses (each listener gave four responses) produced interesting results which shed new light on what may constitute actual criteria for perceiving the various quantities as different. One of the test tapes contained stimuli for the triplet *taba* 'lock' /Q1/ - *tapa* 'kill' Imp.Sg2. /Q2/ - *tappa* 'kill' Inf. /Q3/; the other for the triplet *sada* 'hundred' Nom.Sg. /Q1/ - *saada!* 'send' Imp.Sg2. /Q2/ - *saada* 'get' Inf. /Q3/.

As far as the triplet *taba* - *tapa* - *tappa* is concerned, on the basis of the judgements of the listeners, Lehiste concluded that the duration of the second syllable is relevant in identifying the three quantities. A shorter duration in the second syllable (90 msec) favours an assigning to quantity three, a longer duration (180 msec) favours assignings to quantity one and quantity two. The second syllabic duration is not independently contrastive; what has to be considered here is the ratio between the durations of the first and second syllables. This experiment reveals the manifesting of three-way contrast at the level of the disyllabic sequence. Mention must also be made here of the consonants relevant to the appearing of the three quantity grades. In

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[46] Lehiste 1975, 1989, Fox and Lehiste 1987, 1989.

[47] Details and results of this experiment may be found in Lehiste 1975, 1983.

explaining the possible quantity occurrences in relation to their position in the syllable, Lehiste states:[48]

> ... in triplets like *taba* - *tapa* - *tappa* ... /p/ is in Q1, Q2 and Q3. The segmental quantity of /p/ in *taba* is really non-contrastive; what we have here is different placement of the syllable boundary in the disyllabic sequence. In *taba* -- Q1 -- the syllable boundary is before /b/ , in *tapa* -- Q2 -- the first syllable ends in a short /p/ and the second syllable starts with a non-contrastive initial /p/ (the syllable boundary is within the consonant, approximately in the middle), and in *tappa*, the first syllable ends in a long /p/ and the second syllable starts with the same kind of short /p/ that we get in *taba* and *tapa*.

With the *sada* - *saada!* - *saada* triplet the situation is more complex. The test material consisted of disyllabic sequences of: (i) different first syllabic durations (seven 20 msec steps between 120 and 240 msec), (ii) different second syllabic durations (180 msec, 120 msec and 240 msec), and (iii) three different fundamental frequency patterns (level pattern: 120 Hz; step down pattern: 120 Hz on the first syllable and 80 Hz on the second syllable; and falling pattern: first syllable falling from 120 Hz to 80 Hz, second syllable level at 80 Hz). The results of the listening tests are reproduced here as follows:[49]

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48 Lehiste (personal communications).

49 See Lehiste 1983:17.

Table 1. *Saada* responses with different Fo contours (all V1 durations combined). V2 duration = 90 msec.

Fo contour	Q1	Q2	Q3	Total
Monotone	669	1096	419	2184
Step-down	605	1326	253	2184
Falling on V1	608	688	888	2184
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Total	1882	3110	1560	6552

Table 2. *Saada* responses with different V2 durations (all V1 durations and Fo contours combined).

V2 duration, msec	Q1	Q2	Q3	Total
180	717	1114	353	2184
120	596	1054	534	2184
90	569	942	673	2184
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Total	1882	3110	1560	6552

The conclusions clearly evident from these results point to what constitutes the difference between quantity two and quantity three. Thus, whereas the distinction between Q1 and Q2 quantities was made on the basis of durational differences alone, the distinction between Q2 and Q3 was made primarily on the basis of pitch contour, and to a far lesser degree on the basis of duration in the second syllable.

> These results leave no doubt of the perceptual significance of Fo. ... It is important to recall here that there were some durations which could be changed from Q2 and Q3 by the pitch contour alone. In these intermediate durations, then, it was the pitch contour that the listeners used for making the distinction between the words. But pitch is not the only distinction; overlong Q3 is normally longer than long Q2... (Lehiste 1983:18)

Having observed the role of pitch in the perception of degrees of quantity, Lehiste (1983) concludes that in Estonian a prosodic change is in progress: i.e. that tonal patterns form, in place of quantity degree alternations. This assumption is by no means new, Jakobson (1931) having included Estonian in the polytonicity-Sprachbund around the Baltic Sea.[50] Whether or not Estonian is developing into a tonal language lies beyond the scope of the present discussion. What is important, though, is to realize that duration may not be the only component in the prosodic system of Estonian.

More recent research on Estonian quantity appears to give further weight to the role of stress in the analyzing of phonological quantity. A summary together with a critical evaluation of this newest development of the "accent theory" may be found in Lehiste (1989). Here I merely outline the main points of this theory.

Eek and Help (1987) have described Estonian prosody within the framework of metrical theory. According to their interpretation, the "foot is the minimal unit of stress" (p. 220), stress being "the temporally organized amount of speech energy produced by all the activities" of the speech organs. Further, "detailed modifications of a stress impulse may be controlled by two kinds of hypothetical commands." (p. 220) The authors operate with such concepts as "switching command" and "striving command" as signifying the means by which modification of a stress impulse may be controlled, for it is their claim that Estonian can be defined as a quantity and accent language in which syllable switching and foot-striving control strategies together constitute an integral whole. (p. 223) They argue for the necessity of distinguishing between an "even" and a "sharp" accent, on the

50 Jakobson was using Polivanov's data. Lehiste observes (1983) that even though Polivanov's description of Estonian was inadequate, there is little doubt that Estonian prosody does include a tonal component.

basis of manifested articulatory intensity. If the articulatory intensity is distributed evenly over a stressed syllable, without being localized in one part of it, this signifies an even accent; if the articulatory intensity on a long stressed syllable is uneven (=localized), that signifies a sharp accent.

In the course of her paper (1989) Lehiste expresses doubt as to the relevance of distinguishing between even and sharp accents, and indeed as to the relevance of stress altogether in the perceiving of the three different quantity degrees.

> In my first experiment with synthesized speech (Lehiste 1970-75), no such energy contours were synthesized and the listeners were nevertheless capable of distinguishing between the three traditional quantities. It follows then that differences in energy contour are not necessary for distinguishing between the accents Eek calls even and sharp. (Lehiste 1989:81)

Further, she questions the relevance of the concepts "switching command" and "striving command":

> ...if listeners perceive distinctions between accents in words synthesized without attempting to produce "switching" and "striving" types of energy distribution and contact between elements of a syllable, then these commands are not necessary for perception. (Lehiste 1989:81)

Recently Lehiste has confirmed the results of her earlier experiments by means of newer tests constituting discriminatory analysis (Fox and Lehiste 1987, 1989). It is interesting to note, however, that these tests raise certain concerns as to the perceiving of the third degree of quantity.

> ...intersyllabic ratio is sufficient for discrimination between Q3 and Q1. In case of identical overall durations... the "same" judgements of ratios 2:1 and 2:1 were 96.9; in the case of different overall durations..., the recognition score

> dropped to 82.2%, which is still relatively high. In the identification of meaningful words, however, correct identification score never rose above 51%... Thus the addition of the falling contour to the first syllable of an actual word failed to provide the necessary cue for identification at a level better than chance. (Lehiste 1989:85)

That the addition of Fo did not result in higher scores in the judgement of Q3, may suggest that another cue was needed. Lehiste does not exclude the possibility that this additional cue may prove to be one of the features Eek was proposing in his theory outlined earlier.

The above survey of research on Estonian quantity may convey something of the complexity of the issues involved. Such research has sought to establish the characteristics of linguistically important alternations, and its results have significant implications for the analysis of languages other than Estonian where quantity plays a similar essential role in the phonology.

3.2. Sámi

In comparison with Estonian, it is even more difficult to determine how to interpret the quantity system in Sámi. Earlier researches aimed at describing the complex length alternations in many Sámi dialects (Nielsen 1903, Collinder 1929, Wiklund 1914, 1915, 1919, 1921, T. Itkonen 1916, E. Itkonen 1946, among others). More recent studies (such as Magga 1984, Engstrand 1987) similarly concentrate on the role of duration in the quantity of the Sámi dialects under examination.

It has been customary to regard quantity alternations as manifestations of consonant gradation phenomena.[51] As might be expected, the consequence of this approach was that quantity

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[51] For a brief summary of the consonant gradation phenomena in Sámi, see pp. 39-41.

alternations were assigned to consonants only (Wiklund 1914, 1915, 1921, and Setälä 1896 being among the most influential proponents of equating quantity alternation with consonant gradation).

As for taking other suprasegmental features into consideration, it must be said that very few studies have thus far done so (the most important being Ravila 1961,1962, Korhonen 1971, 1975, and Sammallahti 1977). Ravila recognized that durational differences between consonants may not reflect what is perceived as differences in quantity by speakers of Sámi. For example, in the minimal pair *borre* 'edge' Nom.Sg. /Q2/ and *bor're* 'eat' Part.Prs. /Q3/ the difference in duration of the consonants is only partially responsible for the difference between Q2 and Q3, there being differences also in the pitch movement of the first syllabic vowel, as well as in the stress in the second syllable.[52] While in Q2 the vowel has rising pitch movement, Q3 is characterized by falling pitch movement (Ravila 1962:492). In Korhonen (1971, 1975) second syllable stress is claimed to be significant in distinguishing between Q2 and Q3 (see below). As pointed out earlier (pp. 24-26) Sammallahti gives consideration to the role of an extra pulse in connection with the third quantity degree. As far as the phonetic correlates of this extra pulse are concerned, Harms observes: “In Utsjoki this extra pulse is clearly discernible on spectrograms as an additional increase in amplitude.” (1975:436).

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[52]I am not aware of any empirical evidence that Ravila may have used in order to establish his theory of the role of pitch movement and stress in the perceiving of linguistically significant quantity degrees.

These assumptions, as to the presence of another prosodic factor beside duration being significant in the surfacing of the third quantity degree, have so far remained at the level of hypothesis; no tests have been made to determine whether the speaker's perception corresponds to the assumed characteristics of the difference between Q2 and Q3.[53] Earlier experimental analyses concentrated on determining durational characteristics in Sámi (Äimä 1918, Lagercrantz 1927).

In what follows I shall summarize in more detail the results of quantity analyses of Skolt Sámi. In addition, because the duration of disyllabics in the two Skolt Sámi dialects will be analyzed in connection with the main structural types of these dialects,[54] a brief survey of the gradational phenomena will also be given (most structural types represent disyllabics with consonants in the weak, strong or overlong grades). An understanding of grade alternation in Skolt Sámi is essential for distinguishing between what traditionally has been referred to as "overlong grade" (i.e. the strongest grade of consonant length) and "overlong degree" (i.e. phonologically relevant quantity, that may not mean length difference only and may not be assigned to consonants only.)

3.2.1. Gradation

Consonants participating in grade alternation have traditionally been grouped by Lappologists into three series: x-series, xx-series and xy-series. Members of the first series include single consonants in the weak grade, and these alternate with short geminates in the strong grade. Members of the

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53 The only empirical evidence in this respect is the acoustic analysis of the apparent extra pulse (see fn. 35).

54 The division of Skolt Sámi disyllabics into different structural types (E. Itkonen 1946) will be discussed in Chapter 2.

xx-series are short geminates in the weak grade, and alternate with long geminates in the strong grade. Members of the xy-series consist of short consonant clusters in the weak grade, and alternate with long consonant clusters in the strong grade.

Gradation of intervocalic consonants was historically a low level phonological rule. Basically, gradation can be looked upon as a lenition process, intervocalic consonants weakening when the syllable is closed. Gradation may be either quantitative (long consonants alternating with short consonants), or qualitative (consonants of different quality alternating), or a combination of the two (consonants that alternate differing both in terms of quantity and quality). In Skolt Sámi consonant gradation has become entirely morphologized. The original phonetic motivation for the alternation of Grade I and Grade II has completely disappeared. Historical processes, the loss of many word-final consonants being most important in this connection, have rendered gradation rules opaque, gradation having lost its original conditioning environment. Examples: *suõvv* 'smoke' *suõv* Gen.Sg., *pue´tted* 'come' *puäđam* Sg1., *kue´ss* [s:s] 'guest' *kue´ss* [ss] Gen.Sg., *ku´mpp* 'wolf' *ku´mp* Gen.Sg.[55]

The overlong grade, that has developed independently of weak and strong grades, is an historically more recent phenomenon.[56] When consonants of the x-series appear in the strong grade, with quantity similar to that of the strong grade of the xx-series, the former quantity is referred to as the overlong

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55 The data are presented in the recently developed Skolt Sámi orthography (Korhonen et al. 1973). See Appendix A for explanation of the individual symbols. The length of geminates is not indicated in the orthography; after short vowels the geminates are long, after long vowels they are short. Again, because the length of the diphthongs is not marked, the geminates following may be either long or short (Korhonen et al. 1973:22), as may be seen from the examples above.

56 For a summary of the historical development of the overlong grade in Sámi, see Korhonen 1981:153-157.

grade: for example, *võrr* 'blood' (strong grade), *võõr* Gen.Sg. (weak grade) and *võ´rre* (overlong grade). The relationship between the strong grade of consonants of the x-series and the strong grade of consonants of the xx-series may be represented in the following diagram:

	Weak Grade	Strong Grade
x-series	C	CC (long)
	C	C:C (overlong)
xx-series	CC	C:C

3.2.2. Segmental quantity

Vowels

Vowels in the first syllable (both monophthongs and diphthongs) occur in two distinctive quantities, short and long.[57] A short vowel is phonetically realized always as short, e.g. *jokk* 'river'. A long vowel may be realized phonetically as long (in monosyllabic and disyllabic words always, and in polysyllabic words when the syllable following has a vowel bearing secondary stress), for example *mââ´nn* [â:] 'egg', *ää´võõllad* [ä:] 'open' (Inf.), or half-long (in words with three or more syllables when the second syllable contains a reduced vowel, i.e. when the second syllable is stressless, for example *mainstam* [ma˙in^{A}stam] 'tell' (Prs.Sg1.).

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57 In reviewing segmental quantity in Skolt Sámi I summarize Korhonen's analysis (1971, 1975). For marking length see fn. 31. Raised capital letters designate reduced vowels.

Vowels in the second syllable (only monophthongs being found there) may occur in two different quantities: short and long. The phonetic realization of short vowels depends on (i) the presence of secondary stress in the syllable in question, and (ii) whether the vowel is being followed by a consonant. Thus, when the syllable is stressed, the short vowel is realized phonetically as short; when the syllable is unstressed and the vowel is not followed by a consonant, the short vowel realizes phonetically as reduced, for example *kuätta* 'Lappish tent' Ill,Sg., and *vuâsk* [vuâsk^A] 'catfish'. Vowels in unstressed syllables when followed by a consonant are phonetically realized as short vowels, for example *mõõnam* 'go' (Prs.Sg1). The long vowel realizes phonetically as long in open syllables, for example *ää´võõlam* 'open' (Prs.Sg1), or as half-long in open syllables when the word consists of at least two more syllables after the syllable in question, for example *ää´võõlažem* 'open' (Freq.Pot.Sg1).

Consonants

Single consonants may be realized as half-long or short. They are half-long after short stressed vowels, for example *ää´ve´ked* [k˙] 'open' (Imp.Pl2.); short after a long vowel, for example *mõõnam* 'go' (Prs.Sg1.), or after a reduced vowel between the second and third syllables, for example *tuoddri* [tuodd^{A}ri] 'hill' (Gen.Pl.).

Geminates may be realized phonetically as follows: long (after short vowels in the first syllable and before reduced vowels in the second syllable) for example *eč̌ča* 'father' Ill. Sg., *kue´ss* [kue´ss^E] 'guest'; half-long (after short vowels in all other instances), for example *vä´ʒʒal* [ʒ˙] 'walk' Prs.Sg3.; and short (after long vowels), for example *viiv* [vi:v^A] 'son-in-law' Gen.Sg.

Consonant clusters may be realized phonetically as follows: after short vowels the first member of the cluster is long and the second member is half-long, for example *kuä´stte* [s:t˙] 'appear'

Prs.Pl3.; after a long vowel in the first syllable or after a reduced vowel between the second and third syllables, the consonant cluster is short, for example *joordak* 'think' Prs.Sg2., *maainsted* [ma˙in^{A}sted] 'tell' Inf.

3.2.3. The distinctive function of stress

Korhonen had proposed (1971, 1975)[58] the following theory for understanding phonologically relevant quantity in Skolt Sámi (Suonikylä dialect). There are but two different quantities in connection with the first syllable. However, in connection with the second syllable, he asserts that stress has an important role together with duration in the distinguishing of quantity degrees. Korhonen claims that, in the triplet (a) *sä´lbb* [sælb̥b̥^{E}] 'bolt' Nom.Sg., (b) *sä´lbbe* [sælb̥b̥e] 'prick the needle' Prs.Pl3., and (c) *sä´lbbe* [sælb̥b̥e:] 'bolt' Prs.Pl3., stress is distinctive between the pair (a) and (b), and that both stress and length have to be considered in the contrast between (a) and (c).[59] Viitso (1974) has challenged Korhonen's assumption by questioning the presence of stress in (c). Korhonen responded to Viitso's criticism in his 1975 paper:

> Die Antwort is einfach: *e* ist betont, weil alle *Observationen* [my emphasis] zeigen, dass es schwach betont ist. (p. 32)

It may be added that there is as yet no experimental documentation for justifying the presence or absence of stress as relevant for the perceiving of phonological quantity in Skolt Sámi.

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58 The earlier version contained the same arguments concerning the role of stress and duration in the quantity degree manifested in the second syllable.

59 Korhonen 1975:13

CHAPTER 2

ORGANIZATION OF THE MATERIAL AND DESCRIPTION OF INVESTIGATION PROCEDURES

1. Structural types in Skolt Sámi

As mentioned earlier, it is assumed in Erkki Itkonen's work (1946) that durational relationships must be investigated in stress-groups. Accordingly, eight structural types are posited for the Skolt Sámi dialects. Division into these groups is based upon the differences manifested in the durational distributions of the first syllabic vowel in relation to the duration of the intervocalic consonant and the second syllabic vowel. These structural types are as follows:[60] (1) ɜx̄xᶟ, (2) ɜx̄ȳᶟ (ɜx̀y̆ᶟ, ɜx̀y̆yᶟ), (3) ɜ̄xɜ, (4) ɜ̄xxᶟ, (5) ɜ̄xyᶟ (ɜ̄xỳᶟ), (6) ɜ̄xɜ ~ɜ̀xɜ\`, (7) ɜ̄xxᶟ ~ ɜx̀xɜ\` , (8) ɜ̄xyᶟ (ɜ̄xỳᶟ) ~ ɜ̀xyɜ\` (ɜ̀xỳɜ\`). Of these eight types only five are relevant to the Suonikylä dialect, where Types 6-8 have merged with Types 3-5 (Itkonen 1946:137). According to measurements made of test words spoken by the Petsamo dialect informant, the same five structural types are relevant there also.[61] E. Itkonen further distinguishes four subtypes in each structural group. Two of these subtypes comprise those words in which there is a historically contracted vowel in the second syllable (these two subtypes being based on the distinction between open and closed syllables). In my classification of these structural types I do not employ the

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60 In traditional Lappish transcription /ɜ/ stands for a vowel, and /x/ and /y/ for consonants. The diacritic [¯] signifies a long segment. The symbol /ˊ/ here represents half-long segments. Raised symbols stand for reduced segments.

61 In E. Itkonen (1946:137) only the Suonikylä and the now extinct Nuortijärvi dialects have five structural types instead of the eight. According to the durational measurements of disyllabics as spoken by the Petsamo subject, the length alternations associated with Types 6-8 are not relevant there either (see analysis of duration in Chapter 3) .

subtypes occurring in E. Itkonen's grouping, because my durational measurements do not justify differentiating between the subtypes of open vs. closed syllables. Those test words that have a contracted vowel will be analyzed separately (for justification, see below). Another subtype consists of words with three or more syllables, but because such words were not included in my analysis that particular subtype is not relevant here. In E. Itkonen's study the word-final vowel in the third structural type is symbolized as short, the other structural types having a reduced vowel in that position. However, analysis of the data I was working with suggests that this distinction between the respective structural types does not seem to be justified.

In my analysis, I shall distinguish between six main structural types. The first five are those that are listed above;[62] the sixth type contains words with a contracted vowel in the second syllable. As mentioned earlier, on the basis of the durational measurements made it does not seem necessary to distinguish between words with open or closed syllables. In connection with the first, fourth, and sixth structural types, on the basis of the pattern of the distribution of duration it seems justified to divide each of these types into two subgroups (see below).

The six structural types under investigation will be referred to as Type 1a (the consonant centre contains long geminate liquids, nasals or non-sibilant fricatives), Type 1b (the consonant centre contains long geminate plosives, affricates or fricatives: sibilants and the palatal fricative), and Type 2 (the consonant centre contains a long consonant cluster). Type 3 has a short consonant in the consonant center; in Type 4 the consonant is half-long, and in Type 5 the consonant cluster is short. Type 4 has two subgroups: the consonant centre containing a voiced

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62 Types 1-5, see p. 44.

interdental or alveopalatal fricative (Type 4a); and the consonant centre containing a voiceless plosive, affricate or voiceless fricative (Type 4b). Type 6 has a contracted vowel in the latus; this type is divided into two sub-groups according to whether the consonant centre has geminates (Type 6a) or consonant clusters (Type 6b).[63] Type 6a is further subdivided into two groups: Type $6a_1$ has liquids, nasals or non-sibillant fricatives in the consonant centre; Type $6a_2$ has plosives, affricates and fricatives (sibilant or the palatal fricative) in the consonant centre. Examples: *kue´ll* 'fish' *võrr* 'blood' (Type 1a); *juukkâd* 'drink' Inf., *leäšš* 'lie' Sg3. (Type 1b); *ju´rdded* 'think' Inf., *peäldd* 'field' (Type 2); *kiedâst* 'hand' Loc.Sg., *mõõni* 'go' Past.Sg3. (Type 3); *piä´zz* 'nest' Gen.Sg. (Type 4a); *kue´ss* 'guest' Gen.Sg. (Type 4b); *vue´sti* 'buy' PastSg3., *joordam* 'think' Sg1. (Type 5); *kualla* 'fish' Ill.Sg., *jäurra* 'lake' Ill.Sg. (Type $6a_1$); *i´tte* 'appear' PastPl.3., *äkka* 'old woman' Ill.Sg. (Type $6a_2$); and *vue´sttem* 'buy' PastSg1., *vä´ldde* 'take' Pl3. (Type 6b).

2. Quantitative status of the latic vowel

In the first five types the vowel in the latus may drop or become reduced in word-final position. There is an optional phonological rule that either reduces word-final short vowels or

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63 The division of Type 6 disyllabics is justified on the basis of geminates or consonant clusters in the consonant centre. However, the distribution of duration on the basis of the second syllabic vowel is different only with disyllabics containing geminates in the consonant centre. As will become apparent during the course of this analysis, disyllabics belonging to Type 6 having consonant clusters in the consonant centre have distributions similar to those of Type 2. However, for the sake of clarity I have decided to follow the traditional approach in grouping together disyllabics with a contracted vowel in the latus. There is another reason for regarding these disyllabics differently from Type 2 disyllabics: those in Type 6 do not undergo compensatory lengthening (see Chapter 5).

deletes them (the latter occuring mostly during casual speech).[64] I made measurements, in each of the five structural types, of the vowel centre and consonant centre with respect to the durational status of the latus, i.e. when the latus is present, and when there is a reduced vowel or ø in the latus. The implications of the differences concerning the duration of the vowel centre and the consonant centre in relation to latic quantity will be discussed in Chapter 5.

3. Description of the experiment

During my field trips in 1983 and 1984, I selected two speakers of Skolt Sámi with whom I decided to make recordings suitable for acoustic analysis. One informant, H.S. (female, 60 years of age at the time of the recording) is a speaker of the Suonikylä dialect; the other, K.J. (female, 55 years of age at the time of the recording) of the Petsamo dialect. Both subjects were prepared during several training sessions prior to the recordings that were made at the University of Manitoba in 1987.

The number of test words was 550. In selecting the test material, the objective was to have a balanced representation of each of the structural types (see Appendix B). The subjects were asked to place each word in the sentence frame *cie´lǨ ... e´pet* 'say ... again' (subject H.S., speaker of the Suonikylä dialect), and *saar ... e´pet* 'say ... again' (subject K.J., speaker of the Petsamo dialect). They were given a group of 100 test-words at a time, and were instructed to maintain a steady speech tempo.[65] There were only a few mistakes during recording and whenever these occurred the speakers were asked to repeat the word within the

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64 V → ø / — # (for example, *võõr* /võõrâ/ 'blood' Gen.Sg., but *võõrâst* Loc.Sg. *kuä´đ* /kuäđe/ 'Lappish tent' Gen.Sg. but *kuä´đest* Loc.Sg. The relevant vowels *â* and *e* are the respective stem-vowels).

65 Concerning the speech tempo of the sentence frame, see p. 49.

sentence frame. Each test-word was repeated three times (at different recording sessions) by both subjects. The total number of test words available for acoustic analysis is 3300.

The recording was made with a Scully Full-Track Broadcast Machine tape recorder: the tape speed was 7.5" per second. The microphone was placed about 18 inches from the subject. The test-words were read by the subjects from 3" x 5" filing cards. The reason for putting the test words on these cards was to eliminate any noise that might be caused by turning pages; thus, background noise was negligible. The material was recorded on Ampex Audio Mastering Tape (7" reel), and simultaneously dubbed on cassettes to serve as working tapes. Preliminary measurements were made using these working tapes; these measurements were then checked against the data recorded on the reels.

The software used for preliminary durational measurements was the DSPS Digital Signal Processing Software, Real Time Signal Lab. The MacSpeech Version 2 software was used for the final evaluation of the data. Both types of software are designed to produce spectrograms (narrow and wide band) together with continuous waveform displays. Ability to expand both spectrograms and wave-forms contributed to the achieving of the desired accuracy. The MacSpeech program had several additional features (among them, a multiple layout frame, expanded time waveform, fundamental frequency plots, and segment energy envelope). All these features proved very useful when attempting to identify segment boundaries.

4. Segmentation

The objective of the acoustic analysis of the test-words was to obtain durational measurements of the vowel centre, consonant centre and latus. For the purpose of control, the duration of the test words as well as the duration of the sentence were also measured. The mean duration of the vowel centre, consonant centre and latus in all of the individual test words in each structural type will be presented and discussed in Chapter 3.

It is a well known fact that the rate of speech tempo may have an effect on the duration of the individual segment (Peterson and Lehiste 1960, Edwards and Beckman 1988). In order to assure a constant speech tempo, the average duration of the sentence frame was calculated.[66] Test-words in a frame with a duration varying significantly from the average were not considered for measurement.

When proceeding with segmentation, the facts concerning coarticulation cannot be ignored. The difficulties in attempting to draw segment boundaries in continuous speech are well known to everyone attempting to make measurements of segments. However, when proceeding with segmentation it is advisable to refer to the two basic categories established by considering the discontinuous aspect of speech as outlined in Fant (1962). These categories are (i) segment type features (these determine segment boundaries), and (ii) segment pattern features (these determine segment contents). The first category is associated with the manner of articulation, the second with the place of articulation. In determining the boundaries of the segment to be measured, criteria that in research have traditionally served in connection with segmentation were considered as main guidelines (Peterson 1955, Peterson and Lehiste 1960, 1961, Fant 1958, 1962, Umeda 1975, 1977, Haggard 1973, Klatt 1979, Diehl 1987, Jassem 1962, among others). I shall refer to guidelines found in the literature cited in connection with specific segments. Magga's study (1984) contains a brief summary of problems in connection with

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66 I proceeded along the lines suggested in Peterson and Lehiste (1960:698). The duration of the test words was subtracted from the duration of the frame.

segmentation in relation to a North Sámi dialect. In the following sections I shall outline the criteria that I have been working with for the identification of segment boundaries. In general, most segment boundaries were relatively easy to identify on the basis of acoustic discontinuities signaling transitions of different acoustic patterns or changes in intensity.

4.1. Voiceless plosives

Voiceless plosives in Skolt Sámi are unaspirated word-initially. Word-internally the voiceless plosives occur with preaspiration (see pp. 79-80). In both positions the burst was followed by a subsequent silent interval. This silent interval is shortest for /p/ and longest for /k/. According to previous measurements of Finnish voiceless plosives (Lehtonen, 1970) the duration of the silent interval for /p/ is 1.7 cs, for /t/ 1.8 cs, and for /k/ 2.9 cs. Magga (1984) obtained similar results for North Sámi. There have been different ways of determining how this silent interval should be accounted for: i.e. being counted as part of the consonant, or being added to the duration of the following vowel. Wiik (1965), and Wiik and Lehiste (1968) follow the former practice. Fischer-Jørgensen (1964), and Elert (1964) locate the separation point at the beginning of the rise of the intensity curves. Klatt (1979) considers burst and aspiration as parts of the following segment.[67] In Peterson and Lehiste two methods are employed: first, the beginning of the vowel is counted from the centre of the releasing spike; second, the vowel is considered to start directly after the silent interval. Fant (1958) points out that, in addition to the fact that voiceless stops may be composed of four distinct sequences (stop gap + explosion + frication +

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[67] Klatt 1979:287.

aspiration),[68] a preceding or following vowel may also contribute to the identification of these consonants.

In this study, I shall regard the silent interval after the burst as the property of the consonant. The vowel starts immediately after this silent period, and the beginning of the vowel is signaled by the rise in amplitude of the intensity curves.

The status of the palatal plosive in Skolt Sámi involves a certain degree of uncertainty. In Korhonen et al. (1973:18) the orthographic symbol /ǩ/ is considered as a palatalized quite forwardly articulated [k]. It is not clear whether acoustic differences between palatal and palatalized segments may be revealed by new acoustic parameters, or whether there are differences merely of degree (Sepp 1987:37). The basis for regarding this particular sound as a palatal rather than a palatalized segment, is its auditory effect: in this respect the auditory properties making it closer to a palatal plosive than to a palatalized segment.[69] On the spectrogram there is a relatively large area associated with the burst in the high frequency region. In Fant (1970:197) this fact is referred to, as the main peak of the palatal sound is in the F3 area. The cessation of the frication is considered the end point of this segment.

Voiceless plosives also occur in consonant clusters. As the first member of clusters, /p/ occurs most frequently, followed by another voiceless plosive or by a voiceless sibilant. In either case the burst of the first member was easily noted, and the boundary was drawn after this burst. In the case of a sibilant following the

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68 This latter component is not relevant in connection with Skolt Sámi voiceless stops.

69 I may also add that during my field work I consciously articulated palatal plosives instead of palatalized forward [k] and my pronunciation was judged by the speakers of Skolt Sámi as the same as theirs (that I perceived acoustically as palatal plosives).

voiceless plosive, the beginning of the striation pattern provided a clear-cut division point.

As second members of consonant clusters, voiceless plosives may be preceded by liquids and voiceless sibilants. The criteria for determining the end of the liquids and sibilants will be discussed in the sections below.

4.2. Voiced plosives

In Skolt Sámi the voiced plosives /d/ and /g/ occur word internally as single consonants (weak grade), geminates (in the strong grades) and (/b/ also) as second members of consonant clusters. In this latter case the plosives are usually partially voiced. The beginning of the voiced plosive following the vowel in the vowel centre was determined by comparing the broad and narrow spectrograms in order to find the moment when the higher harmonics showed a sudden decrease of acoustic energy. This method was suggested by Peterson and Lehiste (1960). The palatal plosive /ğ/ only occurs word-internally in Skolt Sámi. In determining the boundaries of this segment the same criteria were employed as described in connection with /ǩ/. According to Elert (1964) and Magga (1984), segmentation of voiced plosives is more difficult, the factor of uncertainty being double that encountered with voiceless plosives. The software that I used made the finding of boundaries more easy than it was for Elert and Magga, through utilizing the multiple window layout feature with the 11.9 msec time frame at both cursors in order to identify the decrease of acoustic energy with more certainty. As second members of consonant clusters, the voiced plosives occur in combination with semivowels and liquids. Criteria for determining the beginning of voiced plosives in such combinations will be discussed in the relevant sections below where the segmentation of semivowels and liquids will be outlined.[70]

4.3. Fricatives

The boundary of a voiceless fricative preceding a vowel was easily identified on the wide-band spectrogram. The beginning of the vowel was determined by the onset of voicing in the region of the first formant (Peterson and Lehiste, 1960). The starting point of a voiceless fricative after a vowel was recognized by the onset of random noise. Klatt (1979) measured the duration of fricatives by the visibility of the frication noise (or changes in the voicing source if no frication is visible).[71] I followed the criterion of Peterson and Lehiste, determining the end of the vowel as soon as the noise pattern characteristic of voiced fricatives began, even though voicing in the lower harmonics was still continuing.

The labiodental voiceless fricative /f/ occurs only word-initially and in but a few recent loan words. The cessation of high frequency frication and the abrupt start of voicing for the vowel formed an easily recognizable cut signalling the end of this fricative.

The two voiceless sibilants /s/ and /š/ occur word-initially, word-finally and word-internally. Word-internally they may occur as geminates (half-long or long, see Chapter 4, p.113) and as members of consonant clusters (first components of a cluster most times, and second components with the semivowel /u/). Recognizing both of these fricatives caused no difficulty. The ends

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70 The few instances when voiced plosives may occur word-initially concern only some recent loans (for example, *baŋk* 'bank'); adverbs (for example *de* 'so') are usually pronounced with voiceless plosives. Even such words as *dååma* 'at home' from Russian are most often pronounced with the plosive devoiced.

71 Ibid., p.287.

of striations characteristic of both these voiceless fricatives were clearly seen in the spectrogram. The start of the increase of intensity curves of the following vowel, or the occlusion interval for the stop following the fricative in question, provided a clear-cut boundary. These criteria were employed also in Peterson and Lehiste 1960, Elert 1965 and Lehtonen 1970.

The voiceless glottal fricative /h/ occurs word-initially (in a relatively small number of words) and word-internally (as first member of a cluster). In the first case, the onset of voicing was used for determining the end of the fricative; in the second, the cessation of frication before the following consonant provided an easily recognizable division point.

The voiced interdental fricative /đ/ occurs word-internally as single consonant, geminate or first member of a consonant cluster. The intensity curves of vowels preceding and following were used as cues for segmentation, even though the curves do not show a clear-cut segmenting point. Similar criteria were used for the segmentation of the voiced velar fricative /g̣/. The point where the increase of the curves shows a definite rise was chosen as the separation point.

The word-initial voiced labiodental fricative was recognized by the abrupt end of the frication. The division between this sound and the following vowel can be seen relatively easily on the broad band spectrogram. Utilizing the multiple window layout feature with the 11.9 msec time frame proved adequate for accurately determining the end of this fricative. Voiced labiodental fricatives also occur word-internally as geminates or as members of a consonant cluster. In the former case the segmentation criteria were similar to those employed for determining the boundaries in word-initial position. When the labiodental voiced fricative occurs as the first member of a cluster it functions as a glide. Abrupt differences in the spectral pattern of the following consonant provided easily recognizable segmentation points.

The voiced sibilants /z/ and /ž/ were identifiable by the presence of energy in the higher frequency regions. These two fricatives occur as geminates only word-internally. The decrease in amplitude of the intensity curves for the vowel preceding, and the subsequent start of the rise of the intensity curves, served as cues for isolating these two fricatives.

The palatal fricative /j/ occurs word-initially and word-internally as a single consonant or as a geminate. In identifying the end of /j/, the point where the intensity curves start rising steeply was chosen. The end of /j/ was determined on the basis of criteria discussed in Peterson and Lehiste (1960), where it is pointed out that the frequency of the third formant is higher than that of any of the vowels following it. The transition to the vowel following is signaled by a lowering of the third formant. The point at which this lowering commences was chosen as the segmentation point. Although this criterion was employed by Peterson and Lehiste in connection only with the palatal glide, I found it a workable approach also with the palatal fricative.

4.4. Nasals

The nasals in Skolt Sámi are /m/ /n/ /ŋ/ and /ɲ/. Of these /m/, /n/ and /ɲ/ may occur word-initially, /ŋ/ only word-internally as a single consonant or a geminate; /m/ and /n/ may also occur word-internally as a single consonant, geminate or member of a consonant cluster. All nasals may occur word-finally as well.

The spectrogram of nasals shows a fairly fixed formant structure determined by the nasal tract and the pharynx, the lowest formant having the dominant intensity level.[72] All nasals are easily recognizable by the gap between low first formant

[72] Fant 1970:147.

frequency and the second formant frequency appearing in the region of the 2000 Hz. The noticeably much lower intensity level present in the formants of nasals following a vowel made segmentation relatively easy. The end of a nasal preceding a vowel was usually easily recognized by observing the abrupt change from the steady formant pattern followed by the transition.

4.5. Liquids

The liquids /l/ and /r/ occur in Skolt Sámi both word-initially and word-internally. In the latter case they may occur as single consonants, geminates or members of consonant clusters. The end of the lateral was determined at the point where the harmonics in the narrow band spectrogram showed a marked change from the steady state of formants to the transition state. This movement was also accompanied by the rise of the intensity curves associated with the vowel.

The beginning of the lateral after a vowel was not always easily observable. In most cases I followed the principles of Peterson and Lehiste (1960); thus, sometimes the change from the third formant of the vowel to the usually higher third formant of the lateral was observed and utilized. When this transition was not very clear,[73] the tenth harmonic in the narrow band spectrogram that signalled the change of the fundamental movement from a higher to a lower value, was used as indicator for identifying the beginning of the lateral.

The trill shows a formant structure on the broad band spectrogram different from that of the following vowel. This difference is also accompanied by a rapid rise of the intensity curves associated with the vowel. The spectrogram of the trill

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73 When the lateral follows a back vowel, this transition is either negative or very short in duration (Jassem 1962).

shows a series (most frequently three) occlusions of brief duration. The intensity curves of /r/ have two or three peaks. The cutting point after a vowel was chosen on the basis of the acoustic discontinuity that was clearly seen between the two segments in question.

4.6. Semivowels

The two semivowels -- /i/ and /u/ in Skolt Sámi orthography -- occur in consonant clusters in that language as a first member of the cluster. In his study, Magga refers to difficulties in separating these semivowels from the preceding vowels (1984:65). The beginning of each of these semivowels was determined by associating the characteristic transition movements leading to the steady state with these semivowels. In the case of the /i/ the start of the rapid rise of the third formant was chosen as the division marker, whereas with the /u/ the beginning of the transition leading to the low second formant was considered a division point. In those more difficult cases where the /u/ was preceded by a vowel with a low second formant, differences in acoustic energy distribution were considered for determining the segment boundary, the semivowel being associated with lesser acoustic energy reflected in the smaller amplitudes of the intensity curves. In general, recognizing the segment boundary for the /i/ proved to be simpler than for the /u/, due to the easily discernible third formant transition movement.

The spectrograms presented below illustrate the points discussed in this section concerning the segmentation of consonants.[74] In *Figures 3-22* examples are given of test-words belonging to structural Types 1-6 (see pp.45-48). Each test-word

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[74] The test-words are presented in Skolt Sámi orthography (see fn. 55). Those word-final vowels subject to being reduced or dropped (pp. 47, 139-140) are not represented in Skolt Sámi orthography (see fn. 101). The glosses of the test-words may be found in Appendix B.

is represented twice, as spoken by both subjects. The durational measurements of the relevant segments as well as the duration of the sentence frame are indicated.

Figure 3. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *ciel'k kue'll* 'fish' [uə̆lə] *e'pet* as spoken by subject H.S. Time scale: 16 millimeters = 191 msec.The duration of the whole utterance: 1.44 s. Test-word: *kue'll.* Structural type: Type 1a. The segments measured: [uə̆] = 217 msec., [l] = 165 msec., [ə] = 20 msec.

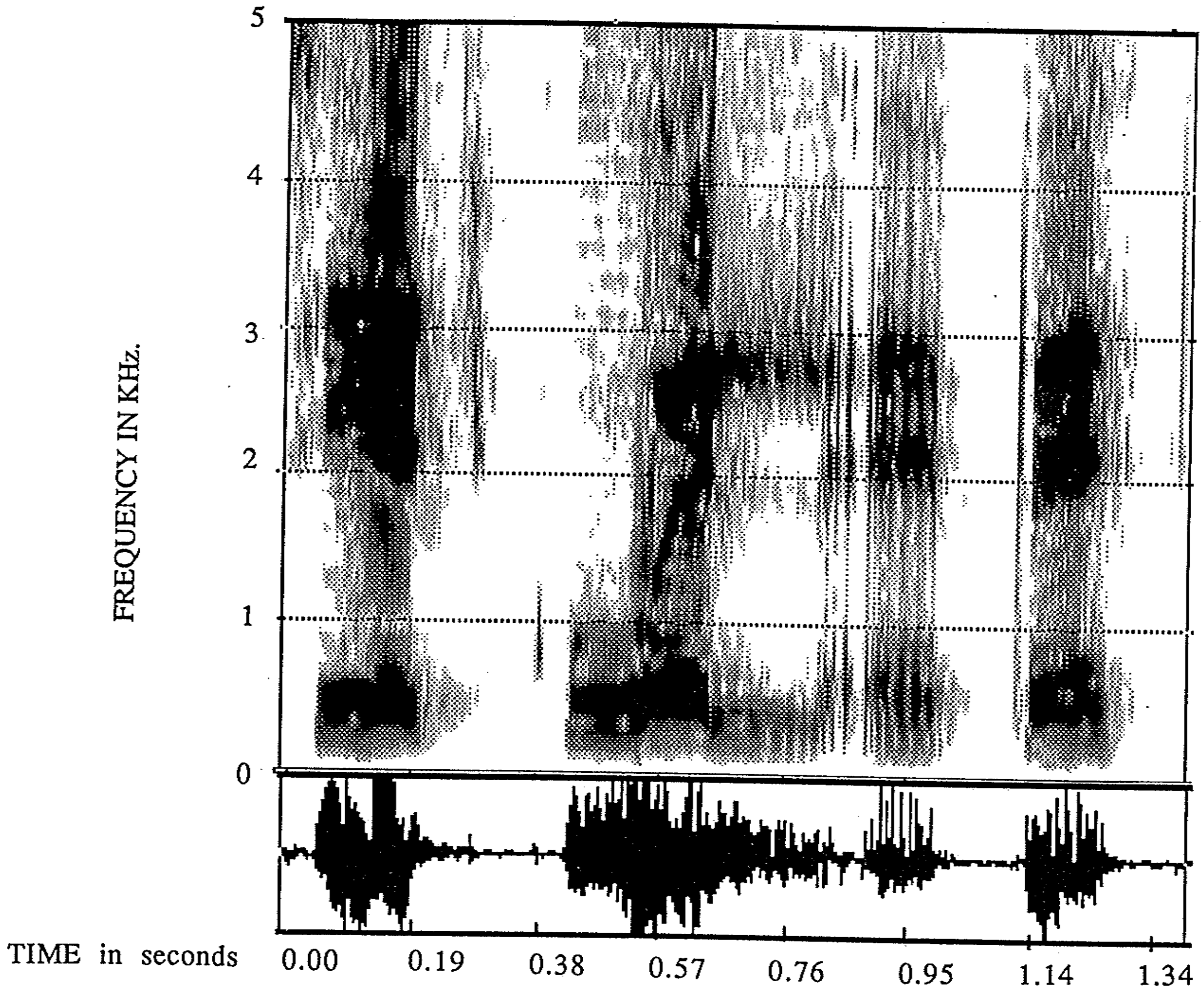


Figure 4. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *saar kue´ll* 'fish' [uə̆lə] *e´pet* as spoken by subject K.J. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 2.38 s. Test word: *kue´ll.* Structural type: Type 1a. The segments measured: [uə̆] = 236 msec., [l] = 177 msec., [ə̆] = 43 msec.

