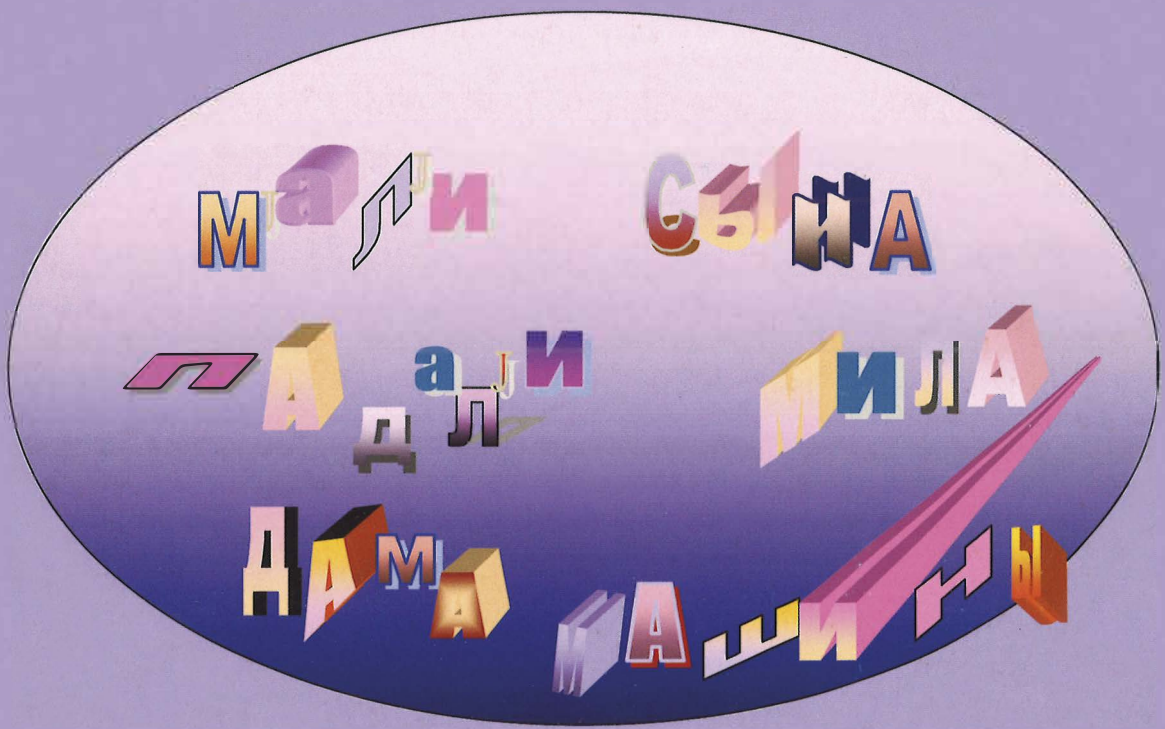
Viola de Silva

# Quantity and Quality as Universal and Specific Features of Sound Systems

## Experimental Phonetic Research on Interaction of Russian and Finnish Sound Systems




STUDIA PHILOLOGICA JYVÄSKYLÄENSIA

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# ABSTRACT

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The present study investigates the differences on word level between Russian and Finnish, namely, the rhythmic structure of disyllabic, trisyllabic and quadrisyllabic words and segmental quality involved in the rhythmic structures. Finnish is a language whose phonological system includes the opposition of short/long both in consonant and in vowel quantity which is not an indication of stress as both stressed and unstressed vowels can be long and short. In Russian duration is a parameter of stress and vowels have three different stages of duration. Apart from the duration V [+stress], V [-stress1] and V [-stress2] can have different quality as well. Where Russian consonant system is concerned the duration can be dependent on the intrinsic quality of the consonant as well as it can be affected by palatalization. Word melody was also studied.

The present study included six experiments. Three of them were pilot studies on knowledge of Russian stress and perception of Russian stress by Finns, and Finnish stress by Russians. Also, there was a pilot study on duration of vowels in disyllabic Russian (N=86) and Finnish (N=84) words, both isolated and in sentences, read by Russians and Finns, and an experiment on disyllabic (N=142) and trisyllabic (N=95) Russian isolated words read by a Russian normative speaker and four Finns. One pilot study consisted of Russian (N=18) and Finnish (N=9) quadrisyllabic words which were read by Russian and Finnish subjects isolated as well as in different sentence positions, accented and unaccented.

The results of the analysis proved that the three-leveled hierarchy of vowel duration exists in the normative Russian pronunciation, but the negative interference of Finnish leads to two stages: (very) long and (very) short. The vowel duration together with durational differences in consonants whose durational distribution is greater in the pronunciation of Finns disturb the rhythmic structure of single words in Russian. The vowel quality in the studied vowels, phonemes /a/ and /i/, had less variation in the pronunciation of the Finnish subjects than in the pronunciation of the Russian. The variations in melody curves were more in the pronunciation of the Russian subject.

Keywords: phonetics, Russian, Finnish, word prosody, foreign language quisition, segmental duration, segmental quality, word melody

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My interest in phonetics started during my student years at the Moscow State University. At the very inception of learning the Russian language, the importance of phonetics in the study of any foreign language dawned upon me. My deeper interest in this subject, however, started during my last years at the university especially in the seminars conducted by lecturer Jelena Andrejevna Bryzgunova. Her unbound enthusiasm for the subject spurred me on.

The practical importance of phonetics was always a subject of interest for me during all my years as a teacher of Russian at the university of Jyväskylä. Although I tried to forget phonetics as a subject of deeper investigation for a period of over ten years, I never succeeded in totally dismissing it from my mind. It always pursued me and this study is the final result.

Nevertheless, this study would not have been completed without encouragement and support from many people of whom I want to mention only the most important. First of all, I am grateful to Dr. Sirkka Laihiala-Kankainen for the practical realization of this work as she afforded me the possibility of participating in the project entitled 'Language and Education in Intercultural context'.

I also acknowledge my deepest obligation to the Department of Phonetics of the St. Petersburg State University which has become my 'rodnaja kafedra' (home department) during the various stages of this work. I am most grateful to Professor Lia Vasiljevna Bondarko, the head of the department, for the personal interest she took in my work and for making my visits there most pleasant and comfortable. I deeply appreciate her comments and invaluable advice which I have used in my study. My sincere thanks are also extended to Ljudmila Pavlovna Ščerbakova for her encouragement and help. I also thank Dr. Hannele Dufva for her valuable suggestions and comments which I have tried to incorporate in this work to the best of my ability.

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# PHONETIC TRANSCRITION OF RUSSIAN

| VOWELS | | CONSONANTS | | | |
|---|---|---|---|---|---|
| IPA | Russian | IPA | | Russian | |
| *a* | *а* | p | $p^j$ | п | п’ |
| a | ·a | b | $b^j$ | б | б’ |
| ʌ | ʌ | m | $m^j$ | м | м’ |
| ə | ъ | f | $f^j$ | ф | ф’ |
| $^i$ə | ь | v | $v^j$ | в | в’ |
| ɨ | ы | t | $t^j$ | т | т’ |
| i | и | d | $d^j$ | д | д’ |
| ɨ | ы | s | $s^j$ | с | с’ |
| ɪ | и | z | $z^j$ | з | з’ |
| | | ts | | ц | |
| | | n | $n^j$ | н | н’ |
| | | ɬ | $l^j$ | л | л’ |
| | | r | $r^j$ | р | р’ |
| | | | $j^j$ | | j |
| | | ʃ | | ш | |
| | | | $ʃ^j$: | | ш’: |
| | | ʒ | | ж | |
| | | | $ʒ^j$: | | ж’ |
| | | | $tʃ^j$ | | ч’ |
| | | k | $k^j$ | к | к’ |
| | | g | $g^j$ | г | г’ |
| | | x | $x^j$ | х | х’ |

# OTHER SYMBOLS

| | |
|---|---|
| PW | phonetical word |
| TP1 | transitional part in the beginning of a sound |
| TP2 | transitional part at the end of a sound |
| SP | steady state |
| [+stress] | stressed |
| [-stress] | unstressed |
| [-stress1] | unstressed, first stage of reduction |
| [-stress2] | unstressed, second stage of reduction |
| [+pal] | palatalized |
| [-pal] | non-palatalized |
| [+lab] | labial |
| [-lab] | non-labial |
| [+vel] | velarized |

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# 1 INTRODUCTION

The teaching of phonetics especially when it concerns a foreign language, comprises of many different problems. It is well known that the differences of vowels and consonants as well as the prosodic systems have been a subject of study of continuous contrastive research in the case of major languages, e.g., English, German, French and Russian. However, it is interesting to note that with the increasing demand for the knowledge of the Finnish language, as has been evinced in the researches conducted in present times, the study of the rhythmic structure of the Finnish language vís á vís other languages has become a focal point of interest.

Russian language has been intensively taught to foreigners since the early 1950's. In the process of teaching the language to speakers of other languages, phonetics has played an important role and methods of teaching phonetics to foreigners have been developed. Teaching phonetics is based on studies on interference of different languages (IZS 1987), including the Finnish interference in Russian (Ljubimova 1988).

One major problem for foreign language learners in the Finnish phonetical system is the short and long consonants and vowels and their durational relationship in the rhythmic structure of Finnish words. This question was thoroughly studied in the 1960's by Wiik (Wiik 1965, Wiik&Lehiste 1968), Lehtonen (Lehtonen 1970) and Lehiste (Lehiste 1970). Teaching Finnish to foreigners has become an earnest pursuit only lately and rhythmic structure with short and long sound segments has appeared to be among the most difficult features of the Finnish phonetical system to learn for foreigners, including, e.g. Russians, whose need and interest to study Finnish has increased tremendously. From this aspect it is interesting to study the Russian rhythmic structure as well and com-

pare it with Finnish. The problem arises in both ways: when teaching Russian to Finns and Finnish to Russians.

This research is the first effort to compare the rhythmic structures of Russian and Finnish. As the whole question is vast, this work can only be considered as the tip of the iceberg. It will give evidence of three types of rhythmic structures, namely CVCV(C), CVCVCV(C) and CVCVCVCV(C) structures, and of those with limited vowel set up, namely of /a/ and /i/ in different positions.

In the comparison of the above mentioned rhythmic structures of words in the two languages, namely, Russian and Finnish, all possible factors which could effect the word's rhythmic structure should be taken into consideration. Thus, it is necessary to study the differences both in segmental and prosodic systems. When the word structure is compared in this work, sentence prosody is left out as such and the main subject of the study is word prosody. Nevertheless, the rhythmic structure of single words includes two different types of phenomena: firstly, the features of the word itself such as the number of syllables, the place of stress, the length of the phonologically meaningful words, and, secondly, the features which depend on the position of the word in a phrase such as in an accented and unaccented position.

This research concerns the characteristics of the Russian sound system which differs in their nature and function from Finnish:

1) The phonetic rules in the organization of the rhythmic structure of words, absolute and relative (intrinsic) duration of vowels and consonants in disyllabic, trisyllabic and quadrisyllabic words and the ways of realization of the frequency of the fundamental tone).

2) The special qualities of sound segments, vowels and consonants, mostly concentrating on the features which are included in the phonological opposition of the hard ([-pal]) and soft ([+pal]) consonants (coarticulation, quality of vowels, features of consonants).

This research is built on the contrast of normative Russian pronunciation with the differences which appear in the Russian pronunciation of Finnish subjects. The conception of normative Russian pronunciation is based on the corresponding works on Russian phonetics and on the results of the analysis made by the author.

The experimental data of this work consists mainly of disyllabic and trisyllabic Russian isolated words read by the above mentioned subjects. For the purpose of comparing the sound quality also some Finnish words were read by these subjects. Apart from that, the data includes Finnish and Russian disyllabic isolated words and the same words in sentences which were read by different Finnish and Russian subjects in the mother tongue as well as in the non-native language, and some Russian and Finnish quadrisyllabic words which were read both in isolated as

well as in different sentence positions. All the mentioned data was acoustically analyzed. Before the acoustic analysis there were perception tests which consisted of Russian isolated words and words in short texts as well as Finnish isolated words.

The present study has an essential meaning in understanding the relationship between the universal features of sound systems (which are connected with their anthropomorphic nature as the sound sequences are generated and perceived by human beings) and the special qualities which are dependent on a concrete phonological system. Russian and Finnish in this case represent a great interest as the phonetically similar phenomena (duration of vowels and consonants, quality of vowels) have different phonological status. Experimental phonetic research of the objective (acoustic) characteristics and their meaning for perception of speech by natives must give important information about the relative importance of the universal and special qualities in the sound system of the language concerned when it is used by a native as well as by a non-native who is studying the language.

# 2 COMPARISON OF SOUND SYSTEMS

## 2.1 Phonological and phonetical system of Russian

The phonetical system of Russian language forms the foundation of this study. The final task in teaching pronunciation is to achieve correct rhythmic structure of Russian disyllabic and trisyllabic words with the basic segmental contents and syllable structure, i.e. CVCV(C) and CVCVCV(C), and to try to eliminate the Finnish interference in the pronunciation of Finns learning Russian. For that purpose we have to make a contrastive analysis of the phonetical and phonological systems of both languages.

The Russian phonetical structure includes a fairly simple vowel system but a complicated consonant system. Considering the distribution of vowels vs. consonants, there are considerably more consonants in speech than vowels. One can state that the ratio of vowels and consonants in Russian is completely different from Finnish, which incidentally is very rich in vowels. Although the situation has changed from the statistics given by Hakulinen, where for 100 vowels there are 96 consonants in Finnish and 150 in Russian (Hakulinen 1968:15), the basic difference between Finnish and Russian remains. Russian has more consonants due to two reasons. Firstly, each syllable has only one vowel, i.e. there are as many syllables in a word as there are vowels. Secondly, there are more consonant clusters of different consonants and they may appear in all positions in words, i.e. in word-initial, word-medial as well as in word-final position. In native Finnish words, in contrast, consonant clusters or

geminates are not allowed in word-initial and word-final positions although in loan words they do appear as, for example, in *prinssi* (a prince).

Where Russian consonants are concerned they are pronounced clearly and comparatively equally long in any word position, unlike the vowels. Generally, the duration of consonants changes less than the duration of vowels. Thus, the rhythmic structure of a word is less dependent on the features of consonants than on the features of vowels.

### 2.1.1 Russian vowels

Vowels play an important part in word and syllable structure in Russian as they are the only syllabic segments. Every syllable has a vowel, i.e. it is the syllable nucleus, and, as mentioned above, there is only one vowel in each syllable in words of Russian origin, i.e. there are no double vowels or diphthongs.

There is much variation in vowels within a word because of the coarticulation of the adjacent consonants. The changes are very strong especially after [+pal] consonants. That is seen in the formant structure of all vowels, but most clearly in vowel [*a*], as when it is in position $C^jVC^j$, the $F_2$ -pattern is in the normal a-position only for a short period.

The Russian vowel system is dependent on the word stress as well. More vowels appear in the stressed, [+stress], position than in the unstressed, [-stress], position. Apart from that, the quality of the vowels is strongly dependent on the stress, i.e. the [-stress] vowels are reduced (shorter) and often different in quality compared with the [+stress] ones. Generally the Russian vowel segments are not considered difficult for a Finn to learn, except one vowel, [ɨ] which is central, i.e. [-front] and [-back], and thus differs from [i] although both are [+close].

#### 2.1.1.2 Main vowels

The Russian vowels which appear in [+stress] positions each have one variant which is considered as the basic form of the particular vowel. The articulatory division is mostly used. According to closeness, the main vowels can be divided into:

1) close (high) (гласный верхнего подъёма), [i], [ɨ] and [u],
2) medial, or half close and half open (гласный среднего подъёма), [e] and [o], and
3) open (low) (гласный нижнего подъёма), [*a*].

According to frontness the main Russian vowels can be divided into

1) front (гласный переднего ряда), [i] and [e],
2) central (гласный среднего ряда), [ɨ] (and [*a*]), and
3) back (гласный заднего ряда), [u], [o] (and [*a*]).

The vowel [*a*] is considered as a) [+front] (Ščerba 1983, Matusevič 1976), b) central (mixed) (Avanesov 1984) or c) [+back] (Jones&Ward 1969, Bondarko 1998). The feature [+back] would mean the similarity with the equivalents in many other languages, including Finnish. According to Ščerba, the Russian [*a*] differs from the similar vowels in some European languages (French, English and German) (Ščerba 1983:56). The articulatory division of the main vowels is given in Figure 1.

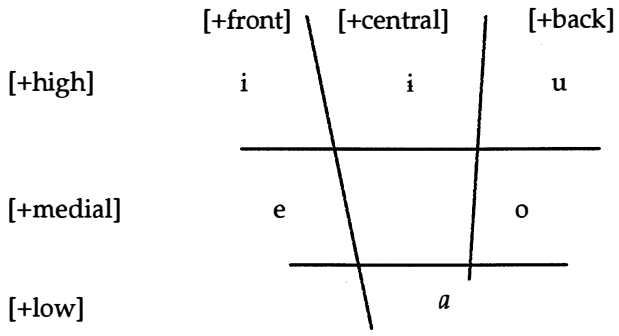


FIGURE 1 Articulatory division of the Russian main vowels.

Of the main vowels [u] and [o] are labialized ([+rounded]) (лабиализованные/огублённые). It means that only [+back] vowels are in Russian [+rounded]. This causes problems for Russians in pronouncing Finnish [œ] which is [+front] and [+rounded].

In teaching pronunciation it is common to start the introduction of the Russian vowels from the 6 segments, [*a*], [o], [u], [e], [i] and [ɨ] (Bondarko 1977, 1981a and 1998, Matusevič 1976, Ščerba 1983a, Grammatika 1982 etc.). Another principle is to start from 5 main vowels leaving [ɨ] off (Avanesov 1984). Anyway, all six vowels appear in [+stress] position, for example, *дам* [d*a*m] (I give), *дом* [dom] (a house), *дул* [duɬ] (blowed), *дело* [dʲeɬʌ] (a business), *пили* [pʲilʲɪ] (drank), *пыли* [pɨlʲɪ] (genitive of dust).

The differences between the formant structures of the main vowels can be acoustically measured. The F-pattern is the set of resonance frequencies of the vocal tract during the different articulation movements. There is always a connection between articulation and acoustics (Bondarko 1977 and 1981, Fant 1970, Halle 1971, Ladefoged 1979 etc.).

Thorough acoustic investigations of the Russian sound system including vowels have been done in Moscow by Zlatoustova (1962), in St.Petersburg (Bondarko 1960, 1974 and 1977) as well as by Fant (1970) and Halle (1971). Fant and Halle have discussed the Russian vowel system in the framework of acoustic distinctive features (Jakobson, Fant & Halle 1952).

The special articulation features of the main Russian vowels compared, for example with Finnish, are the diphthonglike quality of [o] and [ɨ]. The vowel [o] starts with an u-like sound which is said to be caused by more lip-rounding at the beginning of the articulation. Moreover, [ɨ] starts with a lower and a more back position of the tongue which are its typical features and ends like [i]. Apart from that, the diphthongization is typical to all Russian vowels in [+stress] position, except [i] before or after a soft consonant (Bondarko et al. 1997:62). The diphthonglike quality is clearly seen also in the $F_2$-patterns of all mentioned vowels (Kuznetsov 1997). According to Šerstinova the diphthong quality is most common in [e] where 28 % of all its realizations were like diphthongs, while 18 % of realizations of [ɨ] were diphthongs (Šerstinova 1997:136).

### 2.1.1.2 Allophones of vowels

The quality of the main Russian vowels changes contextually, i.e. instead of the main allophone they have their combinational allophones. The most obvious change happens in the initial and final part of the vowels before and after a palatalized consonant (C [+pal]/C$^j$) but also labial coarticulation before and after a labial consonant (C [+lab]) is noticeable.

Where the *palatalization* is concerned, it can be noticed as an i-transition, i.e. a rise of $F_2$ in the spectrum of the vowel on the side of C [+pal]. In articulation it means that the vowel following C$^j$ is closer than the same vowel following C [-pal] . That is most obvious in vowel [a] and least obvious in vowel [i]. The non-palatalization or palatalization of the preceding consonants can be seen in the combinatory transcription signs of the above mentioned vowels:

C [-pal] (C) + [*a*], [o], [u], [ɛ], [ɨ]
C [+pal] (C$^j$) + [a], [ɵ], [ʉ], [e], [i]

The effect of the following [+pal] consonant on the preceding vowel is less than the effect of the preceding C$^j$ (Bondarko 1974, 1977, 1981). However, in more exact transcription it could be taken in consideration.

The medial part of the Russian vowels, even of the [+back], often remains the same as it is in an isolated pronunciation of the vowel. Thus, using the IPA transcription signs [a], [ɵ], [ʉ] for V [+stress] after C [+pal], which are used in Western literature (Jones&Ward 1969), does not give a full picture of the nature of the vowels.

The effect of C [+lab] on the following or preceding vowel is that the frequency value of $F_2$ is lower. The frequency of such an occurrence is more certain if the consonant concerned is [-pal]. This is not taken in consideration in the IPA transcription used here.

The pronunciation as well as the acoustic characteristics of Russian vowels depend a lot on their position in the word. The place of stress in the word defines the vowel duration and quality. The main vowels and the combinatory allophones which were described above are all vowels in a stressed position, V [+stress].

When any vowel occurs in an unstressed position, V [-stress], it becomes shorter, i.e. it undergoes a quantitative reduction. Apart from that, some vowels undergo a qualitative reduction as well. Vowels [u], [i] and [ɨ] have only the quantitative reduction, but [*a*] has both quantitative as well as qualitative reduction in [-stress] position. But where vowels [e] and [o] are concerned, they appear in [-stress] position only in very rare cases in loan words and foreign names, such as *радио* ['rad$^{j}$ɪo] (radio), *Шопен* [ʃo'pɛn]. Otherwise [e] and [o] alternate with other vowels in [-stress] positions.

There are also two different [-stress] positions. The first stage of reduction, [-stress1], where the reduction is weaker, concerns the syllable preceding the stressed one and the initial syllable of the word starting with a vowel as well as the word-final open syllable, for example, *автомобиль* [ʌftəmʌ,b$^{j}$il$^{j}$] (a car), занято ['zanʲətʌ] (occupied). Only the following vowels are possible in position [-stress1]:

C + [ʌ], [u], [ɨ]
C$^{j}$ + [ɪ], [ʉ]

The second stage of reduction, [-stress2], where the reduction is more intensive, concerns the rest of the [-stress] positions. The following vowels are possible in position [-stress2]:

C + [ə], [u], [ɨ]
C$^{j}$ + [$^{i}$ə], [ɪ], [ʉ]

The acoustic studies of Russian vowels, especially the movements of $F_2$-pattern, have proved that V [-stress] undergoes a constant change in the quality within a short period of time during the pronunciation and in the process of its perception can be identified as many other different vowels (Kuznecov 1997, Šerstinova 1997). This means that the quality of the original vowel might be lacking completely.

Table 1 shows that there are more [+stress] vowels in Russian than [-stress] vowels. Altogether, there are 8 vowels which appear in [+stress] position:

[*a*], [a], [o], [ɵ], [e], [ɛ], [i] and [ɨ]

but only 6 vowels which can appear in [-stress] position:

[ʌ], [ə], [ʲə], [ɨ], [ɪ], [u] and [ʉ].

The articulation features of the vowels [ʌ], [ə] and [ʲə] differ from the other vowels in such a way that [ʌ] is [+back] and medial, [ə] (in Russian transcription ъ) is central and medial, and [ʲə] (in Russian transcription ь) is half-close [+front]. The last one, [ʲə], is so much different from [ə] that a different transcription mark is necessary.