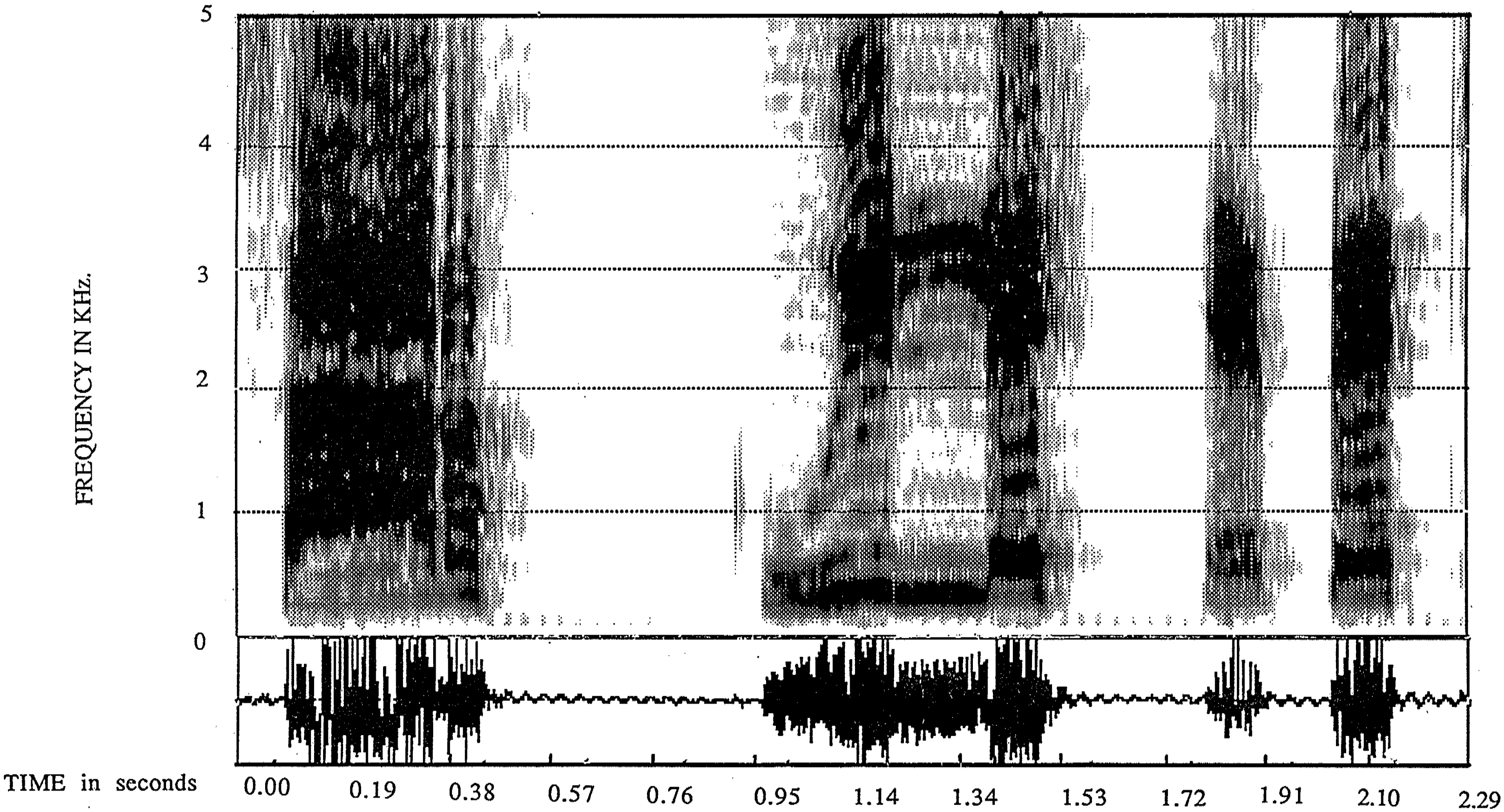


Figure 5. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *ciel'k juukkâd* 'drink' (Inf.) *e'pet* as spoken by subject H.S. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 1.67 s. Test-word: *juukkâd.* Structural type: Type 1b. The segments measured: [u] = 210 msec., [k] = 225 msec., [ʋ] = 90 msec.

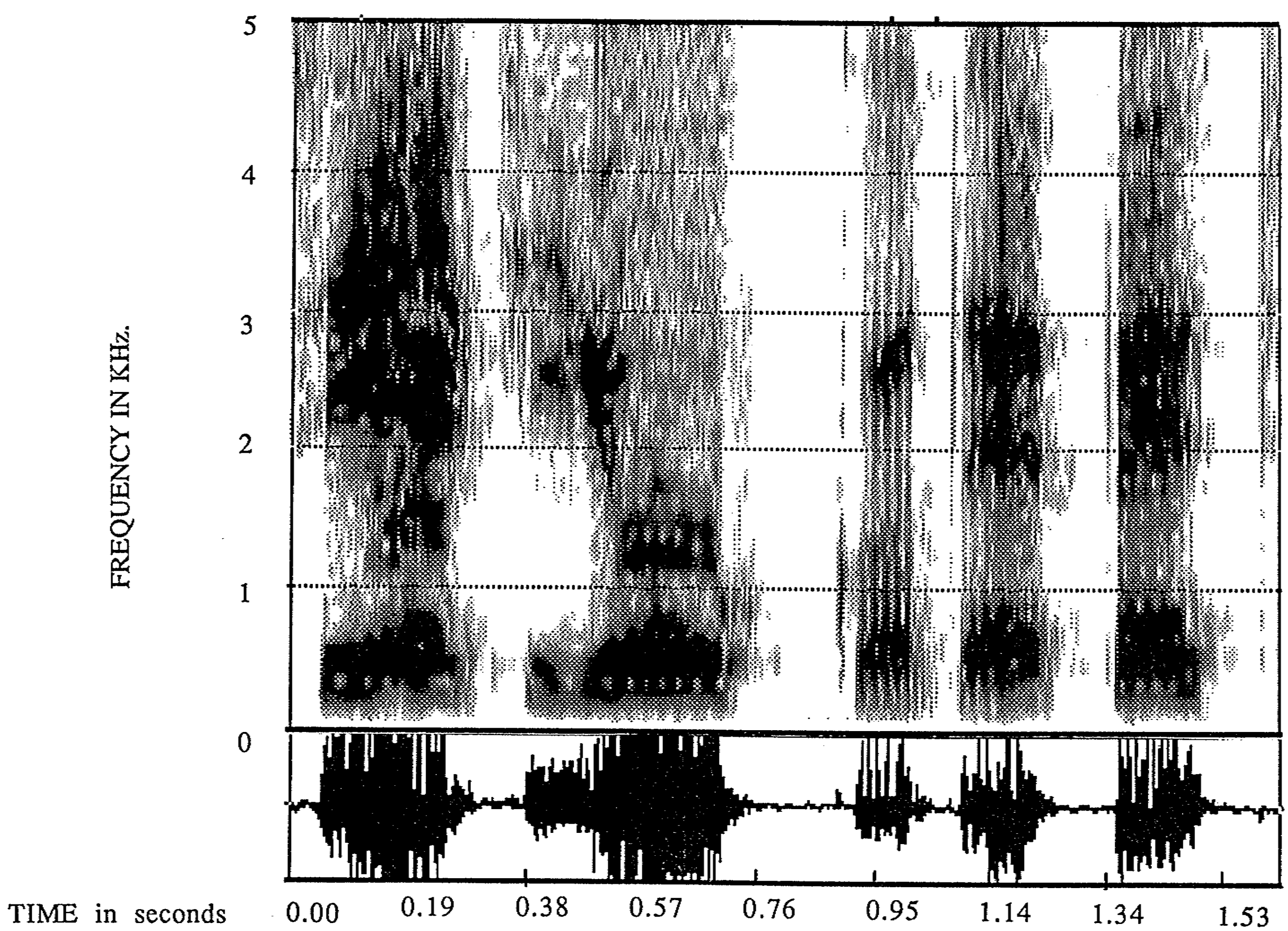


Figure 6. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *saar juukkâd* 'drink' (Inf.) *e´pet* as spoken by subject K.J. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 2.18 s. Test word: *juukkâd.* Structural type: Type 1b. The segments measured: [u] = 195 msec., [k] = 247 msec., [ʋ] = 75 msec.

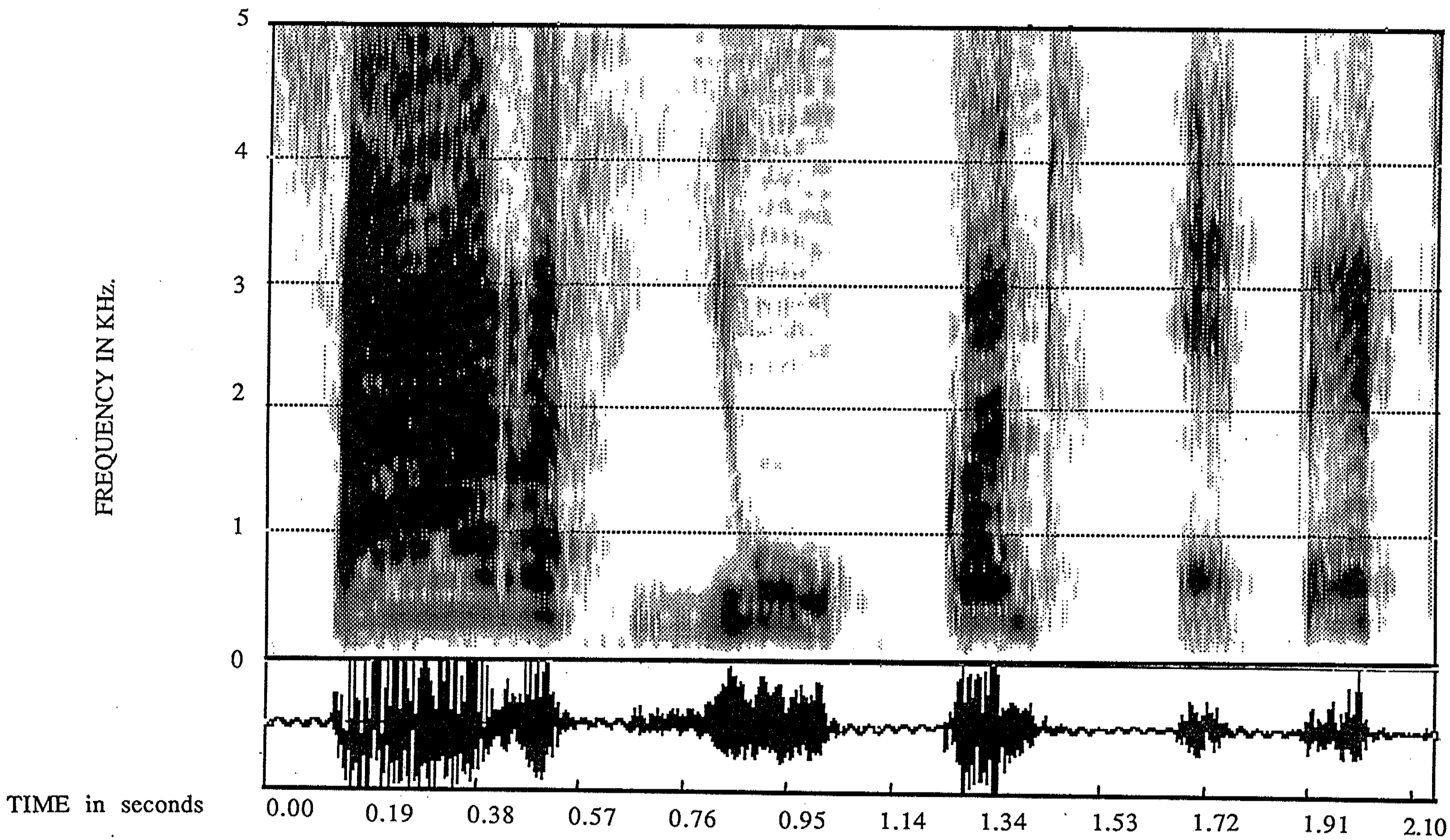


Figure 7. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *ciel´k kuoskkâd* 'touch' (Inf.) [ŭə]*e´pet* as spoken by subject H.S. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 1.81 s. Test-word: *kuoskkâd*. Structural type: Type 2. The segments measured: [ŭə] = 131 msec., [s] = 236 msec., [k] = 124 msec., [ʊ] = 104 msec.

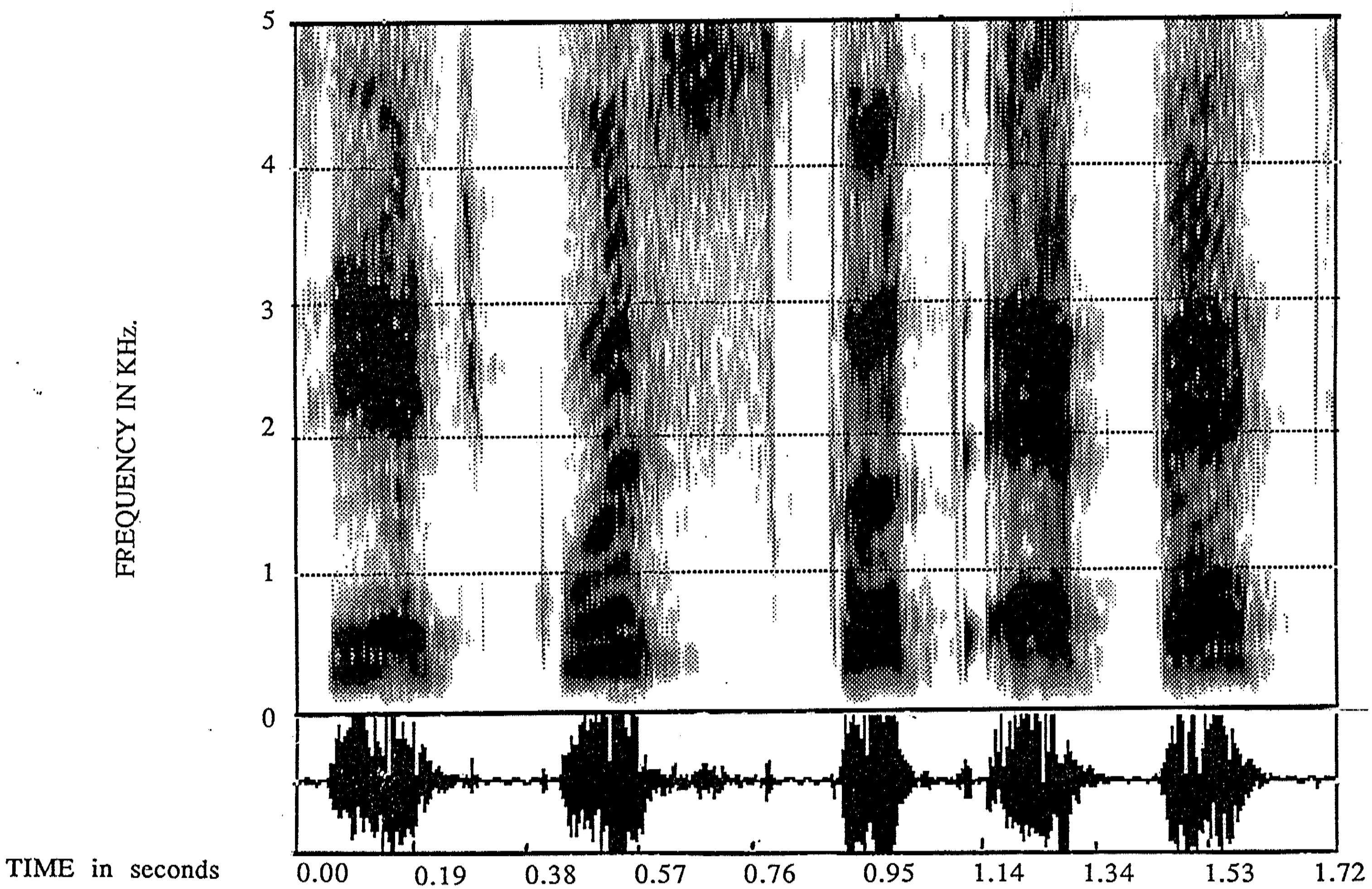


Figure 8. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *saar kuoskkâd* 'touch' (Inf.) [ŭə] *e´pet* as spoken by subject K.J. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 2.84 s. Test word: *kuoskkâd*. Structural type: Type 2. The segments measured: [ŭə] = 120 msec., [s] = 242 msec., [k] = 138 msec, [ɒ] = 70 msec.

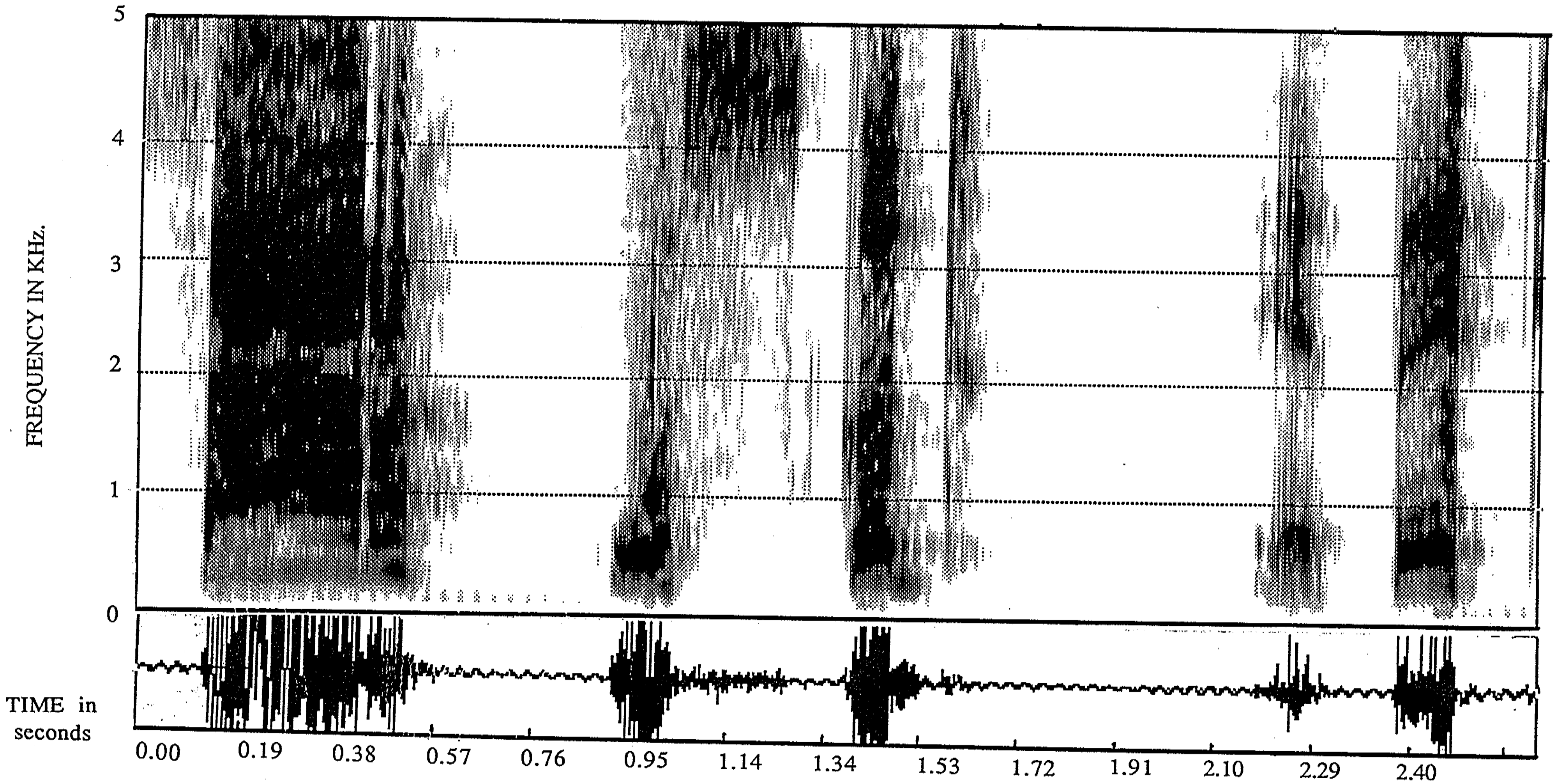


Figure 9. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *ciel'k tieđi* 'know' (Past.Sg3.) *e'pet* as spoken by subject H.S. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 1.71 s. Test-word *tieđi*: Structural type: Type 3. The segments measured: [ie] = 300 msec., [ð] = 67 msec., [i] = 110 msec.

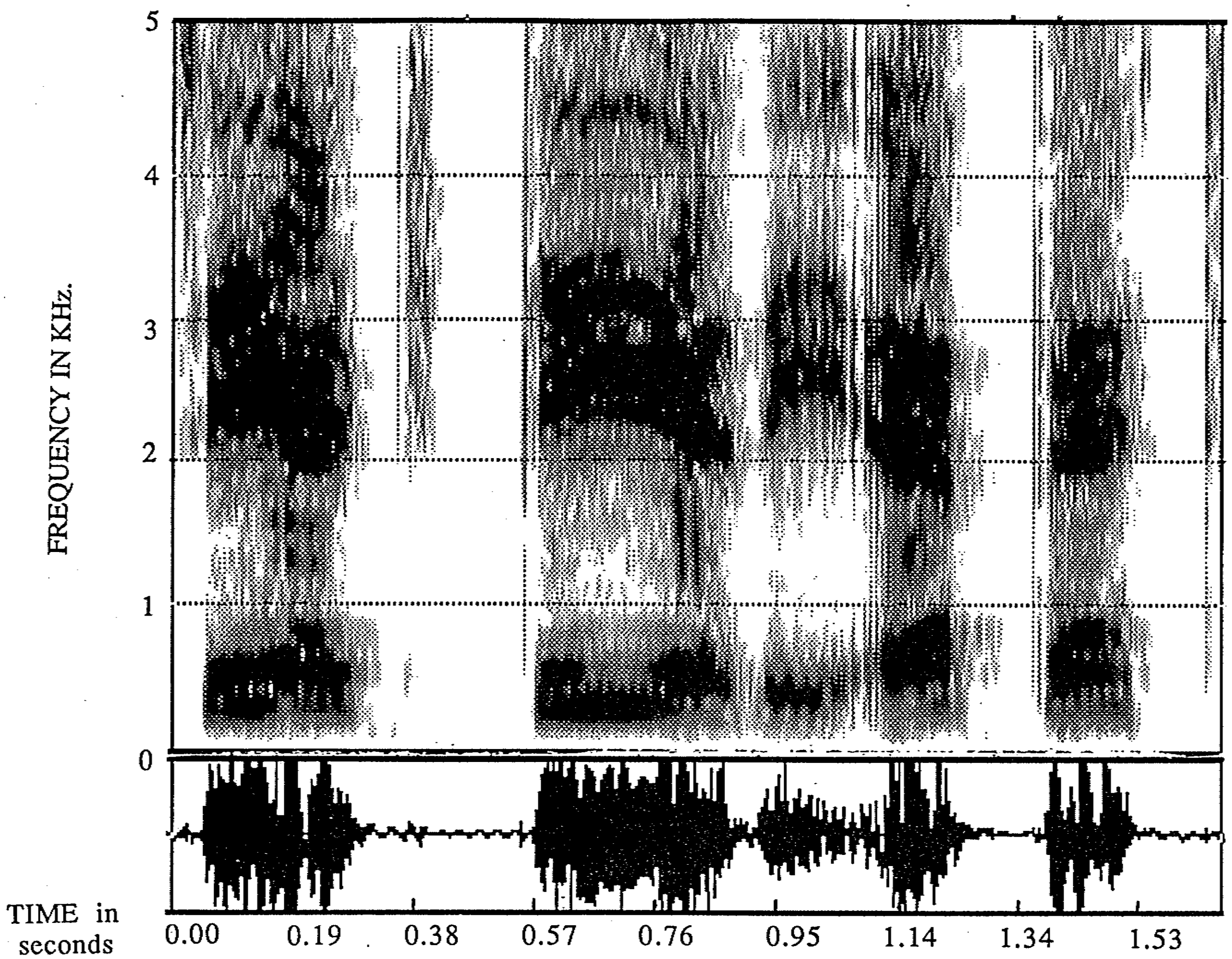


Figure 10 . Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *saar tieđi* 'know' (Past.Sg3.) *e´pet* as spoken by subject K.J. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 2.19 s. Test word: *tieđi*. Structural type: Type 3. The segments measured: [ie] = 300 msec., [ð] = 75 msec., [i] = 105 msec.

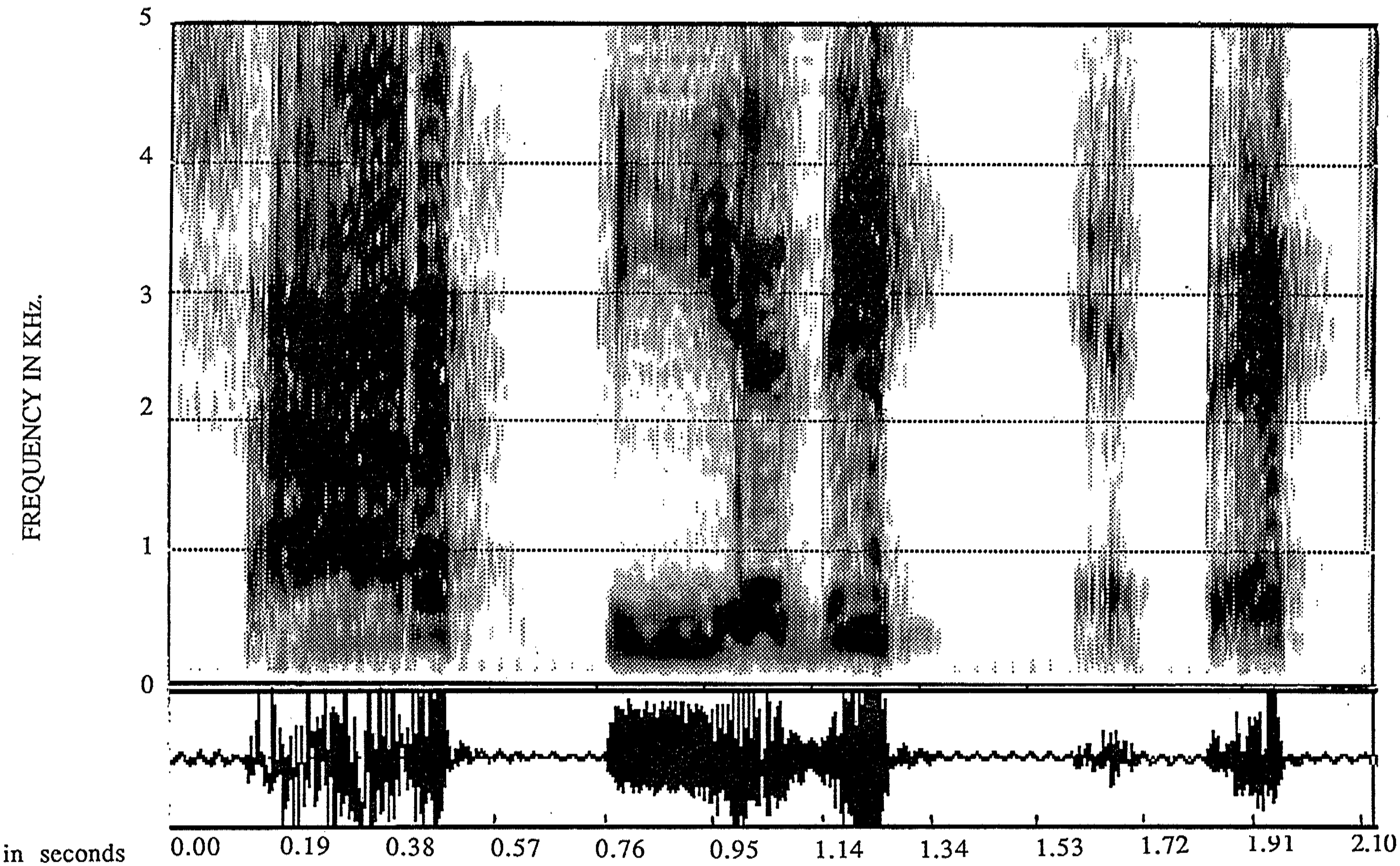


Figure 11. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *ciel'k jooggâst* 'river' (Loc.Sg.) *e'pet* as spoken by subject H.S. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 1.68 s. Test-word: *jooggâst.* Structural type: Type 4a. The segments measured: [o] = 210 msec., [ɣ] = 150 msec. [ʋ] = 82 msec.

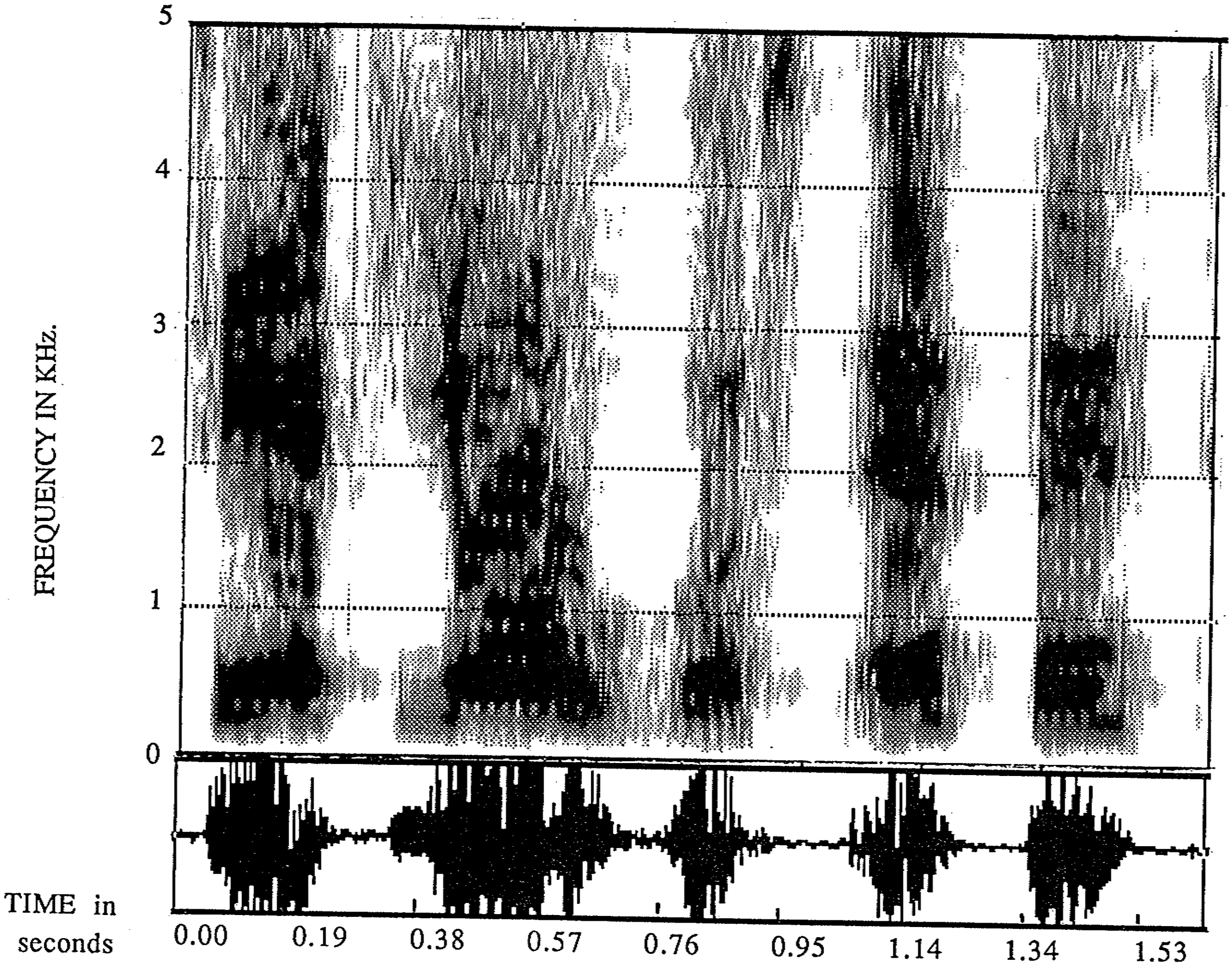


Figure 12. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *saar jooggâst* 'river' (Loc.Sg.)*e´pet* as spoken by subject K.J. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 2.09 s. Test word: *jooggâst* . Structural type: Type 4a. The segments measured: [o] = 225 msec., [ɣ] = 157 msec., [ʋ] = 75 msec.

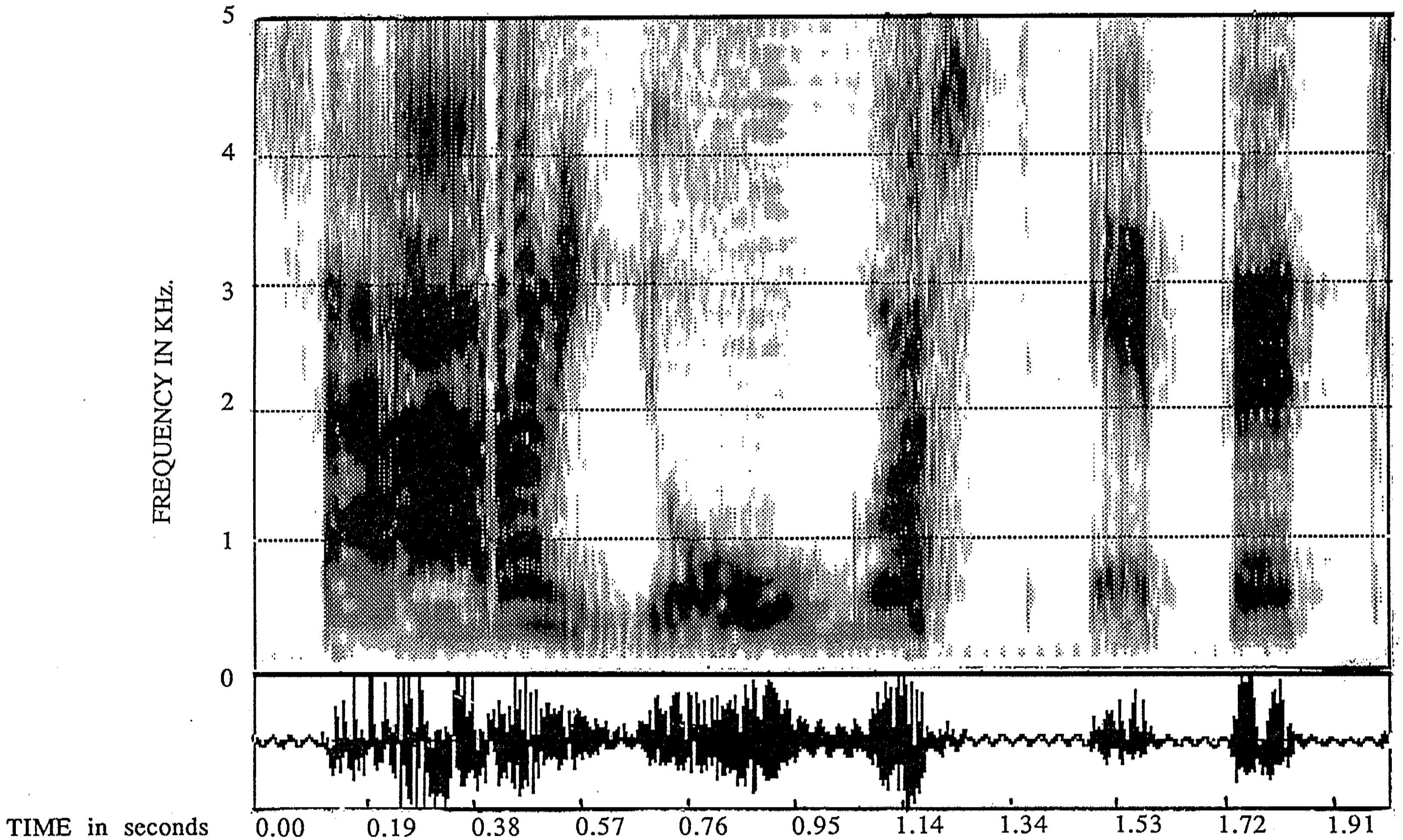


Figure 13. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *ciel´k miä´ccest* 'forest' (Loc.Sg.) *e´pet* as spoken by subject H.S. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 1.75 s. Test-word:*miä´ccest.* Structural type: Type 4b. The segments measured: [ie] = 210 msec., [ʦ] = 232 msec. [e] = 82 msec.

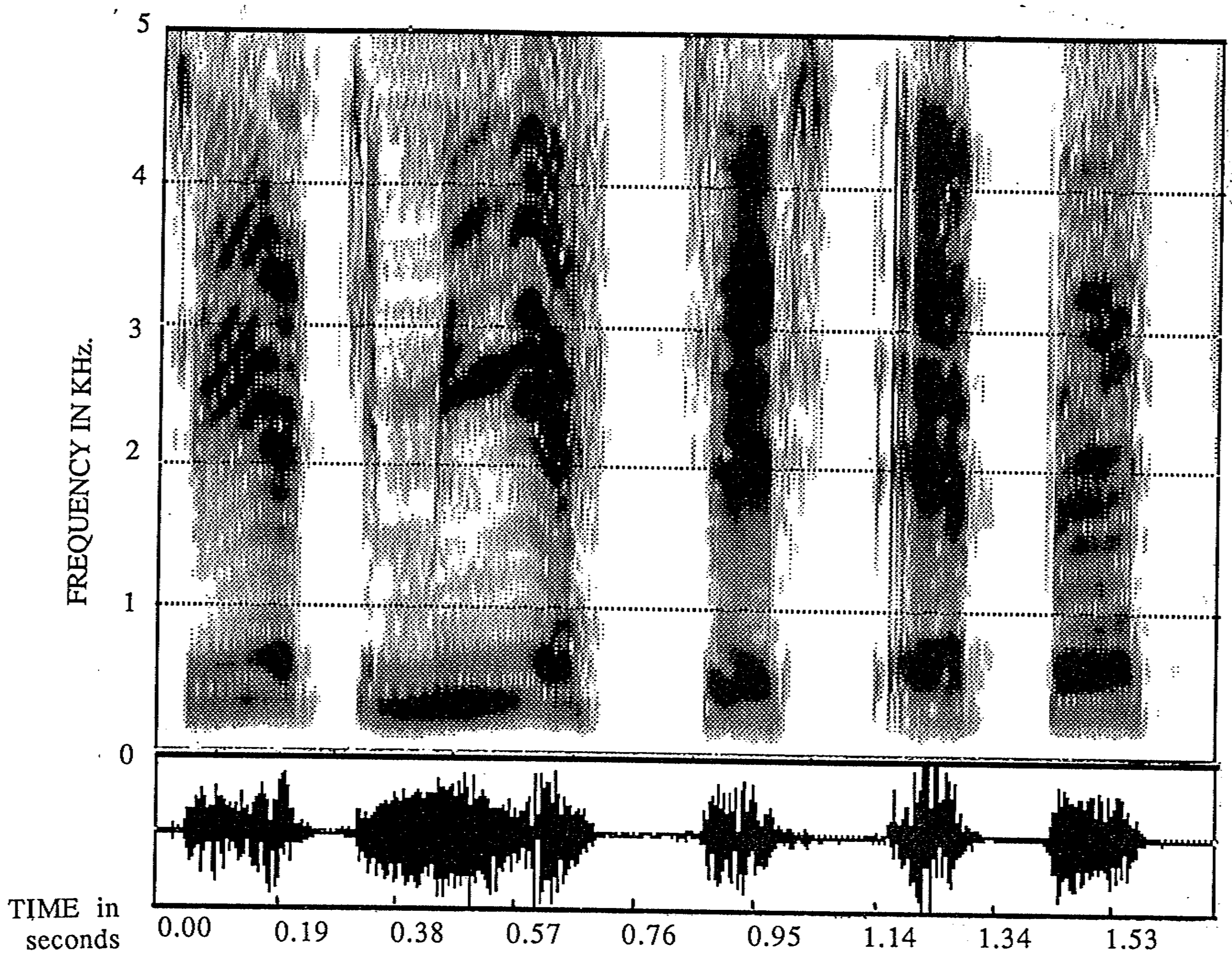


Figure 14. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *saar miä´ccest* 'forest' (Loc.Sg.) *e´pet* as spoken by subject K.J. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 1.94 s. Test word: *miä´ccest* . Structural type: Type 4b. The segments measured: [ie] = 195 msec., [ts] = 210 msec., [e] = 67 msec.

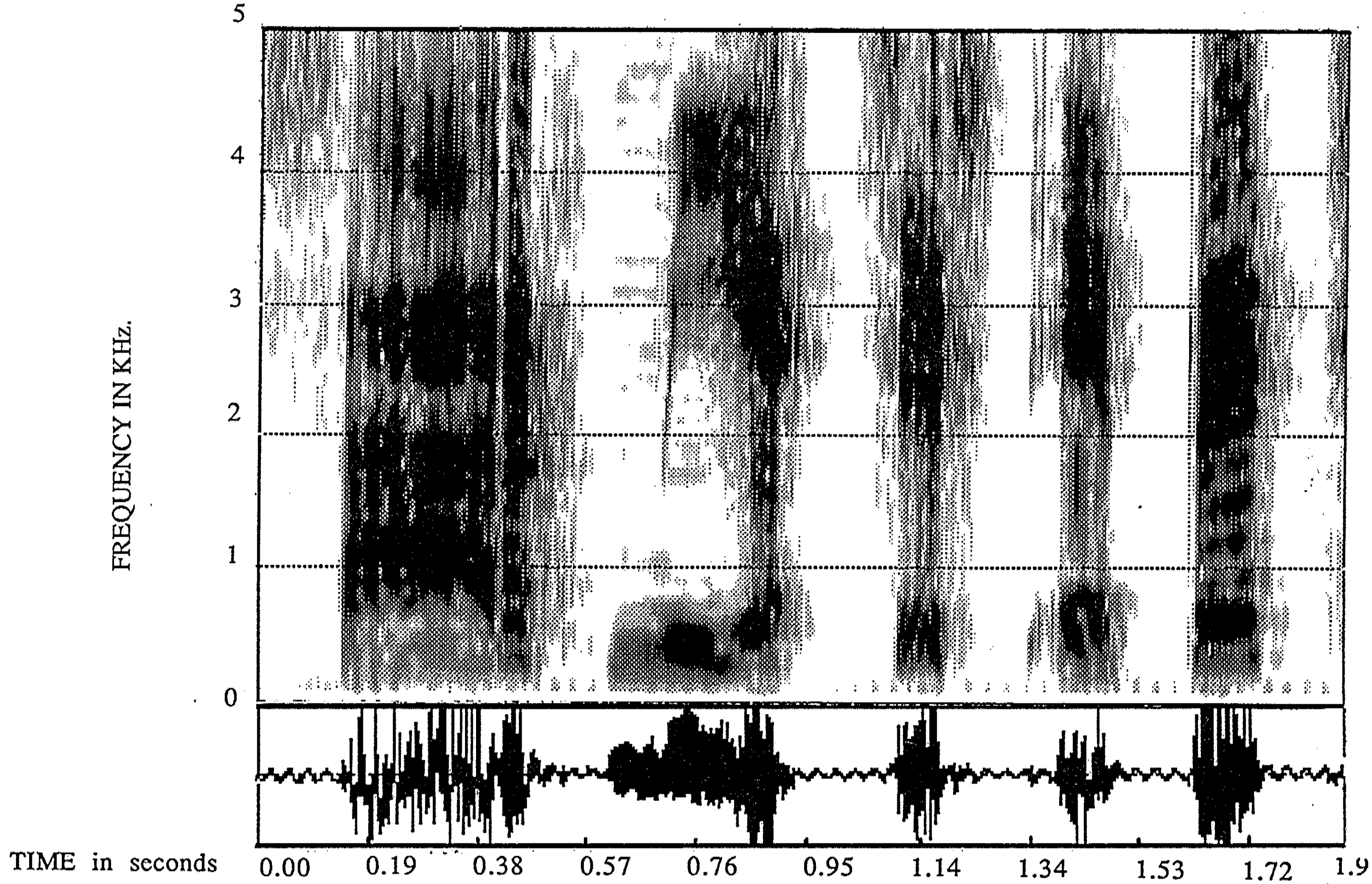


Figure 15. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *ciel'k vuästam* 'buy' (Prs.Sg1.) *e'pet* as spoken by subject H.S. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 1.65 s. Test-word:*vuästam*. Structural type: Type 5. The segments measured: [uɐ] = 179 msec., [s] = 101 msec. [t] = 78 msec., [a] = 82 msec.

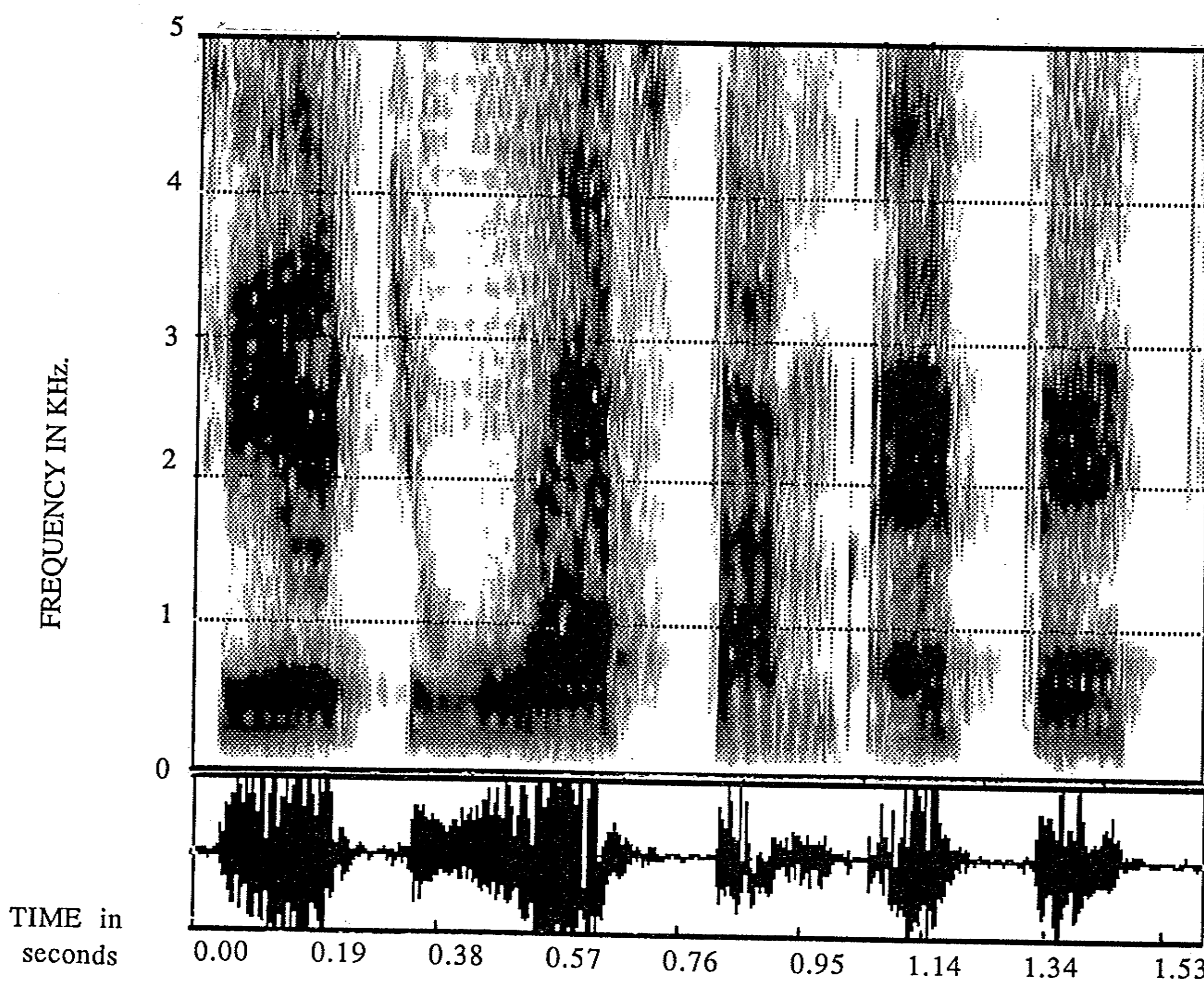


Figure 16. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *saar vuästam* 'buy' (Prs.Sg1.) *e´pet* as spoken by subject K.J. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 2.00 s. Test word:*vuästam* . Structural type: Type 5. The segments measured: [uɛ] = 195 msec., [s] = 108 msec., [t] = 82 msec., [a] = 75 msec.

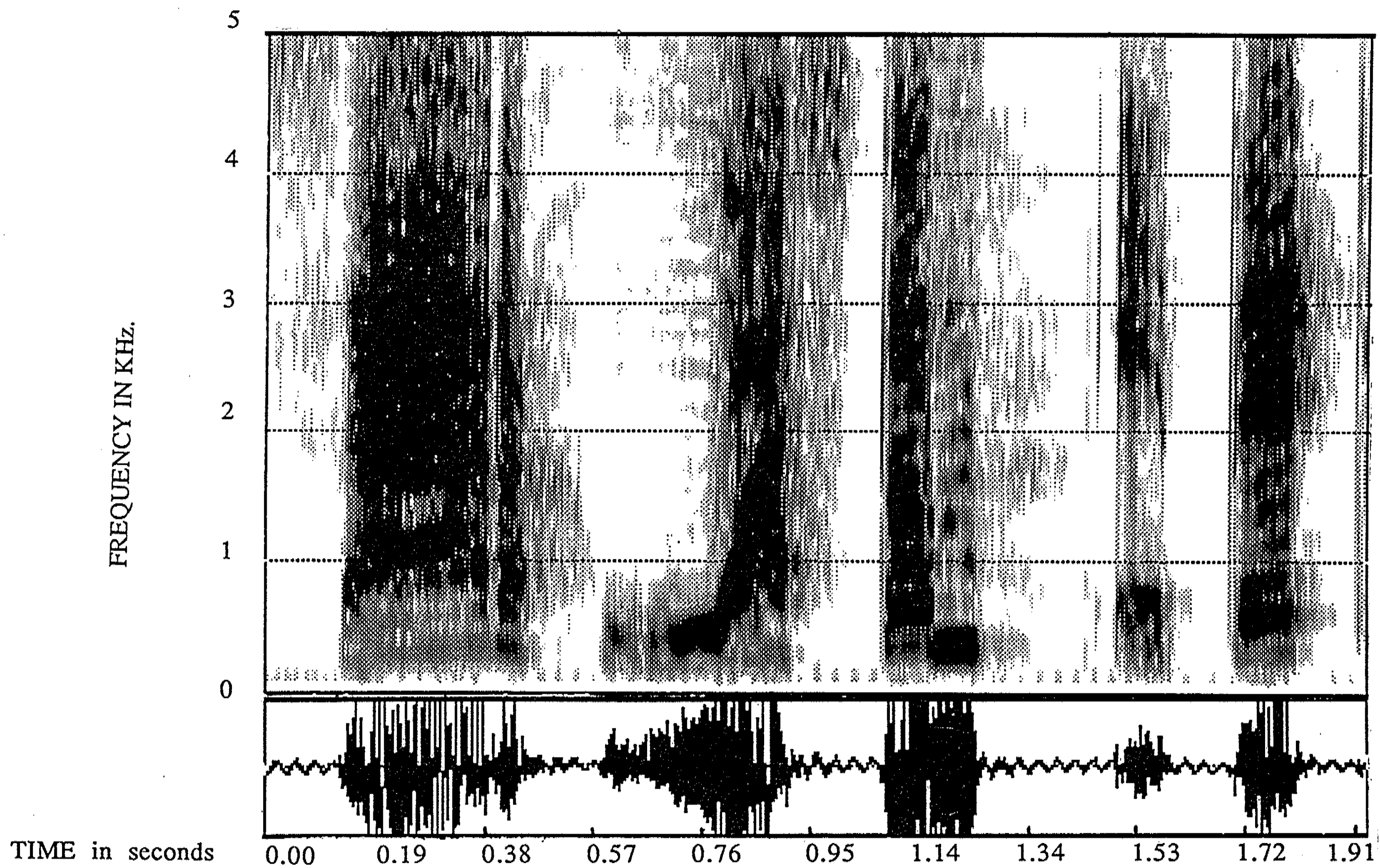


Figure 17. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *ciel'k to'lle* 'fire' (Ill.Sg.) *e'pet* as spoken by subject H.S. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 1.56 s. Test-word:*to'lle*. Structural type: $6a_1$. The segments measured: [o] = 135 msec., [l] = 247 msec., [e] = 67 msec.

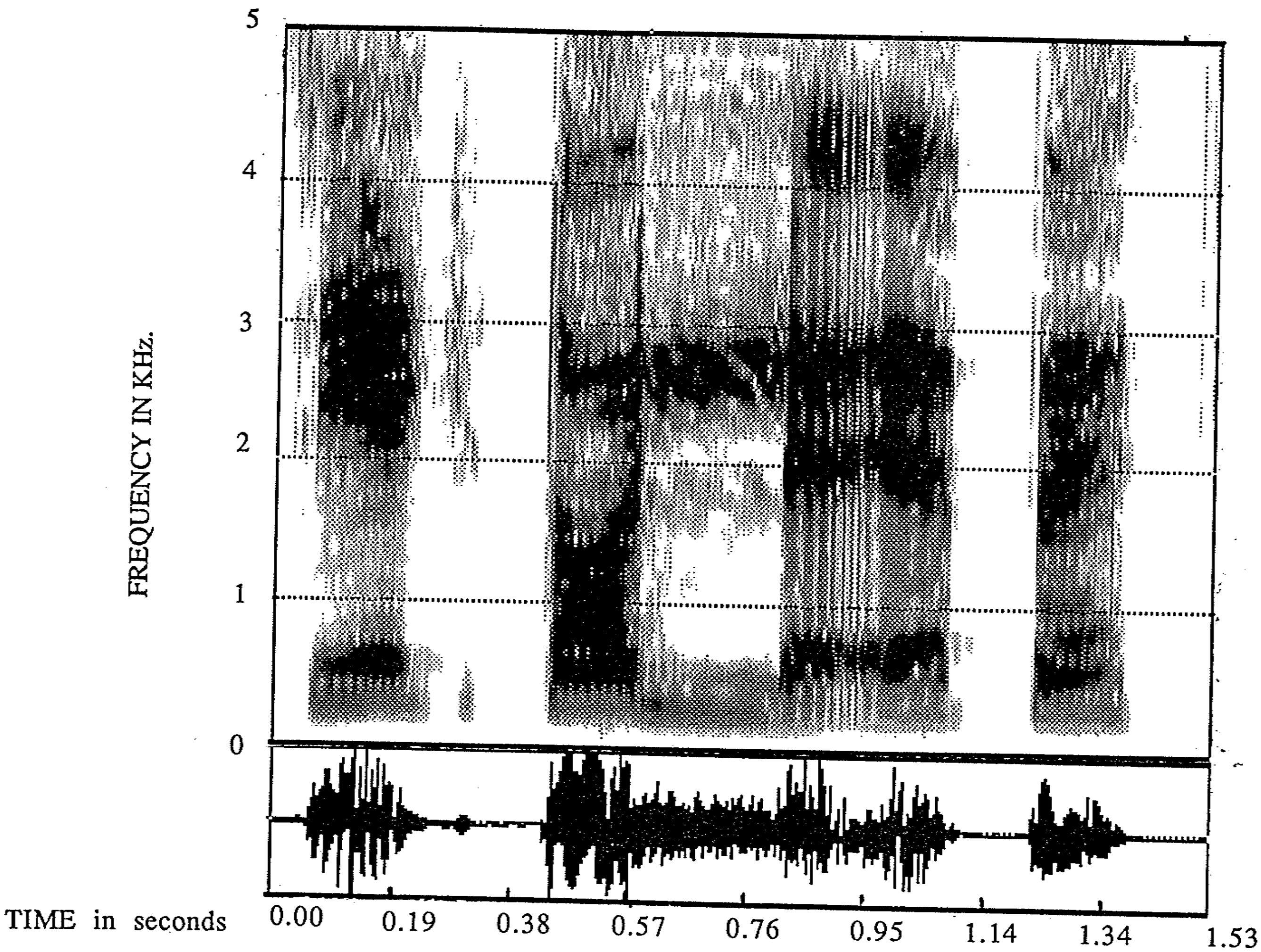


Figure 18. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *saar to´lle* 'fire' (Ill.Sg.) *e´pet* as spoken by subject K.J. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 2.37 s. Test word: *to´lle.* Structural type: Type $6a_1$. The segments measured: [o] = 105 msec., [l] = 280 msec., [e] = 82 msec.

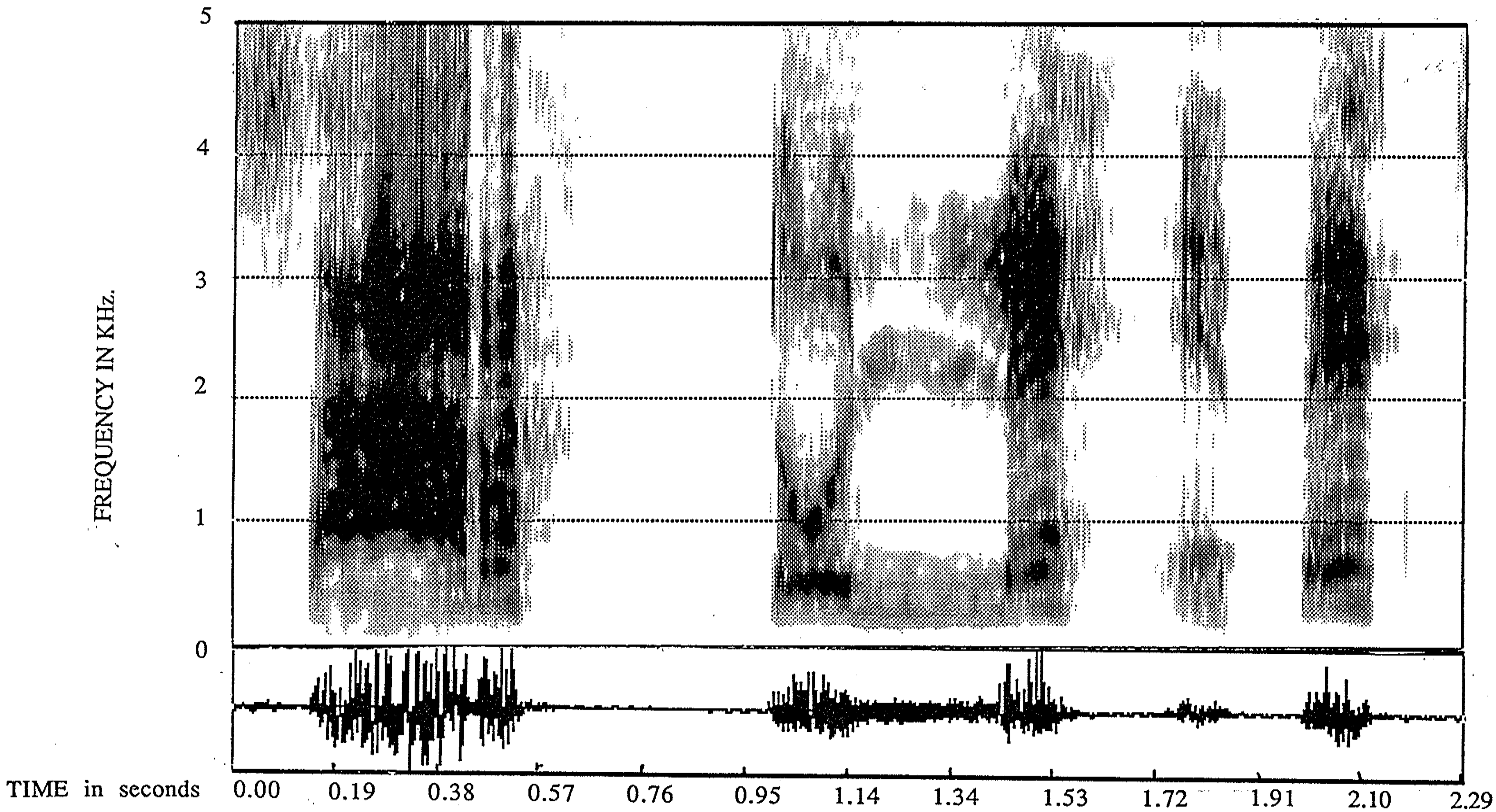


Figure 19. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *ciel'k puä'tte* 'come' (Past.Pl3.) *e'pet* as spoken by subject H.S. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 1.68 s. Test-word: *puä'tte* . Structural type: $6a_2$. The segments measured: [ui] = 112 msec., [t] = 352 msec., [e] = 90 msec.

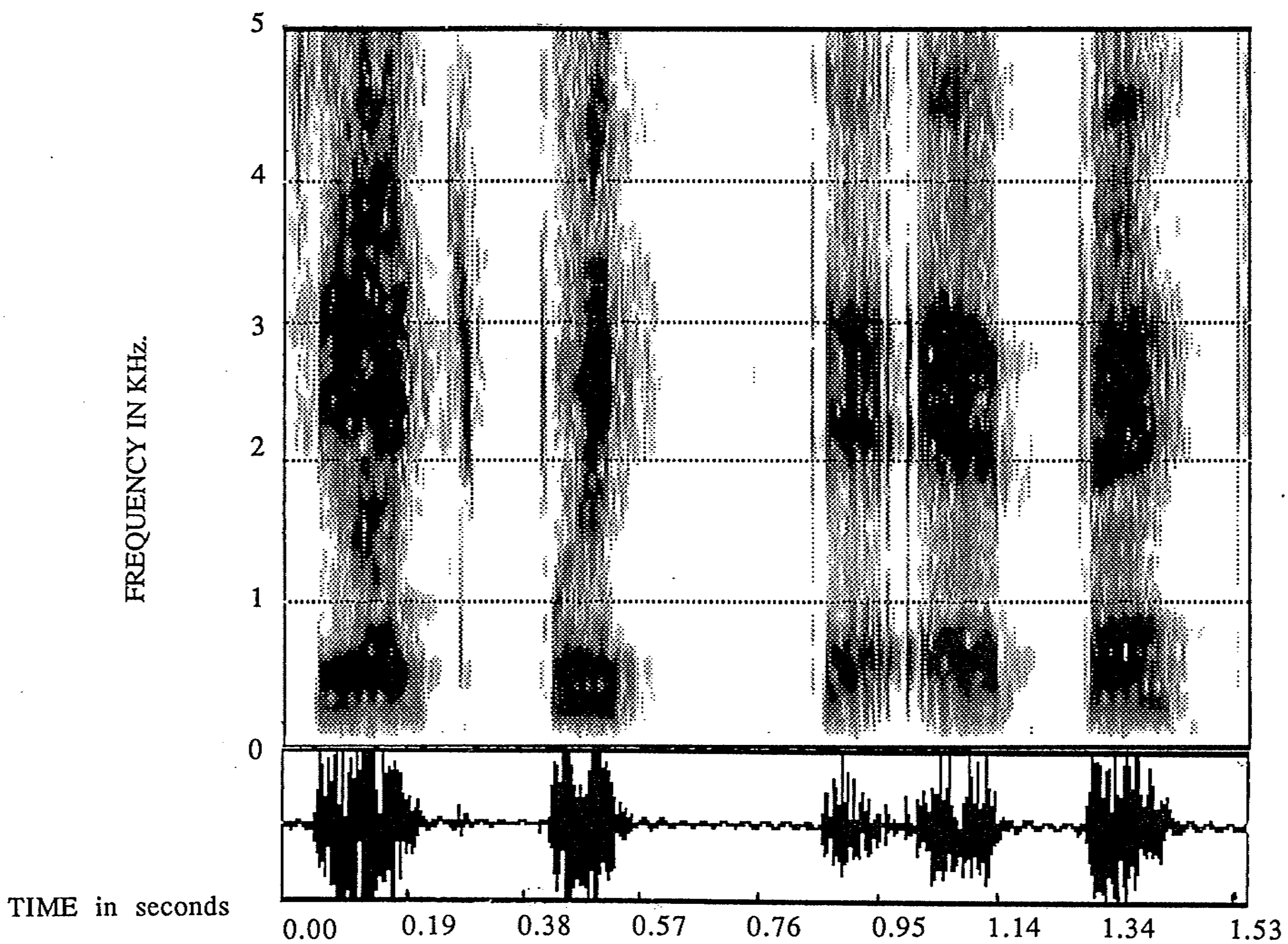


Figure 20. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *saar puä´tte* 'come' (Past.Pl3.) *e´pet* as spoken by subject K.J. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 2.13 s. Test word: *puä´tte.* Structural type: Type 6a$_2$. The segments measured: [ui] = 105 msec., [t] = 380 msec., [e] = 75 msec.

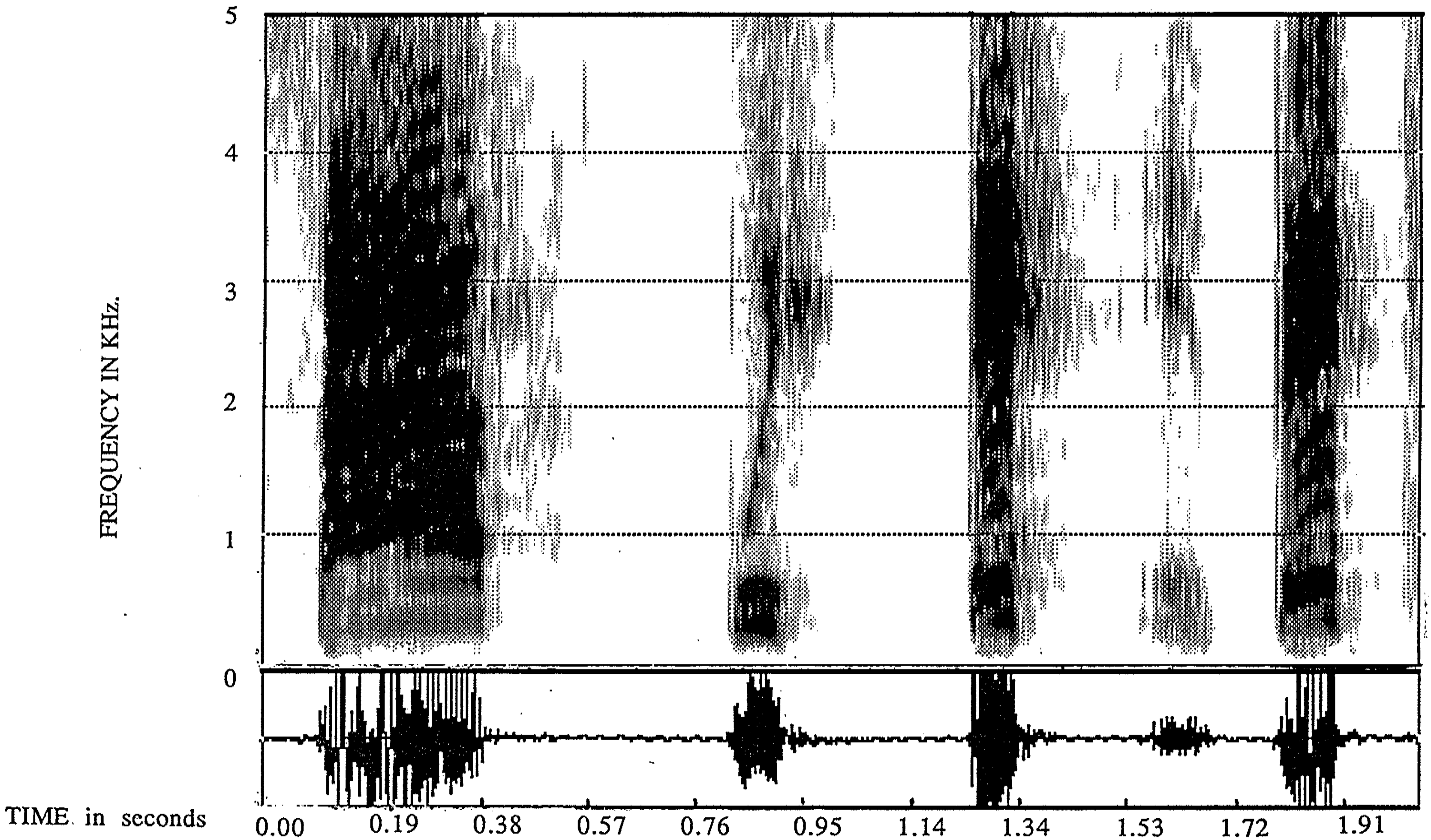


Figure 21. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *ciel'k ju'rddem* 'think' (Past.Sg1) *e'pet* as spoken by subject H.S. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 1.76 s. Test-word: *ju'rddem* . Structural type: 6b. The segments measured: [u] = 98 msec., [r] = 112 msec., [d] = 195 msec., [e] = 82 msec.

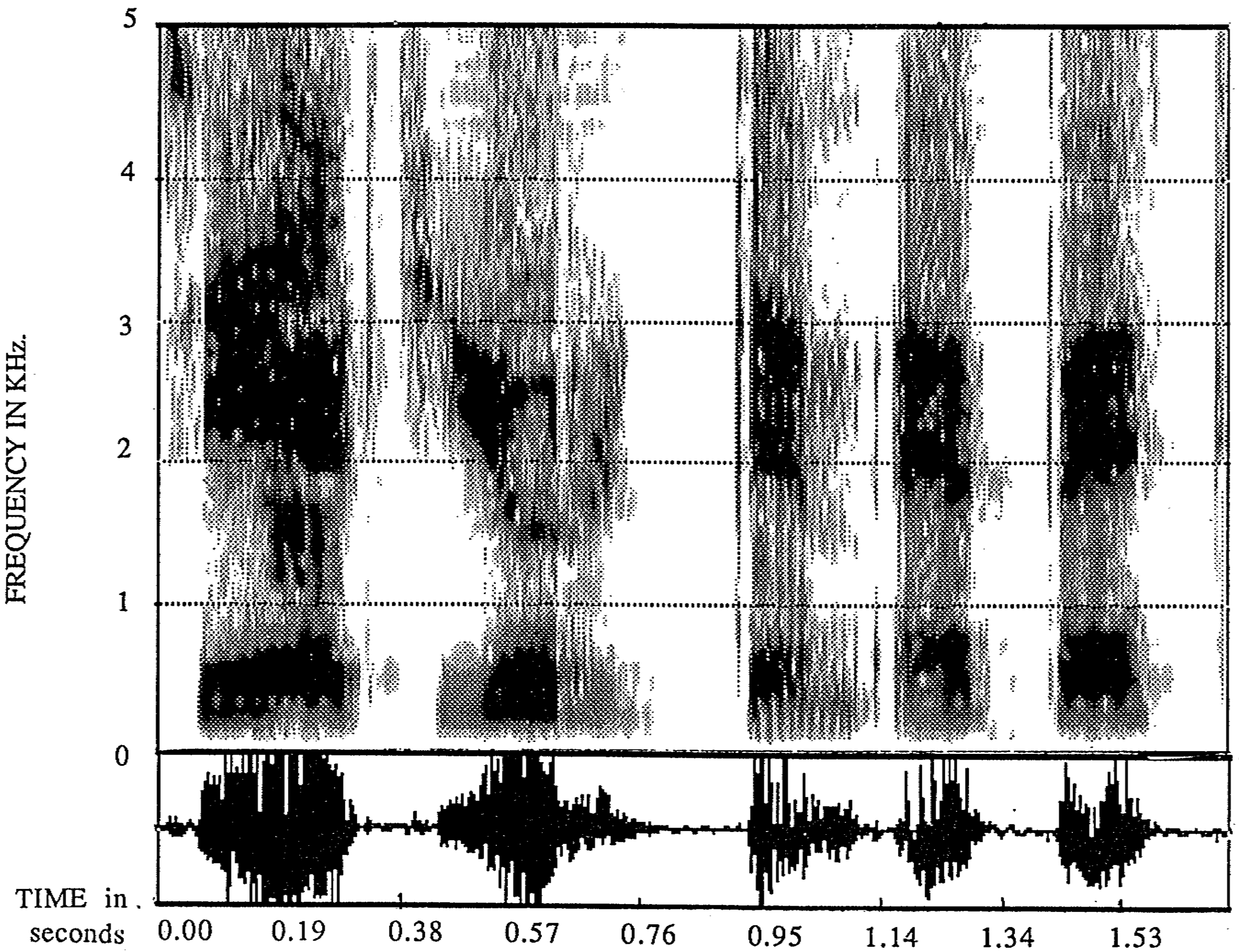
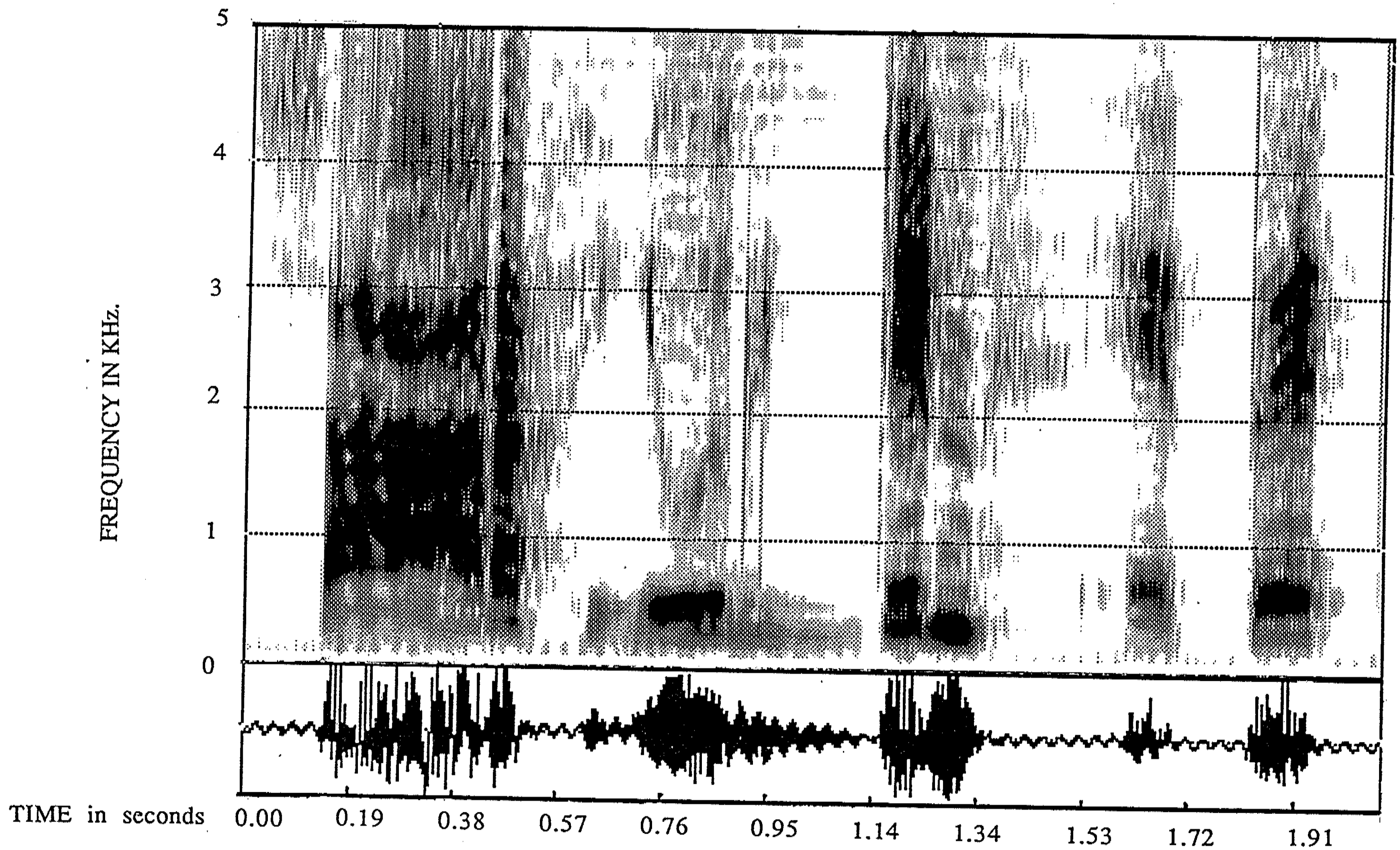


Figure 22. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *saar ju´rddem* 'come' (Past.Pl3.) *e´pet* as spoken by subject K.J. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 2.15 s. Test word: *ju´rddem* . Structural type: Type 6b. The segments measured: [u] = 127 msec., [r] = 90 msec., [d] = 210 msec., [e] = 65 msec.



4.7. Vowels

The segment boundaries of the vowels were usually determinable without difficulty. Spectrograms characteristic of the vowels in question, and associated with wave-forms of high intensity curves in comparison with the neighbouring consonants, were adequate for identifying the beginning and end of the vowels.

However, there was a problem in identifying the end of those vowels followed by voiceless plosives. The problem is associated with the preaspiration phenomenon appearing in connection with these consonants. In this study the duration of the preaspiration period (60-90 msec)[75] is counted towards the duration of the consonant. This approach was suggested by Trubetzkoy (1936), Haugen (1958) and Liberman (1971). However, associating preaspiration with the consonant following is by no means generally accepted. There are three possible ways to analyse preaspiration: (i) in association with the vowel preceding, (ii) considered as an independent segment, and (iii) associating preaspiration with the consonant following. Ilse Lehiste (personal communication) suggests counting the duration of preaspiration in with the vowel duration. Engstrand (1987) considers preaspiration as a separate segment, and Garnes (1973) also argues for regarding preaspiration as a separate segment.[76] Liberman (1971) considers preaspiration as a junctural phenomenon, for preaspirated affricates do not seem to be

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[75] The average duration of preaspiration in Grade II disyllabics is 64.78 msec, while the average duration for Grade III disyllabics is 82.21 msec (McRobbie 1991).

[76] Garnes mentions that durational values for preaspiration decrease in accordance with increasing duration of the corresponding vowel. This accords with the tendency to maintain constant duration from the onset of the vowel to the onset of the consonant in Icelandic (1973:279).

plausible phonological entities.[77] But he does not conclude by providing a definite answer. He is of the view that to posit a set of aspirated vowels in Lappish would not be a plausible solution, because preaspiration always occurs in connection with consonants only. This seems to be the most appropriate way of approaching the problem of preaspiration, and it is on this basis that I chose to count the duration of the period of preaspiration in with the following consonant. I have presented (McRobbie 1991) two arguments in support of counting preaspiration duration in with the consonant duration when proceeding with segmentation. The first argument is an acknowledgement of the fact stated above, i.e. that preaspiration does not occur before other consonants: the CV sequence where preaspiration is relevant must contain a voiceless plosive as the second member of this sequence. The second argument may be stated as follows: after [u] there is no preaspiration attestable before voiceless plosives.[78] However, consonant duration measured from the end of the vowel up to the release of the closure is the same after [u] as durations measured with the inclusion of the preaspiration period present after all the other vowels. Were preaspiration to be counted in with the duration of the preceding vowel it would mean that all vowels would be of similar duration (197.5 + 64.78 msec for Grade II words, and 108.6 + 82.21 msec for Grade III words), but only 197.5 msec (Grade II) or 108.6 msec (Grade III) for the vowel [u] -- an unlikely assumption.[79]

The spectrograms below (*Figures 23-27*) illustrate the points discussed here concerning preaspiration in Skolt Sámi.

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77 Liberman (1971:273).

78 In McRobbie (1991) this fact is elaborated and discussed in detail.

79 For the details of these measurements see McRobbie (1991).

Figure 23. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *ciel'k kua'tt* 'Lappish tent' *e'pet* as spoken by subject H.S. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 1.68 s. Test-word: *kua'tt* . The segments measured: [ua] = 240 msec., [preaspiration + t] = 262.5 msec.

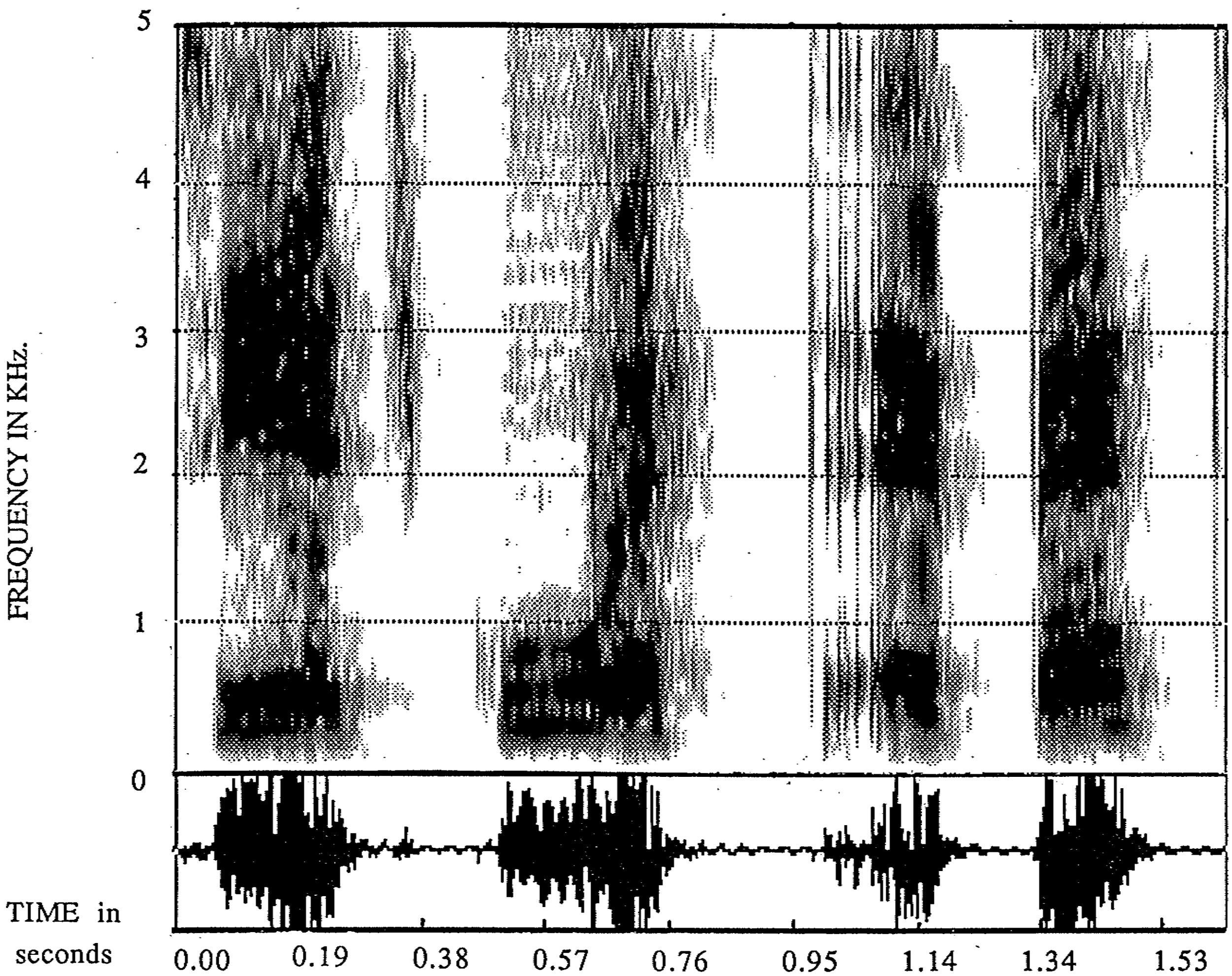


Figure 24 . Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *saar hâ´dd* 'price' *e´pet* as spoken by subject K.J. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 2.18 s. Test word: *hâ´dd.* The segments measured: [â] = 90 msec., [preaspiration + d] = 375 msec.