TABLE 1 The stressed vowels and their reduced ([-stress]) equivalents in Russian

| | **a** | **o** | **e** | **i** | **ɨ** | **u** |
|---|---|---|---|---|---|---|
| C[-pal]+V [+stress] | *a* | o | ɛ | | ɨ | u |
| C[+pal]+V [+stress] | a | ɵ | e | i | | ʉ |
| C[-pal]+V [-stress1] | ʌ | | | | ɪ | u |
| C[+pal]+V [-stress1] | | | | ɪ | | ʉ |
| C[-pal]+V [-stress2] | ə | | | | ɪ | u |
| C[+pal]+V [-stress2] | ʲə | | | ɪ | | ʉ |

The vowel [ʌ] is only possible in the first stage of reduction ([-stress1]), for example, *дала* [dʌ'ɬa] (gave), *ваза* ['vazʌ] (a vase), while the vowels [ə] and [ʲə] are possible only in the stronger reduction (see below). The central medial vowel [ə] differs in quality in different environments, i.e. its quality strongly depends on the coarticulation of the adjacent consonants, for example, *самовара* [səmʌ'varʌ] (a samovar) - *потихоньку* [pətʲɪ'xonʲku] (little by little), while [ʲə] is close to [i], as in *часовой* [tʃʲəsʌ'voj] (of one hour's duration). Vowel [ʲə] could be considered as an allophone of /i/.

The experimental data of this research includes [*a*], [a], [ɨ] and [i] of the [+stress] vowels and [ʌ], [ɨ], [ɪ], [ə] and [ʲə] of the [-stress] vowels.

### 2.1.2 Vowel phonemes

There are two divergent opinions among the Russian phoneticians regarding the amount of vowel phonemes in Russian. On the one hand, the

representatives of the St. Petersburg phonological school (Bondarko, Verbickaja, Zinder etc.) along with some others (for example, Gvozdev) continue the tradition of Ščerba in their acceptance of six vowel phonemes corresponding to the six main vowels given above. The representatives of the Moscow phonological school, on the other hand, are of the opinion that there are only five vowel phonemes since they consider [ɨ] as an allophone of /i/.

According to Ščerba /ɨ/ could be considered as an independent phoneme but not to the same extent as /a/, /e/, /i/, /o/, /u/, as it plays a semantic role in some word roots (Ščerba 1983:50). In his other works, Ščerba analyzes the position of /ɨ/ in comparison with /i/, for example, agreeing that /ɨ/ cannot differentiate words in a similar manner like /i/: in Russian *u* [i] (and), and he agrees with the principle of the complementary distribution where [ɨ] alternates with [i], even in morphological endings, but, at the same time, he sticks to the idea of a separate phoneme (Ščerba 1957:177).

Using the basic phonological rule of complementary distribution, however, it can be proved that [ɨ] is not a separate phoneme but an allophone of /i/ as they are in a complementary distribution: [ɨ] does not ever occur in a word-initial position after a [+pal] consonant and while /i/ can start a word, it never occurs after C [-pal], nor is it an independent phoneme in the acoustic interpretation suggested by Jones. In the opinion of this author, the distinctive features of Russian vowels could be described as following: open/close and rounded/unrounded but not front/back and high/low tongue positions (Jones 1971:161).

Baudouin de Courtenay shared a similar opinion that there is only one phoneme /i/and added to this argument that in the rhymes of poems, /i - ɨ/ form the rhyme together, for example, *забыла* [zʌ'bɨłʌ] - *носила* [nʌ's$^{j}$ɨłʌ] (Baudouin de Courtenay 1912:98). In this case, the Russian vowel system has five vowel phonemes. He thus agrees with the theory of the representatives of the Moscow phonological school (Avanesov 1984, Reformackij 1995, Panov 1979, Kasatkin 1995 etc.) that there are only five vowel phonemes in Russian and [i] and [ɨ] are allophones of the same phoneme. Trubezkoy (1969), a representative of structuralism, also shares the opinion of the Moscow phonological school.

There exists another, a third, way to approach the Russian phonological system which is in direct opposition to both ways described above. This approach takes the vowel system as a foundation and the hard and soft consonants as allophones of the same consonant phonemes. On the basis of this approach, there would be two phonemes for each vowel. This was the suggestion forwarded by Jones (Jones 1971:159).

There have also been three different opinions in phonological literature whether the unstressed vowels are allophones or not: firstly, they

can be considered as allophones of the original stressed vowels. Secondly, the [-stress] vowels can be considered as separate from the [+stress] vowels as a system in which the stressed phonemes are less in quantity and lack some distinctive features. Thirdly, they could be considered as independent phonemes, as a part of the phonemic inventory of Russian.

According to the Moscow phonological school, phonemes are understood as a part of a morpheme and they form 'phonemic rows' (фонемные ряды) which was an idea developed by Avanesov (Panov 1979). This means that all the positional alternatives within the same morpheme are all the allophones of the same phoneme, in other words, /a/, /o/ and /e/ have their own [-stress] allophones, as the [+stress] and [-stress] allophones can appear within the same morpheme. For example, in the word *возить* [vʌ'zʲitʲ] [ʌ] is an allophone of /o/ since it is represented as [o] in a 'strong position' ([+stress]) in the same morpheme in the word *воз* ['vos], similarly, [ʌ] can be an allophone of /a/ as well (Verbickaja 1976:26-27).

The interpretation of the St.Petersburg phonological school is based on the opposition in [+stress] position of vowel phonemes, such as, /a/ - /o/, /e/ - /i/ and /a/ - /i/, but the [-stress] allophones belong to certain phonemes (Verbickaja 1976:27). Thus, for example, vowel [ʌ] in the word *поэт* [pʌ'ɛt] is an allophone of /a/ and the vowel [ɪ] is the allophone of /i/ even in the word *леса* [lʲɪ'sa], although the same morpheme exists in form лес ['lʲes]. According to the St.Petersburg phonological school, the [-stress] vowels are allophones of the [+stress] vowels, but not always of their equivalent in the stressed position. Table 1 shows that [o] which is different from [a] in [+stress] syllables stops being [+rounded] and different from [a] in [-stress] position, for example, *дала* [dʌ'ɬa] - *дома* [dʌ'ma] or *самовара* [səmʌ'varʌ] - *потихоньку* [pətʲɪ'xonʲku]. Likewise, [a] and [e] after C [+pal] stop being different, for example, *часы* [tʃʲɪ'sɨ], *пяти* [pʲɪ'tʲi], *стена* [sʲtʲɪ'na]), i.e. they are represented by an allophone of phoneme /i/ which is the [+close] [+front] vowel [ɪ].

The interpretation of Halle (Halle 1971:126), that the [-stress] vowels of Russian could be independent phonemes and distinguished by means of the prosodic feature of accented vs. unaccented apart from other distinctive features is not used by others.

The most logical conclusion seems to be that the unstressed reduced vowels are allophones of the original stressed vowels. They differ mainly from the [+stress] allophones because of the reduction which occurs both in quality and quantity (Bondarko 1981:72-74).

In this research I agree with the Moscow phonologcal school in the fact that there are five vowel phonemes in Russian /a/, /e/, /i/,/o/ and /u/. But I take the side of the phonological school of St.Petersburg in the division the allophones, and do not follow the principle of phonemic

rows. It means that /o/ and /e/ have only [+stress] allophones and all [-stress] vowels are allophones of other vowels (Bondarko 1998:22). This principle can be seen in Table 1. Two phonemes /*a*/ and /i/ are studied with their allophones in all positions:

/*a*/: 1) [*a*] and [a] ([+stress]), 2) [ʌ] and [ə] ([-stress])
/ i /: 1) [ɨ] and [i] ([+stress]), 2) [ɪ] and [ı] ([-stress]).

The unstressed allophones include some different orthographic signs as *роса* [rʌ's*a*] (dew), *повези* [pəvʲı'zʲi] (imperative of take).

On the basis of acoustic distinctive features one can come to the same phonemic conclusion as given here. All the five (or six) vowel phonemes have a different formant structure. On the basis of that, the acoustic distinctive features compact vs. diffuse, grave vs. acute, flat vs. plain (Jakobson et al. 1952, Fant 1970) can be applied. Table 2 shows the formant values of Russian vowels calculated by Fant with different methods (Fant 1970).

TABLE 2 The $F_1$, $F_2$ and $F_3$ values of Russian vowels calculated with numerical calculations with high-speed digital computer, measured on a configurative electric analog and from spectrographic analysis (Fant 1970:109)

| Vowel | $F_1$ | $F_2$ | $F_3$ |
|---|---|---|---|
| u | 231 - 300 | 610 - 625 | 2370 - 2500 |
| o | 500 - 535 | 780 - 900 | 2320 - 2500 |
| *a* | 616 - 700 | 1072 - 1080 | 2400 - 2600 |
| e | 420 -440 | 1800 - 1960 | 2550 - 2750 |
| i | 222 - 240 | 2220 - 2250 | 2970 - 3200 |
| ɨ | 285 - 300 | 1480 - 1517 | 2230 - 2413 |

As the table 2 shows, of all the Russian vowel phonemes /a/ is the most compact, i.e. its $F_1$ is comparatively high and $F_2$ low, and /i/ is the most diffuse, i.e. its $F_1$ is low and $F_2$ is high. On the basis of the distinctive features grave vs. acute, [*a*] which is grave (back) can be differentiated from [i] which is the most acute vowel in Russian. The third distinctive feature, flat vs. plain (low tonality), can be used to differentiate [+rounded] vowels, [u] and [o], which are considered flat in contrast to other vowels. Vowels produced by lip rounding have lower formants (Fant 1970:219). All these acoustic features function differently with V [+stress] and V [-stress] (Halle 1971:126).

### 2.1.3 Russian consonants

#### 2.1.3.1 Distinctive features of Russian consonants

The Russian consonant system is complicated. The fact that the phonetic transcription and the way of describing the articulation of consonants used in Russian phonetic literature differ from IPA makes it more difficult to explain the Russian consonant system.

Where articulation is concerned, apart from the place and manner of articulation and opposition of [-voiced]/[+voiced] obstruents, the opposition of palatalization divides the consonants into two groups: C [-pal] and C [+pal], which form pairs in most cases. There are 37 consonants in Russian and 33-37 of them are seen as independent phonemes, depending on their interpretation. All single Russian consonants, [-pal] as well as [+pal], can appear in any position with the exception that the [+pal] velars [$x^j$], [$k^j$] and [+voiced] obstruents can never be in the word-final position, the latter ones because of the neutralisation of voicing opposition. Consonant clusters are frequent and they are possible in word-initial as well as medial and final positions. In this work the main emphasis is on single consonants and thus the consonant clusters are left aside.

The most independent phonetical position in a word where palatalization is concerned for a Russian consonant is the word-final position where its basic qualities could be described. Unfortunately, not all consonants occur in this position. The position in front of a vowel, CV is also quite a convenient position to see the quality of a consonant. The influence of the following vowel depends on the vowel itself, and there are vowels which affect minimally the quality of the consonant. So, for example, for Russian [-pal] dentals the position before [ɛ], for [-pal] velars the position before [*a*], and for all [+pal] consonants position before [i] are most independent (Bondarko 1998:60).

Table 3 shows the division of Russian consonants according to the place of articulation (articulation zones). The division is based on the place of articulation, but in the Russian terminology which differs from IPA, the active articulator, the tongue - 'lingua', is used in this concept. Thus, the dentals, alveolars and palatoalveolars, i.e. more than half of all the consonants, belong to the same 'prelingual' (передне-язычные) group which, no doubt, are divided in more detailed terminology into dentals (зубные), alveolars (альвеолярные) and 'prepalatals' (передне-нёбные). The other zones of articulation are accordingly 'mediolingual' (средне-язычные) - the palatals, and 'postlingual' (заднеязычные) - the velars.

TABLE 3 The places of articulation of the Russian consonants

| Place of articulation | Consonants |
|---|---|
| Labials | [p], [pʲ], [b],[bʲ], [m], [mʲ] |
| Dentilabials | [f], [fʲ], [v],[vʲ] |
| Dentals | [t], [tʲ], [d], [dʲ], [s], [sʲ], [ts], [z], [zʲ], [n], [nʲ], [ɬ], [lʲ] |
| Alveolars | [r], [rʲ] |
| Palato-alveolars | [ʃ], [ʒ], [ʒʲ:], [tʃʲ], [ʃʲ:] |
| Palatals | [j] |
| Velars | [k], [kʲ], [g], [gʲ], [x], [xʲ] |

According to the manner of articulation, the Russian consonants can be divided first into *obstruents* and *sonorants*. Table 4 shows the division of obstruents and Table 5 the division of sonorants.

TABLE 4 Manner of articulation of Russian obstruents

| Manner of articulation | Consonants |
|---|---|
| Fricatives | [s], [sʲ], [z], [zʲ], [ʃ], [ʒ] (sibilants)<br>[f], [fʲ], [v], [vʲ], [x] (spirants) |
| Affricates | [ts], [tʃʲ] |
| Plosives (stops) | [p], [pʲ], [b], [bʲ], [t], [tʲ], [d], [k], [kʲ], [g], [gʲ] |

TABLE 5 Manner of articulation of Russian sonorants

| Manner of articulation | Consonants |
|---|---|
| Nasals | [m], [mʲ], [n], [nʲ] |
| Laterals | [ɬ], [lʲ] |
| Tremulants | [r], [rʲ] |
| Semivowel | [j] |

The IPA division also differs from the one used in Russia to some extent. In the Russian phonetical literature in the group of fricatives (щелевые) only sibilants are separated from the others and they individually form two groups whose differences are not based on the location of articulation. So, what we would call the dental sibilants are in Russian terminology 'whistling sounds' (свистящие) which have two significant articula-

tion features, namely, a narrow 'round' groove (круглая щель, круглощелевые) in the front part of the mouth cavity (in the dental zone) and a constriction that occurs only in one place (однофокусная щель). And what we call the palato-alveolar sibilants are the 'dark sibilants' (шипящие) which have a shallow groove further back in the mouth cavity and another constriction, the secondary velarization, at the back of the mouth cavity, i.e. there are two 'narrow places' (двухфокусная щель).

The three groups of sonorants are common in most of the languages. The Russian lateral [ɬ] is velarised, i.e. the back of the tongue rises during the articulation, and resembles the English dark [ɬ]. The tremulant [r] is a typical alveolar tremulant in the articulation of which the tip of the tongue makes taps against the middle of the alveolar. But the [+pal] sound [rʲ] is not a tremulant in the full meaning of the word (Bondarko 1998:66). In most cases it is articulated as a flap.

The obstruents are

1) [-voiced] [p], [pʲ],[f], [fʲ], [t], [tʲ],[s], [sʲ], [ts], [ʃ], [ʃʲ:], [tʃʲ], [x],
2) [+voiced] [b], [bʲ], [v], [vʲ], [d], [dʲ], [z], [ʒ], [g], [gʲ].

Most of the [-voiced] and [+voiced] obstruents form pairs, but [ts], [ʃʲ:], [tʃʲ] and [x] do not have [+voiced] pairs. The sonorants are [+voiced], and they have no [-voiced] equivalents. Anyhow, it is common in Russian that a sonorant in a word-final position becomes [-voiced].

Where the dental consonants of Russian are concerned, it is helpful to go more into detail to their articulation, namely, the fact that they have a '*dorsal*' articulation (Akišina&Barnovskaja 1990:34, Bondarko 1998:62, Mäkilä&de Silva 1997:68) which means that the tip of the tongue is down while the articulation is formed by the blade of the tongue. This type of articulation is important for all [+pal] consonants, even if they are not dentals.

According to Zinder, the consonants produced with the front part of the tongue can be divided into four groups:

1) those produced with a dorsal articulation (дорсальные), when the whole front part of the tongue including the tip of the tongue articulates;
2) those with an apical articulation (апикальные), when the tip of the tongue articulates;
3) those with a cacuminal articulation (какуминальные), when the whole front part of the tongue withdraws backwards;
4) those with retroflex articulation (ретрофлексные), when the tip of the tongue withdraws backwards (Zinder 1979:149).

A [+pal] consonant has to be dorsal because otherwise the middle of the tongue cannot rise. The same approach is taken, for example, by Skalozub (1960:60), Akišina and Baranovskaja (1990), Mäkilä and de Silva (1996).

In phonetical literature the word 'dorsal' can have different connotations. It can mean the articulation which uses the back of the tongue (compare 'velar') and the 'dentals', 'alveolars' and 'palatoalveolars' would be produced with coronal articulation (Chomsky and Halle 1968). Coronal sounds are produced with the blade of the tongue raised from its neutral position and non-coronal with the blade of the tongue in the neutral position (Ladefoged 1993:5). Palatalization of coronals involves retraction of the primary constriction, but it does not make the consonants dorsals which, according to Keating, means that the active articulator of such consonants is more back than the tongue blade (Keating 1991:11). However it can also be used in the same meaning as we have used it concerning the Russian consonants (Ladefoged and Maddieson 1996).

According to the phonological concept of the Prague linguistic school, palatalization of the Russian consonant system is phonological, i.e. it is one of the distinctive features of consonants. In the opposition of [-pal] and [+pal] consonants the first one is unmarked ([-marked]) and the second a marked ([+marked]) member of the opposition (Trubetzkoy 1969:85). The principle given by Trubetzkoy (Trubetzkoy 1969:129-130) is followed by most Russian (Bondarko 1966, Matusevič 1976, Panov 1967 and 1979, Zubkova 1974 and others) and western (Jakobson, Fant & Halle 1952, Jones 1971) phoneticians as well.

The principle that C [+pal] is the [+marked] member of the opposition is based on the argument that palatalization is always a secondary articulation, but in the case of primary palatalization it is difficult to define as it might not be the [+marked] member of the opposition similarly as C [-pal] is not [-marked] (Bondarko 1966, Reformackij 1970).

In other words, there are [-pal] consonant phonemes in Russian which are in phonological opposition with their [+pal] pairs, which, in theur turn, are also independent phonemes. In this case, palatalization in Russian is a distinctive feature of consonants. This interpretation is based on the assumption that there are five or six vowel phonemes which have different allophones after C [-pal] and C [+pal].

The palatalized consonants are considered independent phonemes. As Ščerba states: " (...) так же как и /p/ и /b/, /d/ и /n/ и т.д. согласные русского языка /ł/ и /lʲ/, /t/ и /tʲ/, /n/ и /nʲ/ и т.д. вполне самостоятельные фонемы, т.е. они могут встречаться в одинаковых фонетических позициях и различать слова" (translation: "... like /p/ and /b/, /d/ and /n/ etc. Russian consonants /ł/ and /lʲ/, /t/ and /tʲ/, /n/ and /nʲ/ etc. are fully independent phonemes, i.e. they can stand in the same phonetical positions and differentiate words") (Ščerba 1983:40). Trubetzkoy's interpretation is similar to Ščerba's (Trubetzkoy 1969:129-130).

However, there is another way to approach the phonological status of Russian consonants as indicated by Bratkowski (1980). According to

him, the [+pal] consonants can be considered as allophones of the [-pal]. In that case there are two types of vowel phonemes, depending on whether the preceding consonant is [-pal] or [+pal]. In this case, the [+pal] consonants would not represent independent phonemes. He states: "I believe, however, that it is vowel fronting that is independent, and that palatalization of consonants is conditioned by the following vowel" (Bratkowski 1980:329). Thus, there would be 10 vowel phonemes in Russian. The orthographic system of Russian would support this point of view as there are two types of graphemes meaning vowels: 1) y, э, a, u, o meaning that the preceding consonant is [-pal], and 2) i, e, я, ю, ё meaning that the preceding consonant is [+pal]. This opinion can be argued against as there are [+pal] consonants ending word forms like *кость* [kosʲtʲ] (a bone), *встань* [fstanʲ] (imperative: get up), and in that position the consonants are independent. There are even minimal pairs where palatalization of the word final consonant is distinctive, for example, *угол* ['ugəł] (a corner) - *уголь* ['ugəlʲ] (coal), *говорит* [gəvʌ'rʲit] (he speaks) - *говорить* [gəvʌ'rʲitʲ] (to speak).

Palatalization is generally considered as a contrast to velarization, "where the tongue constricts the vocal tract in a stricture of open approximation at the velar location simultaneously with another stricture of greater degree at some other location" (Laver 1994:325). According to Laver, all Russian consonants which are [-pal] are velarised ([+vel]). Thus all [+pal] consonants are [+pal] and [-vel] and all [-pal] consonants are [-pal] and [+vel]. Be this as it may, velarization is not a very prominent feature in all Russian [-pal] consonants, with the exception of /ɬ/ (which is the most velarized), /ʃ/ and /ʒ/. According to Jones and Ward, Russian consonants are velarized before [u], [o] and [ɨ]. Apart from velarization before [u] and [o] labialization also occurs. So consonants before these two vowels are always labio-velarized. Before [ɨ] consonants are only [+vel] (Jones&Ward 1969:79-81). One could say that velarization is not used as a distinctive feature in Russian phonology.

One could agree with the majority of scholars that palatalization is a distinctive feature in Russian consonant system as it has a distinctive role in word final position as in

*уго<u>л</u>* ['ugəł] (a corner) - *уго<u>ль</u>* ['ugəlʲ] (coal),
*говорит* [gəvʌ'rʲit] (he speaks) - *говорить* [gəvʌ'rʲitʲ] (to speak)

and before a vowel (CV), for example,

*нос* [nos] (a nose) - *нёс* [nʲəs] (past tense sg. carried),
*быть* [bɨtʲ] (to be) - *бить* [bʲitʲ] (to hit),
*мать* [mɑtʲ] (a mother) - *мять* [mʲatʲ] (to crumple).

Vowel /e/ is an exception for the simple fact that in numerous words which are of foreign origin, many consonants do not generally palatalise in front of it (Avanesov 1984:212-221), for example,

*поэтесса* [tɛ] (a poetess), *фонетика* [nɛ] (phonetics).

Due to the loan words, before /e/ there can be an opposition of [-pal]/ [+pal] consonants like

*постель* [pʌ'sʲtʲelʲ] (a bed) - *пастель* [pʌ'stɛlʲ] (pastel) and
*мер* [mʲer] (amount, genitive plural) - *мэр* [mɛr] (a mayor).

Where the environment of the [+pal] consonants is concerned, any sound may precede a [+pal] consonant and the [+pal] consonant is not dependent on the quality of the following vowel (Zubkova 1974:77). This means that [+pal] consonant can be followed by a [-back] vowel, but, naturally the allophones after C [-pal] (C) and C [+pal] ($C^j$) are different as they have the i-transition, for example,

*мал* [mɑ̯ł] (too small) - *мял* [mʲa̯ł],
*нос* [nos] (a nose) - *нёс* [nʲos] (carried),
*лук* [łuk] (onion) - *люк* [lʲuk] (a trap),

or by a [+front] vowel [e] and [i], for example,

*петь* [pʲetʲ] (to sing),
*лить* [lʲitʲ] (to pour),

but, of course, never by [ɨ].

In some positions, consonant qualities [-pal] and [+pal], as well as [-voiced] and [+voiced] remain without changing, i.e. the consonants are in a *'strong position'*, but in some positions these qualities are affected by assimilation or neutralization, i.e. the consonants are in a *'weak position'* where these qualities are concerned. At the end of the word and in CV combinations, exception being before /e/, the [+pal] consonants are in a strong position or are 'strong phonemes'. The 'weak position' for [+pal] consonants ('weak phonemes') in palatalization appears in front of other consonants where, depending on the consonants which follow, changes in palatalization, i.e. assimilation in palatalization might appear (GR 1982:70-71, RG 1970:17-21). The distribution of the [+pal] consonants includes that in consonant clusters members (mostly two consonants) are [+pal] or [-pal]. This general rule has exceptions like, for example, preceding a velar consonant a [+pal] consonant is in 'a strong position', for ex-

ample, *полка* ['połkʌ] (a shelf) - *полька* ['polʲkʌ] (a Polish woman) (Panov 1979:126).