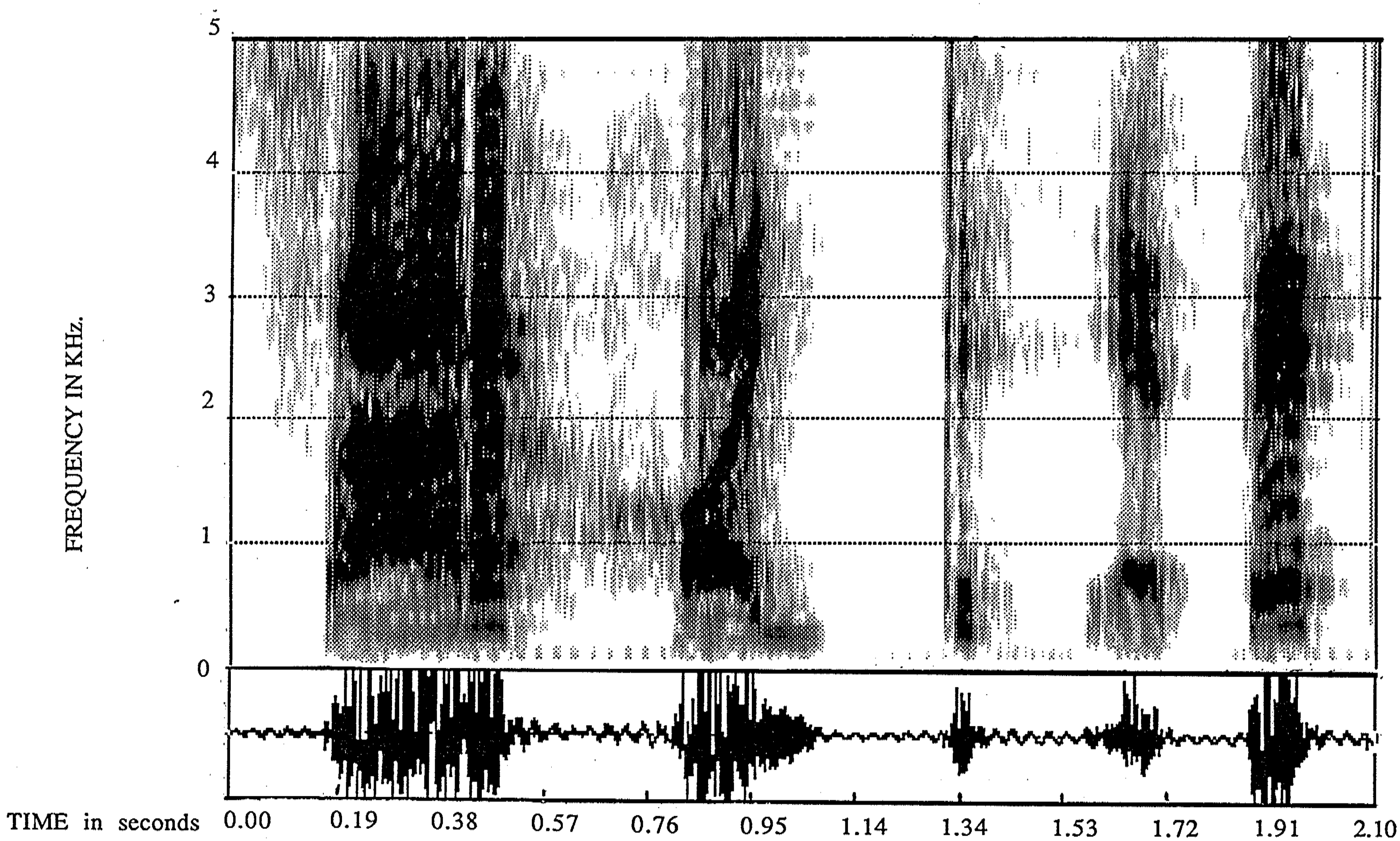


Figure 25. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *ciel´k veekk* 'carry' (Prs.Sg3) *e´pet* as spoken by subject H.S. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 2.06 s. Test-word: *veekk.* The segments measured: [e] = 217.5 msec., [preaspiration + k] = 217.5 msec.

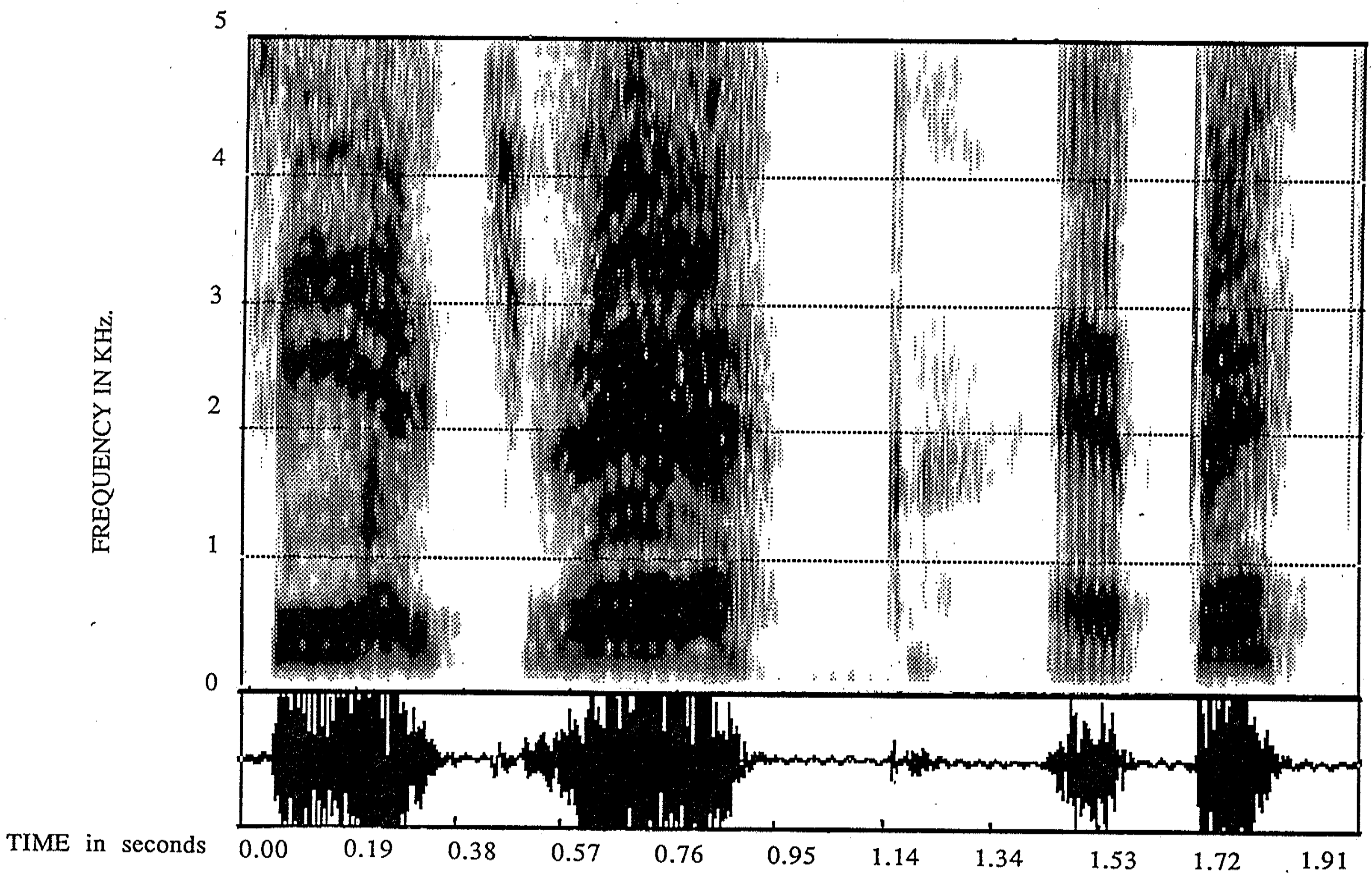


Figure 26. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *saar likkâd* 'jump' (Inf.) *e´´pet* as spoken by subject K.J. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 2.06 s. Test word: *likkâd*. The segments measured: [i] = 165 msec., [preaspiration + k] = 217.5 msec, [ɒ] = 60 msec.

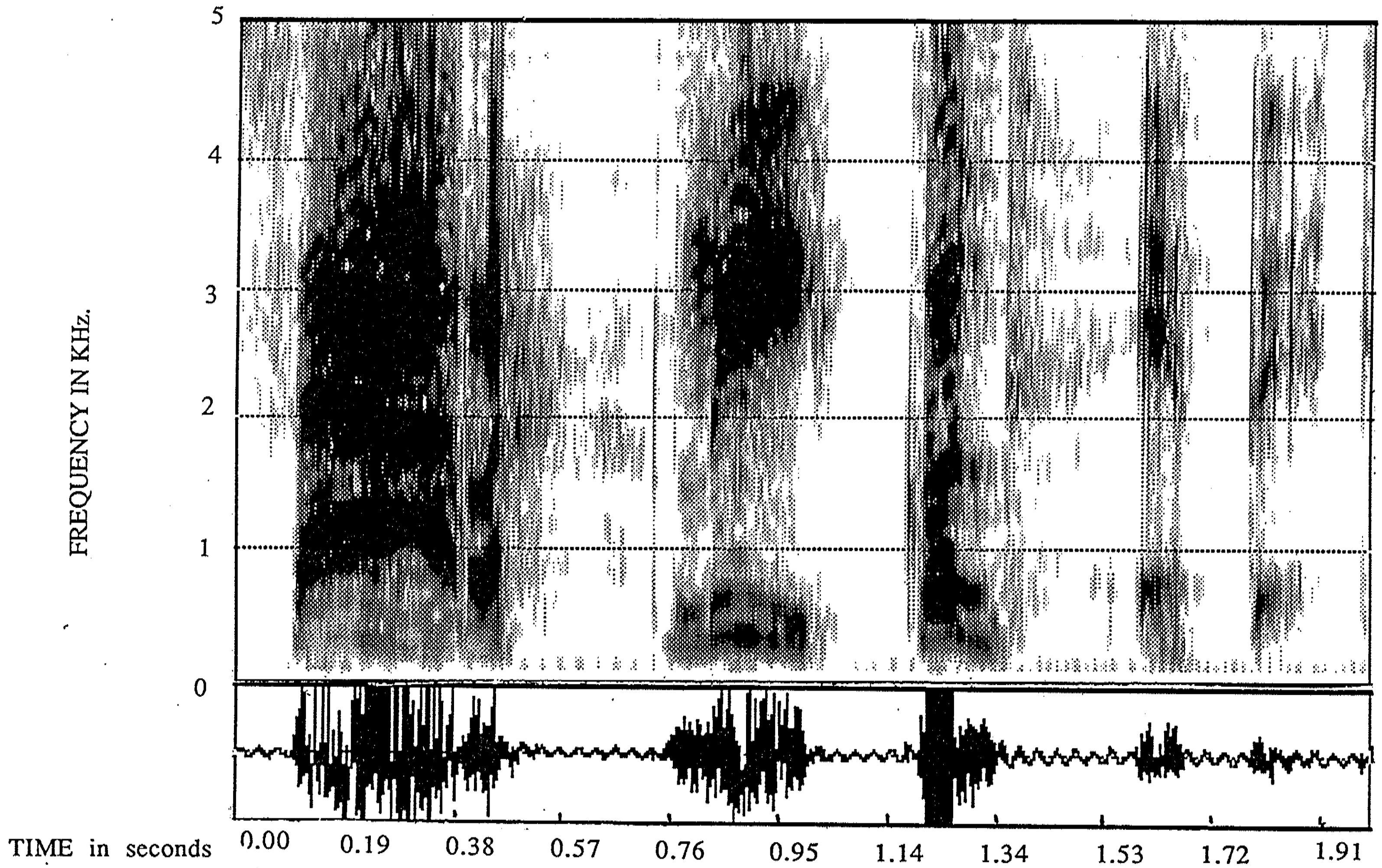
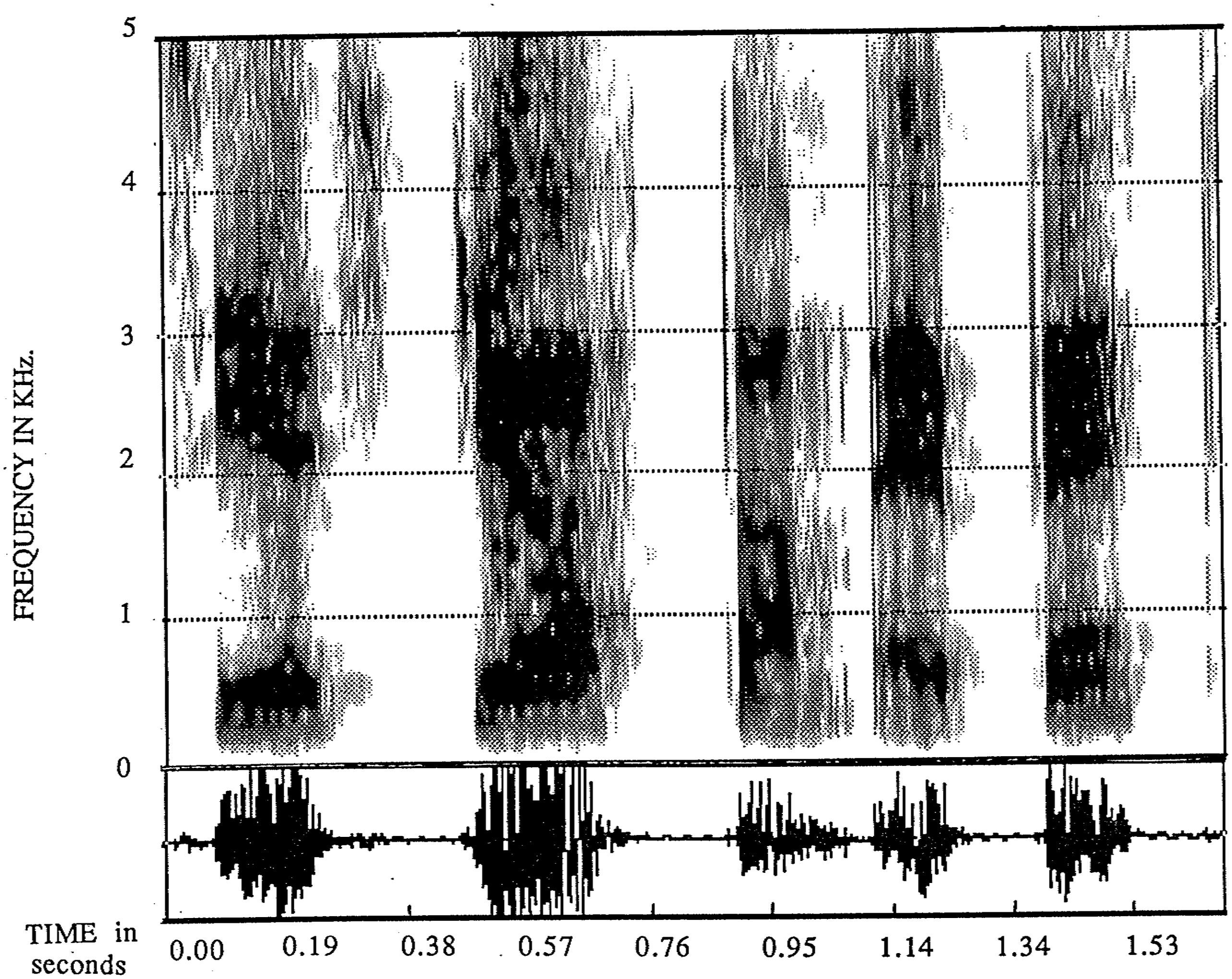


Figure 27. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *ciel'k keattam* 'cook' (Prs.Sg1) *e'pet* as spoken by subject H.S. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 1.72 s. Test-word: *keattam.* The segments measured: [ea] = 180 msec., [preaspiration + t] = 240 msec., [a] = 82.5 msec.



CHAPTER 3

ANALYSIS OF DURATION

1. The duration of disyllabics

In the discussion that follows, the durational measurements of all six structural types will be presented. A list of the test-words analyzed representing each of the structural types may be found in Appendix B. Measurement values will be associated with each informant, and an evaluation of these will follow the presentations of all six structural types.

1.1. Type 1

The test-words that belong to this structural type have two sub-groups (see p. 45). The first sub-group has liquids, nasals or non-sibilant fricatives in the consonant centre (Type 1a); the second sub-group has obstruents (plosives, affricates and fricatives: sibilants and the palatal fricative) in the consonant centre (Type 1b).

1.1.1. Type 1a

Number of test-words: 34. Number of recorded test-words suitable for acoustic analysis: 97 (H.S.) and 86 (K.J.).[80]

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[80] Each test-word was recorded three times by each informant (at different recording sessions). A number of the takes were not suitable for measurement (due to hesitations, mistakes etc.). As a rule, H.S. made relatively few mistakes, the number of unsuitable recordings being somewhat higher for K.J. This may be explained by H.S.'s higher degree of literacy.

Table 3. Mean durations and standard deviations of Type 1a disyllabics

	Vowel Centre		Consonant Centre		Latus	
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
HS	216	23	183	18	90	15
KJ	213	21	184	25	84	14

Table 4. Mean durations and standard deviations of Type 1a disyllabics: Vowel Centre durations

Vowel Centre	HS		KJ	
	$\bar{x}$	SD	$\bar{x}$	SD
u	217	42	213	26
o	197	31	182	20
ie	212	12	203	15
eä	232	21	225	23
ue	217	22	240	31
uä	225	14	217	14

Table 5. Mean durations and standard deviations of Type 1a disyllabics: Consonant Centre durations

Consonant Centre	HS		KJ	
	x̄	SD	x̄	SD
l	174	26	183	41
r	151	18	161	30
n	187	13	150	20
ŋ	198	20	182	16
m	180	15	170	22
đ	207	33	235	16
v	182	33	206	30

1.1.2. <u>Type 1b</u>

Number of test-words: 69. Number of recorded test-words suitable for acoustic analysis: 190 (H.S.) and 173 (K.J.).

Table 6. Mean durations and standard deviations of Type 1b disyllabics

	Vowel Centre		Consonant Centre		Latus	
	x̄	SD	x̄	SD	x̄	SD
HS	208	24	226	30	90	15
KJ	195	20	225	25	80	16

Table 7. Mean durations and standard deviations of Type 1b disyllabics: Vowel Centre durations

Vowel Centre	HS		KJ	
	$\bar{x}$	SD	$\bar{x}$	SD
i	197	21	182	16
e	219	21	198	22
â	200	30	183	18
ä	223	18	184	21
õ	228	16	169	8
u	193	22	183	12
o	216	19	205	17
å	201	30	196	30
a	187	28	180	22
ie	206	17	199	24
eä	213	22	205	16
uo	207	36	210	28
ue	210	27	202	34
ua	213	37	225	21
uä	215	24	211	17

Table 8. Mean durations and standard deviations of Type 1b disyllabics: Consonant Centre durations

Consonant Centre	HS		KJ	
	x̄	SD	x̄	SD
p	239	40	246	35
t	208	33	191	29
k	217	30	243	21
g	190	31	219	29
ǩ	235	30	245	24
ǧ	230	27	244	26
s	255	22	258	26
š	230	32	250	20
c	228	28	239	23
č	235	11	244	24
j	218	36	219	28

1. 2. Type 2

Number of test-words: 55. Number of recorded test-words suitable for acoustic analysis: 160 (H.S.) and 157 (K.J.).

The consonant clusters are of the following types[81]: liquid + plosives (*lp, lt, ld, lg, lk, lǧ, rt, rd,* and *rg, rg*); liquid + nasal (*lm*); liquid + voiced fricative (*lv*); semivowel + plosive (*it, ik, ib, id, iǧ, uk, ug*); semivowel + nasal (*im, in, um*); semivowel + liquid (*ur*); semivowel + voiced fricative (*iv*); sibilant + voiceless plosive (*sk, st, št*); glottal fricative + voiceless obstruent (*ht, hs, hš, hč*); plosive + plosive, both voiceless (*pt*); plosive + fricative, both voiceless (*pš*).

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81 The types of clusters that occur in my material are indicated in brackets.

In the speech of subject H.S., the affricate *č* is substituted by *š* (see clusters *hč* and *hš* respectively).

Table 9. Mean durations and standard deviations of Type 2 disyllabics

	Vowel Centre		Consonant Centre		Latus	
	x̄	SD	x̄	SD	x̄	SD
HS	145	23	354	24	90	16
KJ	151	23	369	33	79	15

Table 10. Mean durations and standard deviations of Type 2 disyllabics: Vowel Centre durations

Vowel Centre	HS		KJ	
	x̄	SD	x̄	SD
i	158	31	142	10
e	128	21	137	17
â	160	18	157	30
ä	155	28	146	28
õ	139	23	147	23
u	139	20	156	22
a	143	11	161	22
ie	154	28	160	30
eä	149	20	160	22
uo	130	24	140	31
ue	150	31	147	28
ua	141	22	160	24
uä	147	24	152	14

Table 11. Mean durations and standard deviations of Type 2 disyllabics: Consonant Centre durations

Consonant Centre	HS		KJ	
	x̄	SD	x̄	S D
lp	400	21	384	30
lt	395	10	405	32
ld	331	31	341	30
lg	347	33	379	34
lǩ	396	33	389	16
lǧ	398	31	405	30
lm	340	11	345	10
lv	333	15	348	30
rt	363	15	410	30
rd	313	18	313	10
rg	346	31	400	33
rǧ	396	28	410	30
it	395	21	415	20
iǩ	382	27	410	28
ib	405	31	371	36
id	341	34	354	35
iǧ	382	30	410	15
im	400	15	367	12
in	325	34	318	31
iv	340	28	348	12
uk	382	12	352	28
ug	332	11	300	15
um	301	26	303	21
ur	301	20	345	10
sk	362	35	403	35
sǩ	382	31	415	30
st	350	32	341	30
št	355	17	405	10
ht	360	33	348	12
hs	357	15	352	17
hč			389	32
hš	370	34		
pt	401	30	352	34
pš	405	33		

1.3. Type 3

Number of test-words: 35. Number of recorded test-words suitable for acoustic analysis: 101 (H.S.) and 99 (K.J.).

Table 12. Mean durations and standard deviations of Type 3 disyllabics

	Vowel Centre		Consonant Centre		Latus	
	x̄	SD	x̄	SD	x̄	SD
HS	304	29	87	16	94	17
KJ	292	18	87	12	82	15

Table 13. Mean durations and standard deviations of Type 3 disyllabics: Vowel Centre durations

Vowel Centre	HS		KJ	
	x̄	SD	x̄	SD
i	315	34	290	20
â	296	22	288	12
ä	310	27	284	16
õ	292	22	288	12
u	328	29	290	13
ie	285	34	287	22
eä	300	30	307	32
ue	298	31	289	24
ua	337	30	330	21
uä	286	32	276	29

Table 14. Mean durations and standard deviations of Type 3 disyllabics: Consonant Centre durations

Consonant Centre	HS x̄	HS SD	KJ x̄	KJ SD
m	104	19	93	10
l	82	18	64	11
r	79	20	108	14
đ	69	11	69	15
v	89	18	82	11
j	101	10	108	13

1.4. Type 4

Number of test-words: 40. Number of recorded test-words suitable for acoustic analysis: 112 (H.S.) and 108 (K.J.). Disyllabics with *đ*, *z* and *ž* in the consonant centre have an average of 50 msec shorter duration in comparison with the duration of the other consonants.[82] On the basis of this durational difference, Type 4 disyllabics will be divided into two sub-types: Type 4a disyllabics (21 test-words) containing the voiced interdental and alveopalatal fricatives in the consonant centre (*đ*, *z* and *ž*)[83]; Type 4b (19 test-words) containing voiced and voiceless plosives, affricates and voiceless fricatives in the consonant centre (*t, k, d, s, c, ʒ* and *ǯ*). Vowel Centre duration does not differ as a result of the differences in duration apparent in the consonant centre.

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[82] These disyllabics with shorter duration are discussed as a separate group in E. Itkonen's classification of structural types (1946:137). They form a sub-group in Grade I disyllabics of the x-series (see pp. 109, 112 in this dissertation).

[83] See pp.45-46.

Table 15. Mean durations and standard deviations of Type 4 disyllabics

	Vowel Centre		Consonant Centre 4a		Consonant Centre 4b		Latus	
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
HS	216	24	156	13	207	28	96	18
KJ	211	22	159	14	217	31	90	24

Table 16. Mean durations and standard deviations of Type 4 disyllabics: Vowel Centre durations

Vowel Centre	HS		KJ	
	$\bar{x}$	SD	$\bar{x}$	SD
i	198	25	215	33
e	220	29	210	24
â	236	20	208	21
ä	225	29	210	25
õ	210	32	220	28
u	203	27	208	21
o	207	11	222	16
å	221	30	204	20
iä	231	21	205	15
eä	206	31	220	27
uo	232	20	235	12
ue	221	32	199	23
ua	196	12	204	25
uä	220	28	205	30

Table 17. Mean durations and standard deviations of Type 4a disyllabics

Consonant Centre	HS		KJ	
	x̄	SD	x̄	SD
g	154	23	158	19
z	160	24	160	30
ž	156	12	160	21

Table 18. Mean durations and standard deviations of Type 4b disyllabics

Consonant Centre	HS		KJ	
	x̄	SD	x̄	SD
t	202	31	216	31
k	210	22	221	22
k̆	222	16	228	16
d	219	18	220	23
s	204	21	218	30
c	211	15	204	26
ʒ	208	26	216	32
ǯ	182	12	210	21

1.5. Type 5

Number of test-words: 61. Number of recorded test-words suitable for acoustic analysis: 179 (H.S.) and 170 (K.J.).

Table 19. Mean durations and standard deviations of Type 5 disyllabics

	Vowel Centre		Consonant Centre		Latus	
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
HS	231	24	174	19	94	17
KJ	220	27	174	22	86	18

Table 20. Mean durations and standard deviations of Type 5 disyllabics: Vowel Centre durations

Vowel Centre	HS		KJ	
	$\bar{x}$	SD	$\bar{x}$	SD
e	228	25	238	35
ä	251	23	249	31
õ	237	30	205	28
u	234	12	215	20
o	229	31	212	30
å	207	28	200	29
a	250	23	243	32
ie	222	31	203	20
iä	213	22	217	20
eä	253	21	235	21
uo	221	15	232	25
ue	203	18	199	25
ua	236	26	219	31
uä	258	25	220	25

Table 21. Mean durations and standard deviations of Type 5 disyllabics: Consonant Centre durations

Consonant Centre	HS		KJ	
	x̄	SD	x̄	SD
lt	182	16	200	10
lǩ	161	18	185	26
ld	145	31	158	19
lj	190	21	177	23
lg̰	157	10		
lv	185	15		
rd	163	13	160	29
rg̰	150	15	142	24
rj	169	18	172	17
rn	163	15	165	12
rv	168	20	158	20
it	165	20	161	21
ib	201	28	191	27
id	172	31	185	10
ig	148	19	140	23
ij	199	26	197	31
im	205	10	167	17
uk	200	24	199	30
ud	154	26	149	27
um	187	11		
ur	171	18	157	29
us	151	27	181	12
ut	167	22	171	28
sk	182	19	209	30
st	197	23	210	28
pš	205	11		

1.6. Type 6

The words that belong to this structural type have an historically contracted vowel in the second syllable.[84] The duration of such vowels is no different from that of the vowels discussed in connection with Types 1-5. However, the distributions of durations of the vowel centre and the consonant centre are different from the durational distributions of the relevant structural Type (Type 1): thus it is justified to discuss those words containing historically contracted vowels as a separate Type. Yet the relevant structural types do not differ durationally, as far as the words with a consonant cluster in the consonant centre are concerned (Type 2), as can be seen from the following Tables of Type 6 words. The two-fold reason for presenting these disyllabics here is that (i) they do not undergo compensatory lengthening (see Chapter 5), and (ii) in order to be consistent with the traditional grouping of disyllabics with consonant clusters in the consonant centre, with regard to the historical status of the latic vowel (see p.46).

As mentioned earlier (pp. 44-45), E. Itkonen presents these disyllabics as sub-groups of structural types $з\bar{x}x^3$ and $з\bar{x}\bar{y}^3$. On the basis of the two different consonant centres (geminates and consonant clusters), the durational measurements will be presented in two groups: Type 6a and Type 6b. Further, Type 6a, similarly to Type 1 disyllabics, will be divided into two sub-groups on the basis of different durational patterns observed in disyllabics with liquids, nasals or non-sibilant fricatives in the consonant centre. These latter structural types will be referred to as Type $6a_1$ with liquids, nasals or non-sibilants in the consonant centre; and Type $6a_2$ with plosives, affricates or fricatives (sibilant or the palatal fricative) in the consonant centre. There

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84 The historical development of the contracted vowel in Sámi is discussed in most detail in Korhonen (1969, 1981) and E. Itkonen (1946).

are no differences in duration apparent in the vowel centre; thus durations in the vowel centre of these two sub-groups will be presented under Type 6a. The durations of the consonant centre will be presented in two separate Tables (24 and 25).

Number of test-words: 87 (55 in 6a, and 32 in 6b). Number of recorded test-words suitable for acoustic analysis: 256 (H.S.) and 248 (K.J.).

Table 22. Mean durations and standard deviations of Type 6a disyllabics

	Vowel Centre		Consonant Centre				Latus	
			$6a_1$		$6a_2$			
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
HS	119	10	242	14	348	29	90	17
KJ	106	11	251	10	355	17	81	16

Table 23. Mean durations and standard deviations of Type 6a disyllabics: Vowel Centre durations

Vowel Centre	HS		KJ	
	$\bar{x}$	SD	$\bar{x}$	SD
i	101	13	99	18
e	118	8	93	26
â	120	13	122	10
ä	128	12	105	8
õ	117	15	107	21
u	114	16	101	18
o	113	23	97	24
å	105	21	97	16
a	127	11	108	19
ie	131	12	111	20
eä	126	14	116	15
uo	120	18	105	20
ue	105	10	95	24
ua	134	16	135	22
uä	129	12	110	16

Table 24. Mean durations and standard deviations of Type $6a_1$ disyllabics: Consonant Centre durations

Consonant Centre	HS		KJ	
	x̄	SD	x̄	SD
l	227	31	242	21
r	233	22	260	25
n	266	27	252	17
ŋ	240	30	255	19
ɲ	245	27	257	26
đ	238	15	260	25
v	252	19	260	25

Table 25. Mean durations and standard deviations of Type $6a_2$ disyllabics: Consonant Centre durations

Consonant Centre	HS		KJ	
	x̄	SD	x̄	SD
p	388	34	360	10
t	373	34	360	32
k	378	30	331	29
ǩ	390	27	387	31
ğ	382	31	390	29
d	341	32	340	34
g	305	20	355	28
c	385	30	397	15
č	337	12	354	30
ʒ	312	21		
ǯ	342	32	357	31
s	352	20	355	28
š	320	29	347	28

Table 26. Mean durations and standard deviations of Type 6b disyllabics

	Vowel Centre		Consonant Centre		Latus	
	$\bar{x}$	SD	$\bar{x}$	SD	$\bar{x}$	SD
HS	115	14	323	14	94	16
KJ	110	11	333	17	87	15

Table 27. Mean durations and standard deviations of Type 6b disyllabics: Vowel Centre durations

Vowel centre	HS		KJ	
	$\bar{x}$	SD	$\bar{x}$	SD
i	106	20	99	21
e	122	13	97	20
â	120	10		
ä	130	14	122	12
õ	98	12	97	13
u	103	13	114	18
o	120	20	124	16
a	118	12	115	20
eä	116	11	125	12
ue	111	14	105	22
ua	127	18	105	22

Table 28. Mean durations and standard deviations of Type 6b disyllabics: Consonant Centre durations

Consonant Centre	HS		KJ	
	x̄	SD	x̄	SD
ld	306	30	331	31
lg	320	31	316	33
lğ	335	27	336	29
lv	305	11	318	12
rt	318	26	338	30
rd	316	20	330	28
rg	341	18	348	32
rm	325	15	358	34
rn	302	26	300	10
rŋ	315	22	335	31
ib	351	24	333	26
ig	345	27	352	30
it	332	20	341	24
ik	334	25	350	32
un	298	10	318	15
st	350	16	344	28
sǩ	324	18	351	31
hč	350	15	358	34

2. Summary of the results of durational measurements

Tables 29 and 30 provide an overview of the durational measurements presented above. The distribution of duration in all six structural types will be summarized in Table 31. Comparison of these measurements in relation to the two subjects shows that, as far as the patterning of durational distribution is concerned, the two Skolt Sámi (Suonikylä and Petsamo) dialects display very little difference.

Table 29. Mean durations of the six structural types (subject: H.S.)

	Vowel Centre	Consonant Centre		Latus
	$\bar{x}$	$\bar{x}$		$\bar{x}$
Type 1a	216	178		90
Type 1b	208	218		90
Type 2	145	359		90
Type 3	304	87		94
Type 4	216	(a) 156	(b) 205	96
Type 5	230	174		94
Type 6a	119	(a_1) 242	(a_2) 348	90
Type 6b	115	323		94

Table 30. Mean durations of the six structural types (subject: K.J.)

	Vowel Centre	Consonant Centre		Latus
	$\bar{x}$	$\bar{x}$		$\bar{x}$
Type 1a	213	169		84
Type 1b	195	231		80
Type 2	151	365		79
Type 3	292	87		82
Type 4	211	(a) 159)	(b) 215	90
Type 5	220	174		86
Type 6a	106	(a_1) 251	(a_2)355	81
Type 6b	110	333		87

As may be seen from the above two Tables, the durational values of the two subjects are very similar, any differences being negligible. Thus it is justified to consider these results as representative of the durational distributions of Skolt Sámi disyllabics, at least as far as these two dialects are concerned.[85] Table 31 summarizes these results by presenting the durational measurements averaged for the two subjects. In the discussion that follows these joint results will be examined.

Table 31. A summary of durational measurements of Skolt Sámi disyllabics

	Vowel Centre	Consonant Centre		Latus
	$\bar{x}$	$\bar{x}$		$\bar{x}$
Type 1a	214	173		87
Type 1b	201	224		85
Type 2	148	362		84
Type 3	298	87		88
Type 4	213	(a) 157	(b) 210	93
Type 5	225	174		90
Type 6a	112	(a_1) 246	(a_2) 351	85
Type 6b	112	328		90

On the basis of these results the following observations can be made:

85 I was not able to make similar recordings with the very few remaining speakers of the Paatsjoki dialect. I made numerous recordings during my field trips among them in 1983 and 1984, but these tapes are not suitable for acoustic analysis of the kind presented here. At a later date I intend to examine the Paatsjoki data, for somewhat different durational patterns may be found there (E. Itkonen 1946).

i. Vowels in the vowel centre occur in three different durations: long (Type 3), short (Type 2, Type 6a and 6b), and half-long (Type 1a, Type 1b, Type 4 and Type 5).

ii. Consonants in the consonant centre occur in three different durations: long (Type 2, Type $6a_2$, and Type 6b), short (Type 3), and half-long (Type 1a, Type 1b, Type 4, Type 5, and Type $6a_1$).

iii. Latic durations in all structural types average 87 msec.

These observations may be demonstrated in the following plots (*Figures 28-30*):

Figure 28. Vowel Centre durations in structural Types 1-6.

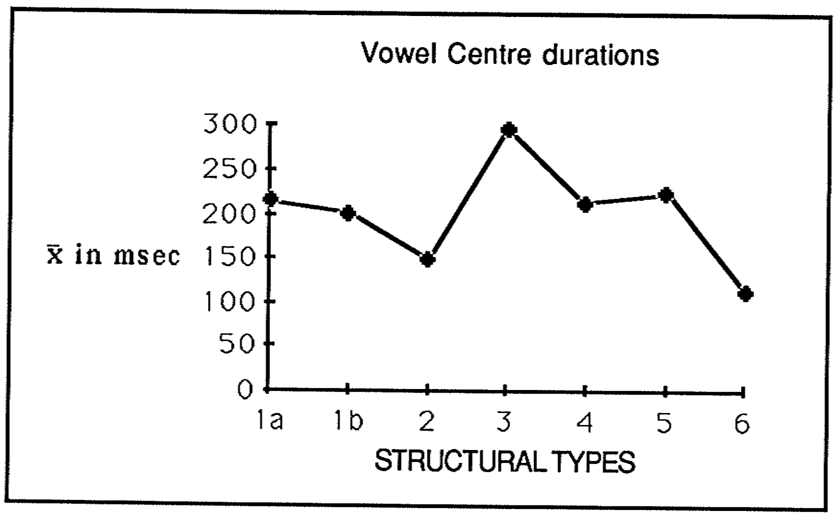


Figure 29. Consonant Centre durations in structural Types 1-6.

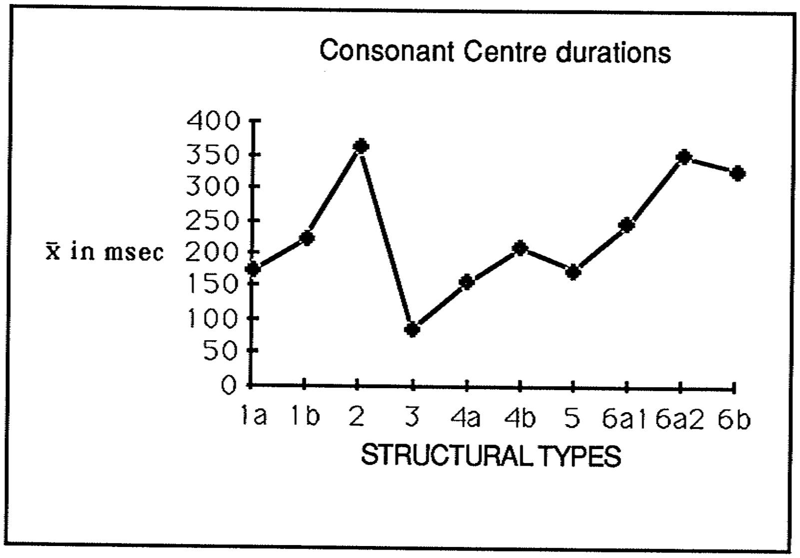
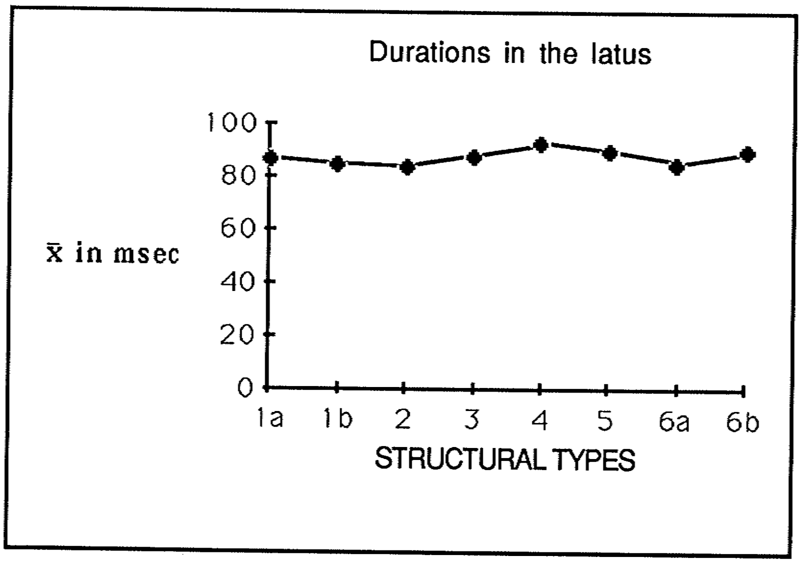
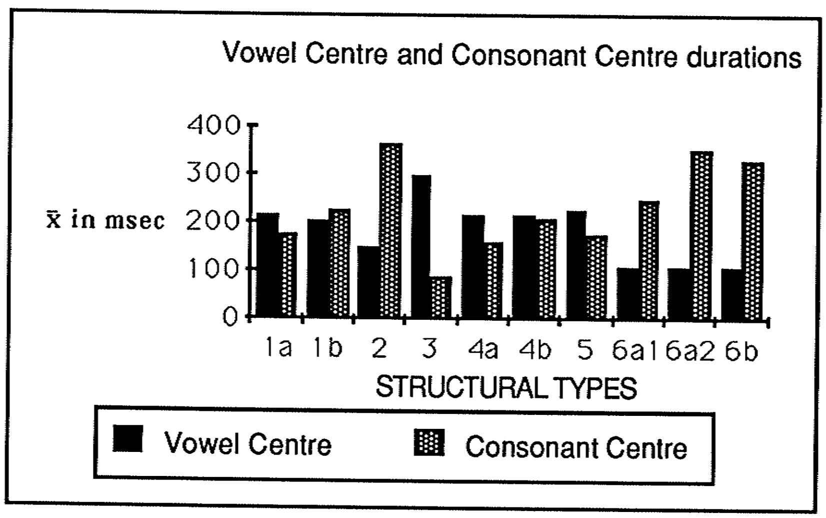


Figure 30. Latic durations in structural Types 1-6.



The above three figures demonstrate the distribution of duration in the six structural types. They show that latic duration is practically identical in all the structural types. The durational distributions in the vowel centre and consonant centre, in addition to illustrating points (i) and (ii) above, suggest a tendency clearly observable from the durational values: namely, a correlation between durational patterns as manifested in one of these stress group locations (vowel centre, consonant centre and latus) in relation to the other. Longer duration in the consonant centre occurs together with shorter duration in the vowel centre in structural Types 2 and 6; longer duration in the vowel centre occurs with shorter duration in the consonant centre (Type 3); and Types 1, 4 and 5 have durations that are half-long both in the vowel centre and the consonant centre, with distinct characteristic ratio patterns. I shall elaborate on this observation later, in connection with consonant gradation where this phenomenon is even more evident (Chapter 4), and in connection with the implication for durational ratios (Chapter 5). The distributions of duration in the vowel centre and consonant centre are illustrated in *Figure 31*.