In assimilation, the opposition [-pal]/[+pal] neutralizes and the [-pal] consonant becomes [+pal] in front of a following [+pal] consonant. The assimilation is always regressive (Avanesov 1984:145). In this case the assimilated consonants could be 'half palatalized', but they have no phonological status. The palatalization assimilation was more common in Russian early this century and especially in the Moscow norm, but the cases of compulsory palatalization are gradually getting less (Avanesov 1984).

Originally the assimilation in palatalization concerned many consonant clusters in Russian. But of the many possible consonant clusters the assimilation in palatalization, according to Panov, remains only in labials before labials and dentals in front of labials and dentals at the present (Panov 1979:127-130).

It can be proved with words which form minimal pairs that palatalization is the only distinctive feature in 12 consonant pairs, i.e. two consonants form a binary opposition and, at the same time, correlation pairs. As Trubetzkoy states: "A paired phoneme is a phoneme that participates in a correlation pair, while an unpaired phoneme is one that does not participate in any correlation pair" (Trubetzkoy 1969:85). Between the pairs there exists a so called private opposition as well (Trubetzkoy 1969:75).

TABLE 6 The paired [-pal] and [+pal] consonant phonemes in Russian

| [-pal] | | [+pal] | |
|---|---|---|---|
| /p/ | *пальцы* ['palʲtsɨ] (fingers) | /pʲ/ | *пяльцы* ['pʲalʲtsɨ] (a tambour) |
| /b/ | *быть* [bɨtʲ] (to be) | /bʲ/ | *бить* [bʲɨtʲ] (to hit) |
| /f/ | *кров* [krof] (gen. pl. carpets) | /fʲ/ | *кровь* [krofʲ] (blood) |
| /v/ | *вал* [vał] (an embankment) | /vʲ/ | *вял* [vʲał] (to wither) |
| /t/ | *говорит* [gəvʌ'rʲit] (he speaks) | /tʲ/ | *говорить* [gəvʌ'rʲitʲ] (to speak) |
| /d/ | *дыма* ['dɨmʌ] (gen. of 'dust') | /dʲ/ | *Дима* ['dʲimʌ] (a male name) |
| /s/ | *сок* [sok] (juice) | /sʲ/ | *сёк* [sʲɵk] (he lashed) |
| /z/ | зов [zof] (call) | /zʲ/ | зёв [zʲɵf] (yawn) |
| /ł/ | *уголь* ['ugəł] (a corner) | /lʲ/ | *уголь* ['ugəlʲ] (coal) |
| /m/ | *мать* [mat'] (a mather) | /mʲ/ | *мять* [mʲatʲ] (to crumple) |
| /n/ | *нос* [nos] (a nose) | /nʲ/ | *нёс* [nʲɵs] (past tense sg. carried) |
| /r/ | *Рэм* [rɛm] (a male name) | /rʲ/ | *рем* [rʲem] (gen. plur. of 'a theme') |

The division of the consonant pairs of which one is [-pal] and the other [+pal] into two different phonemes is clear except where the velars are concerned. The [+pal] velars have been considered as allophones of the

[-pal] velar phonemes /k/, /g/ and /x/ as their distribution is rather limited (Matusevič 1976:146-150) compared with other [+pal] consonants. But according to some phoneticians [+pal] /k/, /g/ and /x/are independent phonemes (Ščerba 1983:45-46, Gvozdev 1973:16 etc.). The [+pal] velar consonants occur only in the beginning of a word and in VC$^{j}$V-positions. There are no minimal pairs to prove the independent phonemic position of the velars either. But 'officially' both [-pal] and [+pal] consonants are considered to be independent phonemes. This opinion is based on the fact that the [+pal] velars are possible before the [-front] vowels [ɑ], [o] and [u] in the Russian forms of foreign names, abbreviations, toponyms (mostly of foreign origin) and in a few original Russian word forms *ткёшь* (you 'weave') [tkʲɵʃ], *ткёт* (he/she 'weaves') [tkʲɵt], *берегя* [bʲərʲɪ'gʲa] ('carrying' - a colloquial form, which was found by Jakobson in Majakovski's poetry) (RG 1982:79, Bondarko 1981:97-98, 1998:34).

The fact remains that there are [+pal] velars in Russian which frequently precede [+front] vowels so that they can be considered independent phonemes. Thus, they can be included in the phoneme inventory of Russian (Reformackij 1970, Bondarko 1998:42).

Apart from the paired there are unpaired [-pal] or [+pal] consonants in Russian. They are all consonants whose palatalization does not depend on the environment. The palatoalveolar sibilants /ʃ/, /ʒ/ and the dental affricate /ts/ occur always [-pal], and the palatoalveolar sibilant /ʃʲ:/ and the palatoalveolar affricate /tʃʲ/ always [+pal]. Some proof can be found that /ʃ/ - /ʃʲ:/ or affricates /ts/ - /tʃʲ/ would be pairing each other in palatalization, i.e. independent phonemes, or that the latter be a palatalized allophone of the same phoneme. In this respect I share the opinion with Bondarko, Avanesov, Matusevič, Panov and others, according to whom /ʃ/ and /ʃʲ:/ are different phonemes and they are not pairs in palatalization while the affricates are independent phonemes and palatalization is not the only distinctive feature which separates them.

TABLE 7 The unpaired [-pal] and [+pal] Russian consonant phonemes

| [-pal] | | [+pal] | |
|---|---|---|---|
| /ʃ/ | *шил* [ʃił] (sew) | /ʃʲ:/ | *ищи* [ɪʃʲi] (imperative of find) |
| /ʒ/ | *жара* [ʒʌ'rɑ] (heat) | | |
| /ts/ | *цирк* [tsirk] (circus) | /tʃʲ/ | *часы* [tʃʲɪsi] (a clock) |

Among the sibilants there has been a marginal phoneme /ʒʲ:/. Its existence in modern Russian is doubtful. Traditionally it has been considered as a phoneme (/ʒʲ:/) and has been a typical sound in Moscow pronun-

ciation (Avanesov 1984:60). But in the Petersburg pronunciation [ʒʲ:] has been only a variant of the same long [-pal] sibilant and thus not considered an independent phoneme (Bondarko 1966:397). At present it is disappearing from the literary norm. This has been noted by Kalenčuk and Kasatkina (1997) who give it only as an alternative in pronouncing two [+voiced] sibilants together, for example, *визжать* (to scream), *дрожжи* (yeast) [ʒʲ:] or [ʒ:], which means that the sibilant remains long without palatalization.

The Russian palatal /j/ is considered as an unpaired [+pal] consonant phoneme (Avanesov, Bondarko, Matusevič, Panov etc.). In most of the other languages a similar sound is defined as a semivowel or palatal sonorant. In fact, its position differs from the palatalization of other Russian consonants for which the palatalization is an additional articulation to the place and manner, but for /j/ the palatal articulation is the primary articulation. On the other hand, Keating states, that palatalization can be also primary, but by this she means that palatalization can become primary in some cases, but even then it is not the original articulation of the consonant (Keating 1993:6). Another question is that the influence of /j/ on the following vowel is similar to that of the [+pal] consonants. Anyhow, /j/ is an independent phoneme in Russian.

The articulatory features of consonants depending on the place and manner of articulation, as well as [-voiced] / [+voiced] quality of obstruents, together with the feature [-pal] / [+pal] are generally described using distinctive features (GR 1982, RG 1970, Bondarko 1998). The acoustic features are rarely used in Russian literature though the acoustical investigations formed a major part of phonetic research during the last decades. The binary distinctive features of Jakobson et al. (Jakobson, Fant and Halle 1952) were introduced to Russian linguists by M.Halle (1962) but they have been used only by a few linguists (Kasevič 1977, Panov 1979). One of the fundamental studies in this field was the 'Preliminaries to Speech Analysis' of Jakobson, Fant and Halle (1952). They introduced a system of binaric features based on minimum redundancy principle. The same system on the material of Russian language was more detailed as described by Fant (Fant 1970 and Halle 1971).

The Russian sound system, including the consonant segments, was studied thoroughly in different parts of the former Soviet Union as well as in many laboratories of experimental phonetics starting from the late 1950s. Maybe the most thorough systematic studies of the consonant system using x-ray and palatographic methods were done in Kiev by Skalozub (1962, 1979). These investigations give a full idea about articulation of Russian consonants, [-pal] as well as [+pal].

With the help of acoustic analysis all qualities of Russian consonants have been studied, for example, by Bondarko (1974, 1977, 1981,

1998), Derkač et al. (1983), Stern (1974), Zinder (1979) and Zlotoustova (1962, 1981). A detailed description is given by Bondarko (1977:81-87).

In the acoustic analysis consonants are easy to distinguish from vowels as well as [+voiced] consonats from [-voiced]. Thus the distinctive features [±vocalic] (Vocalic vs. Non-Vocalic), [±consonantal] (Consonantal vs. Non-Consonantal) as well as [±voiced] (Voiced vs. Voiceless) work in the Russian consonantal system the way Jakobson, Fant and Halle have described (1952). Apart from that in oscillogrammes fricative consonants, sibilants as well as non-sibilants, can be distinguished from plosives as non-periodical vibrations which continue without interruption, i.e. the distinctive feature [±continuant] (Continuant vs. Interrupted) can be used of Russian consonants.

The palatalization is also seen in the burst of the closure of the stop consonants, as less time from the end of the preceding vowel to the release, especially, in the [-voiced] stops [p$^{j}$], [t$^{j}$] and [k$^{j}$]. During the closure of the [-voiced] stops and affricates there are no marks in the spectrogramme or oscillogramme, but the release of the closure is visible. After the burst of the closure of the stop consonants a burst of air without vibration of the vocal folds may occur before the voicing starts. This is called VOT, i.e. Voice Onset Time, and it is typical of aspirated consonants in different languages. VOT has been suggested to act like a distinctive feature, for example, between English aspirated and unaspirated consonants (Keating 1984). The question is: could it be applied to Russian [-pal]/[+pal] opposition of [-voiced] stop consonants? Even if it could, it would be distinctive only in a few pairs of consonants while the palatalization opposition in Russian concerns 12 (or 15) pairs of consonants which represent all kinds of articulation manners and places. The palatalization opposition has to be given as a distinctive feature [±sharped] (Fant 1970, Halle 1971) which can be applied to all [-pal] and [+pal] pairs.

The affricates have the explosion burst after a lesser period of time measured from the end of the previous vowel than plosives. In fact the [-pal] plosives have the longest gap of time between the time after the end of the preceding vowel to the burst of the closure and the [+pal] plosives have a longer gap which is followed by *spirantization* of the plosives. The affricates have a fricative phase after the explosion. The moment of the burst of the closure in the plosives as well as in the affricates can be easily measured in the oscillogrammes.

Apart from that, the stops as well as affricates have high-frequency noise after the explosion burst. The frequency, volume and duration of the noise give clues to the place of articulation which is the source of the noise, i.e. the labials have a weak short noise period, the velars strong noise which registers in lower frequencies and the dentals, alveolars, palatoalveolars and palatals at some place between the two. But these

appearances of turbulent noise do not give a picture which could be exact enough to differentiate, for example, dental articulation from alveolar, which would give an idea whether the Finnish subjects pronounce the Russian dentals the way the natives do.

The distinctive feature [+sharped] also includes that the neighbouring vowel has an i-glide on the side of the [+pal] consonant. The i-glide which is a result of the palatalization of the neighbouring consonant (C [+pal]) is seen in the $F_2$-patterns of vowels, most clearly in vowel [a], which are also characterised by the rise of $F_2$ as well as of $F_3$ as the tongue approaches the [i]-position (Fant 1970:220) According to Bondarko, the [+pal] consonants have longer duration than [-pal] (Bondarko 1998:62). Generally the closure of [-voiced] plosives is longer than the closure of the [+voiced] ones (Bondarko 1988:61).

The labial ([+lab]) consonants can be differentiated from other consonants acoustically with the distinctive feature Flat vs. Plain, which means that their coarticulation in the neighbouring consonants is seen as a slope in the formant structure, especially of $F_2$. Where the Russian labials are concerned the distinctive feature [+flat] concerns only the consonants which are [-pal]. The palatalization of C [+pal] [+lab] influences $F_2$ of the following vowel so strongly that the effect of labialization disappears, i.e. $F_2$ rises in the same proportion as after any C [+pal]. This was proved by Fant with vowel [*a*] in Russian words following C [+lab] (Fant 1970:223). It appeared in his acoustic study that when $F_2$ of [*a*] after C [+lab] [-pal] was 800-920 Hz, its value after C [+lab] [+pal] was 1800-1820 Hz.

In this study the palatalization of the Russian consonants is investigated acoustically especially from the point of view of the effect on vowels and their quality. I have also taken the labial coarticulation into consideration.

### 2.1.3.2 Palatalization of Russian consonants

Palatalization as a coarticulation is possible in any language. For example, Cooper has proved that English consonants /d/ and /t/ preceding /j/ have such coarticulation (Cooper 1983). Some consonants also palatalize in Italian (Lindgren & Hurme 1977) and in Romanian (Murrell 1972). Palatalization can be found in many languages in the territories of the former Soviet Union such as Armenian, Georgian and many other Caucasian languages, Paleosiberian languages and in Yiddish but, most of all, in the Slavonic languages (Russian, Ukrainian and Belorussian (Comrie 1981). In many languages the consonants preceding the front vowels palatalize (Bhat 1974), but in most languages palatalization is not a phonologically distinctive feature like, for example, in standard Finnish.

Palatalization occurs in consonants with /i/ or /j/ on either side of them. But in some languages /i/ and /j/ have joined together with the preceding or following consonant making one sound instead of two, i.e. they are pronounced at the same time (Wiik 1981:93). This is a common factor in the history of the Russian and other Slavonic languages. In the so called historical palatalization, apart from /i/ and /j/, other [+front] vowels could also palatalize a consonant.

In the articulation of consonants palatalization means that the tongue rises towards palatum irrespective of the place or manner of the articulation of the consonant. The tongue rises to the same or almost the same position as in /i/ or /j/ and the place of the tongue which rises is the same as in pronouncing /i/ or /j/. This has been proved by palatograms and roentgenograms (Bogorodickij 1930, Ladefoged 1993, Skalozub 1962, Zubkova 1974 etc.), and acoustically (Bondarko 1960, 1977, Zinder 1979, Fant 1970, Halle 1971 etc.).

In literature, palatalization is described as raising of the middle of the tongue as suggested by Trubetzkoy and Ščerba (Avanesov 1984, Bondarko 1977, 1981, 1998, Zinder 1979 etc.) or raising of the front of the tongue (Bhat 1974, Jones & Ward 1969, Ladefoged 1993 etc.). In fact both mean the same. The 'middle of the tongue' is related to the consonant classification in Russian where /j/ is articulated by 'the middle of the tongue' (среднеязычный). The front of the tongue comes from the classification of vowels as /i/ is a front vowel.

Up to this point the definition of palatalization in this work has been done on a very general level. A closer observation shows that the palatalization process is a very complex one. Bhat gives three points which are involved with palatalization. He states: "A cross-linguistic study of palatalization has revealed that there are at least three distinct processes, namely tongue-fronting, tongue-raising, and *spirantization* which, occurring either individually in different combinations produce the effects that are generally denoted by the cover term, palatalization" (Bhat 1974:17). The tongue-raising and spirantization, which is also called affricatization, are commonly brought up. Apart from the three features mentioned by Bhat, more features of palatalization are given in Russian phonetical literature, like the expansion and change of the place of the striction and closure, change in the lip articulation and the jaw movements (Skalozub 1974, Zubkova 1964, Avanesov 1984, Bondarko 1998, Bryzgunova 1977, Verbickaja 1986 etc.). All the stages involved in the palatalization of each consonant vís a vís of the [-pal] pair are given in Table 8.

As the table shows, palatalization does not affect the articulation movements of all consonants in the same way. Tongue rising and fronting are common movements to all the consonants. The lip movements are

common to all labials, [pʲ], [bʲ], [mʲ], [fʲ], [vʲ], dentals, [tʲ], [dʲ], [sʲ], [zʲ], [lʲ], [nʲ] and the alveolar [rʲ], i.e. to help the tongue rise the lips 'expand' sidewise while pronouncing these consonants (Avanesov 1984, Bolla 1981, Jones & Ward 1969). The labials have a second constriction in the oral cavity, as the first one is in the labial zone.

TABLE 8 Articulation movements included in palatalization of the Russian C [+pal] vs. C [-pal]

| | pʲ | bʲ | mʲ | fʲ | vʲ | tʲ | dʲ | sʲ | zʲ | lʲ | rʲ | nʲ | ʃʲː | kʲ | gʲ | xʲ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tongue rising | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Tongue forwards | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Second constriction | + | + | + | + | + | - | - | - | - | - | - | - | - | - | - | - |
| Expansion of articulation place | - | - | - | - | - | + | + | + | + | + | + | + | + | + | + | + |
| Change of articulation place | - | - | - | - | - | - | - | - | - | - | + | + | - | + | + | + |
| Lip movements | + | + | + | + | + | + | + | + | + | + | + | + | - | - | - | - |
| Jaw movements | + | + | + | + | + | - | - | - | - | - | - | - | + | - | - | - |
| Change of the articulation manner | + | + | - | - | - | + | + | - | - | - | + | - | - | + | + | - |

The articulation place expands in all consonants with dorsal articulation, i.e. the dentals, alveolars and palatoalveolars. This means that the primary articulation changes due to the palatalization. At the same time the location of articulation of [nʲ] and [rʲ] moves backwards, while in the velars, [kʲ], [gʲ] and [xʲ], the location of the closure or constriction moves forwards in the mouth cave.

Palatalization in all cases is often considered as a *secondary* articulation (Avanesov 1984, Bolla 1981, Ladefoged 1971, Trubetzkoy 1969, Wiik 1981 etc.), just like labialization, velarization and pharyngalization. As it is seen in Table 4, in the pronunciation of some consonants palatalization is an addition which narrows the vocal track, i.e. it is a secondary articulation. But in the pronunciation of other consonants palatalization is *primary* like in the velars and dentals where the palatalization expands or changes the place of articulation, where it joins the primary articulation and changes it in one way or another (Bondarko 1966, 1998, Ladeforged 1993, Keating 1991, Reformackij 1970).

The primary palatalization occurs when palatalization joins the original primary articulation of the consonant and changes it in some way

or another. Thus the place of articulation of the [+pal] velars, /kʲ/, /gʲ/ and /xʲ/ can be considered a primary palatalization as their place of articulation is in the palatal zone instead of the velar zone like that of the [-pal] velars (Matusevič 1976:148) or, at least, the palato-velaric zone (Avanesov 1984, Bondarko 1977, Skalozub 1962 and 1977, Jones & Wards 1969).

The other case of primary palatalization is the place of articulation of dentals which is expanded backwards while the location of primary articulation and palatalization join together. As Jones and Ward state: "(...) it (palatalization) may merge with another articulation, so that the 'combined' articulation is produced, as in the pronunciation of palatalized *t, d, n* in Russian, where the blade of the tongue is placed on the teeth-ridge and the front of the tongue is raised towards the hard palate, so that most of the fore part of tongue, including the blade and the front, acts as a single articulating organ" (Jones & Ward 1969:81-82).

Zubkova mentions [nʲ] separately, as she proves that palatalization affects it differently as its articulation place moves completely backwards. Thus in the case of /nʲ/ the primary palatalization is more obvious. But where the dental sibilants /sʲ/ and /zʲ/ are concerned, compared with the [-pal] consonants, the articulation place expands towards the sides, the constriction becomes narrower and the articulation place moves forwards (Zubkova 1962:30-31).

Where the palatoalveolar consonants are concerned, the palatoalveolar place of articulation is next to the palatal, and it is natural that the primary articulation joins the palatalization. Thus, [+pal] consonants /ʃʲ/ and /tʃʲ/ are produced as Jones and Ward describe: "(...) most of the fore part of the tongue, including the blade and the front, acts as a single articulating organ" (Jones & Ward 1969:81, 89).

Spirantization of the stop consonants is a typical phenomenon in the palatalization of Russian [tʲ] and [kʲ]. Especially in [kʲ] it could also be considered as primary palatalization. In [pʲ] and [bʲ] spirantization is minimal. Spirantization or affrication (аффрикатизация) means that the stops become like affricates (Bondarko 1977:85). In this case, the palatalization changes the manner of articulation, which according to the principle given by Ladefoged (Ladefoged 1993:69), is the question about primary palatalization though Keating states: "Thus the primary coronal articulation is retracted and made laminal by the secondary palatalization" (Keating 1991:7). Although Bhat claims that spirantization rarely affects the labials (Bhat 1974:20), it is obvious in the Russian labial plosive [pʲ]. The articulation manner changes in [rʲ] as well. When [r] is always a tremulant with minimally two closures during the articulation, [rʲ], especially in position VCV, it has one fast closure (Bondarko 1998:64), i.e. it is a flap and no more a tremulant.

The following cases represent the secondary palatalization: 1) the palatalization of the labials (/bʲ, pʲ, mʲ, fʲ, vʲ/) where a second constriction is formed in the mouth cavity. 2) In the palatalization of the lateral /lʲ/, the articulation place expands more towards the sides of the mouth cavity. 3) In the palatalization of the labials the lip contact loosens, lips expand sideways (Avanesov 1984, Bolla 1981, Jones&Ward 1969), and the same type of movement can be found in other consonants. 4) During the palatalization of many consonants the jaw is lowered (see Table 8) (Bolla 1981, Ardentov 1979, Skalozub 1962, Jones & Ward 1969)

Another question is: are there different stages of palatalization in Russian? It is a fact that some consonants are more palatalized than others, and that the higher the tongue rises the more palatalized the consonant is (Zinder 1979:133, Skalozub 1979:67). It seems that one can hear even by plain ear that phonetically palatalization has different stages, in other words, some consonant sounds are more palatalized than others. Accordingly, one can try to pronounce the [+pal] consonants more or less carefully and make a difference between the stages of palatalization. 'Half-palatalized' or 'partly palatalized' consonants are possible, for example, in cases of interchange [-pal] - [+pal] within the same word like *мама* (a mother) [mɑmə] - *мамин* (mother's) ['mɑmʲɪn]. According to Bondarko, these changes exist, but they have no phonological foundation, as phonologically there is only opposition [+pal] / [-pal] (Bondarko 1981:103).

The effect of the palatalization on the articulation of the consonant concerned which can also mean the stage of palatalization of Russian consonants depends on different factors:

1) The manner of articulation. For example, in sibilants /sʲ/ and /zʲ/ the tongue rises less high than in the stops /tʲ/ and /dʲ/ (Jones & Ward 1969:129). The palatoalveolar affricate /tʃʲ/ is, according to Zubkova, less palatalized than the dental stop /tʲ/, because of the manner of articulation. The tongue position is the same in both except for that in /tʲ/ it is higher (Zubkova 1962:39). Between the [+voiced] and [-voiced] consonants there is also a difference in the stage of palatalization; the [-voiced] are more palatalized (Zubkova 1962:60).
2) The place of articulation makes the stage of palatalization of apical /rʲ/ less than it is most of the [+pal] consonants (Zubkova 1974:52). Especially where the labials are concerned, when one raises the tongue higher, the palatalization of the consonant increases (Skalozub 1962:21-22). According to Bondarko (Bondarko 1998:66) where /rʲ/ is concerned, there is a change of the manner of articulation compared with /r/ as a result of which /rʲ/ becomes a fricative.

3) According to Jones and Ward, the stage of palatalization in Russian depends on the following vowel. They state: "(...) the more open the vowel, the less likely is the tongue to reach the high, close position of the consonant *j*" (Jones & Ward 1969:93). To some extent this is not in accordance with the opinion of Zubkova. She notes that sometimes palatalization is stronger before a [-back] vowel than before a [+front] vowel (Zubkova 1974:79).

The palatalization of the Russian consonants is acoustically clearly seen in [-voiced] plosives. It makes [+pal] plosives, [$p^j$], [$t^j$] and [$k^j$], similar to affricates, i.e. the explosion burst opens more slowly and the consonant has a fricative phase. But, more than that, the palatalization of all consonants is acoustically more obvious in the $F_2$ of the neighbouring vowels, especially in that of [*a*].

Acoustically the stage of palatalization can be shown in the frequency of $F_2$ of the neighbouring vowel.

## 2.2 Phonological and phonetical system of Finnish in comparison with Russian

### 2.2.1 Finnish vowel system

A common interpretation is that there are eight vowel phonemes in Finnish /i/, /e/, /æ/, /y/, /œ/, /u/, /o/ and /ɑ/ (Hakulinen, Karlsson, Lehtonen, Suomi, Wiik etc.). Their existence is shown, for example, with minimal pairs (Wiik 1965:40):

*tikin* (gen. sing. of tikki 'stich'),
*tekin* ('you too'),
*täkin* (gen. sing. of täkki 'bedspread'),
*tykin* (gen. sing. of tykki 'cannon'),
*tökin* ('I keep pushing'),
*tukin* (gen sing. of 'tukki'),
*tokin* (instructive of tokka 'heard of reindeers),
*takin* (gen. sing. of takki 'coat').

The distinctive features of articulation of Finnish vowels are: 1) [+front] /i/, /e/, /æ/, /y/, /œ/ and [+back] /u/, /o/ and /ɑ/; 2) [+close] /i/, /y/ and /u/, medial (half close/half open) /e/, /o/ and [+open] /æ/, /ɑ/, and 3) [-rounded] /i/, /e/, /æ/, /ɑ/ and [+rounded] /y/, /œ/, /u/, /o/. So both Russian and Finnish vowel systems present a three-class system of timbre (Trubetzkoy 1969:97-104).

It has also been discussed whether the number of segmental phonemes in Finnish could be reduced to five by using a suprasegmental phoneme of length /¨/. That would mean that the [+back] vowels /u/, /o/ and /ɑ/ would be phonetically the same as the corresponding [+front] vowels formed of them in combination with the suprasegmental phoneme, i.e /¨/ + /u/ > [y], /¨/ + /o/ > [œ] and /¨/ + /ɑ/ > [æ] (Wiik 1965:40-41). Wiik, however, does not consider this alternative good.

Anyhow, the phoneme division of Finnish vowels is not this simple. As we know, all Finnish vowels can be single (short) and double (long), for example, *tili* (a salary) - *tiili* (a brick), *salama* (lightning) - *salaama* (hidden), and they can form diphthongs as well, for example, *tie* (a road), *tai* (or). The duration of the vowels is not due to the stress, but [+stress] as well as [-stress] vowels can be longer and shorter, as the examples show. There is a basis to polyphonematic interpretation of the short and long vowels as well as the diphthongs in Finnish, but at the same time a monophonematic interpretation is possible as well, since there is no morphological boundary between the components, and the long vowels are twice as long as a single one (Trubetskoy 1969:55-62).

There are not many languages having the phonological length, i.e. quantity languages, like Finnish and Estonian. One way to handle the fact that there are long and short sounds in a language is to list long and short vowels and consonants in the phonemic inventory of the language, which might double the units in the inventory (Lehiste 1970:43). The question of phonological length has been brought up, for example by Daniel Jones, who suggested the usage of special terms: chrone to denote the phonetical duration and chroneme to denote the phonological length (Laver 1994:436). In principle, a 'chroneme' could be used for Finnish, but the 'identity group' seems to win (Lehtonen 1970:31-33, Karlsson 1982:71).

Somehow the monophonematic interpretation of double vowels has not been used much where Finnish is concerned. In earlier linguistic literature, the phonemic role of the duration of vowels has not even been mentioned (Hakulinen 1961, Penttilä 1963, Sovijärvi 1966). Subsequently the interpretation of single and double vowels where a short vowel is one phoneme and long vowel consists of two identical phonemes has been used (Lehtonen 1970, Karlsson 1982, Suomi 1989, Wiik 1965). According to Karlsson, long vowels in each case form one phonetical segment, but phonologically it is better to call long vowels as well as long consonants identity groups, i.e., units of two equal phonemes (Karlsson 1983:56-57).

The diphthongs in Finnish are always considered as combinations of two different vowels. Any of the eight vowel phonemes may occur as the first segment in diphthongs and six vowel phonemes as the second segment. There are 18 diphthongs in Finnish, which can be divided ar-

ticulatorily into two groups, closing /ɑi, ei, oi, ui, æi, œi, yi, ɑu, ou, eu, iu, æy, œy, ey, iy/ and opening /ie, uo, y œ/ (Karlsson 1982:83).

According to Suomi, there is a good foundation to consider both diphthongs and monothongs in Finnish as two separate sounds, as structurally Finnish diphthongs resemble combinations of single vowels and consonants, for example, [kau] vs. [kas], from a metrical point of view. They both form long syllables, when the syllables with a single vowel are short. The same explanation can be given concerning the long vowels. Apart from the structural explanation, the intuition of a native speaker is equally significant. According to the intuition of a Finnish native speaker, vowels in a diphthong, as well as in a long monothong, there are two different vowels, unlike in English (Suomi 1988:24-25).

Acoustically the durational differences between vowels could be classified as the opposition between tense and lax vowels, and they can be different phonemes. According to Jakobson et al. (1955:36-38), tense phonemes have longer duration than their lax counterparts. Wiik has described the phonetical manifestation of single and double vowels in Finnish (Wiik 1965), as well as Iivonen and Laukkanen (Iivonen & Laukkanen 1993, Iivonen 1995). The formant distribution of the double vowels differ from the one of the single vowels depending on the vowel itself (Wiik 1965:59-60). According to Iivonen and Laukkanen, the short vowels are more centralized where $F_1$ and $F_2$ are concerned (Iivonen & Laukkanen 1993:37).

Where the Finnish diphthongs are concerned, the average formant positions of the first segments are closer to those of the single monothongs than to those of the double ones in most cases. The assimilating influence of the second segment of a diphthong on the first segment is small in Finnish (Wiik 1965:81). The formant positions of the second segments of Finnish diphthongs are close to those of single monothongs (Wiik 1965:93).

Durational differences between single vowels and double vowels, as well as duration of diphthongs have been measured in acoustic data by Lehiste, Wiik and Lehtonen (Lehiste & Wiik 1968, Lehtonen 1970). According to Lehtonen, the long vowels are about twice as long in duration as short vowels in the same position in a word (Lehtonen 1970:33).

One reason for the polyphonemic interpratation of the short and long Finnish segments is the Finnish orthography. A native Finnish speaker or listener hears the sound segments long, when he/she writes them with two letters and short, when he/she writes them with one letter. This is not phonetically correct, as in different positions, the duration differs even between the long and short segments. In disyllabic words the short second vowel is very much longer if the there is a single vowel in the first primary stressed syllable. For example, in Finnish words *maana*

(as a land) and *mana* (a curse) the second vowel, which is short is both words, is twice as long in the second word due to the fact that the first vowel is short (Lehtonen 1970:14-15).

In comparison, for example, with the Russian phonetical system, the duration of Finnish vowels, or sounds generally, means phonological length or quantity and is, in any case, distinctive. But, since the general opinion is to consider the Finnish long vowels as well as diphthongs, polyphonemes, one can also call a short vowel a single vowel and a long vowel a double vowel. There are single and double consonants as well. The segments of the double vowels and diphthongs, unlike the segments of double consonants, belong to the same syllable, but there are a few vowel combinations whose members belong to different syllables, for example, *karkea* (coarse).

Phonologically in Finnish there are only two different lengths, although vowels can have four different types of durations: short, half-long, long and over-long (Wiik 1965:134). Phonetically, however, if the time which is used for articulation of each vowel is measured very carefully, one can notice that there are hardly any vowels with exactly the same duration. This has been taken into consideration, for example in the Finnish-Ugrian transcription. It has eight different quantity degrees: over-short, under-short, short, half-short, half-long, under-long, long, over long (Sovijärvi & Peltola 1964:6-7). A native speaker of any Finnish-Ugric language has no difficulty in producing all durations needed in his or her own mother tongue. But the question arises, however, when a foreigner in whose language the distinction of duration does not exist to the same extent, speaks such a language.

Most probably, a foreigner who listens to a Finnish-Ugric language does not hear so many different durations. It can even be difficult for a foreign speaker to differentiate between short and long sounds, as "there is no absolute, universal 'short' and 'long' quantity. The scales of substitution are the patterns of his own code" (Lehtonen 1970:14).

There is another phenomenon which is typical of the Finnish vowel system: the vowel harmony. But its meaning in a contrastive study of Finnish and Russian is not important as there are no equivalents in Russian to the Finnish front vowels [æ], [y] and [œ]. It means that in a Finnish word which is not a compound word only [i] and [e] can appear with [+front] as well as [+back] vowels, otherwise all the vowels are either [+front] or [+back], for example, *aloittaa* (to start) [a-o-i-a], *hyvää yötä* (good night) [y-æ] and [y-œ-æ]. The foreign words do not always follow the vowel harmony, but its domain which has been the whole word is becoming smaller as is evident in the following two examples, *olympialaiset* (the olympic games) [o-y-i-a-a-e] and *analyysi* (analysis) [a-a-y-i] (Wiik 1965:50-51).

The Russian learners of Finnish have problems with the Finnish vowel systems. The system of Russian vowels differs from the Finnish in two ways. Firstly, all Russian [+rounded] vowels are [+back] as there are no [+rounded] [+front] vowel phonemes like in Finnish, /æ/, /y/, /œ/, i.e. the phonologically distinctive combination [+front] and [+rounded] is unknown to Russians and it is very difficult for them to learn as well. Secondly, there is no short/long distinction in the same stress position, as duration in Russian is a parameter of [+stress] vowel and vowels in [-stress] syllables are reduced, i.e. short. Another basic difficulty for Russians learning Finnish is that consonants before [+front] vowels do not palatalize as in Russian.

### 2.2.2 Finnish consonant system

The Finnish consonant phonemes form a five levelled system The minimal system which appears in native words, the nucleus of phonemes (Karlsson 1983:65-66), includes /p t k m n r l s h v j/. Their phonetic nature is shown in minimal pairs :

| | |
|---|---|
| *kuu* (moon), | *valo* (light), |
| *puu* (a tree), | *jalo* (noble), |
| *suu* (mouth), | *halo* (imperative of cut); |
| *luu* (a bone), | *sauma* (seam), |
| *muu* (another), | *Rauma* (a town in Finland), |
| *juu* (yes); | *lauma* (a herd); |
| *talo* ( a house), | *katon* (genitive of a roof), |
| *palo* (a fire), | *maton* (genitive of a carpet), |
| *salo* (a big forest), | *madon* (genitive of a worm). |

All these 11 consonants phonemes can appear in the word-initial position.

The second level of consonants, according to Karlsson (Karlsson 1983:66), includes, apart from the above mentioned consonant phonemes, /ŋ/ and the third level /d/ which also appear in original Finnish words. Both of these consonant phonemes appear even in Finnish dialects but not in all. The maximal system includes among others the so called marginal phonemes /f b g ʃ/ which appear in words of foreign origin like, for example, *faarao, budda, gamma, šamaani.*

The only [+voiced] obstruent in the original Finnish words, in the minimal system of consonants, is /d/, but its phonological position is problematic. First of all, its opposition with /t/ cannot be categorized as purely voiceless/voiced, as apart from being [+voiced], the articulation place is different, as /t/ is dental and /d/ is alveolar, it is very much shorter, it cannot be double and it does not appear in word-initial and final positions in native Finnish words (Karlsson 1983:56-57). The other

consonant which does not belong to the nucleus group, the nasal /ŋ/, appears in the words of Finnish origin but only in word-medial positions like /d/, and in intervocalic position always as a double consonant.

The question of [+voiced] obstruents /b/, /d/, /g/ is unclear in Finnish. Originally the voiced/voiceless opposition has not existed in Finnish. Together with the words of foreign origin all three voiced consonants have become more common in the Finnish language, but their pronunciation has caused problems to a normal Finn: they tend to become voiceless, or the phonetical structure of the whole word changes so that the voiced consonant is no more necessary, for example, greippi [reippi] (a grapefruit). Some Finns, however, use them without difficulty (Heikkinen 1982, Karlsson 1983, Jarva 1996 and 1998 ).

Although the Finnish consonant system might look less complicated than Russian, for example, it has its own special features which are difficult for foreign learners of the language. Maybe the most difficult phenomenon in the Finnish consonantal system is the phonological opposition of short (single) and long (double) consonants. Of the minimal system of the Finnish consonants /p t k m n r l s/ can be single as well as double but /h/, /v/, /j/ and /d/ can be only single. Apart from that, the last four consonants have another restriction: they can never appear in word-final position. The phonetical character of all these four consonants is not quite clear. It is even possible that /d/ becomes a flap and thus related to [r] with one closure (Karlsson 1983:57). The consonants /v/ and /j/ could be considered as semivowels as well (Karlsson 1983:62). And the fourth one, /h/, is originally considered as a laryngeal fricative, but the coarticulations of the adjacent sounds are always prominent in it so that the location often changes even up to the palatal zone.

Comparison of the Russian and Finnish consonant systems prove that many consonant phonemes, such as /p t v m n r s j/ in both languages have similar distinctive features, articulatory as well as acoustical. But a more detailed investigation shows that only some [-pal] consonants in Russian like the tremulant /r/, and perhaps /p/ and /m/, are phonetically similar to the Finnish equivalents. But most of the consonants are different in both languages like, for example, the consonants /t n s/ in Finnish are alveolar or denti-alveolar and their articulation is not dorsal but apical. The Finnish consonants are labial /p/, labiodental / v/, dental or alveolar /t n s l r/, palatal /j ŋ/, velar /k/ and laryngeal /h/, and thus, Finnish has no palatoalveolars. Apart from that, the opposition [-voiced]/[-voiced] obstruents as well as the palatalization opposition is absent in Finnish.

The Finnish consonants can be single and double in the word-medial position. In the word-initial position there are restrictions concerning consonants in the original Finnish words. Firstly, the consonants /d/

and /ŋ/ cannot start a word of Finnish origin. Secondly, double consonants and consonant clusters cannot appear in this position, but words of foreign origin may have initial consonant clusters such as, for example, *traditio*, *sprii*. In the word-medial position consonant clusters are very common, especially such clusters that include a double consonant, for example, *palkka* (salary), *kimppu* (a bouquet), *kanssa* (with), but also clusters consisting of different consonants, for example, *Ranska* (France) or *vilske* (activeness).

The system of Finnish consonants includes only one sibilant, the dental or alveolar sibilant [-voiced] /s/, whose articulation place may vary from a very front dental to almost palatoalveolar, i.e. it has many allophones (Hakulinen 1979:20). In reality its variations are not that many as one would expect (Lauttamus 1981:352). Acoustic studies have also shown that its place of articulation is mostly alveolar, i.e. quite front (Karlsson 1983:61). And since it has no voiced/voiceless opposition it can have a [+voiced] allophone as well.

In standard Finnish, palatalization is not a distinctive feature of consonant phonemes. Anyhow, this does not mean that there are no palatalized consonants in the language at all, as there is phonetical palatalization in Finnish. It is even possible that any Finnish consonant might have a palatalized (or at least partly palatalized) allophone, although there is no evidence about it in the literature about Finnish phonetics. Anyhow, it is known that the velar plosives have palatalized allophones (Wiik 1981, Karlsson 1982).

The place of articulation of velar plosives moves forwards before [+front] vowels, compared with the place of articulation before other vowels. According to Wiik, the palato-velaric region of articulation of the plosives is very large, depending on how front the vowel is, and the place of articulation of the velar plosives, /k/ and /g/, moves forwards accordingly (Wiik 1981:77). This process is similar to or the same as the palatization of velars in Russian, for example, /k/ in words *kiinni* (closed) and *noki* (tar) is similar to Russian [+pal] /kʲ/.

The Finnish laryngeal fricative /h/ has also a allophone which is similar to the Russian velar spirant [xʲ]. The coarticulation of the neighbouring [+front] vowel brings its place of articulation very much forwards, into the palatal zone. For example, in the word *vihko* (a copybook) [h] is pronounced in the palatal zone, and the passing air stream forms palatal friction (Karlsson 1983:61)

More thorough research might prove that there are more palatalized allophones of consonants in standard Finnish. For example, Zubkova believes that in languages where palatalization is not known as a result of accommodation consonants palatalize before [+front] vowel at least to

some extent, and the perception is the same as of Russian [+pal] consonants before /i/ and /e/ (Zubkova 1974:78-79).

Apart from the standard Finnish, in the eastern dialects (Northern Karelian and Savo) palatalization is common probably because of the influence of Russian. Because of the special feature of those dialects, namely, that the final part of the words shortens up to the last consonant, even some minimal pairs can be pointed, for example (Itkonen 1968:76-77):

*varas* [s] (a thief) - *varas'* [s$^{j}$] (varasi = booked),
*lehmän* (genitive sg. of a cow) - *lehmän$^{j}$* (my cow).

Anyhow, all the consonants cannot palatalize even in the above mentioned Finnish dialects. In most regions only dentals palatalize, but in Savo [h] as well. Besides, this palatalization never concerns C after V [+front], [i] and it never takes place in the word-initial consonant (Leskinen 1963:298, Itkonen 1968:76).

The palatalization in the Finnish dialects is both regressive and progressive. The above mentioned minimal pairs are examples of the regressive palatalization (Leskinen 1963:293-297, Itkonen 1968:77). The geographical spreading is the same with both, and they originate from the same period (Itkonen 1968:79).

According to Leskinen the regressive palatalization occurs when

1) the vowel /i/ has disappeared after a single consonant at the end of the word or inside a word,
2) after the diphthong *-uo* before /i/ and /j/ inside a word and
3) in some Russian loan words which include palatalization in the original form (Leskinen 1963:293-296).

The progressive palatalization occurs in a consonant following a vowel in an unstressed diphthong originally ending with /i/, after the /i/ has disappeared, for example, *'matkoll$^{j}$a'* instead of *matkoilla* (Leskinen 1963:297):

This occurs especially in the western parts of Savo. Sometimes it means that the vowel is not originally /i/, but gradually becomes one and then disappears leaving the beginning of the consonant palatalized (Itkonen 1968:78).

The distribution of palatalization in the Finnish dialects is more limited than in Russian, namely, it concerns only the dentals, /t/, /s/, /n/, /l/ and /r/, and partly /h/, and it does not occur after /i/ or in the word-initial consonant (Itkonen 1968:76). The nature of the palatalization is also different from the Russian palatalization, for example, in the regressive it is concentrated in the glide (transition) between the consonant and vowel, while in Karelian, where the Russian palatalization is obvi-

ous, the palatalization is more the quality of the consonant (Itkonen 1968:81).

### 2.2.3 Duration of consonants

Acoustic data makes it possible to measure the duration of consonants, as well as of vowels, in oscillograms and spectrograms. Nevertheless, there are difficulties in measuring the duration of [-voiced] plosives in word-initial and final positions, as the plosive articulation does not cause any audible sound and the only measurable duration of the plosives is the interval between the explosive burst and the next or following sound in the beginning and end of the word.

In Finnish where durational differences between sound segments are phonetically and phonologically important the duration of consonants has been also studied in detail.

Lehtonen (1970) and Laine (1979) are among those who have measured the durations of Finnish consonants. The absolute and intrinsic (relative) values of single consonants in words read by ten speakers' of standard Finnish in disyllabic word structures (CVCV, CVCVC, CVCVV) were measured by Lehtonen (Lehtonen 1970:71). All consonants were in the word-medial position.

TABLE 9 The absolute (ms) and intrinsic duration of Finnish single consonants in disyllabic nonsense words of structure CVCV, CVCVC, CVCVV (Lehtonen 1970:71)

| | p | t | k | s | h | m | n | l | r | j | v | d |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absolute duration | 106 | 99 | 104 | 93 | 80 | 73 | 59 | 51 | 52 | 90 | 62 | 55 |
| Intrinsic duration | 1,38 | 1,29 | 1,35 | 1,21 | 1,04 | 0,95 | 0,77 | 0,66 | 0,68 | 1,17 | 0,81 | 0,72 |

As Table 9 shows, the plosives [p t k] are the longest consonants in Finnish disyllabic words. The sibilant [s] is the next. The results of Laine also proved that these four consonants are the longest. In his results only /t/ and /k/ were in different order. The biggest durational differences appeared in /j/ and /v/. This, according to Laine, has to be due to the fact that the boundaries of these consonants and other sounds are difficult to fix because of the long transitions (Laine 1979:90).

These are average durations but in all positions of a word, word-initial, medial and final, or in different environments duration of the same consonant can differ as, for example, the adjacent vowel in VCV

position can affect the duration of consonants. The duration depends on the quality of the consonant itself like the manner of articulation or, particularly in Russian, palatalization. Apart from that, the word's rhythmic structure together with vowel duration might affect the duration of consonants. And finally, there can be durational differences between individual speakers even on segmental level.

Lehtonen has counted durational differences in speech of ten Finnish speakers, men and women (Lehtonen 1970:41-43). He noticed that there were differences in speech tempo between the speakers in such a way that women had a slightly quicker tempo of reading than men. While there was no other significant difference in duration of individual sound segments, the first syllable single (short) vowel was longer in the speech of female speakers. But on the basis of this data about Finnish language the only conclusion that can be drawn is that the tempo of speech and the duration of sounds do not correlate significantly with the sex of the speaker (Lehtonen 1970:42).

Where the influence of the adjacent vowel on the duration of a single consonant is concerned, [+round] vowels were found to have a lengthening effect on the duration of the bilabial plosive in Finnish (other positions were not checked) (Lehtonen 1970:85).

The word structure affects the duration of consonants in Finnish disyllables and there are durational differences between sound segments. Firstly, the initial consonant ($C_1$) in $C_1VC_2V$ and $C_1VVC_2V$ structures is durationally slightly longer on average preceding a long vowel, for example, [s] in the word *sama* (the same) is longer than in the word *saama* (participle got). Secondly, $C_2$ in the word-medial position is longer after a single vowel than after double vowel, in open as well in close syllables (Lehtonen 1970:106-107). Thirdly, the intervocalic single consonant does not vary after a single or double vowel when the following vowel is long in both cases, i.e. in word structures CVCVV, CVVCVV, CVCVVC and CVVCVVC, for example, *samaa*, *saamaa*, *samaan*, *saamaan* (Lehtonen 1970:108).

In the Finnish trisyllables with structure CVCVVCV, CVCVVCVV, CVVCVVCV and CVVCVVCVV there were no significant durational differences in the first three segments $C_1VC_2$ and $C_1VVC_2$, but $C_3$ was quite significantly longer before the last double vowel than before the single vowel, for example, *takaama* (guaranteed) and *takaamaa* (Lehtonen 1970:114).