Figure 31. Vowel Centre and Consonant Centre durations



CHAPTER 4

DISTRIBUTION OF DURATION IN RELATION TO CONSONANT GRADATION

A brief summary of the consonant gradation phenomenon was provided in Chapter 1. There it was pointed out that consonants may occur in three different grades: weak grade, strong grade and the so-called overlong grade (examples of each being given on p. 40).

In this Chapter an overview of duration in relation to these three alternating grades will be given. The weak grade will be referred to as Grade I, the strong grade as Grade II and the overlong grade as Grade III. Disyllabics in Grade I will be examined in three main groups:

i. disyllabics containing consonants of the x-series:

Group (a): the consonants in question here are short;

Group (b): the consonants in question here are half-long.[86]

ii. disyllabics containing consonants of the xx-series,

iii. disyllabics containing consonants of the xy-series

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[86] E. Itkonen 1946:137.

1. Grade I disyllabics

Disyllabics in Grade I will be examined in three groups:

i. disyllabics containing consonants of the x-series:

Group (a): the consonants in question here are short

Group (b): the consonants in question here are half-long.[87]

ii. disyllabics containing consonants of the xx-series,

iii. disyllabics containing consonants of the xy-series.

Table 32. Durational measurements of Grade I disyllabics, x-series, Group (a)

	Vowel Centre	Consonant Centre	Latus
$\bar{x}$	298	87	88
SD	23	19	15

Examples: *kue'l* 'fish' Gen.Acc.Sg.,Nom.Pl.; *puäđak* 'come' Sg2.; *mõõni* 'go' Past Sg3.; *jieŋ* 'ice' Gen.Acc.Sg., Nom.Pl., etc.

Table 33. Durational measurements of Grade I disyllabics, x-series, Group (b)

	Vowel Centre	Consonant Centre	Latus
$\bar{x}$	213	157	93
SD	23	14	21

Examples: *jooggâst* 'river' Loc.Sg.; *pie'zzi* 'nest' Gen.Pl.; *liäžžam* 'lay' Sg1., etc.

87 Ibid.

Table 34. Durational measurements of Grade I disyllabics, xx-series

	Vowel Centre	Consonant Centre	Latus
$\bar{x}$	213	157	90
SD	23	13	21

Examples: *kue´ssid* 'guest' Acc.Ill.Pl.; *miäccest* 'forest' Loc.Sg.; *ääkkast* 'old woman' Loc.Sg., etc.

Table 35. Durational measurements of Grade I disyllabics, xy-series

	Vowel Centre	Consonant Centre	Latus
$\bar{x}$	225	174	90
SD	26	20	17

Examples: *joordam* 'think' Sg1.; *peäldast* 'field' Loc.Sg.; *jeeu´rin* 'lake' Loc.Pl.; *čuârvam* 'shout' Sg.1.

As far as the durational distributions between members of the consonant clusters are concerned, the following observations can be made on the basis of taking durational measurements of the individual segments in the cluster:

(i) When the first member of the cluster is a liquid or a semivowel and the second member is a nasal, liquid or voiced fricative, both members have approximately the same duration, averaging around 80-85 msecs.

(ii) When the first member of the cluster is a semivowel and the second member is a voiceless sibilant, the duration of the semivowel is shorter (75-80 msecs) than the duration of the sibilant (90-100 msecs).

(iii) When the first member of the cluster is a liquid or a semivowel and the second member is a plosive (voiced or voiceless), the duration of the first member may be 50-60 msecs shorter (60-70 msecs) than the duration of the second member (110-120 msecs).

(iv) When the first member of the cluster is a voiceless sibilant and the second member is a voiceless plosive, the distribution of the duration is more even, each member having an average of 85-90 msecs duration.

Table 36. The distribution of duration between members of the consonant cluster, Grade I disyllabics, xy-series

	First member of the cluster	Second member of the cluster
	liquid or semivowel	nasal, liquid or voiced fricative
Duration:	80-85	80-85
	semivowel	voiceless sibilant
Duration:	75-80	90-100
	liquid or semivowel	plosive
Duration:	90-100	100-110
	voiceless sibilant	voiceless plosive
Duration:	85-90	85-90

Table 37. Summary of durational measurements of Grade I disyllabics

	Vowel Centre	Consonant Centre	Latus
x-series			
(a)	298	87	88
(b)	213	157	93
xx-series	213	157	90
xy-series	225	174	90

2. Grade II disyllabics

Disyllabics in Grade II have three subgroups:

i. disyllabics containing consonants of the x-series: Group (a) and Group (b), see below.

ii. disyllabics containing consonants of the xx-series

iii. disyllabics containing consonants of the xy-series.

Grade II disyllabics of the x-series show two distinct durational patterns. This is in accordance with the grouping of those disyllabics referred to in the discussion of Grade I durational patterns. In Group (a) consonants in the consonant centre may be liquids, nasals and voiced non-sibilant fricatives. These consonants appear to be short in the weak grade. In Group (b) the consonants in the consonant centre are the voiceless sibilants and the voiceless velar plosive. As indicated above, in the weak grade these consonants are voiced sibilants (z, ž) and voiced fricatives (ɡ̧) respectively, and are of half-long duration.

Table 38. Durational measurements of Grade II disyllabics, x-series, Group (a)

	Vowel Centre	Consonant Centre	Latus
x̄	214	173	87
SD	22	21	14

Examples: *kue´ll* 'fish'; *pue´tted* 'come' Inf.; *mõõnnâd* 'go' Inf.; *jieŋŋ* 'ice' etc.

Table 39. Durational measurements of Grade II disyllabics, x-series, Group (b)

	Vowel Centre	Consonant Centre	Latus
x̄	201	248	85
SD	22	25	15

Examples: *jokk* 'river', *piä´ss* 'nest', *leäšš* 'lay' Sg3.

Grade II disyllabics containing consonants of the xx-series in the consonant centre display two distinct durational patterns, depending on the presence or absence of an historically contracted vowel in the latus. Those disyllabics containing no such vowel in the latus will be examined in Group (a), and those disyllabics with an historically contracted vowel in the consonant centre will be examined in Group (b). In Group (b) a further distinction has to be made because liquids, nasals and voiced fricatives (other than the palatal voiced fricative) display durational patterns in the consonant centre differently, i.e. their duration is considerably shorter (an average of 100 msecs) than those containing plosives, affricates or fricatives (voiceless sibilants or the palatal fricative). The former will be referred to as Group b_1 and the latter as Group b_2.

Table 40. Durational measurements of Grade II disyllabics, xx-series, group (a)

	Vowel Centre	Consonant Centre	Latus
x̄	201	224	85
SD	22	27	15

Examples: *kue´ss* 'guest'; *meäcc* 'forest'; *juukkâd* 'drink' Inf.

Table 41. Durational measurements of Grade II disyllabics, xx-series, Group (b)

	Vowel Centre	Consonant Centre		Latus
x̄	106	(b_1) 246	(b_2) 351	81
SD	10	14	23	16

Examples: *čuoǯǯum* 'stand' PastSg1.; *meäcca* 'forest' Ill.Sg.; *äkka* 'old woman' Ill.Sg.; *kualla* 'fish' Ill.Sg. etc.[88]

Grade II disyllabics containing consonants of the xy-series in the consonant centre may also be divided into subgroups according to the status of the vowel in the latus, i.e. whether it is an historically contracted vowel or not. However, this grouping

88 It has been drawn to my attention (Lehiste, personal communication) that durational differences in the consonant centre in Groups (b_1) and (b_2) may have an effect on duration in the vowel centre. While a compensatory relationship may be expected on the basis of differing consonant centre durations, what actually happens here is the same phenomenon that could be observed in connection with the duration of liquids and voiced fricatives: the duration of these is considerably shorter than that of the other consonants. No compensatory relationship was attested in these groups of disyllabics. The different consonant durations thus simply signal different structural groups; and these structural groups, when examined from the point of view of consonant gradation, display in Grade II two different patterns as far as the duration of the consonant centre is concerned.

may not be justified in terms of the patterning of duration in the vowel centre and the consonant centre, the differences in duration between the two subgroups averaging 40 msecs. The reason for indicating these differences is simply to remain consistent with the classification criteria stated in connection with Grade II disyllabics of the xx-series, as well as because this average 40 msecs durational difference is present in the vowel centre as well. The disyllabics containing no historically contracted vowel in the latus belong to Group (a), whereas those disyllabics containing such a vowel in the latus are in Group (b).

Table 42. Durational measurements of Grade II disyllabics, xy-series

	Vowel Centre				Consonant Centre				Latus	
$\bar{x}$	(a)	151	(b)	112	(a)	365	(b)	328	(a) 79	(b)90
SD	(a)	23	(b)	13	(a)	28	(b)	15	(a) 15	(b)15

Examples: (a) *ju´rdded* 'think' Inf.; *peäldd* 'field'; *jäu´rr* 'lake'
(b) *jäurra* 'lake' Ill.Sg.; *va´lddem* 'take' PastSg1. etc.

The distribution of duration between members of the clusters may be summarized as follows:

(i) When the first member of a cluster is a liquid or a semivowel and the second member is a nasal or a voiced fricative, the duration of the first member (90-100msecs) is about half that of the second member.

(ii) When the first member of a cluster is a liquid or a semivowel and the second member is a voiced plosive, the duration of this plosive averages 40-50 msecs longer than the duration of a voiced fricative or nasal (see above). The duration of the first member remains 90-100 msecs.

(iii) When the first member of the cluster is a liquid or a semivowel and the second member is a voiceless plosive, the duration of this plosive averages between 280-320 msecs; the duration of the first member of the cluster is between 90-100 msecs.

(iv) When the first member of the cluster is a voiceless sibilant and the second member is a voiceless plosive, the sibilant has a duration of between 200-240 msecs, while the duration of the plosive averages between 110-125 msecs. Similar durational distributions were observed when the first member of the cluster is a glottal fricative and the second member is a voiceless plosive.

(v) When the first member of the cluster is a glottal fricative and the second member is a voiceless sibilant, the duration of the first member is between 220-250 msecs, and the duration of the sibilant is between 110-125 msecs.[89]

The above durational patterns are also valid for disyllabics belonging to the xy-series, Group (b), although, as indicated above, the total durations may be about 40 msecs longer in this group. The distributional pattern indicated in connection with the individual segments in the cluster remains the same.

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89 The cluster of the glottal fricative and the voiceless sibilant occurs only in Grade II disyllabics. In the weak grade the glottal fricative is realized as a semivowel.

Table 43. The distribution of duration between members of the consonant cluster, Grade II disyllabics, xy-series

	First member of the cluster	Second member of the cluster
	liquid or semivowel	nasal, liquid or voiced fricative
Duration:	90-100	180-190
	liquid or semivowel	voiced plosive
Duration:	90-100	220-230
	liquid or semivowel	voiceless plosive
Duration:	90-100	280-320
	voiceless sibilant	voiceless plosive
Duration:	200-240	110-125
	glottal fricative	voiceless sibilant
Duration:	200-240	110-125

Table 44. Summary of durational measurements of Grade II disyllabics

	Vowel Centre	Consonant Centre	Latus
x-series			
(a)	214	173	87
(b)	201	248	85
xx-series			
(a)	201	224	85
(b	106	(b_1) 246 (b_2) 351	81
xy-series			
(a)	151	365	79
(b)	112	328	90

3. Grade III disyllabics

Those disyllabics containing consonants of the x-series in the consonant centre in the strong grade may appear in the same duration as disyllabics containing consonants of the xx-series if the latus contains an historically contracted vowel.[90] These disyllabics are traditionally referred to as being in the overlong grade. The distribution of duration of Grade III disyllabics is summarized in Tables 45 and 46.

Table 45. Durational measurements of Grade III disyllabics, Group (a)

	Vowel Centre	Consonant Centre	Latus
$\bar{x}$	112	246	85
SD	11	12	16

Examples: *seärre* 'play' Pl3.; *mõ´nne* 'go' PastPl3., etc.

Table 46. Durational measurements of Grade III disyllabics, Group (b)

	Vowel Centre	Consonant Centre	Latus
$\bar{x}$	106	355	87
SD	14	30	12

Examples: *koätta* 'Lappish tent' Ill.Sg.; *peässa* 'nest' Ill.Sg.

90 See p. 40.

Table 47. Summary of durational measurements of Grade III disyllabics

	Vowel Centre	Consonant Centre	Latus
Group (a)	112	246	85
Group (b)	106	355	87

4. Implications of durational measurements of consonant gradation phenomena in Skolt Sámi

As referred to earlier,[91] consonant gradation in Skolt Sámi has been completely morphologized. The phonetic conditioning for the application of gradation rules has disappeared: i.e. most word-final consonants of disyllabics have become lost,[92] originally closed syllables having become open. However, even though consonant gradation cannot be predicted any longer by a phonological rule in Skolt Sámi, the gradation phenomenon in the language does play a significant role; many of the morphological suffixes having become lost, the gradational status of morphemes has acquired an important grammatical role.[93] For example, it is possible to contrast such words as *kue´ss* [s:s] 'guest' and *kue´ss* [ss] Gen.Acc.Sg., Nom.Pl., or *kue´ll* 'fish' and *kue´l*[94]

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[91] p. 40.

[92] For example, Gen. or Acc. case markers, the plural marker in the Nom. case, etc. For a review of the history and present status of Skolt Sámi suffixes, see Korhonen (1981).

[93] Korhonen 1967, 1969.

[94] When the word occurs in three grades (Grades I, II and III), the weak grade is indicated by a single consonant in Skolt Sámi orthography (cf. the example given in this paragraph, *kue´ss* vs. *kue´ss* [s:], when length is not indicated in the orthography).

Gen.Acc.Sg.,Nom.Pl. entirely on the basis of the gradation phenomenon manifested here.

The results of the durational measurements presented in the preceding Tables reveal the following pattern of correlations between duration and grade alternation:

i. The durational changes that accompany grade alternations are realized in both the consonant centre and the vowel centre. The durational values evident in these two stress-group locations are in accordance with the much studied interdependencies that exist between the vowel centre and the consonant centre.[95] These durational changes are realized in a compensatory relationship: an increase of duration in one of these stress-group locations involving shorter duration in the other.

ii. Latic duration does not differ significantly, in all three grades appearing to be an average of between 80 and 90 msecs.

iii. The difference in duration between Grade I, Grade II and Grade III disyllabics is summarized in Tables 48-49.

a. Disyllabics of the x-series:

Table 48. Mean duration in the vowel centre, disyllabics containing consonants of the x-series, Groups (a) and (b)

	Grade I	Grade II	Grade III
(a)	298	213	112
(b)	213	201	112

95 The phonological relevance of this interdependency is elaborated in Korhonen 1971, 1975.

Table 49. Mean duration in the consonant centre, disyllabics containing consonants of the x-series, Groups (a) and (b)

	Grade I	Grade II	Grade III
(a)	87	173	246
(b)	157	248	355

The durational difference in the vowel centre between the Grade I and Grade II disyllabics of the x-series averages 85 msecs in Group (a). The durational difference between these two grades, as far as the vowel centre is concerned, is insignificant (about 20 msec).[96] This difference is smaller than that between Grades II and III disyllabics where these differences average 101 msec and 89 msec respectively.

The durational differences in the consonant centre between Grade I and Grade II disyllabics of the x-series averages 86 msec in Group (a) and 91 msec in Group (b). This difference is comparable to that between Grades II and III where the durational differences average 73 msec and 107 msec respectively.

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96 This result is somewhat different from that indicated in an earlier publication (McRobbie 1989). Because I was working with fewer data I regard my earlier research as a preliminary examination. The difference between the results of this project as compared with the earlier is about 35 msec.

b. Disyllabics of the xx-series:

Table 50. Mean duration in the vowel centre, disyllabics containing consonants of the xx-series, Groups (a) and (b)

	Grade I	Grade II
(a)	213	201
(b)	213	106

Table 51. Mean duration in the consonant centre, disyllabics containing consonants of the xx-series, Groups (a) and (b)

	Grade I	Grade II
(a)	157	224
(b_1)	157	246
(b_2)	157	351

The durational differences in the vowel centre between Grades I and II disyllabics of the xx-series are insignificant in Group (a); however, in Group (b) there is a difference of over 100 msecs. As far as differences in the consonant centre are concerned, they are greatest in Group (b_2), averaging around 195 msecs.

c. Disyllabics of the xy-series:

Table 52. Mean duration in the vowel centre, disyllabics containing consonants of the xy-series

Grade I	Grade II
225	130

Table 53. Mean duration in the consonant centre, disyllabics containing consonants of the xy-series

Grade I	Grade II
174	345

In connection with disyllabics of the xy-series, there does not seem to be any justification for distinguishing between disyllabics with an historically contracted vowel in the vowel centre and those without such a vowel. The durational difference is around 30 msecs as far as the duration of both the vowel centre and the consonant centre are concerned. Vowel centre durations for Group (a) disyllabics are 151 msecs, and for Group (b) disyllabics 111 msecs; consonant centre durations for Group (a) disyllabics are 365 msecs, and for Group (b) 328 msecs (see p. 116). The measurement values indicated above are mean durations based on measurements made of xy-series disyllabics regardless of the status of the latic vowel, i.e. whether the vowel there is contracted or not.

The durational difference between Grade I and Grade II disyllabics belonging to the xy-series is considerable, averaging around 95 msecs for the vowel centre, and 171 msecs for the consonant centre.

Table 54. Summary of durational differences in the vowel centre of disyllabics of the x, xx and xy-series

	Difference between Grades I and II	Difference between Grades II and III
x-series		
(a)	85	101
(b)	12	89
xx-series		
(a)	12	
(b)	107	
xy-series	95	

Table 55. Summary of durational differences in the consonant centre of disyllabics of the x, xx and xy-series

	Difference between Grades I and II	Difference between Grades II and III
x-series		
(a)	86	73
(b)	91	107
xx-series		
(a)	67	
(b)	89	
xy-series	194	

On the basis of the results presented in Tables 54 and 55, the following interesting pattern may be observed:

1. The difference between the duration of Grade I and Grade II disyllabics (x and xx series) seems to be about the same, in terms of both consonant centre and vowel centre, with the exception of the duration in the vowel centre of disyllabics in x-series Group (b) and xx-series Group (a).

2. The durational difference in the consonant centre and the vowel centre between Grade II and Grade III disylllabics is similar or somewhat greater than that between Grade I and Grade II disyllabics of the x-series.

3. The differentiation in terms of duration between Grades I and II seems to be most evident in connection with disyllabics of xy-series.

From the above three tendencies we may conclude that, although grade alternation is traditionally said to imply durational alternation involving consonants only[97], in the material analyzed here the difference in duration manifested in the vowel centre is by no means negligible. Due to the fact that the originally phonetically motivated rule has completely morphologized, as referred to earlier, durational change in the vowel centre may be considered as a compensatory lengthening phenomenon: shorter consonant duration (weak grades) is accompanied by longer vowel duration, and longer consonant duration (strong grades) by shorter vowel duration. The gradation phenomenon in Skolt Sámi thus has to be described with reference to durational change in both the consonant centre and the vowel centre.[98]

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97 Äimä 1918, T. Itkonen 1916, among others.

98 In recent studies on Skolt Sámi phonology (Korhonen 1971, 1975) length of the intervocalic consonants is predicted on the basis of the length of the vowel preceding. Due to the fact, referred to earlier, that consonant gradation has become completely morphologized, this solution is definitely legitimate. The recently developed orthography for Skolt Sámi also utilizes this approach (Korhonen et al. 1973).

The only time when durational change in the consonant centre does not co-occur with durational change in the vowel centre, is in connection with disyllabics of x-series Group (b), and xx-series Group (a). In the former case the vowels in question are half-long, as opposed to Group (a) vowels of disyllabics of x-series. Further, this is the only case in Skolt Sámi consonant gradation when quantitative change (change in duration) co-occurs with qualitative change: i.e. consonants in the weak grade are different from consonants in the strong grade, for example *piä´ss* 'nest' (strong grade) vs. *piä´zz* Gen.Acc.Sg., Nom.Pl. (weak grade).

It seems then that the distinction between these two grades is signalled by (i) durational differences that are manifested in the consonant centre, and (ii) qualitative differences with regard to the consonants in question. In the case of disyllabics of xx-series Group (a), the situation seems to be somewhat more complex. Both the weak grade and the strong grade display similar durations in the vowel centre. These durations co-occur with consonant durations that are longer in the strong grade, and shorter in the weak grade, than the respective vowel durations. The implications of this fact will be elaborated in the next Chapter where emphasis will be placed upon the importance of considering durational ratios between the vowel centre and the consonant centre.

5. Summary of the distribution of duration in grade alternation

To sum up this discussion on the distribution of duration as manifested in connection with grade alternation, the following conclusions may be said to emerge on the basis of durational measurements:

i. A definite correlation between duration and grade alternation is manifested in both the vowel centre and consonant centre.

ii. The duration of the latus is not affected by the alternation of the three grades.

iii. Durational differences between the three alternating grades are considerable in both the vowel centre and the consonant centre. It has to be pointed out, however, that while these differences between the alternating grades are always significant in connection with the consonant centre, there are two groups of disyllabics, namely x-series (b) and xx-series (a), where the difference between the weak and the strong grades are not manifested in the vowel centre.[99]

iv. The two figures below (*Figures 32* and *33*) summarize the distribution of duration in all three grades, as apparent in the vowel centre and the consonant centre. A comparison of the durational values in these stress-group locations reveals that the durational interdependencies existing between the

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[99] It has to be acknowledged, however, that the disyllabics in question have the same consonants in the consonant centre undergoing two different types of alternation depending on their belonging to the x or xx-series of disyllabics. For example, *peä´ss* [s:s] 'birch bark' (strong grade), *piä´ss* [ss] Gen.Acc.Sg.,Nom.Pl. (weak grade); but *piä´ss* [s:s] 'nest' (strong grade), *piä´zz* [zz] Gen.Acc.Sg.,Nom.Pl. (weak grade).

vowel centre and consonant centre are of a compensatory nature.

Figure 32. Distribution of duration in grade alternation, vowel centre durations

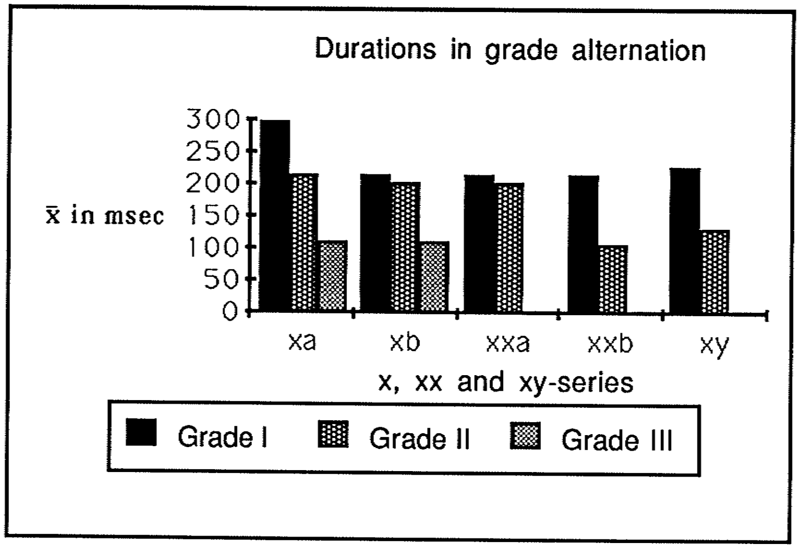
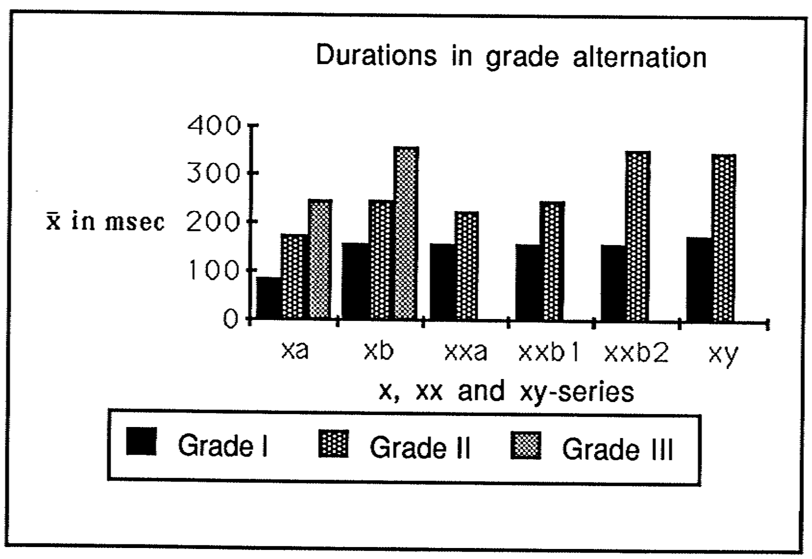


Figure 33. Distribution of duration in grade alternation, consonant centre duration



v. In the following *Figures* (*34-39*) duration of the vowel centre and the consonant centre will be demonstrated in all grades, in disyllabics of the x, xx and xy-series. Each series will be presented separately. These plots are intended to demonstrate the durational changes in both of these stress group locations. As may be seen, durational changes manifested in grade alternations cannot be assigned independently to either of the main stress-group locations: both vowel centre and consonant centre durations undergoing changes in all alternating grades. As was mentioned earlier, the relationship between durational changes in the vowel centre and the consonant centre seems to point to recognition of the importance of durational ratios. This will be elaborated further in Chapter 5.

Figure 34. <u>Duration in grade alternation, disyllabics of x-series, Group (a)</u>

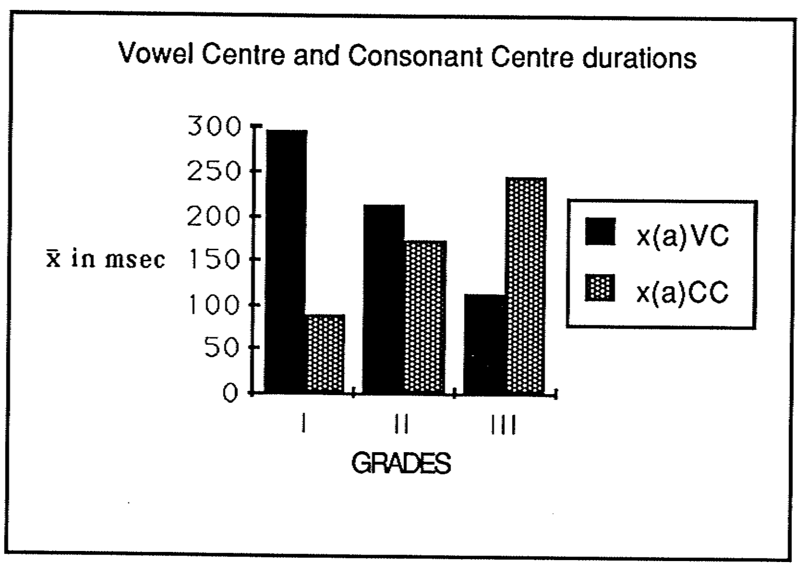


Figure 35. Duration in grade alternation, disyllabics of x-series, Group (b)

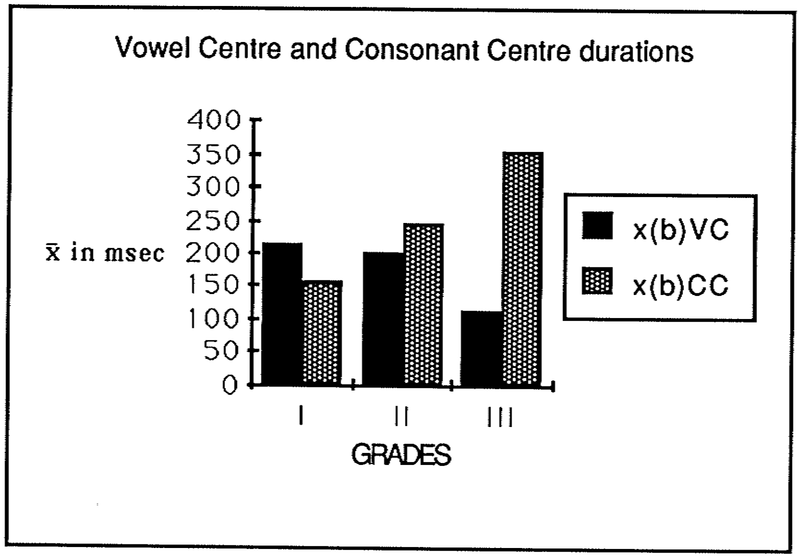


Figure 36. Duration in grade alternation, disyllabics of xx-series, Group (a)

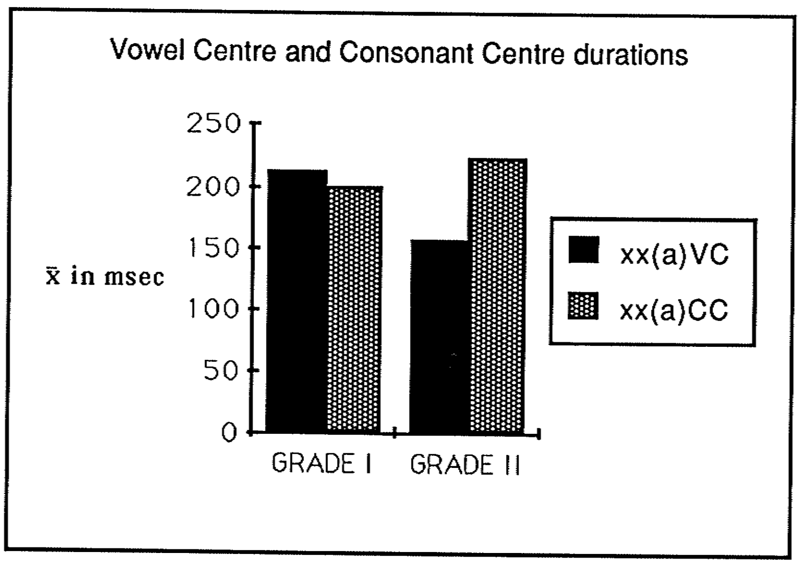


Figure 37. Duration in grade alternation, disyllabics of xx-series, Group b_1

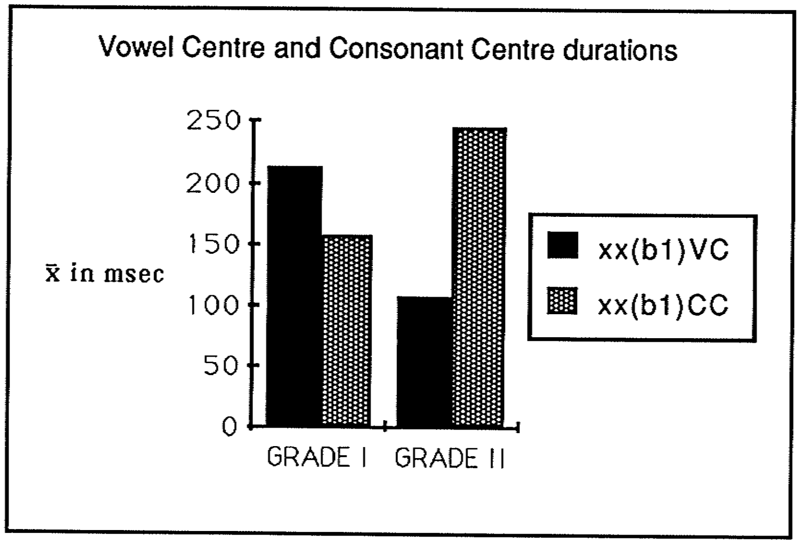


Figure 38. Duration in grade alternation, disyllabics of xx-series, Group b_2

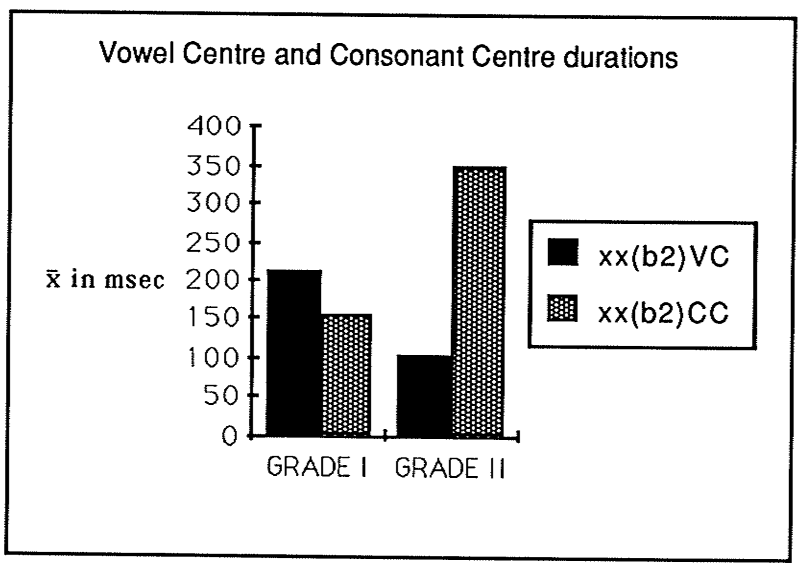
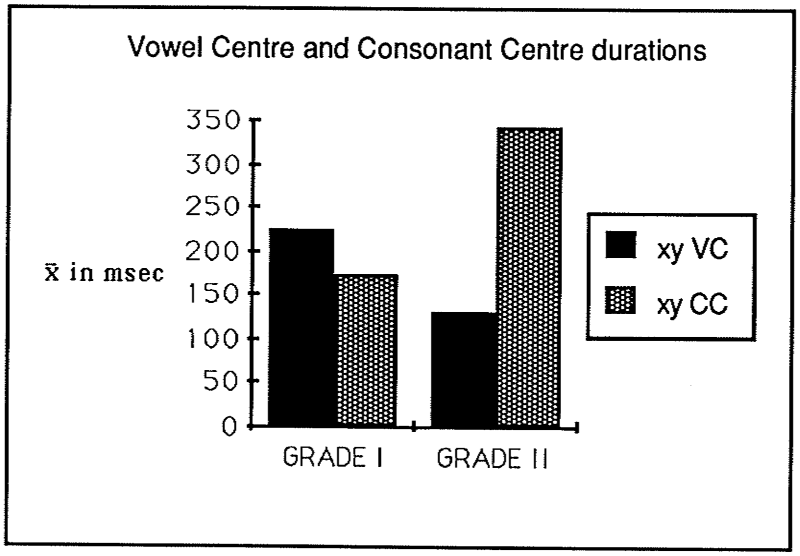


Figure 39. Duration in grade alternation, disyllabics of xy-series



6. Consonant gradation and structural types: relationship with regard to durational patterns

Skolt Sámi disyllabics may be examined on the basis of six structural types (Chapter 3). This classification is grounded on the recognition of durational interdependencies between the main stress-group locations, i.e. vowel centre, consonant centre and latus. For the sake of convenience I shall reproduce the results of the durational measurements as presented in Table 31 (p. 105).

Table 56. A summary of durational measurements of Skolt Sámi disyllabics

	Vowel Centre	Consonant Centre	Latus
	$\bar{x}$	$\bar{x}$	$\bar{x}$
Type 1a	214	173	87
Type 1b	201	224	85
Type 2	148	362	84
Type 3	298	87	88
Type 4	213	205	93
Type 5	225	174	90
Type 6a	112	(a_1) 246 (a_2) 351	85
Type 6b	112	328	90

The three different durations (short, half-long and long) that are manifested in the consonant centre and the vowel centre (see p. 106) seem not to be affected by the duration of the latus. In fact, latic duration can be regarded as the same in connection with each structural type. The implications of this fact are two-fold: (i) contrary to earlier research,[100] second syllabic duration thus proves to be irrelevant in the distribution of duration in the vowel centre and the consonant centre; (ii) this being so, the claim that the syllable has no status whatsoever within the disyllabic unit has to be reconsidered. The distribution of duration in these structural types does not support the earlier claim that the role of the syllable is irrelevant. In the next Chapter additional evidence will be examined in order to confirm the implications of durational relations within the disyllabic stress-group: namely, that the status of the syllable in Skolt Sámi must be reconsidered.

How may we interpret the results of the durational measurements as they are manifested in the different alternating grades? First, let us relate disyllabics of the different structural

[100] Genetz (1896), E. Itkonen (1946), Magga (1984), among others.

types to disyllabics of the three series (x, xx and xy) occuring in the three grades (weak, strong and overlong). It is evident that we are dealing here with two classifications: thus, disyllabics in Skolt Sámi may be classified according to two principles. In the first principle disyllabics are classified on the basis of certain phonetic (especially durational) characteristics. The second principle is based upon consonant gradation of disyllabics belonging to the x, xx and xy series. There is naturally a great deal of overlap, and disyllabics undergoing consonant gradation can also be classified within the different structural types. Consonant gradation is a phenomenon encompassing a large number of words in Skolt Sámi. There are, however, many words which do not undergo consonant gradation, yet the phonetic characteristics (durational characteristics) show that they may be assigned to a given structural type. Thus the classification of disyllabics into structural types is a larger entity based upon the durational interdependencies that are manifested in the main stress-group locations. The phenomenon of consonant gradation is classified on the basis of the kind of consonants occurring in the consonant centre (consonant series), and on how grade alternation modifies the duration of the consonants in question in these series. The change in duration, as it is manifested in the vowel centre during the occurence of the different grades, appears to be the same phenomenon as the distribution of duration in connection with the different structural types -- including those disyllabics that are not affected by the consonant gradation phenomenon. We may conclude, then, that classification according to consonant gradation should be subordinated to classification according to structural type.

It was pointed out, in connection with durational distribution in the six structural types, that the duration of the latus does not seem to play a role in the distribution of duration manifested in the vowel centre and the consonant centre. A similar observation can be made in connection with disyllabics that undergo consonant gradation: no change in latic duration can be observed, regardless of the durational changes evident either in the vowel centre or the consonant centre, or, as is the case almost exclusively, in both of these stress-group locations. It may be concluded, whether the disyllabics undergo consonant gradation or not, that latic duration appears to be (i) the same, and (ii) does not influence the distribution of duration in the vowel centre and the consonant centre.

Table 57 summarizes the relationship between the six structural types and those disyllabics undergoing consonant gradation. Also this Table shows the correspondence between the three grades (in all three series) and the six structural types (as defined in Chapter 2). This summary is essential for a clear understanding of the complexity of durational distributions in disyllabics determined by their status with reference to (i) their structural types, and (ii) their gradation types. By examining the cases of overlap between consonant gradation and structural type, we may observe the following: Grade I disyllabics are associated with four structural types in such a fashion that each series is associated with a specific structural type. Grade II disyllabics in their associations with the six structural types display a somewhat more complex pattern. Structural Type 1b is associated with two series of Grade II disyllabics: x-series (b) and xx-series (a). Disyllabics of xy-series are associated with two structural types, 2 and 6b. Grade III disyllabics do not have any structural types with which they should be exclusively associated: the relevant structural types here overlapping with two of the structural types associated with Grade II disyllabics (xx-series b_1 and b_2). The implication of these interrelationships between consonant gradation and structural type is significant. It confirms the supremacy of classifying disyllabics on the basis of their structural types over classifying them on the basis of gradation types. It was mentioned earlier (p. 135) that because not all disyllabics may be classified under consonant gradation, classification according to consonant gradation must be considered subordinate to that according to structural types. The relationship between these two types of classification observable in Table 57 confirms the above claim: three of the structural types (1b, $6a_1$ and $6a_2$) may be assigned to more than one gradation type. Only one gradation type (Grade II, xy-series) can be assigned to two structural types, but the assignment of disyllabics of the xy-series to Type 6b is only justified by following existing Finno-Ugric literary tradition. For it has been pointed out (p. 46, fn. 63) that the relevant disyllabics here, on the basis of their durational characteristics (p. 105, Table 31), indeed should be classified as Type 2 disyllabics. This latter fact does not justify considering this particular overlap as an argument for the superiority of the classifying of disyllabics on the basis of consonant gradation. However, the overlaps that are associated with structural types 1b, $6a_1$ and $6a_2$, convincingly confirm the priority of classification on the basis of durational characteristics, i.e. on the basis of the structural types.

Table 57. Consonant gradation and structural types

GRADES	STRUCTURAL TYPES 1a	1b	2	3	4a	4b	5	$6a_1$	$6a_2$	6b
Grade I										
x-series (a)				⊙						
x-series (b)					⊙					
xx-series						⊙				
xy-series							⊙			
Grade II										
x-series (a)	⊙									
x-series (b)		⊙								
xx-series (a)		⊙								
xx-series (b_1)								⊙		
xx-series (b_2)									⊙	
xy-series			⊙							⊙
Grade III										
x-series (a)								⊙		
x-series (b)									⊙	

CHAPTER 5

THE IMPLICATIONS OF DURATIONAL RATIOS WITH REGARD TO SYLLABLE BOUNDARIES

On the basis of the previous two Chapters, it may be suggested that latic duration does not influence the duration that is manifested in the vowel centre and in the consonant centre. Latic duration being similar and having but insignificant standard deviation values, one might conclude that only the first two stress group locations (vowel centre and consonant centre) play significant roles in the distribution of durational patterns distinguishing between the six main structural types and signaling the different grades in consonant gradation. It has been noted that duration displays a tendency of a compensatory nature: longer duration in one of these two stress group locations co-occuring with shorter duration in the other. This compensatory relationship was illustrated in *Figures 31,34-39* and in Tables 29-31.

It must be pointed out, however, that there is another phenomenon in Skolt Sámi that has to be refered to, in connection with the distribution of duration in the three main stress-group locations. This phenomenon occurs in connection with a phonological rule: an optional rule that either reduces word-final short vowels, or deletes them (the latter taking place most of the time during casual speech):

$$V \rightarrow \emptyset \;/\; \_\_\_\_ \;\#$$

For example: *võõr*[101] 'blood' Gen.Sg., but *võõrâst* Loc.Sg.; *kuä´đ* 'Lappish tent' Gen.Sg., but *kuä´đest* 'Loc.Sg.' The relevant vowels *â* and *e* are the respective stem-vowels.

With the exception of Type 6, this rule applies in all structural types. When the latic vowel in question becomes a reduced vowel, this reduces in duration by an average of 30-55 msecs. It must be noted that the duration of latic vowels not undergoing this rule averages 87 msecs (see p.106). What we witness here is a change in the status of the latic vowel as far as duration is concerned. The question to be examined in this Chapter is whether this change in the duration of the latus has any effect on the durations manifested in the vowel centre and consonant centre -- and, if so, how we should interpret the nature and characteristics of this effect.

In order to answer these questions, the following analysis will be presented here. In all five structural types the durations of the vowel centre and the consonant centre will be examined separately depending on the status of the latic vowel, i.e. whether there is a full vowel, a reduced vowel, or no vowel at all in the latus. The Tables that follow summarize the analysis of the measurements obtained. Mean durations and standard deviations are given for the vowel centre and the consonant centre separately for disyllabics with and without a latic vowel.

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101 Reduced vowels are not represented in Skolt Sámi orthography. Thus words such as *võõr* 'blood' Gen.Sg., are actually disyllabics when the latus contains a reduced vowel.

Table 58. Durational measurements of disyllabics with a full vowel in the latus (subject: H.S.)

Type	Vowel Centre		Consonant Centre	
	x̄	SD	x̄	S D
1 a	215	16	176	20
1 b	196	14	218	16
2	156	18	303	22
3	281	20	83	9
4 a	217	16	143	12
4 b	217	16	201	18
5	235	21	165	17

Table 59. Durational measurements of disyllabics with a full vowel in the latus (subject: K.J.)

Type	Vowel Centre		Consonant Centre	
	x̄	S D	x̄	S D
1 a	204	11	167	20
1 b	180	18	226	16
2	138	11	341	22
3	265	20	88	8
4 a	196	15	150	10
4 b	196	15	214	12
5	224	21	186	18

Table 60. Durational measurements of disyllabics with a reduced vowel or ø in the latus (subject: H.S.)

Type	Vowel Centre		Consonant Centre	
	x̄	S D	x̄	S D
1 a	245	22	216	20
1 b	225	19	278	22
2	174	15	361	20
3	351	21	88	6
4 a	243	16	178	12
4 b	243	16	246	21
5	265	16	217	14

Table 61. Durational measurements of disyllabics with a reduced vowel or ø in the latus (subject: K.J.)

Type	Vowel Centre		Consonant Centre	
	x̄	S D	x̄	SD
1 a	235	22	198	17
1 b	215	19	253	20
2	166	11	386	23
3	327	20	91	8
4 a	223	14	165	13
4 b	223	14	260	19
5	238	21	241	18

From Tables 58-61 we may conclude, as with the durational distributions pertaining to the structural types and the consonant gradation phenomenon, that the presence or absence of the latus has the same effect on the durations of the vowel centre and the consonant centre in the speech of both subjects, i.e. compensatory lengthening is observable in both of these segments. It is justifiable, then, to regard these results again as indications of a durational pattern that is valid in both of these subdialects for Skolt Sámi. In Tables 62 and 63 the results of the above durational measurements will be averaged and examined together.

Table 62. Durational measurements of disyllabics in Skolt Sámi with a full vowel in the latus

Type	Vowel Centre		Consonant Centre	
	$\bar{x}$	SD	$\bar{x}$	SD
1a	209	13	171	20
1b	188	16	222	16
2	147	14	322	22
3	273	20	85	8
4a	206	15	146	10
4b	206	15	207	15
5	229	21	175	17

Table 63. Durational measurements of disyllabics in Skolt Sámi with a reduced vowel or ø in the latus

Type	Vowel Centre		Consonant Centre	
	$\bar{x}$	SD	$\bar{x}$	SD
1a	240	22	207	18
1b	220	19	265	21
2	170	13	373	21
3	339	20	89	7
4a	233	15	179	16
4b	233	15	253	20
5	251	18	229	16

From the above measurements an important tendency may be observed: namely, the presence or absence of the latus has clear consequences for the distribution of duration in the vowel centre and the consonant centre, i.e. increase in duration as a result of compensatory lengthening. It will be recalled that latic durations were constant in all the structural types once they were realized as full vowels, for an average of 87 msecs; also, that the durations that signal differences between the structural types and/or gradation types are manifested in the vowel centre and the consonant centre. The fact that the presence or absence of the latic vowel affects considerably these durational distributions in the vowel centre and the consonant centre has important implications. The durational changes noticeable in these two stress-group locations have to be recognized as the phenomenon of compensatory lengthening. The absence of the latus, or its reduced status, results in the increase of duration in both the consonant centre and the vowel centre. A closer examination of the realization of this compensatory lengthening reveals durational patterns that have implications of important theoretical significance concerning (i) the role of durational ratios, and (ii) the domain of quantity in Skolt Sámi. The discussion that follows will elaborate on these two issues concerning Sámi quantity.

On the basis of the results of the compensatory lengthening, as represented in Tables 58-63 above, the following observations can be made:

(i) The sum of the durational increases in the vowel centre and the consonant centre combined, is in general fairly close to the duration of the latic vowel:

Table 64. Sums of durational increase in the vowel centre and consonant centre

Type	Sums of durations
1a	67 (VC = 31; CC = 36)
1b	83 (VC = 40; CC = 43)
2	74 (VC = 23; CC = 51)
3	70 (VC = 66; CC = 4)
4 a	60 (VC = 27; CC = 33)
4 b	73 (VC = 27; CC = 46)
5	76 (VC = 22; CC = 54)

(ii) The distribution of durational increase in the vowel centre and the consonant centre, as presented in Table 64, suggests that although the absolute durational values become different, depending on the durational status of the latus, the ratios of duration remain the same. Table 65 summarizes the V/C ratios of duration as they appear in disyllabics with or without a latic vowel:

Table 65. V/C ratios ($\bar{x}$) of disyllabics with a full vowel in the latus or with a reduced vowel or ø in the latus

Type	V/C Ratios ($\bar{x}$)	
	Full vowel in the latus	Ø or reduced vowel in the latus
1 a	1.22	1.15
1 b	0.84	0.83
2	0.45	0.45
3	3.21	3.80
4 a	1. 41	1.30
4 b	0.99	0.92
5	1.30	1.09

The following three *Figures (40-42)* demonstrate the increase in absolute duration in both the vowel centre and consonant centre, as a consequence of compensatory lengthening due to change in the durational status of the latic vowel.

Figure 40. Vowel Centre durations

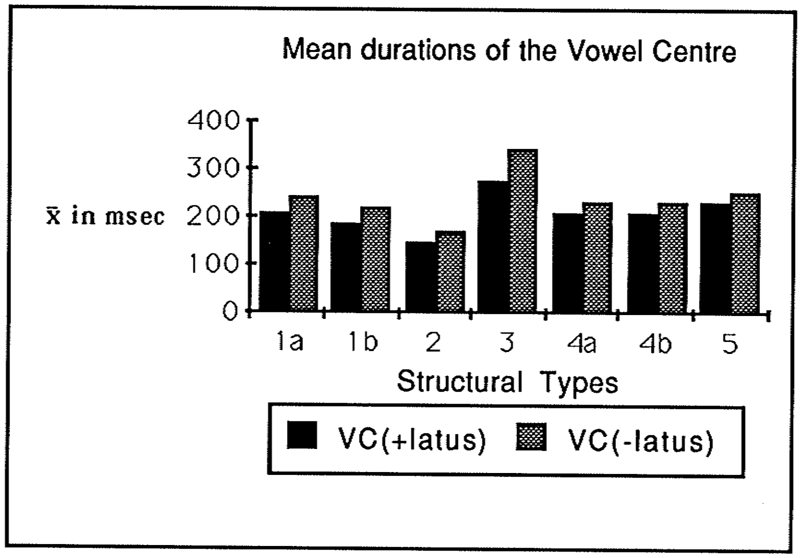


Figure 41. Consonant Centre durations

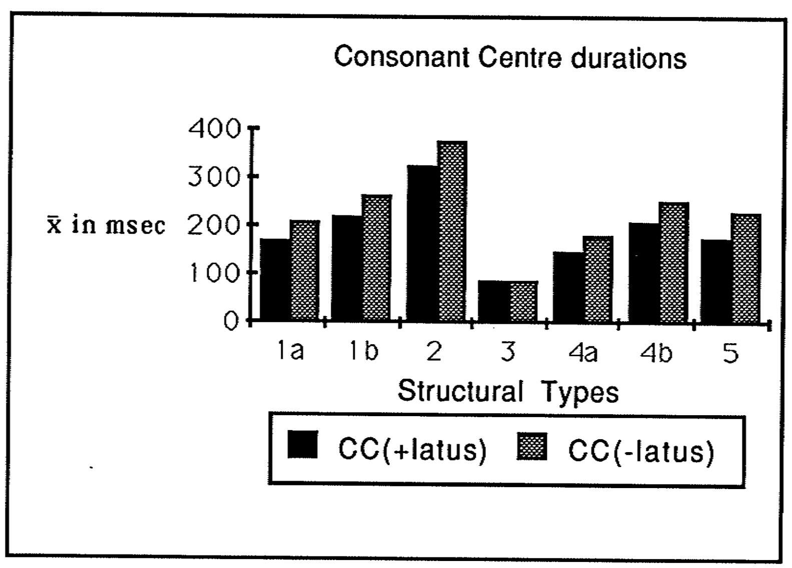
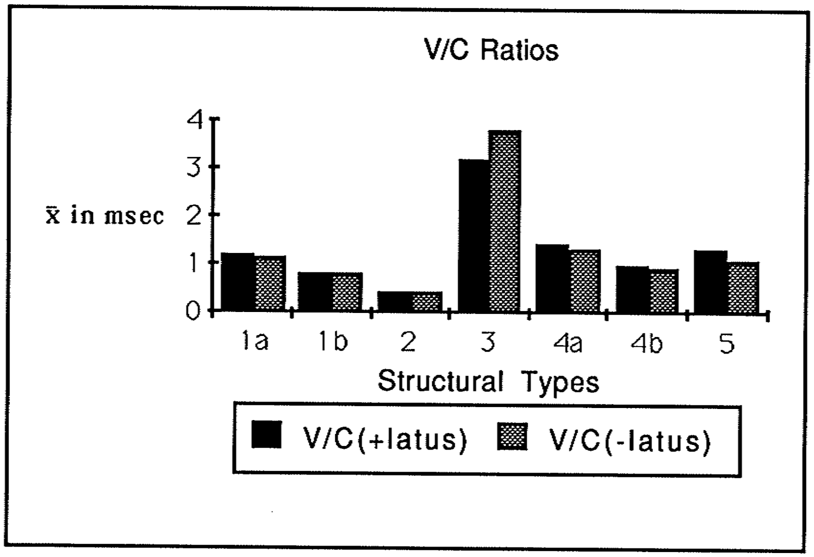


Figure 42 summarizes the V/C ratios ($\bar{x}$) as they appear in disyllabics with a full vowel in the latus, and with a reduced vowel or Ø in the latus.

Figure 42. Mean V/C ratios of disyllabics



The results of durational measurements, as presented in the Tables and *Figures* above, show the realization of the compensatory lengthening process. It can clearly be seen that all these structural types behave similarly in terms of durational increase as a result of compensatory lengthening: i.e. the duration of the vowel that is reduced or missing from the latus, is added to the duration of the vowel centre and the consonant centre.

A closer look at the manifestations of compensatory lengthening reveals another fact that has significant implications for the domain of quantity in Skolt Sámi. While it has been pointed out that the durational increase is manifested in both the vowel centre and the consonant centre, there is one structural type where this pattern does not apply. If we consider the results of the durational measurements in Type 3, we observe that reduced duration of the latus results in compensatory lengthening in the vowel centre only. There is practically no durational increase in the consonant centre (see Table 64, where the increase averages only 4 msecs). Consequently, the results of V/C ratios, that are almost identical in the other four structural types, regardless of the durational status of the latus, are different in Type 3. It will be recalled that Type 3 has a short consonant in the consonant centre, with an average duration of 87 msecs. The implications of there being no durational increase present in the consonant centre in Type 3 disyllabics may be stated as follows: (i) the relevant consonant in Type 3 where no durational increase is apparent, is the onset of the second syllable; (ii) thus compensatory lengthening is manifested in the vowel centre, and in that part of the consonant centre which is to the left of the syllable boundary in the four other structural types (i.e. in the first syllable of the disyllabic stress-group).

The consequences of recognizing that compensatory lengthening is realized in the first syllable only, are of considerable theoretical importance. In the initial discussion on the role of the syllable in the various Sámi dialects (Chapter 1), it was mentioned that E. Itkonen (1946) clearly refutes Lagercrantz's theory (1927) concerning the syllable as being the domain of quantity in Sámi (see pp. 22-23). Acceptance of the assumed irrelevance of the syllable has been the point of departure of research on Sámi quantity in more recent times (Sammallahti 1977, Magga 1984, see p. 23). The arguments against recognition of the status of the syllable, summarized in Chapter 1, may also be supported by the findings frequently referred to, showing that establishing syllable boundaries has very little practical significance in Sámi. Consonant clusters in Sámi display changes in durational pattern, depending on (i) the structural type which the disyllabics in question belong to, and (ii) consonant gradation. The distribution of duration in the individual members of the cluster shows quite a complex pattern. It may be summarized by reference to the two grades of gradation. Thus, in general, in Grade I both members of the cluster are short. In Grade II the first member of the cluster is short when voiced; the second member is a long geminate when voiceless, and somewhat shorter when partially voiced. When the first member of the cluster is voiceless, the first member is long, the second member is short (see pp. 111-112, 116-117).[102] From this summary it may be concluded, given that the distribution of duration in individual members varies a great deal and centres around the syllable boundary, that very little is gained by establishing the syllable boundary between members of the cluster.

However, the results of analyzing durational interdependencies as co-occurences of the compensatory lengthening phenomemon, point in a different direction: namely, to the significance of the syllable, at least as far as these durational interdependencies are concerned. That Type 3 disyllabics do not show any durational increase in the consonant centre, all additional durations being manifested in the vowel centre, and that the other four structural types show durational increases both in the vowel centre and consonant centre, have to be interpreted as valid arguments for reconsidering the role of the syllable in Skolt Sámi.

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102 E. Itkonen's conclusions are somewhat different in this respect (1946:138). According to his opinion, in general the following regularities apply here: in Grade I both members of the cluster are short; when the cluster consists of a voiceless and a voiced consonant, the second component is half-long. In Grade II the first member of the cluster is half-long when voiced; the second member is a long geminate when voiceless, and somewhat shorter when partially voiced. When the first member of the cluster is voiceless, both members are long.

CHAPTER 6

THE INTERPRETATION OF DURATIONAL MEASUREMENTS

The foregoing chapters presented the results of the acoustic analysis of durational measurements made of the speech of two Skolt Sámi speakers. The analysis aimed at (a) examining the durational status of the main stress-group locations (vowel centre, consonant centre and latus), and (b) investigating the apparent interdependencies between the durational manifestations of these stress-group locations.

To achieve the former aim (a), test-words were grouped according to structural type; the durational measurements made revealed the characteristic relationship between the durational values of the main stress-group locations, signalling the differences between these structural types. Because consonant gradation plays a significant part in Skolt Sámi, the durational correlates of the different grades were also examined. These were related to the results of durational relations present in the different structural types. A detailed analysis of the durational manifestations of the relevant disyllabics was presented in Chapters 3 and 4, summarizing the durational characteristics that are important in recognizing (i) the respective structural types, and (ii) the alternating grades.

For the latter aim (b), the apparent compensatory lengthening phenomenon was analyzed in terms of the manifestation of relevant durations. In this part of the investigation an interesting pattern emerged indicating the relevance of durational ratios, rather than absolute durational values, in the stress-group locations in question (vowel centre and consonant centre).

In what follows an interpretation of the above-mentioned analysis will be given, in relation to one of the issues discussed in the first Chapter, i.e. the domain of quantity.[103] It will be argued that, at least as far as the durational characteristics of Skolt Sámi disyllabics are concerned, the established view (Bergsland 1946, E. Itkonen 1946, Sammallahti 1977, Magga 1984, among others) according to which the domain of quantity is the disyllabic stress-group, has to be reconsidered. My durational measurements point to recognition of the syllable within the disyllabic unit, a view formerly elaborated by Lagercrantz (1927) but subsequently rejected by many Lappologists, most notably E. Itkonen (1946).[104] The theory proposed by Lagercrantz, concerning the grouping of Sámi disyllabics into structural types, considers only the durational status of the first syllabic vowel and the consonant(s) following it. No significance is attributed to the durational status of the second syllable, the distribution of duration in the first syllable being considered sufficient for distinguishing between the structural types in Sámi. It was Genetz (1896) who first recognized the role of the second syllabic vowel in the manifesting of the preceding segments. However, he did not actually claim that the influence of the second syllabic vowel is such that it has to be considered when examining the *quantitative* status of a word. He pointed out that the *quality* of the second syllabic vowel affects the *quality* of the first syllabic vowel.[105] On the basis of this,

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103 In connection with the analysis of quantity three important issues have to be considered: (i) the domain of quantity, (ii) the number of degrees of quantity, and (iii) the possible configuration of more than one prosodic feature in the manifestation of quantity degrees. The analysis presented in this study has sought to survey durational patterns characteristic of Skolt Sámi disyllabics. This may contribute to a discussion of issues concerned with the domain of quantity.

104 See Chapter 1, pp.22-23.

105 In Sámi, and especially in Skolt Sámi, the phenomenon of metaphony (the Finno-Ugric usage for umlaut when applied to Sámi) is an essential part of the phonology of the language. In Skolt Sámi metaphony is

words may be viewed as disyllabic units; this is one of the reasons Magga (1984) cites for justifying his analysis of the Guovdageaidnu material from the point of view of disyllabic quantity units. It was pointed out in Chapter 1 (fn.30) that to base such an argument on Genetz's findings is not convincing. It is one thing to recognize interdependencies within the word that reflect a tendency for qualitative agreement (i.e. metaphony); it is quite another to relate this to quantitative issues (i.e. durational relationships between the segmental units within the word).

In addition to Genetz's recognition of a cohesive force between the second syllabic vowel and the segments preceding it, there is another argument that must be considered regarding the relevance of disyllabic quantity units. This is in connection with the consonant gradation phenomenon. As pointed out in Chapter 1, there is clear evidence that the ordered number of syllables has a determining role, as far as the manifestation of the relevant grades in consonant gradation is concerned (see examples with references on p. 21). On the basis of this, it is indeed appropriate to consider disyllabic units, for the realization of alternating grades is repeated in disyllabic sequences. The point on which I shall elaborate below is that this phenomenon is by no means incompatible with recognizing the relevance of the syllable as a basic quantity unit. A similar approach to the analysis of quantity may be observed in connection with Estonian quantity where the relevance of disyllabic units has been demonstrated in a number of convincing analyses (most notable in the works of Lehiste)[106]. The results of this present analysis, based upon durational

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regarded as one of the typical characteristics of the dialect's phonology. A survey of this phenomenon may be found in Korhonen (1967, 1969). An attempt to analyze metaphony in the frame-work of generative phonology may be found in McRobbie (1981).

106 The theory of the relationship of syllables to disyllabic "building blocks" is summarized in Lehiste (1965, 1970 and 1978).

measurements of Skolt Sámi disyllabics, do not confirm the claim that the duration of the second syllabic vowel has to be considered essential in the distribution of quantity apparent in these disyllabics. Instead, the distribution of duration points to the relevance of the syllable as an independent quantity unit (independent, that is, from the durational status of the second syllable).

1. <u>The relevance of V/C ratios in the distribution of duration in the first syllable</u>

As has been pointed out more than once in the course of the foregoing discussion, the duration of the latus is constant when it is present. Its duration averages about 87 msecs, this value remaining constant regardless of whether it is followed by a consonant or not. All structural types and all alternating grades display constant latic duration. Durations of both the vowel centre and the consonant centre, however, represent regular patterns characteristic of the structural types or alternating grades in question. This has to be considered as a strong argument against views advocating the relevance of durational interdependencies in disyllabic units, interdependencies similar to Magga's findings in the Guovdageaidnu dialect where a "bisyllabic sequence might be called a phonological word, in which almost everything affects almost everything else durationally." (1984:150) Notwithstanding the vagueness of the phrase "almost everything", Magga's claim has been considered as definite confirmation of the "disyllabic stress-group" approach. He does not examine the possible relevance of another quantity unit (i.e. the syllable) within this disyllabic entity. In fact, he accepts earlier opinions, especially Sammallahti's (1977), concerning the irrelevance of the syllable in Sámi disyllabic units (Magga 1984:13). But these earlier views were based upon theoretical considerations only. The acoustic analysis carried out in the course of the present investigation, however, points in a different direction, one where the role of the syllable has to be recognized as a unit of independent quantitative status within the disyllabic stress-group. The fact that latic duration is constant while durational relationships differ with regard to the structural type and/or gradational type they represent, has to be considered a valid argument for the quantitative status of the syllable.

There is another argument, one based upon investigation of the compensatory lengthening phenomenon. Here there is indeed a definite tendency to be noted in connection with durational changes in the vowel centre and consonant centre resulting from the differing durational status of the latus. This turns out to be an even stronger argument for recognition of the syllable. It was pointed out in Chapter 5 that whenever compensatory lengthening is attested as a result of the phonological rule operating in Skolt Sámi (p. 139), the increase of absolute duration in the relevant stress-group locations (vowel centre and consonant centre) does not change the characteristic ratios that signal durational differences with regard to the structural types and alternating grades in question. This fact strengthens the case for recognizing the role of durational ratios, rather than absolute durational manifestations, as important in the distinguishing of Skolt Sámi disyllabics. Indications of the role of durational ratios could be noticed in the durational distributions of the various structural and gradation types. The following two Tables summarize these durations as they appear in the vowel centre and the consonant centre, demonstrating the ratios present there. It is clearly to be seen in Chapter 5 that these ratios do not change as a result of the compensatory lengthening phenomenon.

Table 66. Summary of durational measurements of Skolt Sámi disyllabics[107]

	Vowel Centre	Consonant Centre	
	$\bar{x}$	$\bar{x}$	
Type 1a	214	173	
Type 1b	201	224	
Type 2	148	362	
Type 3	298	87	
Type 4	213	(a) 157	(b) 210
Type 5	225	174	
Type 6a	112	(a_1) 246	(a_2) 351
Type 6b	112	328	

Table 67. Summary of durational measurements of Grade I disyllabics[108]

	Vowel Centre	Consonant Centre
x-series		
(a)	298	87
(b)	213	157
xx-series	213	205
xy-series	225	174

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107 This Table is reproduced here from Chapter 3 (p.105) with one change: the durational values of the latus are not included (as mentioned in the above discussion, latic duration is constant, averaging 87 msec).

108 The following three Tables are reproduced from Chapter 4, omitting the durational measurement of the latus (see fn.107).

Table 68. Summary of durational measurements of Grade II disyllabics

	Vowel Centre	Consonant centre	
x-series			
(a)	214	173	
(b)	201	248	
xx-series			
(a)	201	224	
(b)	106	(b_1) 246	(b_2) 351
xy-series			
(a)	151	365	
(b)	112	328	

Table 69. Summary of durational measurements of Grade III disyllabics

	Vowel Centre	Consonant Centre
Group (a)	112	246
Group (b),	106	355

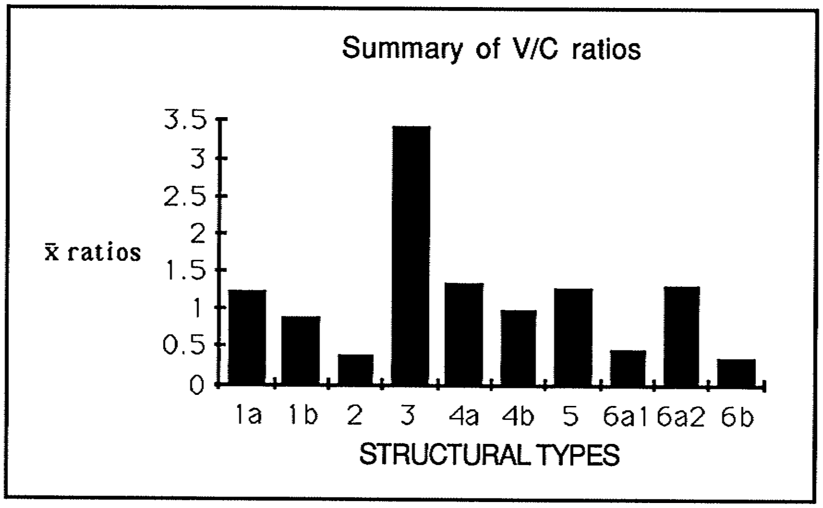
The following Table summarizes the V/C ratios of the above durational distributions:

Table 70. V/C ratios in the six structural types in Skolt Sámi

Structural Types	V/C ratios
Type 1a	1.23
Type 1b	0.89
Type 2	0.40
Type 3	3.42
Type 4a	1.35
Type 4b	1.01
Type 5	1.29
Type $6a_1$	0.45
Type $6a_2$	0.31
Type 6b	0.34

In interpreting the above ratios one has to understand that there are two factors relevant here for distinguishing between the respective structural types: (i) the status of the consonant in the consonant centre (i.e. single consonant, geminate or consonant cluster), and (ii) the distribution of duration in both the vowel centre and the consonant centre. Naturally, the characteristic distribution of duration will play a more significant role in distinguishing between disyllabics having consonants of the same status in the consonant centre. It is at this point that the role of durational ratios becomes important. For example, in distinguishing between disyllabics belonging to Type 1a and Type 1b, the absolute durational values are quite similar. However, Type 1a has longer duration in the vowel centre and shorter duration in the consonant centre, whereas Type 1b has shorter duration in the vowel centre and longer duration in the consonant centre. Absolute durational values alone provide insufficient clues for identifying differences between these two subtypes, because differences in absolute duration in the vowel centre are insignificant, averaging about 13 msec; even in the consonant centre, where the differences in absolute duration between these two subtypes are close to 50 msec, it is more convincing to assume that it is the relationship between the durations present in the consonant centre and the vowel that are to be considered important, the tendency for these ratios to remain constant being very evident in the material examined. Similar tendencies may be observed in connection with Types 4a and 4b: while no significant differences in duration in the vowel centre are apparent (hence duration for the vowel centre was not calculated separately in these subtypes), it is significant to note that in 4a the duration of the consonant centre is noticeably shorter (averaging close to 60 msec, see Table 66), while in 4b the ratio is around 1:1. *Figure 43* summarizes the durational ratios of the six structural types. At the end of Chapter 4, Table 57 presents the relationship between grade alternation and the six structural types. On pp. 133-137 a summary was given of the relationship between the structural types and consonant gradation types. It can be seen that compensatory lengthening as a consequence of the durational status of the latus (i.e. full vowel in the latus vs. reduced vowel or no vowel in the latus) is relevant in the case of disyllabics belonging to two grades (Grade I and Grade II). Thus the importance of durational ratios between the alternating grades may also be interpreted through relating the three alternating grades to the respective structural types with which they overlap.

Figure 43. V/C ratios in the six structural types in Skolt Sámi



In Chapter 5 there is even more convincing evidence of the significance of V/C ratios. The compensatory lengthening phenomenon in Skolt Sámi is a consequence of the changes in the durational status of the latus; it may become reduced or, more commonly, it drops when it is in word-final position (see the Rule on p.139). In arguments for the relevance of the disyllabic unit as the domain of quantity, the durational status of the latus is regarded as crucial; consequences of changes in duration of the latus, as they appear in the vowel centre and the consonant centre, are regarded as basic arguments for the existence of this disyllabic stress-group. In the present analysis consideration is also given to the possible effects of latic durational change on the duration of the vowel centre and consonant centre. However, as discussed in Chapter 5, it does not seem convincing to consider the effects of the compensatory lengthening phenomenon as evidence for the existence of the disyllabic quantity unit. The reason for rejecting the role of latic duration as important, in the distribution of duration in the preceding stress-group location, is because of the way durational distributions appear to be a consequence of compensatory lengthening. Although absolute durational values do change in the vowel centre and consonant centre, there is no change in the characteristic ratios. As was pointed out earlier, when the latus is present its duration is constant in all structural types; the distribution of duration in the vowel centre and consonant centre is thus independent of latic duration. The durational ratios do not change when there is a change in the durational status of the latus. This may be interpreted in the sense that the presence or absence of the vowel in the latus in the VC(C)V sequence determines the duration of the preceding segments. This establishes a cohesive relationship between the first and second syllables. What remains constant is the V/C ratio, preserving the identity of the structural type.

2. Reconsidering the status of the syllable

Here I shall summarize the two arguments elaborated in the previous chapters, to the effect that the status of the syllable has to be reconsidered on the basis of the patterns of durational distribution apparent in Skolt Sámi.

The first argument hinges on the fact that the duration of the latus is constant in all structural types, and that changes in the durational status of the latus do not result in changed durational ratios in the preceding stress-group locations. In the above discussion this was adduced as evidence for the relevance of durational ratios between the vowel centre and cononant centre in Skolt Sámi. That latic duration remains constant, and that compensatory lengthening does not change the characteristic durational ratios, have further implications. For if the latus has no apparent effect upon durational interdependencies prevalent in the vowel centre and consonant centre, then there remains no convincing basis for arguing for the disyllabic stress-group as the domain of quantity with no significance attaching to the status of the syllable. While the relevance of the disyllabic stress-group is not being questioned here (see arguments presented in connection with the sub-radical gradation on p.21 and p.152), it is by no means obvious that the syllable within this disyllabic unit does not have a significant role. On the contrary, evidence that durational ratios remain unchanged regardless of the durational status of the latus, definitely points to recognizing the syllable as a relevant quantity unit within the disyllabic stress-group.

The question of the placing of the syllable boundary has to be addressed as well, for the main argument against the relevance of the syllable focuses precisely on the fact that “all structural restrictions seem to center around syllable boundaries” (Sammallahti 1977, Magga 1984). While the nature of these structural restrictions has yet to be fully explained, it is understood that what is being referred to are changes in duration in the consonant centre especially with regard to disyllabics belonging to the xy-series.[109] In Chapter 4 the durational distributions of members of the consonant clusters in both the weak and the strong grades were presented. These durational distributions confirm the assumption discussed in Chapter 5 in connection with the durational changes evident in Skolt Sámi disyllabics due to the compensatory lengthening phenomenon. While it is true that members of the consonant cluster have different durations depending on the class of consonants they represent, such durational differences should not be interpreted as evidence of the irrelevance of assigning a syllable boundary between them. On the contrary, there is no indication that the second syllable does not start with a short consonant - even though the first syllable may contain consonants of different duration. The general observations by E. Itkonen (fn. 94) are not entirely supported by my durational measurements (see p. 149), but neither Itkonen's observations nor the present acoustic analysis provides support for the assumed "syllable irrelevance - disyllabic stress-group relevance" theory.

[109] See fn.102.

The second argument for the relevance of the syllable, as well as being a plausible explanation for the syllable boundary between the first and the second syllable, comes from observing durational distribution as a consequence of the compensatory lengthening phenomenon in the six structural types. We have seen that the sum of the durational increase apparent in the vowel centre and the consonant centre is divided almost equally between these two stress-group locations (see Table 64). However, it is different in the case of Type 3, in which the V/C durational ratio is near 3.42:1. Contrary to expectations based upon the pattern apparent in connection with all the other structural types, when compensatory lengthening takes place there is no durational increase in the consonant centre. The consonant centre in Type 3 contains a short single consonant. Thus it seems to be a plausible assumption that all of the extra duration is manifested in the first syllable, the short consonant functioning as the onset of the second syllable. When reinterpreting the seemingly fuzzy durational pattern apparent in connection with disyllabics containing clusters in the consonant centre, the boundary will fall before the final short consonant in this cluster, all durations being distributed (as observed previously) in that part of the cluster belonging to the first syllable. Hence the general tendency already referred to regarding the distribution of duration in the consonant cluster (p. 161) remains valid. Because it is evident from the distribution of extra duration in Type 3 that compensatory lengthening (loss of duration in the second syllable) was manifested entirely and only in the first syllable, it has to be assumed that all the other structural types behave similarly.

These two arguments should suffice for acknowledging the relevance of the syllable in Skolt Sámi. While recognition of the syllable does not invalidate the assumption concerning the disyllabic unit as the domain of quantity, it definitely throws doubt upon those approaches to quantity analysis in Sámi which deny or overlook the relevance of the syllable.

Acceptance of the important status of the syllable within the disyllabic unit has an additional consequence, one concerning the terminology more recently employed in analyzing quantity in Sámi. I have been following in this present analysis the tradition of referring to the first syllabic vowel as the "vowel centre", the intervocalic consonant(s) as the "consonant centre", and the second syllabic vowel as the "latus". As mentioned in Chapter 1 (pp. 24-25), this terminology was introduced on the basis of the assumption that the syllable plays no role whatsoever in the distribution of quantity patterns in Sámi. This dissertation may show, however, that at least as far as the distribution of duration is concerned, the syllable indeed is a relevant entity and has to be referred to during analysis of quantity in Sámi. Hence it must be suggested that the traditional terminology may no longer be adequate. For if the theoretical justification is no longer valid, there is little point in adhering to a terminology deriving from what may now seem to be an inadequate assumption: i.e. the irrelevance of the status of the syllable within the disyllabic unit.

3. A durational template for Skolt Sámi disyllabics

On the basis of the foregoing analysis of duration manifested in Skolt Sámi disyllabics, a template may be suggested capable of reflecting the distribution of duration within the stress-group. Such a template is based upon recognition of (i) the significance of durational ratios present in the first syllabic vowel and intervocalic consonant(s), and (ii) the second syllabic duration as being constant. Table 71 demonstrates the durational relationship that exists within the disyllabic unit in Skolt Sámi.

Table 71. A durational template of Skolt Sámi disyllabics. (V1 = first syllabic vowel; C = intervocalic consonant(s); V2 = second syllabic vowel)

	V1 longer duration	V/C	C longer duration	V2 $\bar{x}$
Type 1a	+	1.23	_	93
Type 1b	_	0.89	+	93
Type 2	_	0.40	+	93
Type 3	+	3.42	_	93
Type 4a	+	1.35	_	93
Type 4b	+	1.01	_	93
Type 5	+	1.29	_	93
Type $6a_1$	_	0.45	+	93
Type $6a_2$	_	0.31	+	93
Type 6b	_	0.34	+	93

From this template the shorter vs. longer durations in the first syllabic vowel and the consonant(s) following it may clearly be seen. That the second syllabic vowel does not play a role in the distribution of the preceding segments is also evident.

There is one slight modification to be made to what was said above about durational ratios in relation to the compensatory lengthening phenomenon. It was shown that although there is durational increase in the first syllabic vowel and the consonants following, this increase does not affect the ability of ratios to distinguish between durations of the six structural types. In connection with the third structural type, it was claimed that all of the durational increase present as a result of compensatory lengthening will be manifested in the first syllable: the single consonant here is the onset of the second syllable, and no durational increase is present. If all of the durational increase is realized in the first syllabic vowel, the V/C ratio of Type 3 will naturally be different: with a full vowel in the second syllable, this ratio is 3.21; with a reduced vowel or ø in the second syllable the ratio will be 3.80 (see Table 65). Because only the third structural type has durational ratios between the vowel and consonant close to 3.5, increase in the ratio value due to compensatory lengthening will not reduce the distinctive difference in durational distribution between this particular structural type and the others.[110]

4. Disyllabics that do not conform to the durational template: exceptions

While the majority of Skolt Sámi disyllabics fit into the durational pattern as summarized in the template (Table 71), there are some that display very different durational distributions. These disyllabics have to be classified into two different groups.

4.1. Exceptions: Group (a)

Those exceptions that may be assigned to Group (a) comprise disyllabics that for historical reasons belong to non-

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[110]The duration of the consonant that starts the second syllable is irrelevant because it is obligatory to start the second syllable with a short consonant. In calculating the durational ratios of all the other structural types we may subtract the duration of the obligatory single consonant from the duration of the consonant centre. In doing so the implications of the durational ratios will remain as indicated on p.162; however, the actual values of these ratios will be somewhat modified. While it may be desirable to substract the duration of the obligatory consonant that starts the second syllable, I chose not to follow that option in this dissertation -- for the simple reason that all the calculations had been completed before I discovered the regularity concerning the duration of the ratios in Skolt Sámi structural types. However, when preparing this material for publication I shall recalculate the ratios along the lines indicated, i.e. considering the substraction of the duration of the obligatory single consonant.

productive morphological classes, and are very few in number. Some undergo consonant gradation, while others do not. The common feature that connects these disyllabics is that they all go back to a three-syllabic origin that in today's paradigm may be traced in the derived forms where the original vowel may be manifested as short, or in casual speech more commonly as a reduced vowel. A few examples to illustrate this will suffice here: *kâ´pper* 'hat' Nom.Sg.; *nâa´er* 'dream' Nom.Sg.; *maainâs* 'story' Nom.Sg.; *vä´ʒʒled* 'start to walk' Inf., etc. The various forms that occur in the derivations of these words were also measured, but because most of them display different durational patterns it was deemed appropriate not to include the results in the present discussion.[111] Other disyllabics that belong to this group of exceptions are the so-called contracted stems ("supistuma vartalot").[112] The distribution of duration is, as a rule, different from that demonstrated in the template above.[113] Some examples for contracted stems are: *puäʒʒ* 'reindeer' Nom.Sg.; *mään* 'moon' Nom.Sg.; *kaammi* 'shoe' Nom.Sg.; *ääveed* 'open' Inf., *kuađđjed* 'leave' Inf., etc.

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[111] It has to be noted, however, that a tendency to approach the durational pattern of Type 1 may be observed in those forms of words where the second syllable ends in a consonant (Nom.Sg., Gen.-Acc.Sg., Nom. Pl., with nouns, or Prs.Sg3., Imp.Sg2. with verbs). A more detailed treatment of disyllabics that do not fit the suggested durational template will be the subject of subsequent research.

[112] These stems were also originally three-syllabic stems and they are divided into a number of subgroups according to the segment that started the original third syllable. Although there are several subtypes in the group of contracted stems, they actually comprise a very limited number of words and the group itself is non-productive. (For a survey of these stems, see E. Itkonen 1946, Korhonen 1967, 1969; Korhonen et al. 1973).

[113] Similar to what was mentioned above in connection with the former group, a tendency towards conformity of distribution of duration in the main structural types (Types 1 and 2) may be observed, but this is not typical for the group in question. (For example, only one out of the six recordings of *puäʒʒ* 'reindeer' showed a pattern similar to Type 1b durational distributions).

The disyllabics in this group of exceptions will obviously have to be treated separately. As mentioned above, this is not a particularly numerous group, and it is comprised of stems that may be classified as remnants of historically productive morphological classes. Although not numerous the majority of stems are, however, representative of the most frequently occuring morphemes, so in this respect the distribution of the duration they represent is important. Due to their small number and unproductiveness, the differences in durational distribution in this group of exceptions do not affect the results presented above concerning the majority of Skolt Sámi disyllabics.[114]

4.2. Exceptions: Group (b)

There is another group of exceptions to be referred to in the context of the durational template described above. Disyllabics belonging to Type 1b have a noticeable tendency to display different durational patterns. Thus although the most frequently encountered pattern is demonstrated in Table 71, as well as in the template of the structural types comprising the majority of Skolt Sámi disyllabics, there are divergencies numerous enough to warrant giving attention to the pattern of durational distribution evident there.

Results of these durational measurements show that when the geminates occuring in Type 1b are plosives or affricates (voiced or voiceless), instead of the expected duration ($\bar{x}$: 214

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114 It has to be mentioned that Korhonen (1971, 1975) utilizes the durational differences between Type 6 disyllabics and disyllabics similar to those I treat here as exceptions, such as *ääveed* 'open' Inf. Here the second syllabic vowel has an average duration of 240 msec. While it is true that this duration is different from the duration of the second syllabic vowel in both Type 1 and Type 2 disyllabics, it is doubtful that the handful of unproductive disyllabics that display a durational pattern similar to that evident in *ääveed* 'open' Inf. would justify the positing of an additional structural type. See also Section 5 in this Chapter for arguments in favour of the three phonological quantities as suggested by Korhonen.

msec) their actual duration is on average over 100 msec longer. As for the fricatives, the only consonant that seems to conform to this tendency is the [s] in my data. This increased duration will also result in a significant decrease in duration present in the first vowel: instead of the expected duration ($\bar{x}$: 201 msec) the average is 100 msec shorter. This tendency will appear typically in such disyllabics as: *pue´tted* 'come' Inf.; *likkâd* 'move' (Refl.) Inf.; *čuäǯǯap* 'stand' Prs.Pl1.; *meäcc* 'forest' Nom.Sg.; *kaggad* 'lift' Inf.; *kossâd* 'cough' Inf., etc.

This phenomenon of longer than expected duration in the geminates and the shorter vowel duration that accompanies it, occurs quite frequently. As mentioned in Chapter 2, each test-word was recorded three times by both subjects, each word thus being measured six times. Of these six measurements, at least two (more frequently three, even four or five) conform to the tendency described above (in the speech of both subjects). The question is, how to account for this divergency? Before attempting to do so, it has to be established that the pattern of durational distribution as presented in Table 71) is to be regarded as the norm from which the divergencies are exceptions.

In attempting to account for these occurrences as exceptions, two possible explanations may be offered based on acoustic analysis of the test-words.

1. It was noticed that the duration of the sentence frame (the words which constitute the frame plus pauses that precede or follow the test words) is longer when the increase is evident in the geminates in question (by an average of 90-100 msec). Whether this implies that when the speech rate is faster the second pattern (i.e. that represented in connection with these exceptions) will occur, cannot be determined on the basis of the

data of this particular analysis.[115] *Figures 44-48* show examples of the exceptions discussed here.

2. Another possible explanation may be that we have to postulate a rule in Skolt Sámi that lengthens intervocalic obstruents in the strong grade. This is an optional rule, and it functions in both dialects. As mentioned above, a large proportion of the test-words relevant here provide evidence of the additional duration occurring in these consonants.

Neither of the above suggestions, as to the reason for the additional length in the relevant consonants, excludes the other. On the contrary, it appears that the application of the optional rule coincides with instances of longer than average sentence-frame durations (for H.S. the sentence-frame duration averages 1.61 seconds, for K.J. it averages 2.12 seconds). This fact may suggest that the proposed optional rule can be expected to apply in slower (more formal?) speech situations.