The duration of consonants is not in the same way phonologically distinctive in Finnish as the vowel length, since the syllable boundary always falls between the components of a double consonant. The polyphonematic interpretation was already given by Trubetzkoy (Trubetzkoy 1969:161-162). In Finnish the double consonant in the word-medial posi-

tion, mostly on the boundary of the first and second syllable, occurs in an intervocalic position like, for example, *takka* (a fire place), *loppu* (an end) as well as following a sonorant, for example, *palkka* (salary), *pirtti* (a big farmhouse living-room) (Karlsson 1983:108-109) . In both cases the syllable boundary is seen to be between two equal consonants, such as *tak-ka*, *palk-ka*.

Since there is no opposition of short and long consonants in Russian in a similar sense as in Finnish, the durational differences in consonants do not play such an important role. Double consonants in Russian are rare. They appear in words of Russian origin on morpheme boundary like *поддeлка* [pʌdʲ:eɬkʌ] (not real), *ценный* [tsɛn:ɨj] (valuable). But more often double consonants are also in those cases pronounced like single, i.e. as long. Another origin of double consonants is two equal consonants inside the same morpheme in words of foreign origin as seen in *масса* ['mas:ʌ] (mass) and *террaса* [tɛ'ʀasʌ] (a terrace). In these words the pronunciation depends on the place of stress, i.e. after V [+stress] the consonant is pronounced as double, as the first example shows, but in other positions as single.

The duration of Russian consonants to some extent depends on the place of stress. Thus the average values of consonant duration in [+stress] syllables are longer than in [-stress] syllables (Zlatoustova 1981:17). According to Zlatoustova, the longest individual consonants are the affricates [ts] and [tʃʲ] which are the longest in different types of word structures, from disyllabic to polysyllabic, and the shortest are the liquids [ɬ], [lʲ], [r] and [rʲ] (Zlatoustova 1981:17, 21).

The palatoalveolar sibilant [ʃʲ:] is often considered as the longest Russian consonant which is also marked in transcription. The origin of [ʃʲ:] is a long affricate which at first in the old church Slavic, had sibilants on both sides, [ʃʲtʃʲ]. Until recently it remained an affricate in the Petersburg norm of pronunciation. Because of its origin it has always remained a long sound in the mind of a Russian.

In this study I have measured the duration of consonants in the Russian normative pronunciation as well as in the Russian pronunciation of Finns. My intention was to find out whether the Finnish interference appears in the pronunciation of consonants as well.

## 2.3 Phonetical structure of words

### 2.3.1 Syllable structure

Until now we have concentrated in segmental units on their own. Segmental units do not exist by themselves, however, they form parts of syllables. Anyhow, much of what we have said about the sound segments has meant that the segments are part of syllables. It is clear that the palatalization in Russian is a phenomenon which appears only on the syllable level, because the consonant by itself might not have any acoustic parameters of palatalization (Bondarko 1967:40). And palatalization alone is not the only phenomenon of such a nature.

It all depends on how one approaches the matter, but very often it happens that it is not possible to separate a sound segment in actual articulation, and as Ščerba states: "Всякий речевой поток естественно распадается не на отдельные звуки речи, а на слоги..." (Translation: No speech signal, naturally, divides into individual sound segments but into syllables...) (Ščerba 1983/II:29).

Syllable is here used as the basic unit in analysing phonetical processes (articulation) and it is used especially in prosody as stress and accent are dependent on syllables. A syllable can be defined articulatorily, acoustically and auditively (Wiik 1983:165-168). For example, Ščerba uses the articulatory definition, namely, that syllables are caused by strengthening, i.e. by muscular tension (Ščerba 1983/II:29).

Unfortunately, none of the methods give a straight answer to the question: What is a syllable? The syllable boundaries are difficult to find. The definition of a syllable and syllable boundaries is a universal problem which even today has not been solved satisfactorily (Cruttenden 1986, Laver 1994 ). The same applies to Russian syllables (Bondarko 1998). According to Karlsson, it is difficult to say what a syllable is, but it is easier to find out where its boundaries are (Karlsson 1983:137).

A syllable is described as the minimal pronunciation unit which cannot be divided further. It is the shortest part which can be separated while analysing the articulation movements during speech (Zinder 1979, Bondarko 1977, 1998, Matusevič 1976, Wiik 1983). A syllable can be described as the longest period cut off from a speech signal within which the phonemic combinations have limitations (Padučeva 1958:101).

Acoustic definitions of a syllable are based on acoustic intensity and loudness. The syllable boundaries are located at the lowest point of intensity (minimum), while the maximal point of intensity shows the nucleus of the syllable. But the intensity curves alone might not always give reliable knowledge about syllable boundaries (Wiik 1983:167).

The auditive definitions use sonority. Sonority itself depends on the shape of the vocal tract in such a way that the sounds which are produced while the vocal tract is more open have more sonority. In this case a syllable is the period, which remains between two points with minimal sonority (Wiik 1983:167).

It is a universal tendency to start a syllable with a consonant, which opens the upper part of the vocal tract for articulation, as well as to form syllables such way that the maximum sonority is in the middle (Karlsson 1983:135). This is based on the fact that in the beginning of a syllable the passage for the air in the place of articulation is comparatively small, so it starts from a consonant (Wiik 1983:166). This articulatory basics also leads to the acoustical description of a syllable.

Being a phonetic phenomenon a syllable plays an important role also in phonology. A syllable is such a unit without which the phonologically important prosodic phenomena cannot be described (Padučeva 1958:100). The phonological syllables form the phonological structure. As Laver states, the phonological syllables are helpful for organizing the rhythmic and prosodic facts at levels above the segment (Laver 1994:114).

Syllables are the main components of spoken words and, thus, of word structure. In most languages like, for example in Russian, syllable is always used as the basic phonetical or phonological unit. In these languages the syllabic nucleus consists of one phoneme. Nevertheless, in some languages where syllabic nucleus can have monophonematic or polyphonematic interpretation as for example in Finnish, *mora* can be used as the basic unit as Trubetzkoy suggests (Trubetzkoy 1969:173). That means that the syllabic nucleus can be 'long' and must be considered polyphonematic like in Finnish *kukkaa* (partitive of flower), where the morpheme boundary falls between the beginning and end of the syllable nucleus. Thus, Finnish can be seen a mora-counting language, while Russian is a syllable counting language. Anyhow, syllable as well as mora are both used in Finnish as a basic unit.

### 2.3.2 Syllable structure in Russian

In Russian a vowel is generally the syllable nucleus, i.e. vowels could be given a distinctive feature [+syllabic] and consonants [-syllabic]. But in some circumstances a consonant can form a syllable in spoken Russian. The tendency to open syllables in Russian is obvious. It also has a historical background adhering to 'the law of the open syllables' (закон открытого слога) in ancient Russian until the eleventh century (Ivanov 1983:77). So, for example, there is no difficulty in dividing a rhythmic structure (word) CVCVCVCV into four syllables. Even when there is more than one consonant between vowels the tendency is to start the syllable with

two, three, or even four consonants, for example, *вскрыть* [fskrɨtʲ] (to open).

The consonant clusters have historically a certain order, namely, 'the law of increasing sonority' (закон восходящей звучности) (Avanesov 1984, Ivanov 1983), and a vowel at the end of a syllable was a natural phenomenon having maximum sonority. Large and representative experimental data supports the fact that the tendency of forming open syllables remains in the modern Russian (Bondarko 1998:207).

Apart from the open syllables which end with a vowel in modern Russian, the syllables can be closed, like in most languages, i.e. ending with a consonant or maximum four consonants, for example, *черств* [tʃʲerstf] (stale), covered, i.e. starting with a consonant or maximum four consonants, and uncovered, i.e. starting with vowels. There are at least 10 types of syllables in Russian: V (8,5 %), VC (1,56 %), CV (54,34 %), CVC (14,06 %), CCV (13,62 %), CVCC (0,39 %), CCVC (3,51 %), CCCV (1,32 %) and CCVCC (0,62 %) (Bondarko 1998:212).

One traditional way to fix the syllable boundaries in Russian is to start from the beginning or the end of the word. The principle (used by Lomonosov) is that if the consonant cluster is generally possible in the beginning of a word, it has to be possible also in the beginning of a syllable, for example, *о-**мр**а-чать* [ʌ'mrʌtʃʲatʲ] (to darken), and as the consonant cluster *mr* can appear in the beginning of a word it can start a syllable (Bondarko 1977:127). Another way is to consider the growing sonority.

A very similar suggestion, though based on the position of stress, was given by Ščerba (Ščerba 1983/II:30). He understood a syllable as an impulse of muscular tension (мускульное напряжение) which changes according to the place of stress in the word. If the stress is on the first syllable in a word structure $C_1V_1C_2C_3V_2$, the second consonant $C_2$ belongs to the first syllable, for example *шап-ка* ['ʃap-kʌ] (a cap), while if the stress is on the second syllable, $C_2$ and $C_3$ belong to the second syllable *мо-сты* [mʌ-stɨ]. The same rule concerns longer words as well. One consonant between vowels in the middle of a word (VCV), also according to Ščerba, always belongs to the last syllable (Ščerba 1983/II:30).

Ščerba's suggestion was disproved by Bondarko in an acoustic experiment where coarticulation was used. According to her, $V_2$ as a sign of the fact that $C_2$ belongs to the first or second syllable does not depend on the stress (Bondarko 1977:130-132). When a syllable is taken as an articulation unit it means that the speech sounds, which form the syllable, are pronounced jointly. They influence each other (coarticulation) and cause changes in each other. This was acoustically proved with the help of labialization as a coarticulation (Bondarko 1977:123, Reč', artikuljacija i vosprijatie 1965:129). Nevertheless, the coarticulation depends on the or-

der of the components. In CV-syllables both the consonant and the vowel influence each other much more than in VC-syllables, where the sounds are more independent (Bondarko 1977:125). This fact was proved earlier and used as evidence to prove that the syllable boundary in Russian words really is situated between the vowel and consonant in VC combination (Bondarko 1967:36).

In the acoustic experiments it was also proved that the labial coarticulation of $V_1$ does not influence $C_2$ more than as if there was only one consonant between the vowels ($V_1CV_2$). It means that $C_2$ belongs to the second syllable in a $C_1V_1C_2C_3V_2$, $C_2$ -word (Bondarko 1977:133). Also the little influence of the following consonant on $V_1$ in $C_1V_1C_2C_3V_2$-words, where $C_2$ was a [+pal] consonant proved that $V_1$ and $C_2$ belong to different syllables, i.e. the syllable boundary lays between them (Bondarko 1977:136).

Thus, phonetically syllables in Russian start with consonants and end with vowels (Reč', artikuljacija i vosprijatie 1965, Bondarko 1977, Zinder 1979). Not only does it mean that most Russian syllables are open (V, CV, CCV) but it also means the influence between the preceding consonant and a vowel is stronger than the influence between a vowel and the following consonant. Koževnikov, Čistovič et al. have also proved that the morphological boundary does not influence the phonetical syllable boundary, as it has often been suggested, but even on the boundary of a preposition and a word, the last consonant of the preposition belongs to the first syllable of the word, as for example, *све/рну/л по/д а/рку* [sʲvʲɪ-rnu-ł pʌ-d *a*-rku] (turned under a bow) (Reč', artikuljacija i vosprijatie 1965:152).

On the other hand, Koževnikov, Čistovič et al. suggest that the basic syllable is CV; and that the more complex syllables like CCV, CCCV are complicated variants of the basic syllable (CV). On the other hand, the subjects in their experiments sometimes divided CCV-syllable into two CV+CV, but, on the other hand, the two consonants in the beginning of the syllable were very much joined together. If two consonants were both plosives, the explosion of the second consonant started on the territory of the first consonant. This is a rather common phenomenon in colloquial language (Reč', artikuljacija i vosprijatie 1965:133).

The situation at the end of a word with one or more consonants can be interpreted in two ways. This is normally a close syllable even in Russian. But there is another explanation to those given by Koževnikov, Čistovič et al.: A consonant or consonants at the end of a word can be considered as reduced syllables. It happens especially at the end of a phrase (Reč, artikuljatsija i vosprijatie 1965:225). This was also proved by an auditive test: the final consonants were separated from the preceding

vowels, but yet they were recognisable in 90% of the cases (Bondarko 1967:36).

The concept of a phonological syllable in Russian could be defined and separated from the phonetical syllable. A phonological syllable in a particular language means the allowed combinations of consonants and vowels as well as combinations of different consonants and different vowels within meaningful units, words or morphemes (Bondarko 1981:50, Laver 1994:114). The phonetic syllable in Russian differs from the phonological as it can join elements which do not belong to the same meaningful unit, for example, in *Кот убежал* [kot ubʲɪʒał] (The cat ran away) [tu] is one syllable (Bondarko 1981:52).

### 2.3.3 Syllable structure in Finnish

For a normal user of the Finnish language it is very simple to divide words into syllables. The difficulty arises only when there are combinations of vowels The Finnish syllable structure contains ten different types of syllables, but the optimal type is CV (Karlsson 1983:133,135). Among them there are all the four types which are known in Russian, open, close, covered and uncovered, for example, *i-lo* (joy), *ka-la* (a fish), *as-ki* (a box), *ras-kas* (heavy), *aa-mu* (morning), *saa-da* (to get), *saak-ka* (until), *urk-ki-a* (spy), *pilk-ka* (mockery).

Just as in Russian the syllable nucleus in Finnish is always a vowel. The original Finnish words never start with more than one consonant. The same applies to syllables. That is why the type of a syllable which starts with two consonants may be considered as marginal, although it is rather common in words of foreign origin, for example, ***kruunu*** (Karlsson 1982:133). Traditionally Finnish syllables are divided into short and long. The length of the syllable is not only due to the amount of vowels, namely, short (single) and long (double) vowels and diphthongs and this is the case with consonants as well. Long vowels and diphthongs always belong to the same syllable.

It is common to count the length of Finnish syllables in moras, so that syllables which contain one mora are short, and syllables which contain two or three moras are long. Syllables V and CV contain one mora, VC, CVC, VV and CVV - two moras, and syllables VVC, CVVC, VCC and CVCC contain three moras (Karlsson 1982:133). It is possible to divide CVCC into three moras, since the first one of the two last consonants is always a sonorant. The division of a syllable into moras can be done in the following way (Karlsson 1983:135):

| | BEGINNING | <NUCLEUS> | CONTINUATION OF NUCLEUS | >END |
|---|---|---|---|---|
| MORAS | 1. | | 2. | 3. |

The principle in Finnish is that the syllable nucleus represents the sonority maximum and the continuation has less sonority as in *sain* (I got).

In frequency the open syllables of CV-type are common even in Finnish. The amount of all open syllables is 58 % (Karlsson 1982:139). Many Finnish syllables consisting of two moras have a structure $C_1VVC_2$ and the following syllable starts with $C_2$.

## 2.4 Stress systems and rhythmic structure

### 2.4.1 Stress systems

In non-tonal languages independent words which consist of more than one syllable have one syllable which is more prominent than other syllables. A word stress means that one of the syllables of a word is distinguished with the help of different phonetical features. Sometimes more than one syllable is stressed, but even then, only one syllable in the word has the main stress, the primary stress, and the other stressed syllables have a secondary stress, or tertiary stress. It depends on the language concerned as to how prominent the syllable with the main stress is.

The stress belongs to a certain syllable of a word, but phonetically it can be defined by acoustic parameters which appear together with the vowel qualities in the syllable nucleus. Stress is an important prosodic factor in which the duration, pitch and loudness function. There are four or three acoustic parameters which help to define word stress. The phonetic manifestation of stress varies from language to language, with some exploiting all four parameters of pitch, loudness, duration and quality. The majority of languages with phonological stress seem to make use of only three parameters. Pitch, loudness and duration alone, without the manipulation of phonetic quality, are the triplet of phonetic parameters used by most languages that exploit stress as a phonological device (Laver 1994:512, Bondarko et al. 1991:111). Anyhow, even one of the acoustic parameters might be enough to recognize the stress (Čeremisina 1989:9).

Where Russian is concerned the most important parameters of the stressed syllable are the duration and the quality of the stressed vowel. To compare with German and English, apart from the duration of the stressed vowel, intensity is more important than in Russian. But intensity (loudness) is even more important in Finnish (Bondarko et al. 1991:112). Finnish is somewhat opposite to Russian as the duration of syllables in Finnish does not depend on the word stress, nor does the quality of sounds (vowels) depend on the stressed or unstressed position (Wiik

1965, Lehtonen 1970). The question arises as to how prominent the Finnish stress is compared with the stress of other languages, for example, Russian, for according to Zinder, the word stress in all languages changes the duration of sound segments (Zinder 1979:262).

Thus, in Russian the main parameter of stress is duration, i.e. the main difference between [+stress] and [-stress] syllables is duration. It has been proved in acoustic experiments that in a disyllabic word *мука* [muku], the prolonging of either of the vowels makes them perceived as [+stress], and accordingly the word gets different meanings: ['mukʌ] (torment) or [mu'k*a*] (flour). In more complicated experiments with the help of speech synthesis it has been proved that none of the other factors, loudness and melody, had as important a role in perception of Russian stress as duration (Bondarko 1998:219).

The stress can have two different functions: to indicate a new word and show the boundaries between words. The stressed syllable joins the word into one unit subordinating other syllables to itself and thus has a 'culminative function' (Trubetzkoy 1969:27, Zinder 1979:258). Stress can also be regarded as a phonological property of the syllable. The placement of stress on a particular syllable can change the meaning of the word. In this case the stress is phonological, but when it has no distinctive role it is phonetical (Laver 1994:511).

When the stress always falls on the same syllable it is called a *fixed stress* ('unmovable', in Russian неподвижное, постоянное). Languages like Finnish and Checz have a fixed stress always on the first syllable while in languages like Polish, the stress is always on the penultimate syllable. The latter can be also called a *'bound'* (связанное) stress. In other languages the word stress can be located in different syllables. Apart from being nonfixed, i.e. that the stress can fall on any syllable of the word, the stress can be *'free'* (свободное) or *'movable'* (подвижное). The free stress which is typical in Russian, German and English can fall on any syllable from the first to the last as in

*вода́* [vʌ'd*a*] (water), *да́ча* ['d*a*tʃʲʌ] (dacha),
*поду́мать* [pʌ'dumətʲ] (to think), *написа́ть* [nəpʲɪ'satʲ] (to write).

The movable stress means that the place of free stress depends on the morphological structure of the word, it can be considered as a feature of the morpheme and can be a member of accent paradigms in morphological word changing (Bondarko 1991:113). In this case the stress has a *phonologically distinctive role* like in Russian word forms where the genitive singular has the same ending as the nominative plural in several words:

*бе́рега* ['bʲerʲəgʌ] (a shor, gen. sg.) - *берега́* [bʲərʲɪ'g*a*] (shors),
*до́ма* ['domʌ] (a house, gen. sg.) - *дома́* [dʌ'm*a*] ('houses'),

*руки* ['rukʲɪ] (hands) - *руки* [ru'kʲi] (a hand, genitive sg.).

The words can also have completely different meanings: *атлас* ['atɬəs] (a collection of maps) - [ʌ'tɬas] (shine of silk). This type of a word stress can be also called a lexical stress (Laver 1994:511).

As mentioned above, the stress in Russian can be on any syllable, it can remain on the same syllable, or it can move from one syllable to another in different grammatical forms of the same word, and even a change from an appellative word to the preposition is sometimes possible. But the place of stress in a particular word or wordform has to be in one certain place. An exception can be found only in a few words where the literary norm allows the place of stress to be in different syllables, for example, in the word *налил* (pored) the stress can fall on any of the two syllables. But the dialectical forms often differ from the literary forms where the place of stress is concerned.

The role of stress can be different depending on the language. Anyhow, according to Zinder the distinctive role of word stress is not universally very great, firstly, because it can appear only in languages with unfixed word stress, and they do not include many minimal pairs of this kind, and, secondly, the constitutive function of stress for a word is present everywhere (Zinder 1979:260). The phonological stress in Russian is not an organized system, but more or less contains mostly accidental homonyms like, for example, *пили* [pʲi'lʲɪ] (drank, pl.) and *пили* [pʲɪ'lʲi] (saw, imperative) (Bondarko 1998:215).

In the Russian language the culminative function of word stress is very clear as any vowel in an unstressed syllable is dependent on the place of the stress. Since the Russian stress is nonfixed and free it cannot express the word boundaries, and its function is thus to show clearly the apellative words in speech process (Čeremisina 1989:63), while in other languages like, for example, Finnish and Checz, where the word stress is located always on the same syllable, either on the first or on the last, the stress can be seen as a sign of a word boundary (Trubetskoy 1969:277, Zinder 1979:249-250).

It has been noticed that the word stress in Russian tends to fall closer to the stem of the word and closer to the center of the word, but this is a very general rule and has many exceptions (Bondarko 1998:217). There are no exact rules, except a few grammatical ones, which could give complete guidance to a foreign learner of Russian in finding the place of stress, which incidentally is one of the most difficult aspects in Russian. Table 10 shows how the stress falls in three different types of language usage (Bondarko 1998:217).

TABLE 10 The place of stress in 2-4 syllabic words (N=100) in a transcribed text (Bondarko 1998:217)

| | 1st syllable | 2nd syllable | 3rd syllable | 4th syllable |
|---|---|---|---|---|
| Disyllabic words | 46 | 54 | | |
| Trisyllabic words | 21 | 52 | 27 | |
| Quadrisyllabic words | 5 | 38 | 48 | 9 |

Bondarko bases the calculation on a spoken monologue as well as a dialogue. In some details there are differences, but the main principle remains the same, i.e. in trisyllables and quadrisyllables which include prefixes and suffixes, the stress tends to remain on the stem of the word.

The phonetic stress in Finnish does not appear in the durational difference between [+stress] and [-stress] vowels as both of them can be long as well as short. The sound duration in Finnish is quite a complicated system as the duration of vowels depends on consonants, as well as the duration of other vowels.

Where Russian learners of Finnish are concerned, there are three principles about the vowel duration/length in Finnish which, in a way, disturb the short - long opposition (Wiik 1965, Wiik & Lehiste 1968 and Lehtonen 1969, 1970) and, therefore, can cause confusion about the Finnish stress. Such instances are:

1) /CC/ is shorter after /VV/ than /V/;
2) the single vowel in the second syllable is longer after a short first syllable, and
3) the double vowel of the second syllable lengthens the preceding single consonant more than a single vowel (Karlsson 1983:151).

The phonetic nature of Finnish stress is in any case quite unclear. There is no clear contrast between the [+stress] and [-stress] syllables. As mentioned earlier, the word stress in Finnish is a sign of word boundary, but it is not a singular factor in this function, since there are other phonetical signs to show the word boundary (Karlsson 1983:165). One of them is the glottal stop which appears when the word starts with a vowel (Itkonen 1964, Lehtonen & Koponen 1977). Sometimes the word boundary in Finnish between two vowels, apart from the glottal stop, is obvious because of the disturbance of vowel harmony like *työ alkaa* [tyœ ʔalk*aa*] (the work starts) (Karlsson 1983:165). Sometimes on the word boundary the word-final consonant of the preceding word and the word-initial consonant of the word itself join together as a consonant cluster which is different from the clusters generally accepted in Finnish words, for example, *lr, ln, rl, np, tl* etc. And apart from that, the final lengthening of the conso-

nant in the preceding word also works as a boundary signal (Karlsson 1983:1966).

### 2.4.2 Phonetical words in Russian

In Russian the concept of a word is different whether we mean a lexical word or a word in the phonetical meaning as a pronunciation unit, the so called Phonetical Word (PW). Those lexical words which by themselves have a full meaning, for example, *передача* [pʲərʲɪ'dɑtʃʲʌ] (a radio or TV programme) have one primary stressed syllable, but there are small one-syllable words without stress which are joined to lexical words to add the grammatical meaning like prepositions *на полу* [nəpʌ'łu], or to change the lexical meaning like the negative particles *не надо* [nʲɪ'nɑdʌ]. So the lexical words with full a meaning form the PW either by themselves or together with the prepositions and particles, the joining factor being the word stress.