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115 A different kind of analysis in which speech-rate is considered will have to be undertaken in order to confirm this hypothesis. As mentioned earlier, the objective of the examination necessitated keeping the duration of the sentence-frame as constant as possible. Divergencies from the average duration of the frame seem to be consistent with the occurence of the exceptional pattern. However, the implications suggested here should be regarded as inconclusive.

Figure 44. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *ciel´k vuaggad* 'angle' (Inf.) *e´pet* as spoken by subject H.S. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 1.81 s. Test-word: *vuaggad.* The segments measured: [ua] = 150 msec., [preaspiration + g] = 270 msec., [ʋ] = 97.5 msec.

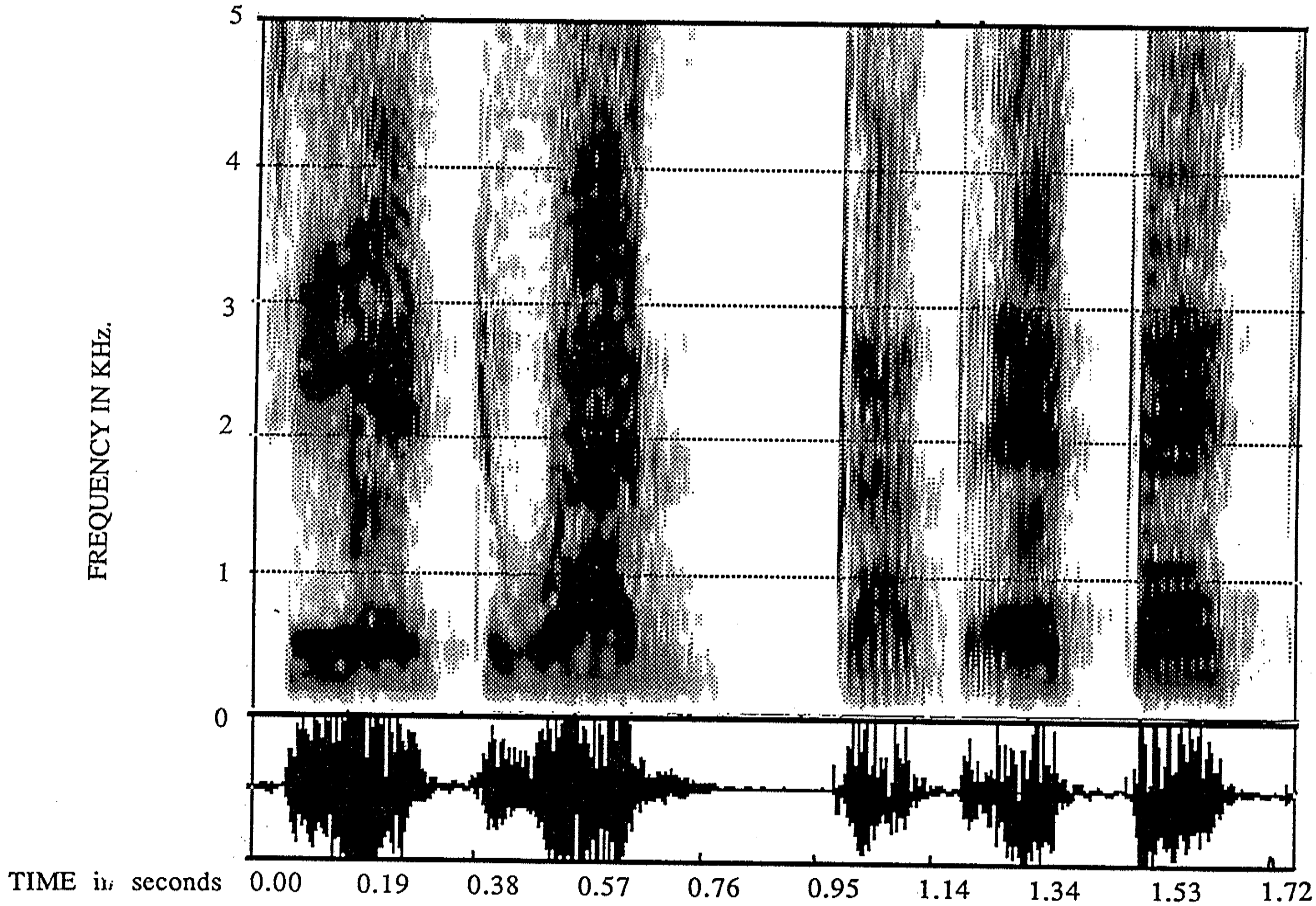


Figure 45. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *ciel'k vuaggad* 'angle' (Inf.) *e'pet* as spoken by subject H.S. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 1.65 s. Test-word: *vuaggad.* The segments measured: [ua] = 135 msec., [preaspiration + g̥] = 181 msec., [ʋ] = 97.5 msec.

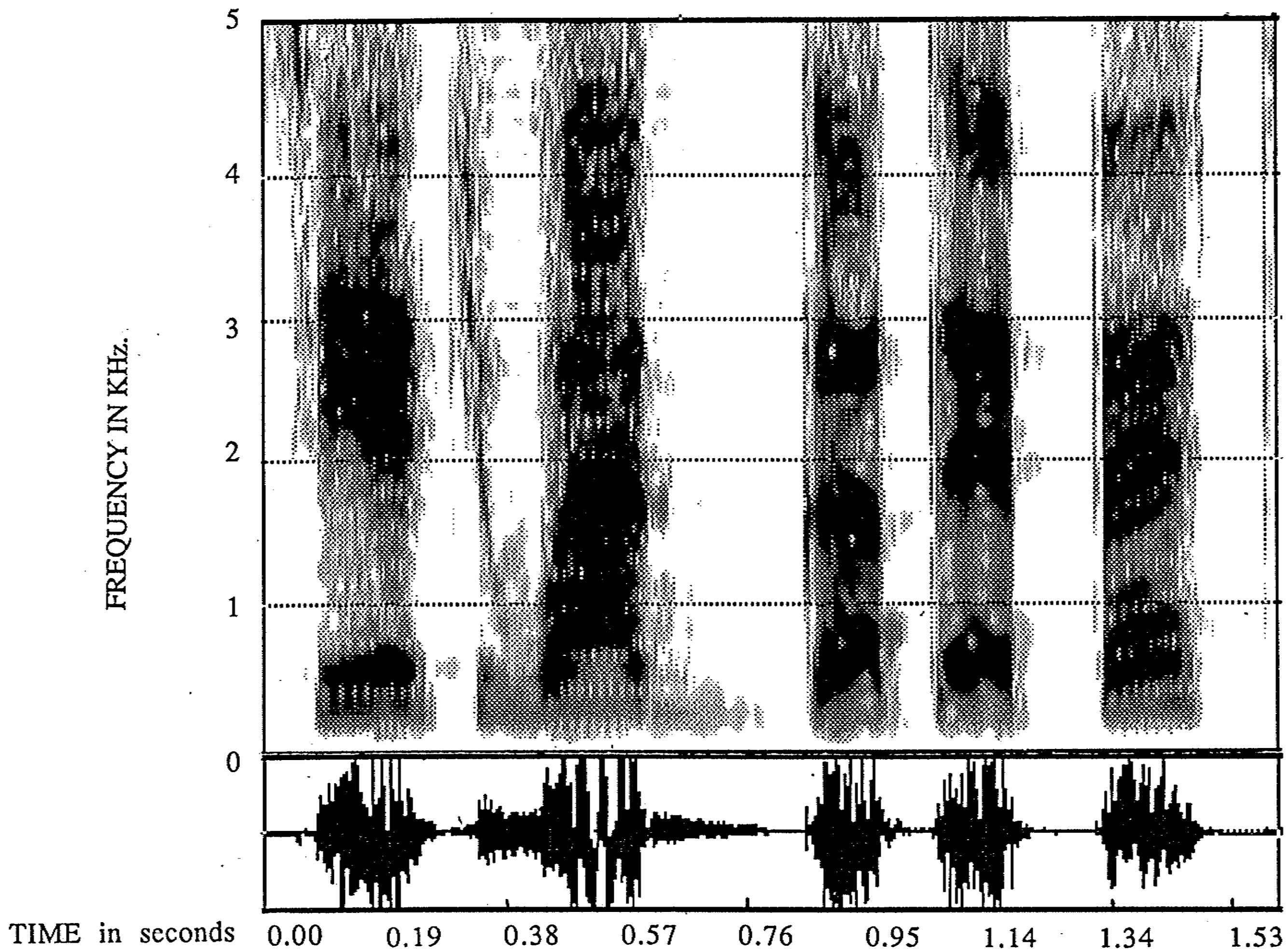


Figure 46. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *saar repp* 'ptarmigan' *e´´pet* as spoken by subject K.J. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 2.03 s. Test word: *repp*. The segments measured: [e] = 90 msec., [preaspiration + p] = 415 msec.

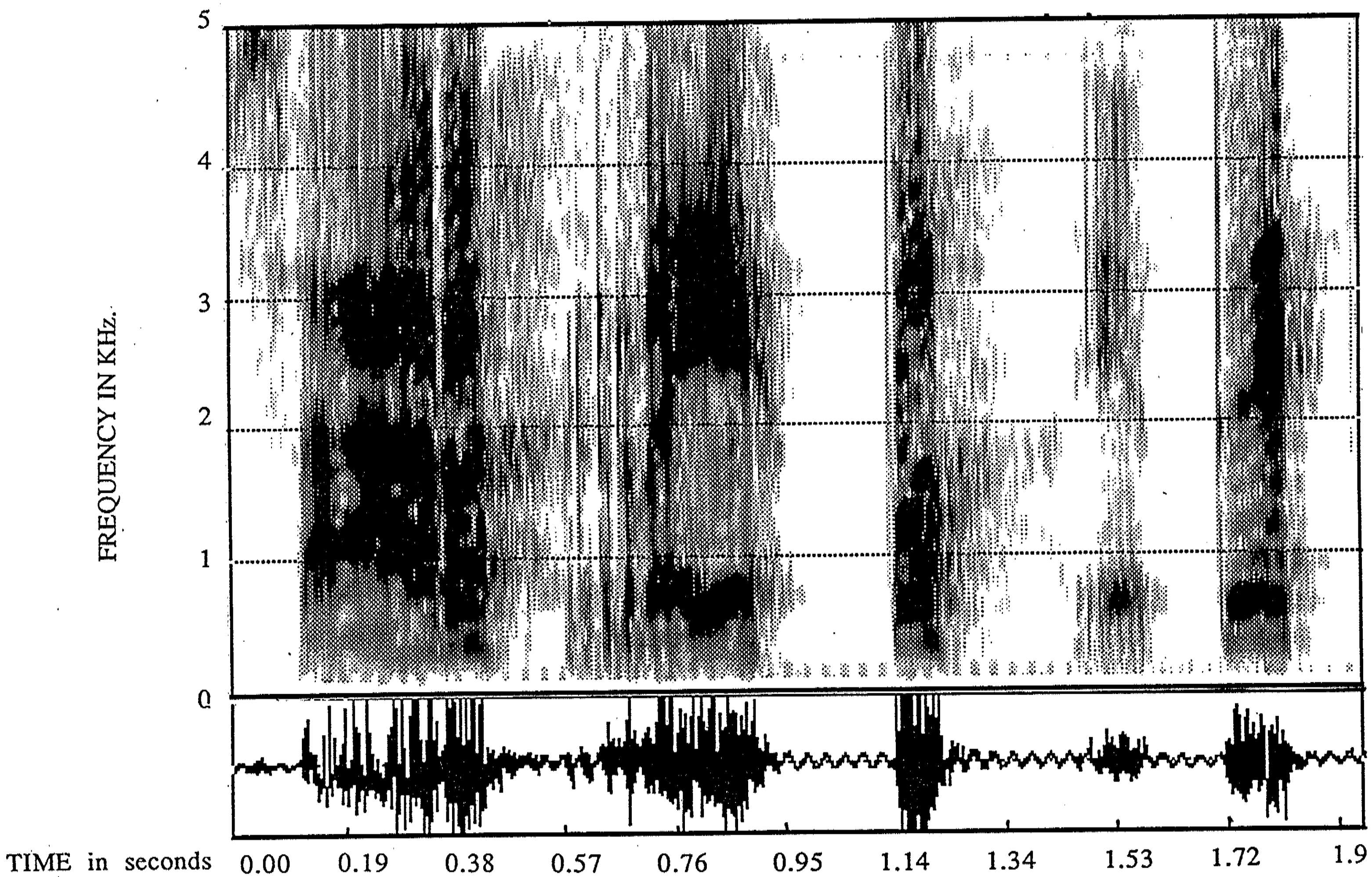


Figure 47. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *ciel'k jokk* 'river' *e´pet* as spoken by subject H.S. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 1.66 s. Test-word: *jokk.* The segments measured: [o] = 127.5 msec., [preaspiration + k] = 405 msec.

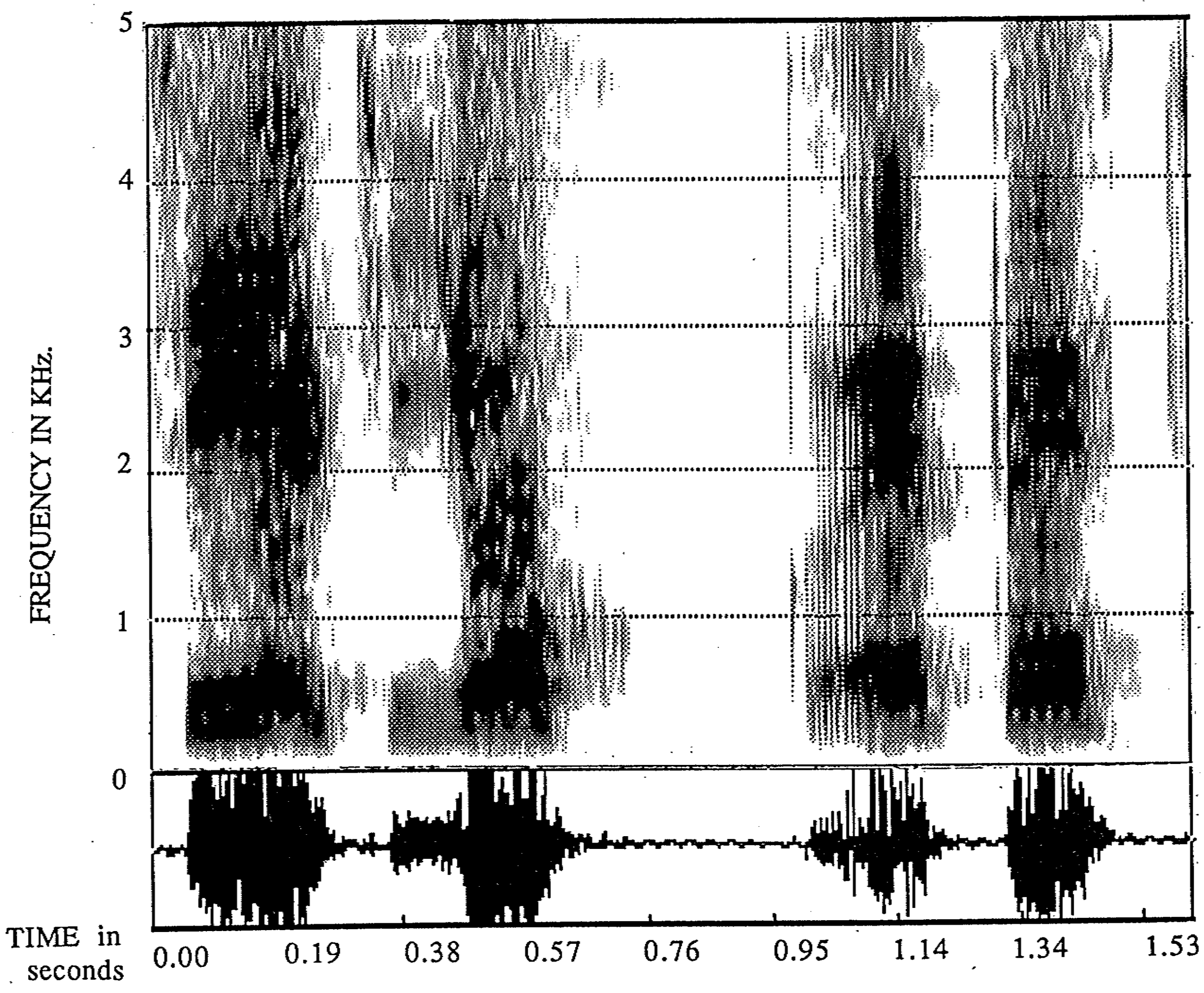
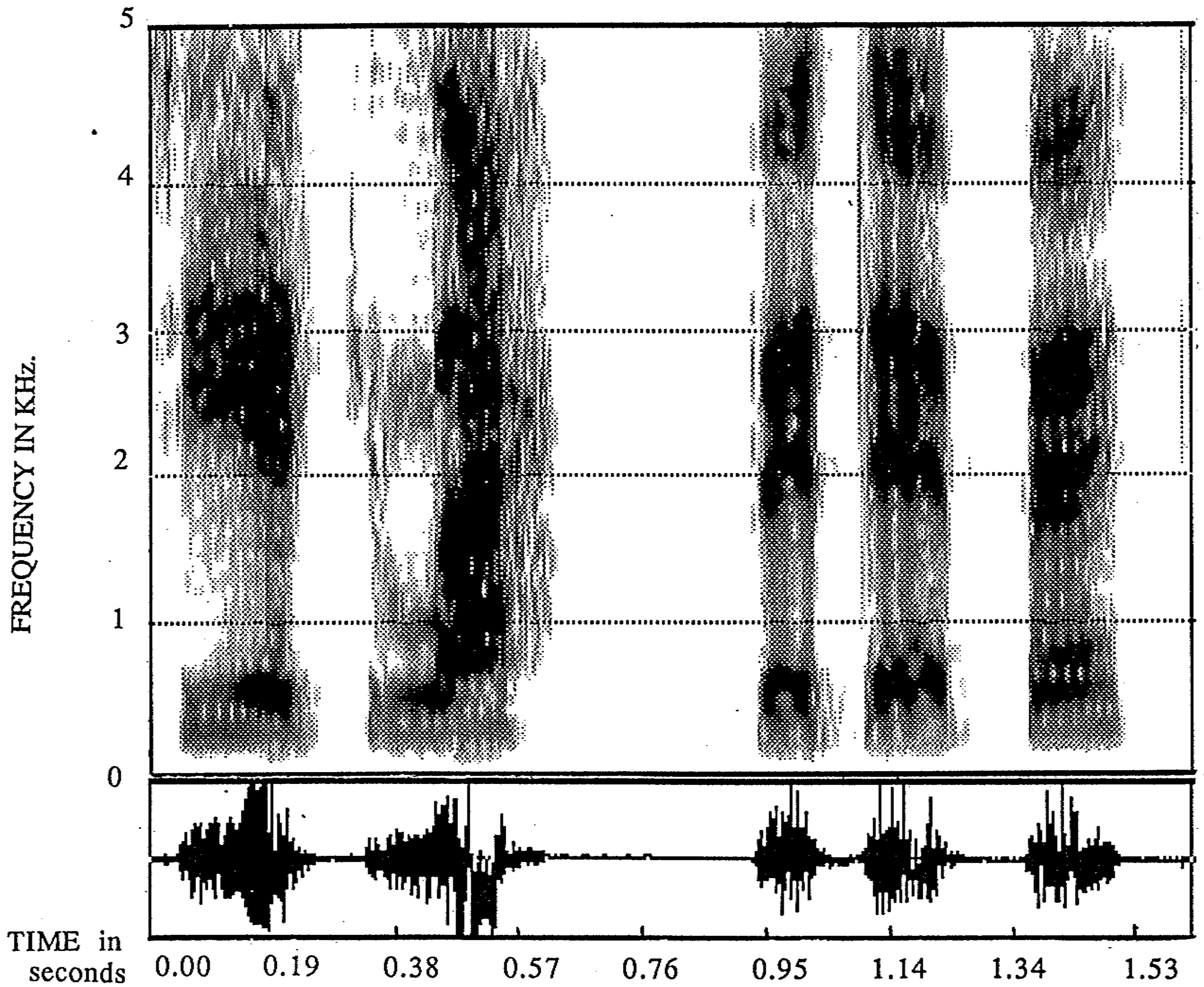


Figure 48. Broad-band spectrogram (300 Hz bandwidth) and time waveform of the utterance *ciel'k lä'pped* 'lose' (Inf.) *e'pet* as spoken by subject H.S. Time scale: 16 millimeters = 191 msec. The duration of the whole utterance: 1.67 s. Test-word: *lä'pped.* The segments measured: [ɛ] = 105 msec., [preaspiration + p] = 405 msec., [e] = 75 msec.



5. <u>Phonological quantity</u>

In the introductory Chapter the matter of the number of phonological quantities was raised. Sámi, similarly to Estonian, is known to have three distinctive quantities. However, while the acoustic correlations of Estonian phonological quantity are well researched (see Chapter 1), the same cannot be said of phonological quantities in Sámi. The question naturally arises: how may the present discussion contribute to an understanding of the characteristics of phonological quantity in Sámi.

First of all we have to make a distinction between the dialects examined here and those better known dialects (above all, the North Sámi dialects) where the existence of three distinctive quantities is beyond dispute (Collinder 1951, Ravila 1962, among others). The acoustic correlates of these quantity degrees, as far as duration is concerned, were examined in Magga 1984. In Skolt Sámi we must be aware of two things: (i) though the first syllabic vowel may occur in three distinctive quantities in North Sámi dialects, this is not the case in Skolt Sámi, and (ii) according to Korhonen's analysis (1971, 1975), it is the second syllabic vowel that may occur in three distinctive quantities, the phonetic correlates of the distinctive quantity being duration and stress (see p. 43).

This dissertation aims at surveying the durational relationships between (i) the first syllabic vowel and the consonant(s) following, and, (ii) the second syllabic vowel and the preceding segments, consonant(s) and the first syllabic vowel. It has been stated that durational measurements show the second syllabic vowels as having an average duration of 87 msec (p. 106). The triplet cited by Korhonen as evidence for the existing three distinctive quantities is (a) *sä´lbb* [sælb̥b̥ᴱ] 'bolt' Nom.Sg., (b) *sä´lbbe* [sælb̥b̥e] 'prick the needle' Prs.Pl3., and (c) *sä‘lbbe* [sælb̥b̥e:] 'bolt' Prs.Pl3. The claim that length is distinctive between the pairs (a) and (b) is correct, for in (a) the second syllabic vowel appears as a reduced vowel with duration not exceding 40-45 msec. In this regard, the distinction between (a) and (c) also can be seen as based on durational differences. However, that (b) and (c) and also (a) and (b) do not differ in duration only but in stress -- that is, in the presence or absence of secondary stress -- prompts Korhonen to conclude that the distinction between (a) and (c) is twofold, consisting of both stress and length. The critical issue here, naturally, is the presumed stress difference between (b) and (c). Because the present dissertation is concerned only with the analysis of duration, no assessment can yet be made of this difference in stress placement between disyllabics similar to the examples shown in (b) and (c). As far as the durational measurements show, as pointed out earlier, the difference in duration is evident between (b) and (c), see fn. 114 concerning the duration of disyllabics similar to (c). It remains to investigate the claim made for different stress placement in the second syllable of the relevant disyllabics. Such an investigation would constitute a second stage of the present research where the theoretical claims for durational differences have already been confirmed experimentally. In Section 6.1.1. in this Chapter I shall elaborate on the possible assumption of different stress status and its consequence in connection with disyllabics similar to (a) and (b), i.e. disyllabics belonging to Type 1 and Type 6 respectively.

Concerning phonological quantity in Skolt Sámi, we must conclude, in terms of both the phonetic components of this quantity and their distribution, that we have here a very different phonological realization of quantity from that of Estonian phonological quantity. It has been a widely accepted assumption that both Estonian and Sámi have three distinctive phonological quantity degrees, and on the basis of this assumption in my present research I have chosen as point of departure the results of the more thoroughly analyzed Estonian phonological quantity. As far as the research procedure for examining the phonetic correlates of phonological quantity in Estonian is concerned, the present dissertation owes a great deal to previous research in Estonian in this respect. There is no doubt that thorough acoustic analyses of the phonetic components of quantity, followed by listening tests, are essential prerequisites for establishing the linguistic relevance of the assumed phonetic correlates. In North Sámi, where three distinctive quantity degrees are attested (see p. 38), it is possible to arrive at results similar to Lehiste's analysis, in terms of a possible interrelationship between Fo patterns and duration. In Skolt Sámi, however, the three quantity degrees that are presumed to be phonologically relevant (see above) are expected to have stress and duration as phonetic components of these distinctive quantities.

There is yet one point where analysis of quantity in Skolt Sámi coincides with that in Estonian: namely, in connection with the domain of quantity being the disyllabic stress-group. In this respect the prosodic structures in both languages show considerable similarities. In the proposed phonological interpretation of the acoustic analysis presented in the next section of this dissertation, reference will be made to these prosodic similarities between Estonian and Sámi.

6. Theoretical implications

The theoretical implications of the speaker's interpretation of phonetic properties -- in particular, in the case of quantity, suprasegmental properties -- are of considerable significance. The validity of the following SPE hypothesis has to be reconsidered:

> Given the surface structure of a sentence, the phonological rules of the language interact with certain universal phonetic constraints to derive all grammatically determined facts about the production and perception of this sentence. These facts are embodied in their 'phonetic transcription'. (Chomsky and Halle 1968:293)

The "phonetic transcription" is thus regarded as the terminal output of the grammar, suitable for phonetic interpretation in an automatic way. The physical utterance, according to the SPE approach, is not generated by the grammar.

In a recent review of this assumption, Keating (1985) queries the extent to which phonetic representation in any language can be interpreted by a set of phonetic conventions. In effect, she is expressing doubt as to whether translation from segments to articulation can be treated as automatic, or whether instead some revision of this automatic aspect of interpretation of the phonetic component may be necessary. Keating's conclusion is that -- at least where such timing variables as intrinsic vowel duration, extrinsic vowel duration, and voicing timing are involved -- segmental phonetic transcription cannot be interpreted by phonetic conventions. On the basis of an analysis of the above-mentioned phonetic patterns, she argues that "language specific rules extend further into phonetics than was assumed in the constrained SPE model." (p. 129)

Similar doubts concerning the SPE assumption that phonetic conventions are universal rules, were expressed by Garnes (1973), Allen (1973), Nooteboom (1972, 1973) and Lehiste (1984, 1987) among others. These studies shared a common skepticism concerning acceptance of the phonetic transcription as being the terminal output of the grammar; all consider phonetic phenomena involving time variables to be relevant to the grammar of the language. They conclude that certain aspects of the phonetic component, the temporal being one of the most prevalent, have to be considered essential parts of the phonology of the language.

The analysis of quantity in Sámi involves issues which so far have resisted incorporation into any existing phonological theory. The overview of research on quantity in the first Chapter, indicates the complexity involved in describing both the characteristics and the role of quantity in languages such as Estonian and Sámi. It may be assumed that descriptions of quantity have to take into consideration all aspects of quantity that are relevant in the language in question. An examination of what constitutes linguistically relevant quantity in Skolt Sámi may have significant implications for phonological theory, for it may indicate the extent to which Sámi phonological rules must have access to those suprasegmental properties that signal phonologically relevant quantity differences.

Recent phonological theories (autosegmental phonology, and especially newer developments in metrical phonology) have furthered our understanding of the incorporation of suprasegmental phenomena into the phonological description of a number of languages. As far as Estonian phonology is concerned, the contributions of Prince (1980, 1983) and Hayes (1989) are significant.[116] It is beyond the scope of this dissertation to evaluate the results of metrical phonology concerning the analysis of Estonian quantity. It has to be emphasized, however, that where the incorporation of prosodic properties into phonological descriptions is concerned, the metrical approach has definitely opened up new and valuable perspectives. In the next section I shall attempt to explore the possibility of incorporating some of the results of the acoustic analysis of Skolt Sámi duration into the theoretical framework of moraic phonology, a branch of prosodic phonology. The version of the moraic theory I intend to apply to the interpreting of Skolt Sámi data, is that introduced and developed by Hayes (1989). While Hayes's theoretical approach seems most suitable for the analysis of prosodic phenomena in Skolt Sámi, it must be said that moraic theory owes a great deal to segmental prosodic theories (Levin 1985, Lowenstamm & Kaye 1986, and Itô 1986): some of the premises basic to moraic

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116 There have appeared several more studies in which attempts at interpreting Estonian quantity may be found (e.g. Hyman 1985). It is not my purpose to give a complete survey here.

phonology are essentially the same as those developed in segmental prosodic theories (see below).

6.1. The analysis of compensatory lengthening in moraic phonology

One of the two important results of acoustic analysis of duration in Skolt Sámi is the recognizing of the role of the syllable within the disyllabic stress-group (see Section 2 in this Chapter). The effect of the compensatory lengthening phenomenon, as observed in this language, offers crucial evidence in this respect.

The compensatory lengthening (CL hereafter) that occurs in Skolt Sámi is one of the most commonly attested types: CL by vowel loss.[117] (The phonological rule that is responsible for the CL is stated on p.139.) It may be recalled that vowel loss in the second syllable results in the lengthening of the preceding syllable where both segments will lengthen in such a way that the durational ratios characteristic of the relevant structural types will remain constant. The significance of this fact, as elaborated above, is that the identity of structural type is preserved after CL takes place. Two issues have to be examined in connection with the occurrence of CL in Skolt Sámi, both of them through employing the theoretical framework of moraic phonology. These are (i) compensatory lengthening occurring only in five structural types (Types 1-5), and (ii) the realization that CL is different in Type 3 disyllabics from the pattern observed in Types 1,2,4 and 5.

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117 The other typologically distinctive CL types (Double Flop and CL from Glide Formation) are also discussed in considerable detail in Hayes (1989).

6.1.1. Compensatory Lengthening occurring only in five structural types:

As pointed out earlier, the phonological rule responsible for the loss of the word-final vowel in Types 1-5 does not apply in the sixth structural type. It will be recalled that in Types 1-5 the phonetic duration of the second syllabic vowel is identical to the duration of the vowel in the same position. Why is it, then, that vowel loss - and as a consequence, CL - does not take place in disyllabics belonging to Type 6? One possible answer to this question may be provided by analyzing prosodic differences between the structural types in question.

Consider the following disyllabics: *jokk* /jokka/ 'river' Nom.Sg. (Type 1); *â'lmm* /âlmme/ 'sky' Nom.Sg. (Type 2); *nõõd* /nõõda/ 'stalk' Nom.Sg. (Type 3); *kooz* /kooza/ 'cough' Nom.Sg. (Type 4); *põõrt* /põõrta/ Gen.Sg. 'hut' (Type 5); and *i'tte* /itte/ 'appear' PastPl.3. (Type 6). The moraic structure of these disyllabics may be represented according to the following syllabification algorithm:[118] (i) selecting the sonorous segment as the nucleus of the syllable, (ii) assigning onset consonants to the syllable node, and coda consonants to the preceding mora.

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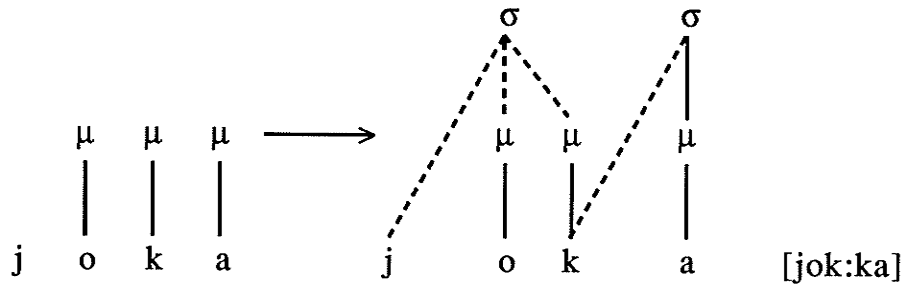
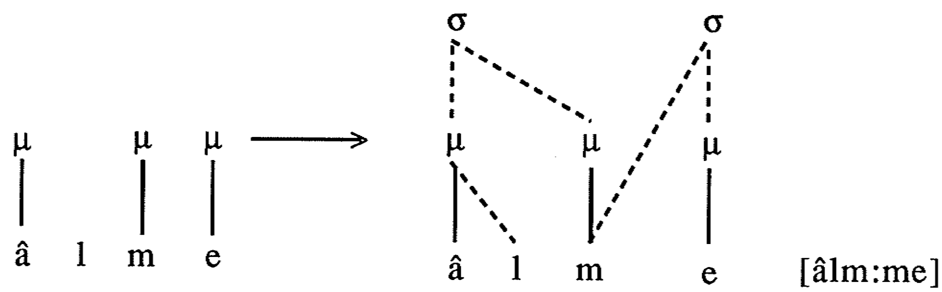
118 The procedures of syllabification have been developed by Steriade (1982), Dell and Elmedlaoui (1985) and Itô (1986), among others. The algorithm employed here is based upon essentially the same principles as those proposed in the works referred to here, except for associating segments of the melodic tier to moras instead of the skeletal tier. As will become apparent below, segmental theories of prosodic phonology pose certain problems one can avoid by employing the formalism developed by moraic phonology (Hayes, 1989.)

Figure 49. Prosodic structures of Type 1-6 disyllabics

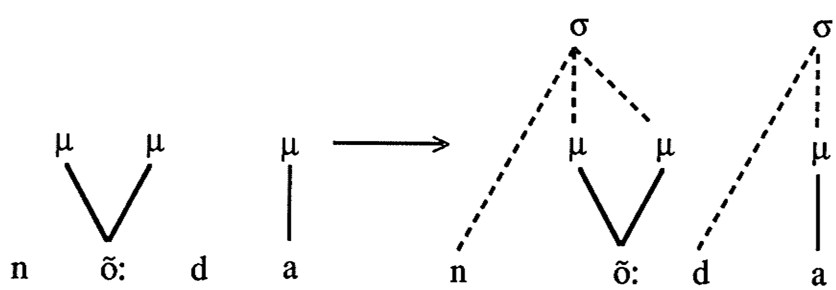
a.



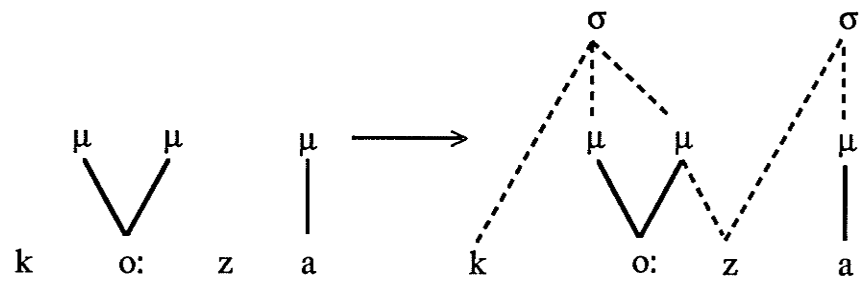
b.



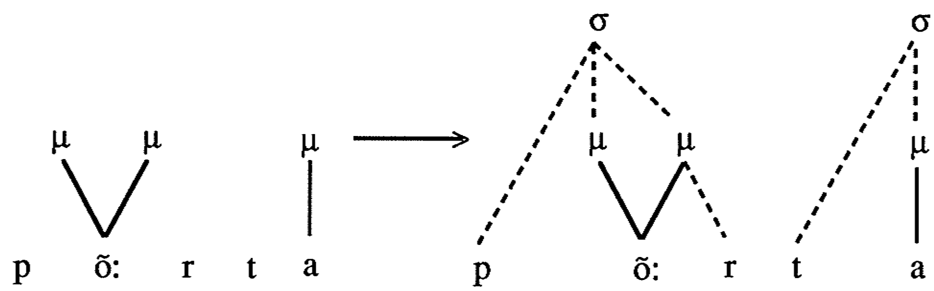
c.



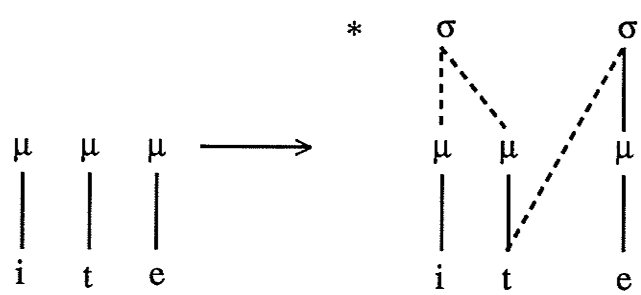
d.



e.



f.



[it:te]

From the above representations the following assumptions may be read: underlying long vowels correspond to two morae; an underlying geminate has one mora; its consonant melody having "flopped", it will become the onset of the next syllable (Hayes 1989:258). The significance of this interpretation of the syllabic structure will become evident when considering the realization of the effect of CL in relation to the individual structural types (see below). The syllabification principles outlined above are in accordance with the Prosodic Licensing as elaborated in Itô (1986:2). Prosodic Licensing requires that "all phonological units must be prosodically licensed, i.e. belong to higher prosodic structure (modulo extraprosodicity)." The above syllabification indeed assigns segments to morae, and morae to syllables: prosodic licencing may, of course, extend its domain and assign syllables to metrical feet and metrical feet to phonological words. Indeed, it is relevant to assume that the above disyllabic prosodic structures belong to a higher level prosodic unit, the disyllabic stress-group, containing at least one foot -- Types 1-5 -- and that they may contain two feet, such as those disyllabics belonging to Type 6.[119]

Having established the syllable structure differences relevant in the underlying representations between these structural types, the next step is to account for the prosodic change as a result of CL. Hayes proposes the Parasitic Delinking Rule that accounts for the consequences of syllable loss in the structure (see fn. 114 in this dissertation for the theoretical significance of this rule).

> Parasiting Delinking: Syllable structure is deleted when the syllable contains no overt nuclear segment.

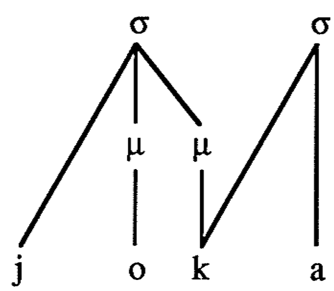
In the five structural types (Types 1-5) where CL occurs, the following syllable structure adjustments may be observed, following the applying of the Vowel Drop Rule:

119 In this respect Prince's analysis of Estonian quantity (1980) is relevant and valid in interpreting the quantity differences between these structural types (Types 1-5 on the one hand, and Type 6 on the other). I shall return to these differences later in this section.

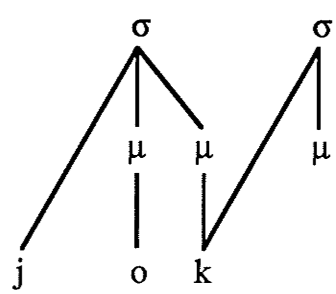
Figure 50. Compensatory Lengthening in Types 1-5

a. Type 1.

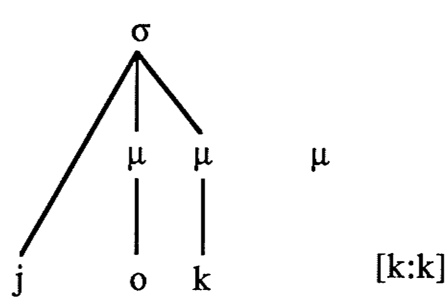
Input



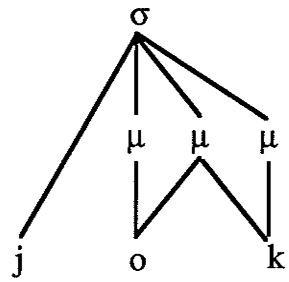
Vowel Drop



Parasitic Delinking

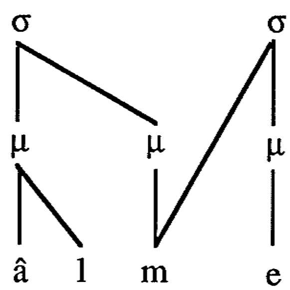


CL → Resyllabification



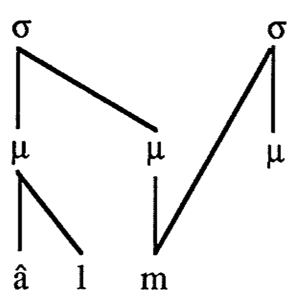
b. Type 2.

Input

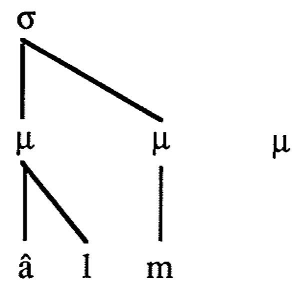


[lm:m]

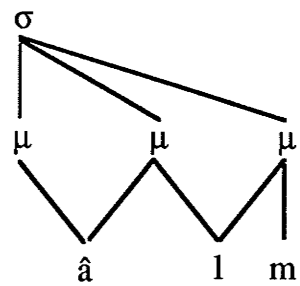
Vowel Drop



Parasitic Delinking

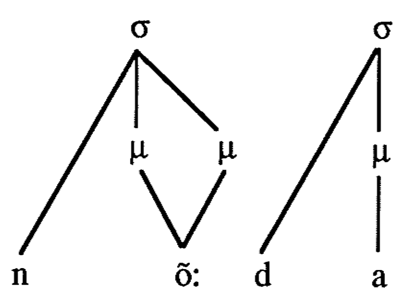


CL → Resyllabification

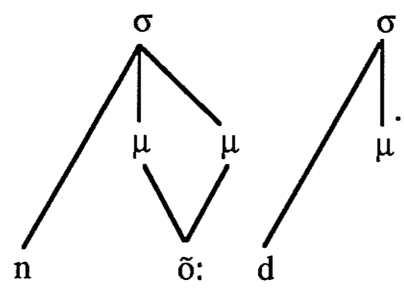


c. Type 3.