The structure of PW affects pronunciation of vowels which have a three-levelled hierarchical system inside the phonetical word: V [+stress], V [-stress1] and V [-stress2]. V [+stress] can occupy any position in the phonetical word. The place of V [-stress1] and V [-stress2] depends on the stressed syllable. Table 11 shows the possible models and structures in disyllabic and trisyllabic words.

TABLE 11 The rhythmic structure in disyllabic and trisyllabic phonetic words in Russian with examples of vowel /a/ in positions C [-pal] + V

| Model | Rhythmic structure | Examples |
|---|---|---|
| '— — | $C_1V_1$[+stress]$C_2V_2$[-stress2]$C_3$<br>$C_1V_1$[+stress]$C_2V_2$[-stress1] | *дамам* ['dɑməm]<br>*дама* ['dɑmʌ] |
| —'— | $C_1V_1$[-stress1]$C_2V_2$[+stress]<br>$C_1V_1$[-stress1]$C_2V_2$[+stress]$C_3$ | *дома* [dʌ'mɑ]<br>*домам* [dʌ'mɑm] |
| '— — — | $C_1V_1$[+stress]$C_2V_2$[-stress2]$C_3V_3$[-stress2]$C_4$<br>$C_1V_1$[+stress]$C_2V_2$[-stress2]$C_3V_3$[stress1] | *радовать* ['rɑdəvətʲ]<br>*занято* ['zɑnʲətʌ] |
| — '— — | $C_1V_1$[-stress1]$C_2V_2$[+stress]$C_3V_3$[-stress2]$C_4$<br>$C_1V_1$[-stress1]$C_2V_2$[+stress]$C_3V_3$[-stress1] | *на память*[nʌ'pɑmʲətʲ]<br>*напала* [nʌ'pałʌ] |
| — — '— | $C_1V_1$[-stress2]$C_2V_2$[-stress1]$C_3V_3$[+stress]$C_4$<br>$V_1$[-stress1]$C_2V_2$[-stress1]$C_3V_3$[+stress] | *городам* [gərʌ'dɑm]<br>*города* [gərʌ'dɑ] |

The rhythmic structures according to different models in Table 11 give a very general picture about Russian disyllabic and trisyllabic words. It does not, however, give an idea about the different positions where CV and C$^{j}$V combinations are concerned in different stress positions.

As the table shows V [-stress1] can be in the first syllable preceding stress, it can occupy the word-initial position if the word starts with a vowel or the word-final position if the word ends with a vowel. In the two last positions V [-stress1] competes with V [-stress2] which generally appears in the other syllables preceding the stress besides the first and in any syllable after stress.

Vowel /a/ has all the three stages, [*a*] (CV) and [a] (C$^{j}$V) in the [+stress] position, [ʌ] in the [-stress1] position, [ə] (CV) and [$^{j}$ə] (C$^{j}$V) in the [-stress2] position, while /i/ which has two allophones in the [+stress] position, [i] (C$^{j}$V) and [ɨ] (CV), has the same allophones in the position [-stress1] and [-stress2], [ɨ] and [ɪ].

In this basic concept, phonetic words in Russian appear isolated. In this context the rhythmic structure can change in such a way that the sentence stress falling on a word affects the [+stress] syllable and the vowel in it, as well as in fast speech reduction of V [-stress] can be stronger etc. Anyway, this model of structures in a phonetic word as a basis has been maintained in this study.

### 2.4.3 Rhythmic structure and stress in Russian and Finnish

The word is a central independent unit in languages both as in grammatical and lexical as well as in phonetical and phonological sense. The words consist of segments which are phonetically closely combined in syllables. The rhythmical (accent) models of words are formed of the characteristics of syllables and the place of stress. The word stress is one of the joining elements between syllables, the other joining element being harmony of vowels in some languages (Bondarko el al. 1991:111).

The length of the rhythmic structures can vary, but both Russian and Finnish have, on one hand, very short words, consisting of one syllable, and on the other hand, very long words, consisting even of eight or nine syllables. Anyway, within the limits of this study a greater part is concentrated only on disyllables and trisyllables although quadrisyllables are not completely ignored.

#### 2.4.3.1 Rhythmic structure in Russian

Every Russian appellative word has a stress, for example, *самовар* [səmʌ'v*a*r], *читаю* [tʃ'ɪ't*a*jʉ], плохо [płóxʌ]. Short, normally monosyllabic non-appellative words, like prepositions or particles form a phonetical

word with the words they modify, for example, *на полу* [nəpʌ'ɬu] (on the floor), *не знаю* [nʲɪzn*a*jʉ] (I don't know). The stress is a distinguishing mark of an appellative word as a whole (GR I 1982:90).

The place of the word stress in Russian is not fixed. It can fall in principal on any syllable of a word, from the first to the last. Apart from that the place of stress can move from one syllable to another in different grammatical forms of a word, i.e. it has a grammatical distinctive function in some words like, for example, *дома* ['domʌ] (at home, genitive of a house) - *дома* [dʌ'm*a*] (houses), i.e. the stress characteristics in Russian are dependent on the grammatical structure (Fedjanina 1982:24). Most of the words in which the stress shifts in different morphological forms are disyllabic words. In longer words the change of stress is possible, but it does not happen as frequently. That is why it is not necessary to make special groups for them.

Word stress represents the characteristics of rhythmic structure of a word. The word stress never appears by itself, for when a word is pronounced isolated, it is by itself a rhythmic unit, like a phrase. The stage of expression of the word stress depends on the position in a sentence or phrase, being most distinctive in a strong phrase position, i.e. where the word stress is at the same time a sentence stress, for example, *Вот мой* ***брат*** [vot moj "br*a*t] (He is my brother). The word stress is weaker in the beginning of a phrase like, for example, *Мой* ***брат*** *никогда не опаздывает* [moj 'br*a*t nʲɪkʌ'gd*a* nʲɪʌ'p*a*zdɪvəjət] (My brother is never late). The word stress is very weak (even disappears) in cases like, for example, *Ты, брат, не сердись* [tɨ br*a*t nʲɪsʲɪr"dʲɪsʲ. Experiments where Russian native subjects were listening to words separated from the context proved that if a word was in a weak phrase position, i.e. the phrase stress did not fall on it, the place of stress was found correctly only in 60-40 % of the cases. That means that such words like *дама* ['d*a*mʌ] (a lady) and *дома* [dʌ'm*a*] (houses), *пили* ['pʲilʲɪ] (they drank) and *пили* [pʲɪ'lʲi] (imperative of saw) were not differentiated from each other (Bondarko 1981, Švetozarova 1982).

Generally a word has one stressed syllable only, but in some cases there are two [+stress] syllables of which one has the primary stress and the other one a weaker secondary stress. The words which have two stresses are mostly compound words, but some of them consist of a stem and a prefix. The principle is that if there are the two stresses on a word, the secondary stress is nearer to the beginning of the word and the main stress is more towards the end, for example, *дàльневостóчный* (far-eastern), *самолётостроéние* (aeroplane building), *кòе-ктó* (somebody) (RG 1982:91).

Table 12 shows the rhythmic models of disyllables and trisyllables. As it is seen from the transcription, the phonetical position of the last vowel (/a/) changes in a close syllable vís a vís syllable.

TABLE 12 The rhythmic models of Russian disyllabic and trisyllabic words (— syllable, ' stress)

| Model | Examples |
|---|---|
| '— — | *дама* ['dɑmʌ] (a lady), *дамам* ['damәm] (to the ladies) |
| — '— | *дома* [dʌ'mɑ] (houses) |
| '— — — | *занята* [zanʲәtʌ], *лампочкам* ['ɬɑmpәtʃʲkәm] |
| —'— — | *картина* [kʌr'tʲinʌ] (a picture), *картинам* [kʌr'tʲinәm] (dative of a picture) |
| — — '— | *города* [gәrʌ'dɑ] (towns) |

In Russian rhythmic structure the changing parameter is the durational ratio between [+stress] and [-stress] vowels (Zlatoustova 1981b:106). The vowels are the only segments whose duration changes within a word. And the durational changes of vowels change the rhythmic structure.

### 2.4.3.2 Rhythmic structure and stress in Finnish

The Finnish words consist of primary-stressed, secondary-stressed and unstressed syllables. Tertiary-stressed [1] syllables in Finnish could be the same as unstressed. The place of the primary stress in Finnish is fixed, i.e. it falls on the first syllable of each word. Thus, it does not give any variation in the rhythm.

The secondary stress is a phenomenon of long words. The place of the secondary stress in Finnish does not fall as regularly on a certain syllable as the main stress and its place can be used to differentiate meanings, albeit marginally (Wiik 1981:110). Basically the place of the secondary stress is on the third, fifth etc., i.e. on every second syllable. But even if this is not the case, it can often be predicted, i.e. its place is mostly automatic, when one knows, whether the word is single or compound, as well as the number and structure of syllables. Depending on the word structure, the secondary stress can fall on the fourth syllable instead of the third, and after that on every second syllable but not on the last (Karlsson 1982:150). Anyhow the problem of secondary stress does not concern the data in this study as there is no secondary stress in disyllabic and trisyllabic words.

[1] Tertiary stress is used, for example, by Wiik (1965).

There is no strong contrast between primary-stressed, secondary-stressed and other syllables in Finnish. There are also some Finnish words (conjunctions, adverbs, personal pronouns) which are left without the primary stress in a context, for example, *ja* (and), *jos* (if), *kun* (when), *kuin* (than), *jo* (already), *nyt* (now), *hän* (he or she), *ne* (those), *se* (it). Most of them are monosyllabic (Karlsson 1983:150).

Compared with the Russian system when the basis of the main stress is taken into account, the Finnish rhythmic structure is simple. The disyllabic and trisyllabic words have one model each. But if we add all the possible variations of long and short vowels the system is more complicated than in Russian. A Russian speaker on hearing the following words would be confused as to the location or position of the stress. For him it would be logical to associate a stress in every long vowel.

TABLE 13 The Rhythmic models of Finnish disyllabic and trisyllabic words containing single consonants (— syllable, ' stress)

| Structure | Model | Examples |
|---|---|---|
| CVCV(C) | '— — | *sata* (hundred) |
| CVVCV(C) | '—— — | *saada* (to get) |
| CVCVV(C) | '— —— | *sataa* (to rain) |
| CVVCVV(C) | '—— —— | *saadaan* (will be got) |
| CVCVCV(C) | '— — — | *satama* (a harbour) |
| CVVCVCV(C) | '—— — — | *saatava* (to be got) |
| CVVCVVCV(C) | '—— —— — | *paalaama* (piled by someone) |
| CVVCVVCVV(C) | '—— —— —— | *paalaamaa* (partitive of to be piled) |
| CVCVVCV(C) | '— —— — | *salaava* (hiding something) |
| CVCVVCVV(C) | '— —— —— | *salaamaa* (hidden by someone) |
| CVCVCVV(C) | '— — —— | *salamaa* (partitive of lightning) |
| CVVCVCVV | '—— — —— | *saatavaa* (something to be got) |

When comparing the rhythmic models of Finnish with the Russian, the important differences are seen in the place and nature of stress. As mentioned earlier, in Finnish the place of stress is a sign of a new start of a word or a rhythmic unit. According to Wiik (1965:128-129), it is not only the primary stress in Finnish words which signifies a start but a secondary stress (or tertiary stress) does that as well. The stress unit can formate between the two stresses, i.e. between the two primary stressed syllables or between two secondary-stressed syllables.

The nature of stress is important. As has been shown, the duration of vowels in Russian is an important parameter of stress, i.e. V [+stress] is

longer than V [-stress]. The vowels V [+stress] and V [-stress] could be compared with the Finnish long and short vowels. A thorough comparison of the rhythmic patterns should include the consonantal structure of the syllables as well.

### 2.4.4 Role of /a/ and /i/ in the phonetical systems of Russian and Finnish

This study is focussed on the examination of the word structures of 2-4 syllabled words with the basic syllable structure CV, where the word-final syllable can be open, CV, or closed CVC. Within this frame work of word and syllable structures, Russian vowel phonemes /a/ and /i/, their duration and quality in different stress positions and different environments are the main interest of this study. They serve as the basic material of the contrastive study of Russian and Finnish.

For this purpose it was deemed reasonable to choose the two vowel phonemes /a/ and /i/ as a target of investigation for three reasons. Firstly, these two vowel phonemes are the most frequent vowels representing more than half of the Russian vowel system in speech. In any calculation, i.e. counted in texts, in different morphemes, stems as well as in affixes, the functional activity of /a/ is more than that of any other vowel in Russian, and /i/ occupies the second place (Bondarko 1998:29-30). Secondly, /a/ and /i/ with all their allophones give a vast picture of the Russian vowel system as a whole in CV syllable structure. Thirdly, the phoneme /a/ with its allophones gives a complete picture, more than any other vowel in Russian, about the realization of [-pal]/[+pal] opposition, and /i/ adds to the necessary information about this opposition.

Furthermore, the vowel phoneme /a/ gives the maximal variations in its allophones as well. Apart from the [-stress1] and [-stress2] allophones the coarticulations of the surrounding consonants, especially the palatal coarticulation of C [+pal] and labial coarticulation of C [+lab] are clearly seen in its spectral analysis. As the purpose of this research is also to establish the Finnish interference in the pronunciation of the Finnish subjects, the $F_2$-pattern of /a/ can show the lack of palatalization of the preceding or following consonant. Apart from the palatalization, the labial coarticulation of the adjacent consonant can be seen in /a/.

The vowel phoneme /i/[2] is in opposition with /a/ only in [+stress] position, i.e. its [-stress1] allophones [ɨ] and [ɪ] appear instead of

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[2] Phoneme /i/ is one of five vowel phonemes according to the Moscow phonological school, i.e. it includes both [ɨ] and [i].

/a/ as well. The vowels [ɨ] and [ɪ] have a certain interest from the point of view of the Finnish interference in Russian.

Where the duration of vowels is concerned, /a/ [+stress] is the longest Russian vowel, as [+open] vowels are generally longer than others (Zinder 1979:186-187). On the other hand, the strong reduction in position V [-stress2] appears in its allophones [ə] and [ⁱə], and the weaker reduction in the allophone [ʌ] in position C [-pal] + V. In position C [+pal] + V [-stress1] the opposition between /a/ and /i/ does not exist, and the vowel pronounced in the above mentioned position is [ɪ] as in the case of *пять* [pʲɪ'tʲi]. Thus, the phoneme /a/ makes it possible to analyze sound duration in different positions of the word structure. Apart from that, its duration can be compared with the duration of /i/ and its allophones.

In Finnish single /a/ is one of the longest vowels, while /i/ is one of the shortest (Wiik 1965, Lehtonen 1970, Laine 1979a). The order of vowels according to their duration in Finnish changes in the view of these authors. As has been mentioned above, both of these vowels in Finnish can be single or double. The quality of the single and double vowels does not differ significantly, as one can see from the formant values of the single and double vowels in Table 14.

TABLE 14 The formant values of /aa/- /a/ and /ii/ - /i/ in Finnish according to 1. Wiik (1965:58-60) and 2. Iivonen (1993:34)

| | /aa/ | | /a/ | | /ii/ | | /i/ | |
|---|---|---|---|---|---|---|---|---|
| | 1. | 2. | 1. | 2. | 1. | 2. | 1. | 2. |
| $F_1$ | 720 | 676 | 710 | 657 | 275 | 294 | 340 | 300 |
| $F_2$ | 1240 | 1106 | 1345 | 1190 | 2495 | 2380 | 2355 | 2261 |
| $F_3$ | 2455 | 2761 | 2505 | 2789 | 3200 | 3112 | 2789 | 3026 |

As is seen in Table 14, in the view of the above mentioned authors, $F_2$ of the single /a/ is higher than $F_2$ of the double vowel. And $F_1$ of the single /i/ is higher than $F_1$ of the double /ii/ and $F_2$ of the double /ii/ is higher than $F_2$ of the single /i/.

Table 15 shows the formant values of the Russian vowels given by Bolla (Bolla 1981). The comparison of Tables 14 and 15 shows that in Finnish the changes of $F_1$ values between the long and short /a/ as well as /i/ are very minimal, except for /i/ - /ii/ in the results of Wiik. Instead, the differences in $F_2$ values were bigger in Finnish. In Russian the difference in $F_1$ between [a] and [ʌ] was greater than the difference between the i-vowels, while between [a] and [ʌ] $F_2$ values were very similar and in [+stress] [ɨ] and [i] the values were 155 - 270 Hz higher than in the [-stress] vowels.

TABLE 15 The $F_1$, $F_2$ and $F_3$ values (Hz) of Russian vowels [ɑ] - [ʌ], [i] - [ɪ], [i] - [ɪ]. There is also a duration distinction between [+stress] and [-stress] pairs (Bolla 1981: 63, 66-67)

| | [ɑ] | [ʌ] | [i] | [ɪ] | [i] | [ɪ] |
|---|---|---|---|---|---|---|
| $F_1$ | 755 | 660 | 285 | 315 | 290 | 310 |
| $F_2$ | 1360 | 1370 | 1655 | 1500 | 2190 | 1825 |
| $F_3$ | 2500 | 2430 | 2465 | 2350 | 2865 | 2335 |

As we have seen by now even comparing only two languages, Russian and Finnish, the duration of sound segments, vowels as well as consonants, is a universal feature. Duration is used in the phonetical system of both languges but for different purposes. Using durational differences is not limited only to Finnish and Russian but it exists in every language in one way or another. Nevertheless, the usage of the durational differences of vowels and consonants in a particular language is a special feature of the language concerned. Thus, in Russian, duration is a parameter of word stress, while in Finnish, duration is a permanent feature of vowels and consonants.

Another universal feature which concerns all languages is joining a word phonetically as one complete unit, but the way of doing it in a particular language is a specific feature of every language. In Russian it is done with the help of stress in such a way that the location of the [+stress] syllable with a longer duration of vowel is free and movable, while other syllables with different types of reduced vowels have a certain hierarchy. In Finnish, on the contrary, the stress, a sign of word boundary, always falls on the first syllable. Apart from that, another phonetical special feature of distinguishing words in Finnish is the vowel harmony.

From all this follows that Russians who study Finnish or Finns who study Russian are bound to have difficulties due to the negative transfer of their mother tongue. But on the other hand, the universal nature of many features gives a good foundation in the second language acquisition.

# 3 PHONETICS IN THE FOREIGN LANGUAGE LEARNING

## 3.1 Interference

When using a second or a third language one cannot prevent the influence of the native language on the target language. In this research the first language is Finnish while the target language is Russian. The languages can be said to be in contact when they are used by the same person. In the case of a person using two different languages he/she is called bilingual and the practice can be called bilingualism. Although the terms bilingual and bilingualism are used in a larger meaning it is not always correct as many people nowadays, especially in a small country like Finland, speak more than two languages. Nevertheless, it is the native language whose structure and phonetical system mostly affect the foreign language. In a larger context this phenomenon is called *transfer*. It can be positive or negative. Many of the mistakes in foreign language pronunciation can be considered as a result of the negative transfer which can be called *interference*.

Weinreich was one of the first scientists who brought up in the linguistic circles the question about interference in foreign language learning in the 1950s. According to Weinreich, 'the term interference implies the rearrangement of patterns that result from the introduction of foreign elements into the more highly structured domains of language, such as the bulk of phonemic system, a large part of the morphology and syntax, and some areas of the vocabulary' (Weinreich 1974:1).

Later in conjunction with studies about children learning a second language, the so called interlanguage phonology also became the object of study among the other aspects of language (Ioup & Weinberger 1987).

When a Finn communicates in Russian with a native Russian the native speaker notices in his or her speech mistakes in pronunciation, which can be generally called a Finnish accent in Russian, apart from the possible grammatical and lexical mistakes. The pronunciation mistakes consist of mistakes in the segmental level as well as in the prosodic level. In the segmental level the mistakes might appear in the wrong pronunciation of a particular sound segment like, for example, [x] as [h], or of a whole class like the [+pal] or [+voiced] consonants and pronouncing dental consonants with apical articulation instead of dorsal (Ljubimova 1988, Mäkilä&de Silva 1996, de Silva 1997). The mistakes in pronunciation of the target language can be divided into phonological, i.e. they disturb the differentiation on the phonemic level and phonetical mistakes which appear in pronunciation of a particular sound which is incorrect but which does not cause misunderstanding in the phonological level.

It is unfortunate that the learner of Russian, irrespective of the effort he or she makes, cannot get rid of the mistakes in pronounciation without the help of proper teaching.

### 3.1.1 Interference on phonemic level

The phonetic mistakes appearing in the different pronunciation of a particular allophone might only give a personal feature to the pronunciation of the subject, but do not lead to misunderstanding the person concerned. Weinreich calls the interference in speech reception and pronunciation (mispronounced sounds) phonic interference. The real 'interference arises when a bilingual identifies a phoneme of the secondary system with one in the primary system and, in reproducing it, subjects it to the phonetic rules of the primary language' (Weinreich 1974:14).

According to Weinreich there are four types of phonetic interference (Weinreich 1974:18-19):

1) 'Under-differentiation of phonemes' which occurs when two sounds of the secondary system whose counterparts are not distinguished in the primary system are confused;
2) 'Over-differentiation of phonemes' which involves the imposition of phonemic distinction from the primary system on the sounds of the secondary system, where they are not required;
3) 'Reinterpretation of distinctions' which occurs when the bilingual distinguishes phonemes of the secondary system by features which in that system are merely concomitant or redundant, but which are relevant in his primary system;

4) 'Phone substitution' which applies to phonemes that are identically defined in two languages but whose normal pronunciation differs".

Where Russian and Finnish are concerned with their completely different phonogical systems, the under-differentiation of phonemes in both [-voiced]/[+voiced] and [-pal]/[+pal] opposition is common for Finns. Typical to the palatalization opposition in Russian is that it has different phonetic correlates in different cases. So in some consonants, for example, between the labial pairs [p $p^j$], [b $b^j$], [f $f^j$], [v $v^j$], [m $m^j$], the phonetical differences are not very prominent, compared with the dental pairs [t $t^j$], [d $d^j$], [ɬ $l^j$], [r $r^j$] etc. This can also lead to a reinterpretation of distinction in the pronunciation of Finns where the i-glide of vowels after C [+pal] in Russian as [j], i.e. $C^jV$ > CjV, is concerned.

A similar case for Russians is the under-estimation of the short/long opposition. The over-differentiation in Russian from the Finnish point of view is to use the short/long opposition in the Russian vowel hierarchy, and from the Russian point of view, the palatalization of consonants in Finnish after [+front] vowels. The pronunciation of dental consonants in Russian by Finns with apical articulation serves as an example of the phone substitution, and vis a vis, the Finnish apicals with dental dorsal articulation by Russians.

Interference is always due to differences in phonetical and phonological systems. According to Wiik there are four types of differences in sound systems (Wiik 1965:15-16):

1) Physical differences: i.e., a physical sound or group of sounds occurs in one language but not in the other.
2) Relational differences: i.e., two physically similar sounds exist in both the NL and the TL, but the sounds are grouped differently into phonemes.
3) Distributional differences: i.e. similar sounds or phonemes occur in both languages, but in different environments.
4) Segmental differences: i.e. phonetically similar stretches of speech occur in both languages, but the stretches are differently divided into phonemic segments.

There are many phonetical and phonological differences between the two languages which cause interference (Baranovskaja 1982, de Silva 1987). All the above mentioned differences have their impact on the Russian pronunciation of Finns or, in contrast, in the Finnish pronunciation of Russians. The existence of a group of palatoalveolar or soft (palatalized) consonants in Russian is a physical difference in Russian for Finnish speaking people. We can point a few examples of the physical, relational, distributional and segmental differences.