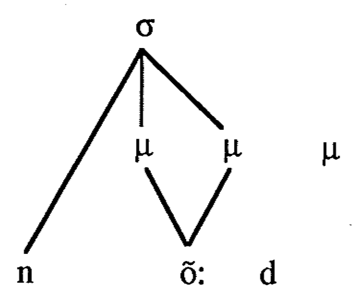
Input



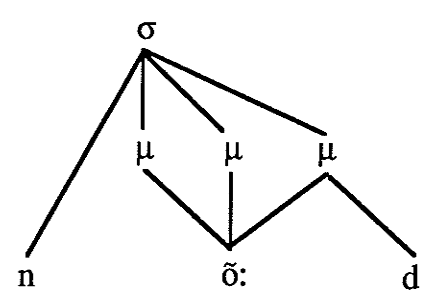
Vowel Drop



Parasitic Delinking

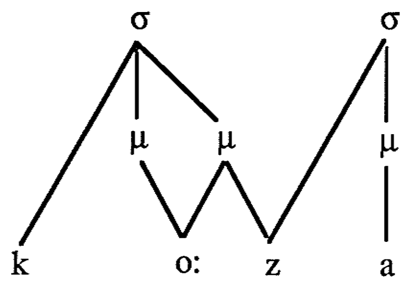


CL → Resyllabification

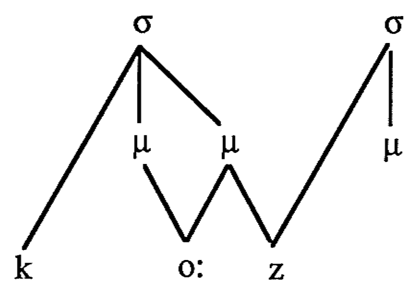


d. Type 4.

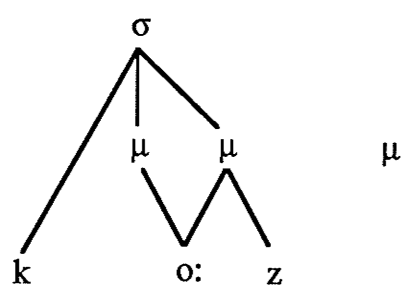
Input



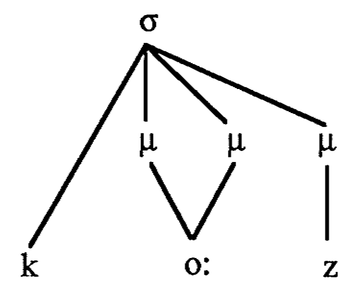
Vowel Drop



Parasitic Relinking

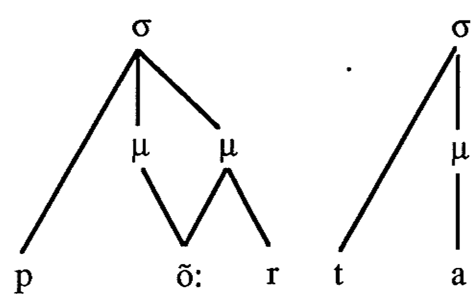


CL → Resyllabification

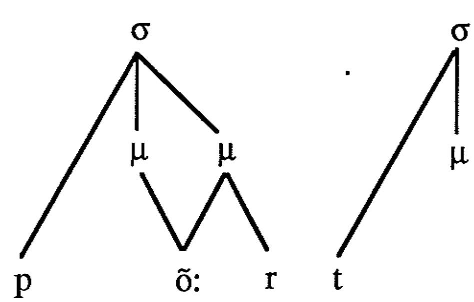


e. Type 5.

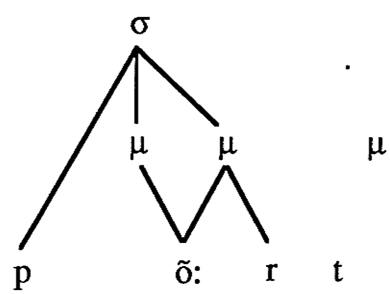
Input



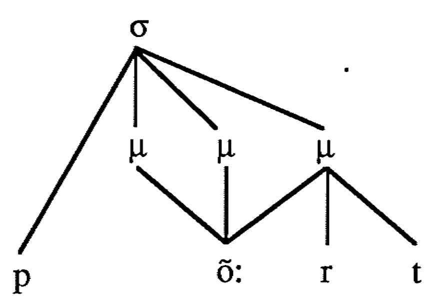
Vowel Drop



Parasitic Delinking



CL → Resyllabification



We now return to the question posited at the beginning of this section: why do Type 6 disyllabics not undergo CL? Earlier, on the basis of the acoustic analysis of duration, it was stated that there is no durational difference between the second syllabic vowels in the six structural types in question. This assumption justified representing the prosodic structure of Type 6 disyllabics similarly to those belonging to Type 1 (see 1b and 1f respectively). There is nothing that would indicate, just by looking at the representations of the two structural types, that the vowel may drop word-finally when the disyllabic belongs to Type

1, but not when it belongs to Type 6.[120] Therefore I shall propose an analysis which may predict correctly the occurrence of CL in all the structural types in question, and predict also that Type 6 disyllabics are not subject to this phonological process.

In justification of the fact that vowel loss does not apply to disyllabics belonging to Type 6, I shall employ the argument which utilizes differences in syllable weight. It has been suggested by de Chene and Anderson (1979) that the prosodic conditions which govern CL are at least partly language-specific. The concept of "syllable weight distinction" is further elaborated in Hyman (1985). Syllables that contain more than one mora are considered heavy. The rule formulated to account for heavy syllables is referred to as the "Weight by Position" rule. The claim made for this is that a syllable may contain no more than two morae. Hayes considers this claim too strong, for the reason that allowing a maximum of only two morae for a syllable would be to assume that syllable distinction is binary. This claim is not consistent with languages where three distinct phonological quantities occur: the analyses of Estonian by Prince (1980) and Hayes (1989) argue convincingly for the existence of syllables with three morae (see Section 6.3 in this Chapter).

I shall claim that the difference between structural Types 1-5 and Type 6 is manifested in the difference in syllabic weight. To be more explicit, word-final vowels in Type 6 syllables have a different underlying prosodic structure: the vowel in question is here bimoraic, whereas vowels that are subject to the Vowel Drop Rule are associated with only one mora. The difference in syllable weight would thus explain the non-application of the Vowel Drop Rule in disyllabics belonging to Type 6. Modifying the

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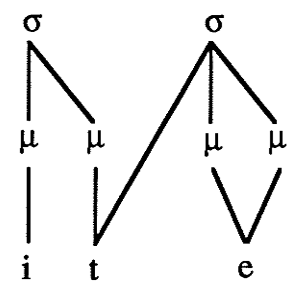
120 Here I do not distinguish between the relevant sub-types. However, it has to be understood that the prosodic structure of Type 6b may be analyzed similarly to the prosodic structure of Type 2. See below for the argument against the assumption of this prosodic similarity.

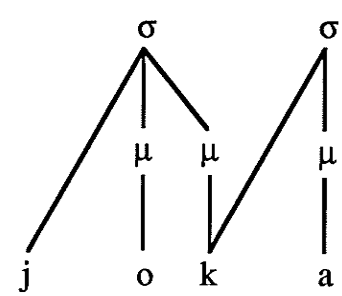
representation of the prosodic structure of disyllabics belonging to Type 6, we arrive at the following representation:

Figure 51. Prosodic structure of Type 6 disyllabics



Compare this structure with the prosodic representation of Type 1 disyllabics:

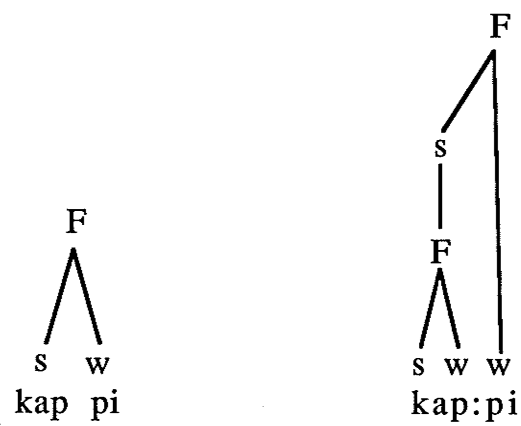
Figure 52. Prosodic structure of Type 1 disyllabics



These prosodic structures provide definite justification of the differring behaviours of the vowels in question in these different structural types. Here I shall refer to two arguments for justifying the different status of the second syllabic vowel in Type 6 disyllabics, with regard to their different syllable weight.

The first argument is based upon Prince's analysis of Estonian overlength (1980). I shall briefly summarize his claims and relate them to the Sámi material. In his analysis Prince investigates the systematic properties of overlength (seven in number) in the light of a foot-based theory. Because only one of these properties is relevant to the present discussion, I shall refrain from mentioning the others. The particular systematic property is the one according to which an overlong syllable (henceforth Q3) seems to invite a following stress. On the basis of examining Estonian quantity relations, Prince concludes that the systematic properties of Q3 are consequences of their special status in the metrical structure: namely, that they represent a metrical category between the syllable and the word. This intermediate category he terms a “foot”. Thus the difference between the two Estonian words *kappi* 'cupboard' Gen.Sg. (Q2) and *kappi* Part.Sg. (Q3) is revealed by comparing their metrical representations:

Figure 53. <u>The metrical representation of Estonian Q2 and Q3 disyllabics</u>



From this it can be seen that the distinction between Q2 and Q3 length reflects an esential difference in the metrical structure: namely, that the metrically strongest syllable (Q3) is a foot, while the Q2 syllable is only part of a foot. In Estonian, Q3 syllables may be followed by a syllable bearing secondary stress, as Prince stated in the above-mentioned systematic property of overlength.

The situation is strikingly similar in Sámi. All Type 6 disyllabics contain Grade III consonants (Type 6a) or Grade II consonants durationally similar to the above-mentioned Grade III consonants (Type 6b).[121]

The assumption that Type 6 disyllabics have a vowel in the second syllable that is prosodically different from Type 1-5 disyllabics is then supported by recognition of the differences in stress.

The other argument promoting recognition of the different prosodic status of the second syllabic vowel in Type 6 disyllabics, is an historical one. The origin of the second syllabic vowel in Type 6 disyllabics differs from that of the word-final vowel of Types 1-5 disyllabics. Type 6 disyllabics have developed from three-syllabic words in which the dropping of the intervocalic consonant between the second and third syllabic vowels resulted in contraction. These contracted vowels are the predecessors of the second syllabic vowel in Type 6 disyllabics. All disyllabics belonging to Type 6 contain a contracted second syllabic vowel. A three-syllabic pre-contraction string in Sámi, is, for example **kɔtajen* 'Lappish tent' Ill.Sg. After the contraction process the first syllable was upgraded to a foot, as a result of compensatory lengthening that produced overlong consonants: **kot:tan*. With word-final consonant drop and first syllabic diphthongization, we arrive at the present form: *kuätta*.

From the preceding acoustic analysis in this dissertation, we know that the duration of the last vowel of Type 6 disyllabics is short, as are the word-final vowels of disyllabics of Types 1-5. Its different prosodic status, however, must have been preserved, the vowel here being bimoraic. The phonetic representation of this extra mora, then, is not one of duration. Korhonen (1971, 1975) has suggested that these vowels here are stressed, having secondary stress. That this assumption is indeed plausible is

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121 See Chapter 4.

supported by recent analyses of Estonian quantity (most relevant here is Prince's, 1980) where the claim that overlong syllables may be followed by stressed syllables is argued convincingly. And indeed this is what we can assume in connection with the relevant Sámi disyllabics: all Type 6 disyllabics contain Grade III consonants (Type 6a) or Grade II consonants durationally similar to the above mentioned Grade III consonants (Type 6b). The above arguments based on (i) the historical evidence, and (ii) the assumption that the second syllable is stressed, both contribute to the plausibility of accepting the different syllable weight explanation for the occurrence vs. non-occurrence of CL.

6.1.2. The realization of Compensatory Lengthening in relation to the defining of the syllable boundary

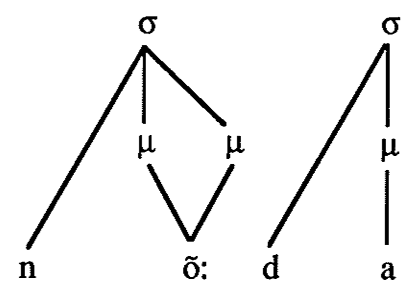
I have elaborated earlier in this dissertation on the fact that Type 3 disyllabics do not display any durational increase in the consonant following the first syllabic vowel, and that this has important implications with regard to recognizing the validity of the syllable as a prosodic entity within the disyllabic stress-group. All the other structural types where CL occurs display a somewhat different pattern in terms of the realization of the durational increase. This increase which is present both in the vowel and the consonant(s) following it, has the effect of preserving the prosodic identity of the structural types. In connection with Type 3 disyllabics this is not the case, all durational increases being manifested in the vowel centre (see Chapter 5). It may be recalled that only Type 3 disyllabics have a single short consonant following the first syllabic vowel. All other structural types have either geminates or consonant clusters.

Syllabification constraints, as stated in Itô (1986), indeed do predict that no lengthening will be manifested in the single consonant of Type 3 disyllabics. She proposes the Universal Core Syllable Condition which would automatically assign this consonant to the onset of the following syllable. The same principle is restated by Hayes in his theoretical framework of moraic phonology. He assumes that prevocalic consonants are linked to the following syllable as non-moraic onset elements. The implication of this (stated also in Hyman 1985) is that onset elements are never subjected to acquiring weight position. The universal constraint of syllabification, as formulated in Itô, would then account for the fact that CL in connection with these disyllabics will be manifested only in the first syllabic vowel.

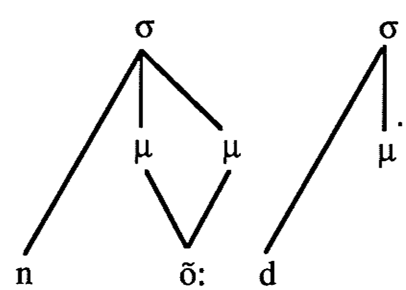
Let us examine the CL process again as it occurs in Type 3 disyllabics:

Figure 54. Compensatory Lengthening in Type 3 disyllabics

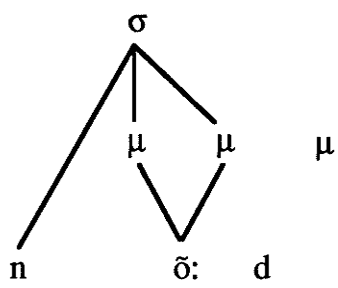
Input



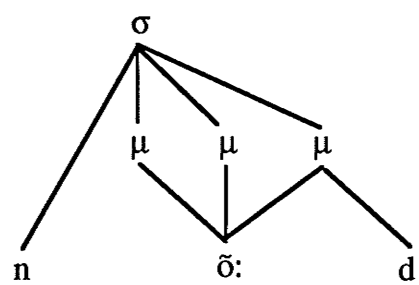
Vowel Drop



Parasitic Delinking



CL → Resyllabification

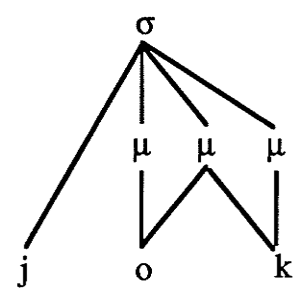


The acoustic analysis of duration certaily confirms the prediction made by Itô in her Universal Core Syllable Rule (Onset Rule). In Type 3 disyllabics there is no extra duration present in this consonant which definitely belongs to the second syllable. In all the other structural types, then, the prosodic structures assumed above (*Figure 54*) accord with the results of the durational measurement, CL affecting the segments before the syllable boundary.

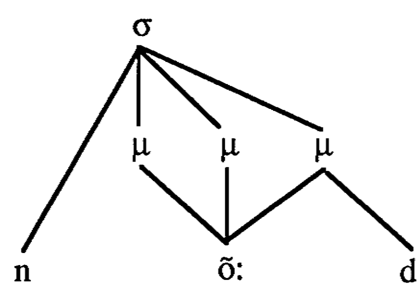
It will be recalled that, in these representations, it is assumed that geminates and long consonants are linked both to the preceding mora and to the next syllable. The last part of these segments then functions as the onset of the second syllable, all extra durations being confined to the first syllable only. This is, again, in accordance with the typology of CL as observed in numerous languages (Hayes 1989). *Figure 55* demonstrates the difference in resyllabification between structural Types 1 and 3.

Figure 55. <u>Resyllabification of disyllabics belonging to Type 1 and Type 3</u>

a.



b.



6.2. <u>Moraic conservation in Skolt Sámi</u>

There is a language-specific fact, however, that has to be acknowledged in Sámi, in connection with the realization of CL in both the first syllabic vowel and the consonant following it. The increase of duration is distributed evenly in order to preserve the ratios important for distinguishing between the various structural types (Chapter 5). On the basis of cross-linguistic behaviour of CV as a result of vowel loss, the segment expected to undergo lengthening is the first syllabic vowel. The language-specific fact recognized in Sámi -- i.e. that durational increase is manifested in both the vowel and the consonant following it -- leads to the conclusion that the domain for CL in Sámi has to be extended: it being the syllable that is affected by the second syllabic vowel loss. Observations indicated above, concerning the different pattern of CL realization, point to the significance of the syllable as a prosodic unit within the larger entity of the disyllabic stress-group.

I am not aware of any analyses of CL in which extra length would be realized by preserving the characteristic ratio values between the segments that constitute the syllable. It may be assumed, however, that the length of the vowel is the phonologically relevant factor here, and that the increase of duration manifested in the consonants following it could be derived by a low-level rule resulting in the appropriate ratio values associated with the relevant structural types. Obviously more research is essential here concerning the theoretical validity of such an assumption.

The most important fact that has to be acknowledged in connection with the realization of CL in Skolt Sámi is the preservation of the prosodic identity of the stress-group. This has been pointed out in various connections in the above discussion. The theoretical significance of the preservation of prosodic identity is elaborated in Hayes's moraic phonology. He claims that the predictions of moraic phonology may be summarized by recognizing the Moraic Conservation Principle:

Moraic Conservation: CL processes conserve mora count.

The process of CL in Skolt Sámi is a case in point here: the prosodic identity characteristic for all structural types that are subject to CL is preserved after the application of CL. In this respect, then, Sámi confirms the claim of moraic phonology as proposed by Hayes: "The essential claim of the theory is that segment length is not mere double association, as in X theory, but instead is closely bound up with the representation of prosody - - that is, moraic structure provides a *prosodic frame* that guides the action of compensatory processes." (Hayes 1989:285).[122]

6.3. Three-moraic syllables

The above representations of Skolt Sámi syllable structures contain some syllables which dominate three morae. It has been the tradition to view syllables as having a maximum of two morae. However, Hayes addresses this question in his study (1989) and argues convincingly for the recognition of three-moraic syllables. In addition to languages which have a three-way quantity distinction, Hayes cites examples from several languages (among them Komi Ižma and Persian) in which the analysis of CL processes requires recognition of three-moraic syllables. In the

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[122] This assumption seems to be indeed a crucial one in the decision to attempt to analyze the Skolt Sámi material within the framework of moraic phonology. There are additional factors that favour selecting moraic phonology over other widely utilized versions of metrical phonology (CV Phonology, or the later developed version of CV phonology where C and V are replaced by the so called "skeletal tier" = X theory). While the formalism of the X theory is just as convenient as that of the moraic theory, the assumptions concerning syllabification constraints seem to be more convincing within the framework of moraic phonology. In connection with CL as a result of vowel loss, X-theory allows expansion of the melody-to-skeleton reassociations in the following way: consonants occupying onset positions are allowed to be flopped to positions originally functioning as nuclei; similarly, it allows vowel segments to spread to slots on the skeleton ties originally functioning as onset slots. By introducing the Parasiting Delinking Rule, Hayes recognizes the ill-formedness of the whole syllable after vowel loss:

> Parasiting Delinking: Syllable structure is deleted when the syllable contains no overt nuclear segment.

By recognizing the universal validity of this principle, resyllabification undergoes adjustment according to language-specific syllabifications: the underlying assumption being that "syllabification is an everywhere process." (Hayes 1989:267) above representations of resyllabification, I simply adopt the formalism suggested by Hayes.

SUMMARY

This dissertation reports on the acoustic analysis of Skolt Sámi disyllabics, as spoken by subjects of two dialects (Suonikylä and Petsamo). The objective was to survey the durational status of the first syllabic vowel, intervocalic consonant(s) and the second syllabic vowel within the disyllabic unit. Durational relationships were presented as they appear in the six main structural types, these types comprising the majority of all Skolt Sámi disyllabics. Reference was made to durational interdependencies present in the phenomenon of consonant gradation, a phenomenon apparent in most disyllabics in the dialects under investigation. The durational status of segments relevant in consonant gradation was related to that observed in connection with the structural types, there being apparent a considerable degree of overlap here.

Two important findings have emerged: (i) there is convincing evidence that durational ratios (of the first syllabic vowel and consonant(s) following it) play a more important role than absolute duration in signalling different structural types and/or gradational types; (ii) the syllable appears to be a discernible unit within the disyllabic stress-group. Analysis of durational interdependencies appearing as a consequence of compensatory lengthening, provides strong evidence confirming both of these statements. The consequence of recognizing this pattern in the distribution of duration, points to the need for reevaluating the hitherto assumed hypothesis according to which the domain of Sámi quantity is the disyllabic stress-group in which the syllable has no relevance at all. Although the present analysis does not challenge the validity of the disyllabic stress-group concept as being the domain of quantity, it does question the validity of the assumption according to which the syllable has no relevance in the distribution of quantity within the disyllabic unit. The results of the present analysis definitely point to the need to recognize the role of the syllable within the stress-group.

In the introductory Chapter three aspects of the analysis of quantity were indicated. While acknowledging the complex issues concerning quantity (three vs. two degrees of phonological quantity, the domain of quantity, the possible configuration of different prosodic elements in the realization of different quantity degrees) this dissertation seeks to take the necessary initial step towards the analysis of Sámi quantity: that is, by providing a survey of the durational relationships within a hypothesized domain (disyllabic stress-group) and interpreting the implications of the analysis of duration. For the Sámi dialects in question the next step will be to test the hypothesis as put forward by Korhonen (1971, 1975): namely, to investigate the relationship between duration and stress (see p.43). Completion of the acoustic analysis of such a subsequent investigation followed by listening tests will no doubt assist in arriving at a better understanding of what actually constitutes phonologically relevant quantity in Skolt Sámi.

The results of the acoustic analysis presented in this dissertation were subjected to examination in the theoretical framework of moraic phonology as proposed by Hayes (1989). Other theoretical works concerning prosodic phonology also were consulted, the most relevant for this dissertation being Itô's dissertation on syllabic theory in prosodic phonology (1986) and Prince's analysis of Estonian overlength in the framework of metrical phonology (1980). Possibilities of incorporating the results of acoustic analyses of Sámi into the framework of moraic phonology have not yet, to my knowledge, been explored in any previous research. It is hoped that the present analysis will contribute to the understanding of the role of prosodic differences in the six structural types of Skolt Sámi disyllabics in the phonology of the language.

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Appendix A

All examples in the text are given in Skolt Sámi orthography. These orthographic characters will be listed here, together with their traditional Finno-Ugric symbols as well as the symbols of the International Phonetic Alphabet. (Symbols interpreted according to standard IPA practice are not listed in the chart below).

Skolt Sámi orthography	FU	IPA
å	o̜	ɔ
a	ɑ	ɑ
õ	ɛ̜	œ
â	ɑ̜	ɒ
ä	ȧ	æ
ǩ	ḱ̦	c
ǧ	ǵ̦	ɟ
c	ts	t̪s̪
č	tš	tʃ
ʒ	dz	d̪z̪
ǯ	dž	dʒ
š	š	ʃ
ž	ž	ʒ
đ	ð	ð
ǥ	ɣ	ɣ
nj	ń	ɲ

The symbol [ˊ] is the palatalization symbol. Vowels are fronted before the palatalization symbol. The consonants (t, c, d, ʒ, s, š, z, ž, r, l and n) are palatalized before this symbol.. The consonants (k and g) are articulated fronted as well as palatalized before the palatalization symbol, according to Korhonen et al. In my recordings both of these consonants are articulated as palatal plosives, IPA [c] and [ɟ] respectively (see Chapter 2, p. 52.).

Appendix B

(A listing appears below of the test-words employed for the acoustic analysis of duration of the six structural types of Skolt Sámi disyllabics)[123]

Type 1a.

ǩiõll 'snare' Nom.Sg.

puäll 'button' Nom.Sg.

kue´ll 'fish' Nom.Sg.

kue´llen 'fish' Ess.Sg.

kue´lled 'fish' Part.Sg.

kuullâd 'hear' Inf.

kuullâp 'hear' Prs.Pl1.

jie´lli 'living' Prs.Part.

toll 'fire' Nom.Sg.

jiälled 'walk' Inf.

jeällam 'walk' PastPart..

mie´ll 'sandbank' Nom.Sg.

mie´ll 'mind' Nom.Sg.

sierrâd 'play' Inf.

sierrâp 'play' Prs.Pl1.

siõrr 'game' Nom.Sg.

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123 The test-words appear in the order in which their measurements were tabulated in the Tables in Chapter 3. Thus the order of the durational measurements in the consonant centre will be matched with the order of test-words, as the same consonants appear here in the consonant centre.

poorrâd 'eat' Inf.
muorr 'tree' Nom.Sg.
võrr 'blood' Nom.Sg.
võrrân 'blood' Ess.Sg.
viärr 'soup' Nom.Sg.
mõõnnâd 'go' Inf.
mõõnnap 'go' Prs.Pl1.
mâânn 'go' Prs.Sg3.
mõõnnâm 'go' PastPart..
mõõnni 'go'Prs.Part.
jieŋŋ 'ice' Nom.Sg.
nõmm 'name' Nom.Sg.
ǩiđđ 'spring' Nom.Sg.
kue´đđed 'leave' Inf.
vivv 'son-in-law' Nom.Sg.
vivvân 'son-in-law' Ess.Sg.
jävv 'flour' Nom.Sg.
suõvv 'smoke' Nom.Sg.

Type 1b.

ǩiepp 'stick' Nom.Sg.
läpped 'loose' Inf.
rääppad 'dig' Inf.
rääppap 'dig' Prs.Pl1.
čuõppâd 'cut' Inf.
ǩiõtt 'hand' Nom.Sg.
ǩe´tted 'cook' Inf.
kua´tt 'Lappish tent' Nom.Sg.

pue´tted 'come' Inf.
puätt 'come' Prs.Sg.3.
pue´tted 'come' Imp.Pl2.
puuttâd 'finish' Inf.
poott 'finish' Prs.Sg.3.
puuttâm 'finish' PastPart..
tie´tted 'know' Inf.
tie´tti 'know' Prs.Part.
tie´ttep 'know' Prs.Pl1.
tiätt 'know' Prs.Sg.3.
jå´tted 'walk' Inf.
jåått 'walk' Prs.Sg.3.
ee´tted 'appear' Inf.
suukkâd 'row' Inf.
juukkâd 'drink' Inf.
juukâp 'drink' Prs.Pl1.
juukkâm 'drink' PastPart..
juukki 'drink' Part.Prs.
sokk 'relative' Nom.Sg.
likkâd 'move' Inf.
viikkâd 'carry' Inf.
veekk 'carry' Prs.Sg3.
čååkkad 'comb' Inf.
laakk 'roof' Nom.Sg.
kaggâd 'lift' Inf.
kägg 'lift' Prs.Sg.3.
vuaggad 'angle' Inf.
vuäggam 'fish' PastPart..
ââ´ǩǩ 'age' Inf.
jue´ǩǩed 'divide' Inf.

reä´ǩǩ 'sin' Nom.Sg.

veä´ǩǩ 'help' Nom.Sg.

ä´ǩǩ 'old woman' Nom.Sg.

jeä´ǧǧ 'swamp' Nom.Sg.

teä´ǧǧ 'money' Nom.Sg.

re´ss 'twig' Nom.Sg.

koossâd 'cough' Inf.

kue´ss 'guest' Nom.Sg.

ǩiä´ss 'summer' Nom.Sg.

piâssâd 'leave' Inf.

piäss 'leave' Prs.Sg3.

piä´ss 'nest' Nom.Sg.

piä´ssen 'nest' Ess.Sg.

pess 'gun' Nom.Sg.

pessan 'gun' Nom.Sg.

luõss 'salmon' Nom.Sg.

sie´ss 'aunt' Nom.Sg.

liâššâd 'lie' Inf.

leäšš 'lie' Prs.Sg.3.

meäcc 'forest' Nom.Sg.

čiä´cc 'uncle' Nom.Sg.

mäcced 'return' Inf.

mäcc 'return' Prs.Sg3.

kõõččâd 'ask' Inf.

kõõččâp 'ask' Prs.Pl1.

kõõččâm 'ask' PastPart.

kiččâd 'look' Inf.

pääččâd 'shoot' Inf.

e´čč 'father' Nom.Sg.

piijjâd 'put' Inf.

piijjâd 'put' Imp.Pl2.

Type 2.

njolpp 'fool' Nom.Sg.
sä´ltt 'salt' Nom.Sg.
mie´lǩǩ 'milk' Nom.Sg.
puälddam 'burn' PastPart.
peäldd 'field' Nom.Sg.
pealddan 'field' Ess.Sg.
mie'ldd 'with'
vä´ldded 'take' Inf.
älgg 'start' Prs.Sg3.
vuälgg 'leave' Prs.Sg3.
vuâlggam 'leave' PastPart.
älğğep 'start' Prs.Pl1.
älğğed 'start' Inf.
vue´lğğed 'leave' Inf.
vue´lğğep 'leave' Prs.Pl1.
ä´lğğ 'boy' Nom.Sg.
kõlmm 'cool' Adj.
tä´lvv 'winter' Nom.Sg.
põrtt 'hut' Nom.Sg.
ju´rdded 'think' Inf.
suä´rdded 'fall' Prs.Pl1.
miârkk 'sign' Nom.Sg.
sõrgg 'soon' Adv.
jeä´rğğ 'ox' Nom.Sg.
äitt 'barn' Nom.Sg.
päi´ǩǩ 'place' Nom.Sg.

le´ibb 'bread' Nom.Sg.
ne´ibb 'knife' Nom.Sg.
reiddad 'struggle' Inf.
reidd 'struggle' Prs.Sg3.
äi´ǧǧ 'time' Nom.Sg.
säi´mm 'net' Nom.Sg.
vuei´nned 'see' Inf.
vuäinnam 'see' PastPart.
vuäinn 'see' Prs.Sg3.
kuäivvad 'dig' Inf.
laukk 'bag' Nom.Sg.
jaukkâd 'delay' Inf.
âugg 'need' Prs.Sg3.
oummu 'man' Nom.Pl.
jäu´rr 'lake' Nom.Sg.
kuoskkâd 'touch' Inf.
kuoskkâp 'touch' Prs.Pl1.
kuä´sǩǩ 'aunt' Nom.Sg.
vuä´stted 'buy' Inf.
vue´stti 'buy' Prs.Part.
vuästtam 'buy' PastPart.
lue´štted 'slide' Inf.
kuäškkad 'drop' Inf.
pä´htt 'rock-face' Nom.Sg.
pu´htted 'bring' Inf.
mähssed 'pay' Inf.
mähss 'pay' Prs.Sg3.
čõhčč 'autumn' Nom.Sg.
vuoptt 'hair' Nom.Sg.
šapšš 'leveret' Nom.Sg.

Type 3.

nõõmi 'name' Gen.Pl.
ǩiõlid 'snare' Acc.Pl.
kue´lest 'fish' Loc.Sg.
kue´l 'fish' Gen.Acc.Sg.,Nom.Pl.
kue´lid 'fish' Acc.Pl.
kue´lez 'fish' Nom.PxPl3.
kuulam 'hear' Prs.Sg1.
tool 'fire' Gen.Acc.Sg.,Nom.Pl.
jie´lim 'walk' Past.Sg1.
sieram 'play' Past.Sg1.
vää´r 'hill' Gen.Acc.Sg.,Nom.Pl.
vää´rest 'hill' Loc.Sg.
võõr 'blood' Gen.Acc.Sg.,Nom.Pl.
veär 'soup' Gen.Acc.Sg.,Nom.Pl.
miâr 'sea' Gen.Acc.Sg.,Nom.Pl.
vuâr 'turn' Gen.Acc.Sg.,Nom.Pl.
ǩiedâst 'hand' Loc.Sg.
kuäđest 'Lappish tent' Loc.Sg.
puä´đ 'come' Imp.Sg2.
puäđak 'come' Prs.Sg2.
teäđam 'know' Prs.Sg1.
tie´đi 'know' Past.Sg3.
teäđak 'know' Prs.Sg2.
teäđaid 'knowledge' Acc.Pl.
teäđast 'knowledge' Loc.Sg.
vuađ 'bottom' Gen.Acc.Sg.,Nom.Pl.
vuađast 'bottom' Loc.Sg.
vuađain 'bottom' Loc.Pl.
mueđest 'aunt' Loc.Sg.
suu´v 'wound' Gen.Acc.Sg.,Nom.Pl.
viiv 'son-in-law' Gen.Acc.Sg.,Nom.Pl.
räävam 'dig' Prs.Sg1.

čuõv 'light' Gen.Acc.Sg.,Nom.Pl.
vuâjam 'travel' Prs.Sg1.
piiji 'put' PastSg3.

Type 4a.

kââggam 'rub' Prs.Sg1.
juuggam 'drink' Prs.Sg1.
juuggak 'drink' Prs.Sg2.
jooggâst 'river' Loc.Sg.
joogg 'river' Gen.Acc.Sg.,Nom.Pl.
saagg 'message' Gen.acc.Sg.,Nom.Pl.
saaggast 'message' Loc.Sg.
viiggam 'bring' Prs.Sg.1.
kaazz 'cat' Gen.Acc.Sg.,Nom.Pl.
ǩeäzzest 'summer' Loc.Sg.
piäzzam 'remain' Prs.Sg.1.
piäzzak 'remain' Prs.sg2.
piäzz 'nest' Gen.Acc.Sg., Nom.Pl.
pie´zzi 'nest' Gen.Pl.
luõzz 'salmon' Gen.Acc.Sg., Nom.Pl.
luõzzâs 'salmon' Nom.PxSg3.
põõzzam 'wash' Prs.Sg.1.
põõzzak 'wash' Prs.Sg2.
liäžžam 'lie' Prs.Sg.1.
liäžžak 'lie' Prs.Sg2.
muåžžam 'bend' Prs.Sg1.

Type 4b.

ǩeattam 'cook' Prs.Sg1.
ääkkast 'old woman' Loc.Sg.
čuu´kk 'box' Gen.Acc.Sg.,Nom.Pl.
kååddam 'kill' Prs.Sg1.
reedd 'shore' Gen.Acc.Sg.,Nom.Pl.
låå´dd 'bird' Gen.Acc.Sg.,Nom.Pl.
kaass 'cat' Gen.Acc.Sg.,Nom.Pl.
kue´ss 'guest' Gen.Acc.Sg.,Nom.Pl.
kue´ssid 'guest' Acc.Pl.
piä´ssest 'birch-bark' Loc.Sg.
peessain 'gun' Com.Sg.
peessas 'gun' Nom.PxSg3.
miäccest 'forest' Loc.Sg.
čääʒʒ 'water' Gen.Acc.Pl.,Nom.Sg.
čuäǯǯ 'stand' Imp.Sg2.
čuäǯǯai 'stand' Past.Sg3.
čuäǯǯam 'stand' Prs.Sg1.
viiǯǯ 'fetch' Imp.Sg2.
viiǯǯam 'fetch' Prs.Sg1.

Type 5.

saa´ltid 'salt' Acc.Pl.
peäldast 'field' Loc.Sg.
vääldam 'take' Prs.Sg1.
vääldak 'take' Prs.Sg.2.
vääld 'take' Imp.Sg2.
vaa´ldi 'take' PastSg3.
mie´lkest 'milk' Loc.Sg.
aa´lji 'start' PastSg3.
vue´lji 'leave' PastSg3.

õõ´ljin 'boy' Com.Sg.
õõ´lji 'boy' Gen.Pl.
äälgam 'start' Prs.Sg1.
tää´lv 'winter' Gen.Acc.Sg.,Nom.Pl.
joordam 'think' Prs.Sg.1.
joordak 'think' Prs.Sg2.
juu´rdi 'think' PastSg3.
jeärgaž 'little ox' Nom.Sg.
jiärjest 'ox' Loc.Sg.
jiärj 'ox' Gen.Acc.Sg.,Nom.Pl.
ǩiäđjest [rj] 'stone' Loc.Sg.
ǩiäđǧǧed [rj] 'stone'Acc.Pl.
päärnaž 'little boy' Nom.Sg.
päärna 'little boy' Gen.Acc.Sg.,Nom.Pl.
põõrtâst 'hut' Loc.Sg.
čue´rvid 'horn' Acc.Pl.
ää´itest 'barn' Loc.Sg.
leei´b 'bread' Gen.Acc.Sg.,Loc.Pl.
leei´bi 'bread' Gen.Acc.Sg.,Nom.Pl.
neei´b 'knife' Gen.Acc.Sg.,Loc.Pl.
neei´bi 'knife' Gen.Pl.
reeidam 'struggle' Prs.Sg1.
reeid 'struggle' Imp.Sg2.
ääigaž 'little time' Nom.Sg.
kõõijam 'ask' Prs.Sg1.
kõõ´iji 'ask' PastSg3.
vuâjam 'travel' Prs.Sg1.
ää´ij 'time' Gen.Acc.Sg.,Nom.Pl.
vuõij 'butter' Gen.Acc.Sg.,Nom.Pl.
ee´ij 'year' Gen.Acc.Sg.,Nom.Pl.
eeij 'father' Gen.Acc.Sg.,Nom.Pl.
ee´ijest 'father' Loc.Sg.
sääi´mid 'net' Acc.Pl.

sääi´m 'net' Gen.Acc.Sg.,Nom.Pl.
vuäinam 'see' Prs.Sg1.
vuäinak 'see' Prs.Sg2.
laauk 'bag' Gen.Acc.Sg.,Nom.Pl.
uu´di 'give' PastSg3.
ooudam 'give' Prs.Sg1.
ååumaž 'man' Nom.Sg.
jääu´rest 'lake' Loc.Sg.
jeeu´rin 'lake' Loc.Pl.
jääu´r 'lake' Gen.Acc.Sg.,Nom.Pl.
maau´si 'pay' PastSg3.
pää´utest 'rock-face' Loc.Sg.
čõõuč 'autumn' Gen.Acc.Sg.,Nom.Pl.
kuoskam 'touch' Prs.Sg1.
kuaskas 'touch' Imp.Sg.3.
kuoski 'touch' PastSg3.
vue´sti 'buy' PastSg3.
vuästam 'buy'Prs.Sg1.
šaapšid 'leveret' Acc.Pl.

Type 6a

kualla 'fish' Ill.Sg.
ko´lle 'hear' Prs.Pl3.
to´lle 'fire' Ill.Sg.
ji´llem 'walk' PastSg1.
ji´llik 'walk' PastSg2.
mie´lle 'mind' Ill.Sg.
seä´rre 'play' PastPl3.
värra 'hill' Ill.Sg.
mue´rre 'tree' Ill.Sg.
võ´rre 'blood' Ill.Sg.
jäurra 'lake' Ill.Sg.

mâ´nne 'go' Prs.Pl3.
mõ´nne 'go' PastPl3.
mâŋŋa 'after' Adv.
mâɲɲa 'daughter-in-law' IIISg.
ǩeađđa 'spring' III.Sg.
muađđa 'aunt' III.Sg.
vi´vve 'son-in-law' III.Sg.
rappu 'dig' PastPl3.
ǩi´tte 'hand' III.Sg.
koätta 'Lappish tent' III.Sg.
puette 'come' Past.Pl3.
pui´ttiǩ 'come' PastSg2.
puä´tte 'come' Prs.Pl3.
tie´ttem 'know' Prs.Sg1.
teä´tte 'know' Prs.Pl3.
jå´tte 'walk' Prs.Pl3.
i´tte 'appear' PastPl3.
e´tte 'appear' Prs.Pl3.
ekka 'year' III.Sg.
čokka 'box' III.Sg.
kõ´ǩǩem 'rub' Pastsg1.
kõ´ǩǩe 'rub' PastPl3.
ju'ǩǩe 'drink' PastPl3.
jo´ǩǩe 'drink' Prs.Pl3.
ve´ǩǩe 'bring' Prs.Pl3.
kä´ǧǧe 'lift' PastPl3.
vi´ǩǩem 'bring' PastSg1.
vi´ǩǩe 'bring' PastPl3.
äkka 'old woman' IIISg.
riddu 'shore' IIISg.
lådda 'bird' III.Sg.
meädda 'away' Adv.

meäcca 'forest' Ill.Sg.
kõ´čče 'ask' PasPl3.
va´ʒʒe 'walk' PastPl3.
čuäǯǯa 'stand' Prs.Pl3.
čuoǯǯum 'stand' PastSg1.
čuoǯǯu 'stand' PastPl3.
peässa 'birch bark' Ill.Sg.
kissiǩ 'pull' PastSg2.
pie´sse 'stay' PastPl3.
peässa 'nest' IllSg.
leäšše 'lie' Prs.Pl3.
lie´šše 'lie' PastPl3.

Type 6b

va´lddem 'take' PastSg1.
vä´ldde 'take' Prs.Pl3.
piälddu 'field' Ill.Sg.
seälgga 'back' Ill.Sg.
âlgga 'boy' Ill.Sg.
ä´lǧǧe 'start' Prs.Pl3.
vue´lǧǧik 'leave' PastSg2.
vue´lǧǧem 'leave' PastSg1.
vui´lǧǧe 'leave' PastPl3.
po´rǧǧe 'blizzard' Ill.Sg.
tälvva 'winter' Ill.Sg.
põ´rtte 'hut' Ill.Sg.
ju´rddem 'think' PastSg1.
sue´rdde 'fall' PastPl3.
sue´rddem 'fall' PastSg1.
sue´rddiǩ 'fall' PastSg2.

suä´rdde 'fall' Prs.Pl3.
jeärgga 'ox' Ill.Sg.
tormma 'jail' Ill.Sg.
särnna 'talk' Prs.Pl3.
kuarŋŋu 'climb' PastPl3.
kuärŋŋa 'climb' Prs.Pl3.
neibba 'knife' Ill.Sg.
äigga 'time' Ill.Sg.
äitta 'barn' ill.Sg.
päikka 'place' Ill.Sg.
ka´unnem 'find' PastSg1.
vue´sttem 'buy' PastSg1.
vue´sttiǩ 'buy' PastSg2.
kuä´stte 'appear' PrsPl3.
kue´sǩǩem 'touch' PastSg1.
kuä´sǩǩe 'touch' Prs.Pl3.
čahčča 'autumn' Ill.Sg.