Different allophones of /a/ after [-pal] and [+pal] consonants could be a relational difference as two different vowel phonemes in Finnish correspond to one phoneme in Russian: /a/ which corresponds to the Russian [*а*] after C [-pal], and /æ/ which corresponds to the Russian [а] after C [+pal], especially in $C^jVC^j$ context as in *пять* [$p^jat^j$] (five). This is a relational difference between Russian and Finnish.

The relational differences appear in consonant systems as well. For example, the [+pal] allophone [$k^j$] of the Finnish velar stop /k/, represents a different phoneme in Russian. A similar example in Finnish for a Russian learner is the palatal consonant /ŋ/ which in words like *ongelma* (a problem) is often pronounced by Russians [ng].

The distribution of consonant phonemes in Finnish is more limited than in Russian. The consonant clusters are less, as only a few combinations are possible and they have limitations in original Finnish words. Namely, they cannot stand in the word-final position and not all of them can appear in the word-initial position, so they are common only in the word-medial position (Hakulinen 1964, Karlsson 1982). In Russian, in its turn, consonant clusters up to five different consonants are very common. Thus, when speaking Russian, Finns have to learn many combinations of consonants which are not possible in their native tongue, such as *взгляд* [vzgl$^j$at] (view) (four consonants in word-initial position), *пью* [p$^j$ju] ([-dental]+semivowel) (I drink), *гнать* [gnɑt$^j$] (a plosive and a nasal) (to chase).

Also similar mistakes in the pronunciation of a foreigner caused by the Russian orthography are very common. They include the so called "okanje" and "ekanje" which appear in this instance in the pronunciation of the Estonians (as well as the Finns). The orthography can also cause mistakes such as the lack of assimilation in the consonant clusters. Sometimes mistakes can be also caused by the transliteration of the Cyrillic alphabet (Gor 1998, de Silva 1997, Varjušenkova & Ljubimova 1986).

### 3.1.2 Interference on prosodic level

The quantity of Finnish vowels and consonants forms a segmental difference which Russians do not differentiate. As we know, vowel duration in Russian is connected with [+stress]/[-stress] opposition. Double consonants which are common in Finnish are rare in Russian. They appear only in the word-medial position inside a morpheme as in *касса* [kɑ's:ʌ] (a cash-box), but more often on the morpheme boundary, for example, *рассердил* [rə's$^j$:ir'di'ɬ] (made angry). On very few occasions double consonants play a distinctive role vís a vís the single as in *тона* ['tonʌ] (genitive of tone) - *тонна* ['ton:ʌ] (tone), *подать* [pʌ'dat$^j$] (to give) - *под-*

*дать* [pʌ'd:*a*tʲ] (to add). Finns can hear even smallest differences in duration.

The Finnish short/long opposition also affects the pronunciation of Russian by Finns, but this question has not been studied until now. That is why the purpose of this research is to probe the kind of interference the Finnish quantity system causes in the Russian pronunciation of Finns.

Also on the prosodic level differences in orthography cause mistakes in pronunciation (Wiik 1965:30). The writing systems of Finnish as well as Russian both have a phonetic background albeit differently. Although Russian has very clear rules regarding the pronunciation of a written word, the correct pronunciation depends on the place of stress in the word. The wrong place of stress and the wrong pronunciation of the unstressed vowels easily cause interference in the pronunciation of Russian, i.e. they destroy the rhythmical structure of the words (IZS 1987:24).

The misrepresentations of the qualities of segmental units together with the changes of prosodic features, for instance, the durational relationship between the vowels and consonants, the way of tone movements in the stressed syllables and in the phrase as a whole create an impression of a heavy foreign accent (IZS 1987:24).

The interference of prosodic features of the mother tongue have not been thoroughly studied, even where Russian and the minor languages of the former Soviet Union are concerned. Nevertheless, a few features affecting the word prosody are known. The rhythmical organization of Russian word is often disturbed in the speech of foreigners, including Finns, because of the following reasons:

1) the wrong definition of the place of stress,
2) the wrong relationship in duration of stressed and unstressed vowels, and
3) the wrong realization of the quality changes in unstressed vowels (IZS 1987:260).

A few prosodic interference features concerning Estonian are interesting in this instance. Firstly, the special qualities of rhythmical organization of Estonian words, transferred to Russian language, break the rhythm of the Russian phrase: many subjects who were studied in the experiments had extra long vowels in stressed closed syllables, which often caused a high-low tone movement. Secondly, a vowel can be too short before a consonant cluster as in *негде* ['nʲegdʲɛ]. A Russian hearing mistakes of this nature considers them as mistakes in intonation contour. Thirdly, it is typical in an Estonian accent that the plosives are pronounced with a long implosion after a stressed vowel as in *плот* [płot:] (raft), *Свете* [svʲetʲ:e] (to Sveta), *как* [kak:] (how), while, on the contrary, a long double consonant can be replaced by a short consonant as in *Анна*

['anʌ], which is also a result of the rules of building the quantitative model in Estonian. Durational mistakes of consonants and vowels are perceived by native Russians differently, from lengthening or shortening of vowels. They are perceived by the Russian ear as an extra phoneme, or as not containing a sufficient amount of phonemes (IZS 1987:23).

The rhythmical organization of Russian words in the speech of Finns is disturbed when the place of stress is incorrect, irrespective of the position of stress. It has been noticed that it was easier for Finns to pronounce the Russian words correctly laying a stress on the first syllable than others, as well as the temptation to add another stress, as strong as the first one, later after the next syllable (IZS 1987:262-263).

The purpose of this research is to study Finnish interference on the level of word prosody. For this purpose a comparison between the Finnish long - short opposition with the stress and rhythmic structure in Russian as well as the melody contours of disyllables and trisyllables will be made.

## 3.2 Role of teaching phonetics in the second language learning

It is common that when a foreigner speaks a non-native language a native does not understand what he or she says, even though the foreign speaker might not make a single mistake in grammar. Such a misunderstanding is due to interference. The misunderstanding of single words in the speech of a foreigner is common among unilinguals (Weinreich 1974:21). However, all mispronunciations are not so serious as to cause misunderstanding even in the same context. An example of this nature is mostly seen in phone substitution like pronouncing alveolar [d] instead of dental, or an [-pal] consonant instead of [+pal].

Phonetics plays an important role in language teaching. By teaching phonetics we try to avoid the effect of interference on the phonological and phonetical level. Weinreich says that 'the greater the difference between the systems ... the greater is the learning problem and the potential area of interference' (Weinreich 1974:1).

Apart from avoiding the effects of interference, most people who study a foreign language want to pronounce it as well as possible. Everybody should be given a chance to learn how to pronounce a non-native language as well as the natives do (Dalton & Seidlhofer 1994:12). This can be successfully achieved with the means of proper teaching.

First of all, in teaching phonetics of a particular target language, we have to know the phonological and phonetical system of the first language of the learner, as in the second language acquisition we always have to tackle the problem of negative interference of the native lan-

guage. Interference of sound systems can appear in any part of the sound system, both in segments and in suprasegmentals (IZS 1987:7).

When the learner tries to hear what is said in another language he or she inclines to perform the analysis customary for him/her into his own elementary phonological images, like phonemes, of his/her mother tongue. The listener tries to find it in a complex (i.e. in a successive row) of his own phonological images and break it down into his own phonemes, and even in conformity with his own laws of combining phonemes (Polivanov 1974:223).

Trubetzkoy compares the mother tongue to a sieve through which everything that is said passes (Trubetzkoy 1939:52-53). According to him, every person uses a 'phonological sieve' of his mother tongue to analyse what has been said. This leads to numerous mistakes and misinterpretations, since the 'sieve' is not suited to foreign languages. Trubetzkoy continues: " ... the so called foreign accent does not at all depend on the inability of a particular foreigner to pronounce some sound, but rather on his incorrect evaluation of this sound. And such incorrect evaluation of sounds in a foreign language is conditioned by the differences between the phonological structure of the foreign language and the mother tongue of the speaker" (Trubetzkoy 1939:55).

The concept of a *'phonological ear'* is akin to the 'sieve'. It means that a person changes any unknown speech into the phonemic pattern of his/her mother tongue. There are also certain universal features in any language system as the opposition of vowels and consonants, coarticulation, words representing a combined unit of sounds, and many distinctive features of phonemes (IZS 1987:6).

In the former Soviet Union the question of interference was very important, as the majority of the whole population, which was at one time over 250 million people, was bilingual. Russian, the main language, was taught to everybody irrespective of what nationality the citizen living in the Soviet Union represented. The minimum level of the teaching had to be such that everybody could manage in Russian in everyday life. A great task for phoneticians was to find out all the features of different accents and take them into consideration while teaching Russian as a second language. The scientific basis of phonetical interference of different languages in Russian is given in a book entitled Interferentsija zvukovyh sistem (IZS 1987).

The aim of teaching phonetics should be, firstly, to help the language learner to get free from the phonological image (sieve) of his mother tongue and acknowledge the phonological system of the target language. Secondly, one has to learn the articulation differences and prosodic features of the target language.

On the phonetic level the difficulties generally arise in perception (sensoric) or production (motoric). If the person who speaks the foreign language does not hear the differences of the sounds of the mother tongue and the foreign language, the problem is in the perception. But if the person cannot pronounce the sounds of the target language, because of the different articulation basis of his or her own mother tongue, the mistakes are in the production (IZS 1987:8). The first criteria prove the point that teaching the methods of listening the foreign language is sometimes considered to be the most important task in teaching phonetics (Vihanta 1990:200).

There are two aims in teaching phonetics in the second language acquisition. First of all, the aim is to correct a person's articulation in such a way that he or she does not make mistakes on the phonological level, to eliminate phonological interference in differentiating phonemes and distributing them incorrectly. Secondly, the aimes to correct mistakes in phone-substitution so that the articulation basis, including prosody, of the target language can be achieved. By teaching phonetics we give every learner equal possibilities to learn to use the language orally in the best way possible.

The need of teaching Russian phonetics for Finns has been noted in Russian and research has been made about segmental level (Ljubimova 1988) and it is continuing in the project Fonetičeskij fond russkogo jazyka in the Department of Phonetics of StPGU, but where prosody is concerned, word prosody as well as sentence prosody, this study is starting a new field of investigation. A lot of contrastive analysis has to be done in the near future.

Where teaching Finnish phonetics to Russians is concerned, nothing has been done so far. An increasing number of immigrants whose mother tongue is Russian have already started studying Finnish. Their difficulties in the Finnish pronunciation should be urgently studied so that suitable teaching material could be produced for them. By teaching the correct Finnish pronunciation to the Russians living in Finland we would help them in building their future.

# 4 PROCEDURE

## 4.1 Research area and questions

Research area of this work is limited to the study of the word structures of 2-4 syllabled words with the basic syllable structure CV, the word-final syllable being CV or CVC. Within the mentioned word and syllable structures, Russian vowel phonemes /a/ and /i/, their duration and quality in different stress positions and different environments are the main interest of the study. They serve as the basic material of the contrastive study of Russian and Finnish.

The vowel phoneme /a/ was chosen as the object of the study because of its variety. The acoustic studies of the Russian vowel system have proved that it shows the maximal variations in its allophones. Where the duration of vowels is concerned, /a/ [+stress] is the longest Russian vowel, as [+open] vowels are generally longer than others (Zinder 1979:186-187). More than any other vowel phoneme, it clearly shows the durational differences between [+stress], [-stress1] and [-stress2] allophones (Bondarko 1981 and 1998, Verbickaja 1979). Apart from that, the coarticulations of the surrounding consonants, especially the palatal coarticulation of C [+pal] and labial coarticulation of C [+lab] are clearly seen in its spectrographic analysis. As the purpose of this research is also to establish the Finnish interference in the pronunciation of the Finnish subjects, the $F_2$-pattern of /a/ shows the lack of palatalization of the preceding or following consonant.

The vowel phoneme /i/[3] was chosen as the other main object of the study in the vowel system. Firstly, it gives another phonetical position

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[3] Phoneme /i/ is one of five vowel phonemes according to the Moscow phonological school, i.e. it includes both [i] and [i].

to consonants, C+V [+front], as /a/ is basically [-front]. Secondly, the vowels /i/ and /a/ are in [-stress] position thus becoming a supplement of each other because the [-stress1] allophones [ɨ] and [ɪ] appear instead of the same orthographic forms *а* and *я* as well. Thirdly, from the point of view of the Finnish interference in Russian, /i/ ([i] and [ɨ]) in position C [-pal] V is an interesting feature for this research.

Where the consonant systems of both languages are concerned all types of single consonants were included in the test words. The place and the manner of articulation were taken in consideration. As mentioned, palatalization of consonants as well as the possible lack of it in the pronunciation of the Finnish subjects was studied. The feature of C [-voiced]/[+voiced] did not play a significant role for this research. This is because no deep analysis on the effect of the preceding and subsequent consonant on the vowel besides palatalization and labialization has been done in this research. Furthermore, it has not been clearly proved that the following [+voiced] consonant would have a lengthening effect on the preceding vowel like in English. The [-voiced] and [+voiced] pairs like /p/ - /b/, /t/ - /d/ etc., were considered as one.

Only the basic syllable and word structure were studied in this research. The variation of rhythmic structures in Russian could have been added by a few types of longer words, but two-syllabled, three-syllabled and four-syllabled words with single consonants give sufficient data for this study. In fact the data covers most of the Russian rhythmic structures as two-syllabled words in Russian form 24,47 %, three-syllabled words 29,15 % and four-syllabled words 21,63 % of all the words in speech (Zlatoustova 1981: 53-54), although in Russian as well as in Finnish the most common basic structure, for example, the nominative of a substantive or the infinitive of a verb, is disyllabic (Saukkonen et al.1979)

In Finnish the syllable structures change considerably with double vowels and double consonants. Durational differences between different short and long sound segments in Finnish change according to the word structure and the type of syllables. Thus, according to Lehtonen, the duration of a double consonant is longer if it is preceded by a short vowel rather than a long vowel as in *takka* (a fire place) - *taakka* (a load) and a short vowel in the second syllable is longer after a short vowel in an open first syllable with a short vowel than after a long vowel as in *sama* (the same) - *saama* (participle of to get) and a double consonant is longer before a long vowel than before a short vowel as in *sataa* (to rain) - *sata* (a hundred) (Lehtonen 1970:105- 138). It would be an impossible task to consider all durational changes.

On the basis of the above mentioned features of the sound systems of Russian and Finnish, the purpose of this study was to find answers to the following questions:

1) What is the exact durational correlation in Russian between vowels V [+stress], V [-stress1] and V [-stress2] in the pronunciation of a native? Is there Finnish interference in the durational correlation in the pronunciation of the Finnish subjects? How does the Finnish interference appear?

2) Do the duration and quality of individual consonant segments affect the rhythmic structure of words? Does the different consonant system of Finnish affect the rhythmic structure in the Russian pronunciation of Finns?

3) Does the palatal coarticulation play a role in the rhythmic structure in disyllables and trisyllables in the normative Russian pronunciation? What effects does the palatalization or the lack of it have on the pronunciation of the Finnish subjects?

4) Does the difference in rhythmic structure between the normative Russian pronunciation and the Russian pronunciation of Finnish appear in the quality of vowels /a/ and /i/ and their allophones? What is the significance of the context?

5) Do the fundamental frequency patterns show the difference in duration?

6) How does the word melody differ in the pronunciation of the Russians and the Finns?

## 4.2 Material, subjects and methods

The choosing the data for phonetical analysis was by no means an easy task. The question is not the lack of suitable material as the taping facilities always exist, but human limits in energy and time are the factors which have to be taken into consideration. The basic question in phonetical analysis is whether to use read data or spontaneous speech, or to analyze connected speech or isolated words etc.

The modern emphasis in phonetic research is basically in prosody and prosody means the studying of different prosodic activities in speech or the suprasegmental level which involve complete utterances. Using isolated words as research data is not recommended by most phoneticians. It should, however, be noted that in a sentence a word is involved with other prosodic factors than those belonging to itself, such as phrase intonation, sentence stress, place in the intonation unit etc.

In most cases connected speech or spontaneous speech give a better ground to analyze speech production and speech reception. The analysis of individual features of segments can give completely different results when it is done on the basis of isolated words and connected speech, and even more in spontaneous speech, where from the point of view of perception the role of a single phoneme is minimal (Zinder

1981:103). Anyhow, even simple sound signals taped in a language laboratory can prove to be fruitful for phonetical studies (Aulanko 1997:12).

Where this research is concerned the isolated words taped in a language laboratory give the best possible material, because of the fact that most of the subjects are non-native speakers and, thus, spontaneous speech or frame sentences would have increased the difficulties in pronunciation. As Bondarko states, when we analyze signals which are produced by foreign subjects every word even in connected speech might be like an independent autonomic unit (Bondarko 1997:145). Using non-native speakers as subjects is more complicated as even a word as a speech unit might cause problems, especially when it contains difficult sounds like the palatoalveolar sibilants for Finns in Russian, where the rhythm of the word can get disturbed.

The analyzed material consists of isolated words and words in sentences, but the major part of the data consists of isolated words. Taping was done even on the analyzed isolated words in a frame sentence, but the analysis of some of them proved that analysing the words in the frame sentences would not have given a better idea about the word rhythmic structure. The Russian subject read the words concerned as a separate intonation unit, even in the sentences, as in the Russian intonation system it is possible to do so. Apart from that, the Finnish subjects had more difficulties in reading the Russian sentences, although the frame sentence was rather simple: *Он сказал --- очень быстро.* (He said --- very quickly). The analysis of words in the frame sentences is left for a future research.

Thus, to avoid the above mentioned difficulties and the possible changes in the words as a part of a longer intonation unit, the isolated words to be analyzed were chosen. They give a good basis to start this pioneering contrastive analysis of the Russian and Finnish rhythmic structure of words, where we compare the Russian normative pronunciation with the Russian pronunciation of native Finns.

As mentioned earlier, the data which was analyzed in this research included only a part of the Russian phonetic system which forms the basis of the rhythmic structures, i.e. words as a prosodic unit. Nevertheless, a considerable part of the vowel system was included. Although my study includes only two vowel phonemes /a/ and /i/ with all their [+stress] and [-stress] allophones, they cover the greatest part of all the vowels of Russian, because /a/ and /i/ are the most common vowels in Russian (Bondarko 1998:29-30) and they represent the greatest variety of allophones, as already stated. The vowel phoneme /u/ with all its allophones, both [+stress] and [-stress], as well as /e/ and /o/ which, according to our interpretation, have separate allophones only in the stressed syllables, were left out from the scope of this study.

This research consists of different sets of data. First of all, three experiments were done as a starting point: two experiments for Finnish students on the place of stress in Russian words (Experiment 1 and Experiment 2), and a perception test for Russians with Finnish words (Experiment 3). The other three experiments (Experiments 4-6) contained acoustic analysis of Russian and Finnish words read on tapes by Russian and Finnish subjects.

### 4.2.1 Experiment 1

Experiment 1 consisted of two Russian texts. The words (N=237) included in the texts there were disyllabic (N=100), trisyllabic (N=87), quadrisyllabic (N=29), quintisyllabic (N=14), sextisyllabic (N=5) and septisyllabic words (N=2). In this experiment the Finnish students were given two short typed texts which they read by themselves marking the place of stress on the words.

Experiment 1 consisted of two Russian typed texts (see Appendix), where the Finnish students studying Russian were told to mark the place of stress. All the words were known to the students. This was made sure by checking up with the students after their perusal of the text. All subjects answered 'no' to the question: Are there any unknown words in the text?

The Finnish students (N=35) who took part in the first experiment all studied the Russian language for their first year in the University of Jyväskylä, and prior to that had studied Russian at school or in different courses for about 5-6 years.

### 4.2.2 Experiment 2

Experiment 2 consisted of a series of isolated Russian words (N=61) read on a tape by a native Russian. The list of words included disyllabic (N=27) words which contained 10 such minimal pairs where the stress was in a distinctive role, for example, *атлас* ['atɬəs] (atlas) - *атлас* [ʌ'tɬas] (satin). The other words were trisyllabic (N=32) and quadrisyllabic (N=2). The test words included only vowel /a/. In this experiment the Finnish students (N=36) heard the words through the earphones in a language laboratory and at the same time marked the place of stress on a paper. The rhythmic structure of the words was given as the amount of syllables on the paper like for example, ——— (a word with three syllables). The students also marked in the answering paper whether or not they knew the word which they heard.

Experiment 2 was a listening test, in which the Finnish subjects were told to mark the location of the stress while hearing words that were

read on a tape by a native female Russian. Each word was repeated three times after a short interval. The test was processed in a Prisma Auditec language laboratory. The Finnish subjects marked the stress in the paper where the number of syllables in the words was given. The purpose was to elicit two things: 1) whether they know the word concerned and 2) where they heard the stress. Most of the words were known to the listeners.

In Experiment 2 the Russian words were read by a 58 years old native Russian female speaker from St.Petersburg. Her pronunciation is normative which has been proved on many occasions, as she has been used as a model of Russian normative St.Petersburg pronunciation in phonetical experiments and courses in practical phonetics for foreigners. The listerners were students of Russian language in the University of Jyväskylä who studied Russian for the first or second year in the university.

### 4.2.3 Experiment 3

Experiment 3 was a perception test of Finnish words for Russian natives consisting of isolated Finnish words (N=42) among which there were disyllables (N=5), trisyllables (N=17) and quadrisyllables (N=20). They consisted of the types of words with long and short vowels /a/ and /i/ in different syllables. The subjects heard the words read by a native Finn through earphones in a language laboratory. Their task was to mark which syllable in their opinion was stressed in the Finnish words. The number of syllables was given on the paper.

Experiment 3 was a listening test for Russian natives which consisted of isolated Finnish words with 2-4 syllables with long and short vowels /a/ and /i/ in different syllables. The words were read by a native female. Every word was repeated three times with a short interval inbetween. The test was done in a Tandberg language laboratory in the department of phonetics of St.Petersburg University. None of the subjects knew Finnish nor did they have any knowledge about Finnish stress system. They were told to mark the stress as they heard it from the Russian point of view. Thus it was a case of hearing stress in an unfamiliar language.

The subjects in Experiment 3 were students of the State University of St.Petersburg (N=28). They did not know Finnish or anything about the Finnish phonetical system.

### 4.2.4 Experiment 4

Experiment 4 was a pilot study about the durational ratio in Russian and Finnish disyllabic words. The data consisted of Russian words (N=86) and Finnish words (N=84). The words were read isolated as well as in sentences by three Finnish female subjects who read the Finnish as well as the Russian words and by two Russian subjects, a female subject who read only the Russian words and a male subject who read the Russian words as well as the Finnish words. The duration of each vowel in Russian as well as in Finnish words was measured with EDS end WinCecil programmes in PC computer.

Experiment 4 was a pilot study which focussed on finding out the durational ratio in Russian and Finnish disyllabic words which were pronounced by Russian as well as Finnish subjects. The data was taped in a sound proof high quality language laboratory for speech research in Tourula, Jyväskylä, in the department of the Speech Communication of the University of Jyväskylä. The material was taped with Technics SV 360 tape recorder on TDK Digital Audio Tapes and simultaneously on UR maxell tape. The analysis was done by using EDS (Editing Digital Signals) programme (Sial Co Ltd, St.Petersburg) and partly with WinCecill programme in a PC-computer in order to study the duration of the vowel segments. The results have been published by de Silva and Ščerbakova (de Silva & Ščerbakova 1998).

In Experiment 4 there were three Finnish female subjects. One of them was a student, 28 years old, born, lived and studied in Jyväskylä. Her speaking knowledge of Russian was satisfactory. The second Finnish subject was a graduate, 41 years of age, born and lived 19 years in southeast of Finland, spent 10 months in Kiev and 21 years in Jyväskylä and its suburbs. Her speaking knowledge of Russian was good. The third Finnish subject was a female graduate (licenciate), 52 years old, who was born and had lived the first twenty years of her life in Eastern Finland, studied 6 years in Moscow and after that spent 26 years in Jyväskylä.

There were also two Russian subjects in Experiment 4. One of them was a senior teacher of St.Petersburg University, 58 years, who was born and had spent all her life in Russia, St.Petersburg (Leningrad) (the same as in Experiment 2). The other Russian subject was a male student, 24 years, born and lived 18 years in Ural, 3 years in St.Petersburg and 1 year in Finland.

The subjects in Experiments 1-4 were not numbered as they were not analyzed separately.

### 4.2.5 Experiment 5

#### 4.2.5.1 Data for analysis

The data of the main experiment, Experiment 5, consisted of disyllabic (N=142) and trisyllabic (N=95) Russian words. The disyllables had stress on the first (N=60) or, naturally, on the second (N=82) syllable. The trisyllables had the stress on the first syllable (N=27), on the second syllable (N=35) or on the third syllable (N=33). Apart from the Russian words some Finnish words (N=10) were read by the same subjects in order to compare the vowel quality of /a/, /aa/, /i/ and /ii/.

The basic concept was that all the three possible places of stress in a word give different series of [+stress], [-stress1] and [-stress2] vowels where /a/ is concerned. The vowel /i/ has two stages of stress where the vowel quality is concerned. Apart from that, the open and closed final syllables are different. In the open word-final syllables the lengthening of the last vowel is universal. In a Russian context, this means that when the stress falls on the last syllable, V [+stress] is longer than in the open syllable. Where the unstressed syllables are concerned, the reduced vowel changes accordingly: V [-stress1] in an open syllable becomes V [-stress2] in a closed syllable. All kinds of consonants were represented in the data.

The different kinds of vowel series in disyllabic and trisyllabic words are shown with the following symbols: a = V [+stress], b = V [-stress1] and c = V [-stress2]. The rhythmic structures of the disyllables are simplified as illustrated in Table 16.

TABLE 16 The influence of the rhythmic structure (stress) on vowels in disyllabic words: **a** = V [+stress], **b** = V [-stress1] and **c** = V [-stress2], C is any consonant.

| | Vowel positions | Structure | Examples |
|---|---|---|---|
| 1. | **CaCb** | 'CVCV | ['sɑdʌ], ['pʲilʲɪ] |
| 2. | **CaCcC** | 'CVCVC | ['sʲadʲiəm], ['mitɪx]; |
| 3. | **CbCa** | CV'CV | [gʌ'dɑ], [vʲɪ'zʲi] |
| 4. | **CbCaC** | CV'CVC | [mʌ'dɑm], [sʲɪ'bʲirʲ]. |

As the table shows, $V_2$ [-stress] being open and closed represents two stages of reduction. The open vowel is less reduced than the closed which differs from the corresponding [+stress] vowel also in quality, V1 [-stress]. Where /a/ and /i/ are concerned, the difference is generally only in the duration.

In Table 17 each symbol represents allophones of /a/ as well as of /i/. As we can see from the table, symbol **b**, i.e. V [-stress1] appears in the syllable which precedes the [+stress] syllable and in word-final syllable. Among the words there were two words which started with a vowel, i.e. the word-initial syllable was uncovered as in *о маме* [ʌ'mɑm'ɪ] (about mother). The word-initial position for a vowel should be equal to position **b** after a hard consonant, and I have considered them as that. Anyhow, Zlatoustova has found out that the word-initial uncovered vowel can be even longer than V [+stress], namely in trisyllabic words where the stress falls on the second syllable (Zlatoustova 1981b:106).

TABLE 17 The influence of the rhythmic structure (stress) on vowels in disyllabic words: **a** = V [+stress], **b** = V [-stress1] and **c** = V [-stress2], C is any consonant.

| | Vowel positions | Structure | Examples |
|---|---|---|---|
| 1. | **CaCcCb** | 'CVCVCV | ['zanʲətʌ], [bʲɪ'gʲitʲɪ] |
| 2. | **CaCcCcC** | 'CVCVCVC | ['fʲizʲɪkəm] |
| 3. | **CbCaCb** | CV'CVCV | [bʌ'kɑmʲɪ], [dʲɪ'vʲitsʌ] |
| 4. | **CbCaCcC** | CV'CVCVC | [mʌ'mɑʃəm] |
| 5. | **CcCbCa** | CVCV'CV | [təmʌ'dɑ] |
| 6. | **CcCbCaC** | CVCV'CVC | [nəpʌ'lʲax] |

A problematic area in this data and in the Russian vowel system as well is the word-final position for V [-stress] in open syllables after C [-pal] and C [+pal]. According to Avanesov, /a/ [-stress] after C [-pal] as well as after C [+pal] should be pronounced like /a/ [-stress2], for example, *котята* [kʌ't$^{j}$atə] (baby cats), *няня* [n$^{j}$an$^{j}$ə] (a nanny) (Avanesov 1984:99 and 194). These are grammatical endings, and the only change which Avanesov notices is [$^{i}$ə] > [ə] after C [+pal]. A similar interpretation is given in Russkaja grammatika (Russkaja Grammatika 1982:27-28).

Anyhow, in this position the vowel, even being [-stress] has final lengthening which should mean that its reduction is less than in a closed syllable after stress. Verbickaja states that vowels in word-final [-stress] position change less (Verbickaja 1976:51). This means in practice that [-stress] /a/ after C [-pal] in word-final position is pronounced as [ʌ], and not as [ə] like Avanesov (1984) or Panov (1967 and 1979) suggest. Matusevič states that in this position [ʌ] and [ə] compete with each other, i.e. [ʌ] is pronounced in a speech spoken at a slower rate but otherwise it is pronounced as [ə] (Matusevič 1976:102). Bryzgunova also gives the same two alternatives (Bryzgunova 1977:92). In case the orthographic

form is *я*, it has been suggested (Matusevič 1976:103, GRJ 1970:25) that a different transcription mark should be used for /a/, such as [æ] or [ɑ].

But this sound as well as the other orthographic variant, *e*, have been acoustically analyzed as [ɪ], although the vowel reduction in grammatical endings, including the open word-final syllables, follows mainly the same principle as, any position after stress (Bondarko&Verbickaja 1973:47, Verbickaja 1976:52). Bryzgunova also gives [ɪ] as one alternative (Bryzgunova 1977:92). This opinion is acceptable, unless the data used in this research does not agree with it, i.e. in the word-final [-stress] position one should have vowels [ʌ] and [ɪ] in the pronunciation of the Russian subject. Apart from these two vowels in position C [-pal] V [-stress], vowel [ɨ] should appear. It is for this reason that in all word-final positions for [-stress] vowels **b** is evident.

Experiment 5 formed the major part of the present investigation. It consisted of acoustic analysis of Russian disyllabic and trisyllabic words pronounced by a Russian (RUS) and four Finns (FIN1-FIN4). This experiment included the largest data of disyllables and trisyllables (N=245) which were read by 5 subjects, one Russian and four Finnish students who studied Russian.

The data in Experiment 5 consisted of isolated words read by the subjects from a paper and the stress was marked in every word. The word list was chosen from the basic Russian vocabulary. Each word was found in the dictionary Leksičeskaja osnova russkogo jazyka, edited by V.V. Morkovkin (1984) which contains the lexical minimum of Russian language, i.e. all the words were known to the subjects.

Using data which is pronounced by foreign subjects brings additional difficulties. There can be reading problems as well as problems in producing individual sounds. Thus, the final aim, namely, the investigation of the rhythmic structure, may not be adequately achieved or the results can yield wrong information.

The original idea was to use words with and without frame sentences, but the taping result showed that the frame sentence caused extra problems though it was basically very simple. Apart from the pronouncing difficulties which the Finns had with the frame sentence, the Russian subject divided the phrases into intonation units so that the test words formed own separate intonation units, which roughly means that the final production was the same as with the isolated words.

This being the first study of its kind where this particular problem was concerned, namely, the comparison of rhythmic structures in Russian and Finnish, it was considered better to start from the basic concept with isolated words without the interference of a phrase structure and phrase intonation. On the one hand, every single word can form a minimal phrase or an autonomous part of a phrase, but, on the other hand, when a word

is a part of a bigger intonation unit there are many affecting factors like the word stress (Svetozarova 1982).

#### 4.2.5.2 Subjects

In this study the pronunciation of the Finnish subjects was compared with the *literary norm* of the Russian pronunciation. Apart from the lexical and grammatical norms there is the 'Russian literary pronunciation' (русское литературное произношение) which is strictly followed by a great part of the population. The normative pronunciation is kept by certain people due to their biographical, regional and educational background.

There are two accepted literary phonetical norms, the Moscow and St.Petersburg (earlier Leningrad) pronunciation, which traditionally have had a few differences in their views of pronouncing such as pronouncing the palatoalveolar soft voiceless sibilant as an affricate as is evident in the Petersburg norm, or the pronunciation of the soft palatoalveolar voiced sibilant [ʒʲ:] as, for example, *езжу* ['jeʒʲ:ʉ] (I travel), as found in the Moscow pronunciation. The quantity reduction of unstressed vowels in the Moscow and Petersburg pronunciation are somewhat different, namely, the quantitative reduction in the pronunciation of Moscovites is stronger so much so that the correlation between /a/ [+stress] and [-stress] is different (Verbickaja 1997:108-109). Anyhow, during the last decades, a process has initiated in Russian pronunciation which might finally lead to a single literary norm (Aleksejeva&Verbickaja 1989:20, Reformatskij 1995:349).

Most studies of Russian phonetics are based on the pronunciation of a few representatives of the normative literary pronunciation. The representative of the normative pronunciation is a man or a woman born in an educated family in Moscow or St.Petersburg and having a degree of higher education in his or her home city.

The norms have been maintained by emphasizing the normative pronunciation in education, mass communication, theatre language and even in the every day conversation of educated people. The task of the society is to make the pronunciation culture, achieved within hundreds of years, to survive (Avanesov 1984:242). And it was an achievement of the Soviet society to have been able to keep the literary norm of the Russian language in spite of the threat of the colloquialisms (Panov 1962:3). Even up-to now the norm has survived although the pressure on changing it has become more acute after the political system changed.

In Experiment 5, which was the main experiment, one Russian subject (RUS) and four Finnish subjects (FIN1, FIN2, FIN3 and FIN4) were used. The Russian subject represents the literary norm in this re-

search. He is a Moscovite post-graduate student, 27 years. He, as well as his parents, were born in Moscow and graduated from the Moscow State University. In the opinion of native phoneticians, that is , three members of the staff of the department of phonetics of St.Petersburg State University, his pronunciation of Russian is normative. He represents normative Moscow pronunciation (Reformackij 1995). Table 12 gives the normative features of pronunciation which normally distinguish a person's pronunciation from a dialectical or colloquial (просторечие) speech (Avanesov 1984).

As Table 18 shows, on the basis of the opinions of the Russian phoneticians and the results of the acoustic analysis, the pronunciation of the Russian subject (RUS) can be considered as a model of the normative Russian pronunciation.

TABLE 18 The normative features of Russian literary pronunciation in the speech of the Russian subject (RUS) in the opinion of Russian phoneticians and according to the results of the experiments

| The normative features | Phoneticians | Acoustic proof |
|---|---|---|
| A clear difference between [+stress] and [-stress] vowels | + | + |
| Two stages of reduction of vowels. | + | + |
| 'Akanje' | + | + |
| 'Ikanje' | + | + |
| A long [+pal] palatoalveolar sibilant. | + | + |
| /g/ pronounced as a velar plosive | + | + |
| [+voiced] obstr. > [-voiced] in the word-final positions | + | + |
| [-voiced] obstr. > [+voiced] before [+voiced] obstr. | + | |
| [+voiced] obstr. > [-voiced] before [-voiced] obstr. | + | |

Apart from the Russian subject the data was read by four Finnish male students who studied Russian in the University. Three of them studied in the University of Jyväskylä and one in the University of Helsinki.

All the Finnish subjects spoke standard Finnish, but FIN1 and FIN3 could have had some influence of the Ostro-Bothnian dialectal background. FIN2 could have been influenced by the South-West (Turku) dialect. If so, he would tend to pronounce the second syllable short vowel longer after a short vowel in the first syllable (Wiik 1977). Normally Jyväskylä region is considered as the most neutral place in

Finland where dialectal influence is concerned, but it also partly belongs to the region of eastern dialects and differs in some ways of speaking as, for example, in its expression of word melody (Wiik 1988).

FIN1, male, 30 years, was a third year student of Russian language at Jyväskylä University. He was born and had finished school in Seinäjoki, the Ostro-Bothnian region of Finland. After that he had lived one year in Oulu, 7 years in Helsinki and he had studied and worked in Jyväskylä two years. He had started studying Russian as a C-language in the secondary school and later continued it in an evening school for 2,5 years. He had spent short periods in Russia, comprising altogether of about four weeks.

FIN2, male, 22 years, was a second year student of Jyväskylä University. He was born in Helsinki, but had lived there only for four years. His longest stay was in Turku (twelve years) and shorter periods in Kouvola (two years), Sweden (two years) and Mäntsälä (one year). He had studied Russian for three years at school and ten months in Russia.

FIN3, male, 21 years, was a second year student of the Russian language at the University of Jyväskylä. He was born in Jyväskylä, but moved to Seinäjoki before school age. He had lived in the Ostro-Bothnian region (Seinäjoki and Ilmajoki) until he entered the Jyväskylä University. He had never stayed in Russia.

FIN4, male, 22 years, a third year student of Russian language in Helsinki University, was born and had finished school in Jyväskylä. He studied Russian as a C-language at school and had been in Russia five times for a period of 5-10 days and twice for a month's language course.

The knowledge of Russian of the Finnish subjects was estimated by four teachers of Russian, one Finnish and three native Russians, on the scale: bad - satisfactory - not very good - good - very good - excellent.

The reasons for choosing these subjects were not based purely on practical reasons. After the suitable male representative of normative Russian was found, I chose the Finnish subjects of the same age and sex category. The criteria was that they should know Russian well enough to be able to communicate, i.e. have some fluency even in their pronunciation, so that reading our test material could be done with ease. Had the knowledge of Russian been very limited, the sounds or the Cyrillic letters could have caused extra lengthening of sound segments or even pauses in reading. Another important fact was that the subjects knew the basic pronunciation rules such as the qualitative reduction of vowels like 'akanje' and 'ikanje'. Otherwise the analysis of vowel quality could not have been possible where the [-stress] vowels are concerned.

### 4.2.6 Experiment 6

Experiment 6 was a pilot study of vowel duration in Russian and Finnish quadrisyllabic words. The material consisted of Russian (N=18) and Finnish (N=9) words which were read isolated as well as in different sentences where they had different positions, both accented and unaccented. All together there were 120 realizations of the Russian and 132 realizations of the Finnish quadrisyllabic words. The results of Experiment 6 have already been published (de Silva&Ščerbakova 1998).

Five subjects took part in Experiment 6, three of them were Finns, one of them was FIN1 (Experiment 5). One of the two Russian subjects was RUS (Experiment 5). The other Russian subject was a professor of St.Petersburg University, 62 years, born, studied and lived all her life in St.Petersburg. Both of the Russian subjects in Experiment 6 were representatives of the St.Petersburg norm of literary Russian pronunciation.

### 4.2.7 Methods

All the data which was used in this research was taped in a language laboratory with high class technical equipments. For Test 2 the taping was done in the language laboratory of the language centre of Jyväskylä University with Revox B77 tape recorder. For test 3 the material was taped in the sound proof taping studio of the Department of Phonetics of St.Petersburg University with Sony tape-recorder on a Maxell UR tape. All the data which was meant for acoustic analysis (Experiment1 and Experiment2) was taped on Maxell UR tapes and simultaneously on TDK DAT tapes in the taping studio of the Department of Communication of the University of Jyväskylä with.

The perception tests were processed in ordinary language laboratorys with earphones in the University of Jyväskylä (Prisma), Test 2, while Test 3 was processed in St.Petersburg (Tandberg).

In the acoustic analysis we used at first EDS programme in PC, Osborn 486 (Experiment 1) but later, SoundScope programme in Power Macintosh was used.

In Experiment 1, the duration of sound segments was measured. The main purpose was to measure vowel duration in [+stress] and [-stress] syllables of Russian disyllabic words and compare their duration to Finnish words of the same structure, but with both short and long vowels. In the analysis EDS programme was used.

In Experiment 2 with the use of Sound Scope programme more prosodic parameters were taken in consideration. Apart from vowel duration, consonant duration was measured as well. The fundamental fre-

quency ($F_0$) pattern was measured in more than one place in vowel segments: the initial value and the final value, but in the case of a peak or slope down, one or two more values were measured. On the segmental level the palatalization of consonants was followed in two parameters: in formant structure of the preceding vowels and in VOT (Voice Onset Time) and the explosion time in the word-final position of the plosives. And finally, the quality of vowels according to $F_1$, $F_2$ and $F_3$ of vowels /a/ and /i/ in three different places: in initial stage, in steady state and in final position, including all [+stress] and [-stress] allophones.

The measurements were further calculated in Excel and SPS programmes.

# 5 RESULTS

## 5.1 Perception of word stress

### 5.1.1 Perception of Russian word stress by Finns

The purpose of Experiment 1 was to find out the level of difficulty for the Finnish students studying Russian in noticing the Russian stress. For this purpose some first year students who were studying in the department of Russian language and literature at Jyväskylä Uviversity (Finland) were tested. The texts used in this experiment are given in the Appendix.

Generally, the place of Russian stress is one of the most difficult factors which Finns experience, as it is not fixed and the place can vary within the same word. Surprisingly, the results showed that it was not that difficult for Finns to remember the place of stress in familiar words as only 12-15 % of the answers were wrong. In 70 % of the incorrect answers the stress was marked on an earlier syllable, i.e. more towards the beginning of the word and to the first syllable, for example, *вытекает* ['vɨtʲəkəjət] instead of [vɨtʲɪ'kajət] (flows out), *у старика* [u'starʲɪkʌ] instead of [ustərʲɪ'ka] (with the old man), and *говорит* ['govərʲɪt] instead of [gəvʌ'rʲit] (speaks). In 12 % of the wrong places, the stress was marked on an earlier syllable, for example, *горячо* [gʌ'rʲatʃʲʌ] instead of [gərʲɪ'tʃʲɵ] (an adverb: hot) and *почему* [pʌ'tʃʲemu] instead of [pətʃʲɪ'mu] (why) (de Silva & Ščerbakova 1998).

This result makes it possible to come to the conclusion that the Finnish word structure with stress on the first syllable might affect choosing the place of stress, in other words, the interference of the mother tongue is noticeable.

In Experiment 2 the Finnish subjects listened to Russian 2-4 syllabled words (see Appendix) read on the tape three times by a native Russian. In this experiment some words were unknown to the subjects who were students studying Russian language at Jyväskylä University in their first or second year. Their task was to mark in the question paper the place of stress and whether the word was known to the subject or not.

This experiment showed that perception of Russian stress is not difficult for Finnish students studying Russian as 93,5 % of the answers were correct. Where the wrong answers were concerned the mistakes were apparent in both known and unknown words, but, naturally, they tended to occur more in unknown words.

### 5.1.2 Perception of Finnish word stress by Russians

As the concept of word stress in Russian and Finnish is completely different, my intention was to find out how Russians react to Finnish stress and how Finns in their turn react to Russian stress. In the perception and production of Finnish words (see Appendix) Russian listeners would most probably use the model of their mother tongue, where stress means a longer vowel compared with unstressed syllables.

Table 19 shows the reaction of Russians on the Finnish word stress vís a vís long vowels in different word structures.

TABLE 19 The percentages of syllables considered by Russians to be stressed in Finnish 2-4 syllabled words

| Word structure | 1st syll | 2nd syll | 3rd syll | 4th syll |
|---|---|---|---|---|
| 1 CVCV | 45 | 50 | | |
| 2 CVCVV | 60 | 40 | | |
| 3 CVVCV | 95 | 0 | | |
| 4 CVCVCV | 45 | 43,3 | 11.5 | |
| 5 CVVCVCV | 73 | 24 | 10 | |
| 6 CVCVVCV | 25 | 71,6 | 6.6 | |
| 7 CVCVCCVV | 14,2 | 17.5 | 74,2 | |
| 8 CVCVCVCV | 32 | 31 | 22 | 12 |
| 9 CVCVVCVCCV | 25 | 58 | 27 | 11 |
| 10 CVVCVVCVCV | 70 | 35 | 2.5 | 0 |
| 11 CVCCVVCCVVC | 30 | 70 | 0 | |

In the perception test, Experiment 3, Russian students in the philological faculty of St. Petersburg University heard isolated Finnish words with 2-4

syllables read on a tape three times each with a gap of a short interval. All the words were read by a native Finn and they were taped in the recording studio of the department of phonetics in St. Petersburg University. The test was held in a language laboratory. None of the subjects knew any Finnish nor anything about the Finnish stress system.

The results of this perception test (Table 19) show that the Russian subjects often made the correct conclusion of Finnish stress in 2-4 syllabic words when the vowel in the first syllable is long (double). In 95 % of disyllabic CVVCV words, such words as *tuuli* (wind), in 73 % of trisyllabic words of type CVVCVCV as *saatava* (to be received), and 70 % of quadrisyllabic words type CVVCVVCVCV, like in *raahaamana* (as ragged), the stress was marked correctly.

Longer duration of vowels is generally perceived by the Russians as the sign of stress. This is shown in type 6 CVCVVCV, for example, *salaama* (hidden) where 71,6 % and type 7 where 74,2 % and 9 CVCVVCVCCV, as in *palaamassa* (returning) where 58 % were marked as stressed.

The tendency of vowels being lengthened after the first syllable short vowel in Finnish is also obvious in type 4 CVCVCV as was shown in *salama* (lightning) and in type 8 CVCVCVCV, *palavana* (as burning). The same fact might concern the type 11 CVCCVVCCVVC, *varmaankaan* (probably), where vowels in both the second and third syllable are long, and preceded by double consonants which are long (double), but yet the second syllable was marked stressed in 70 % of the cases.

The results of this perception test prove the validity of both the Russian concept of stress with longer vowel duration and the phonetical features of Finnish stress where the short stressed vowel might have shorter duration than the unstressed short vowel in the second syllable. Vowel lengthening in the word-final position affects the same way as we can see in type 1 CVCV, *sama* (the same), where in 50 % of the cases the last syllable was considered stressed. 5 % could not decide which of the two syllables was stressed. On the other hand, the long word-final vowel in disyllabic words like type 2 CVCVV, *samaa* (of the same), tends to be shortened in Finnish (Lehtonen 1970:164). This explains the reason why the stress was marked correctly in 60 % on the first syllable in this experiment. In other words, the durational differences between the vowels of the first and second syllables in words *sama* and *samaa* are very similar, but yet there remains a difference which only a Finnish ear can finally differentiate.

## 5.2 Duration of sound segments

As mentioned earlier, the material analyzed in this study consisted of disyllabic and trisyllabic Russian words read by a Russian and four Finns. The total amount of words which were analyzed was about 1080 words which consisted of 4-7 sound segments each. Duration of sound segments was measured in Experiments 4 and 5.

The duration of each sound segment was measured in the oscillogramme on the screen of SoundScope programme. Segmentation was done manually with the help of markers. By setting the two markers at the beginning and end of the segment, the required duration was given automatically, but it had to be added manually to the notes. Also it was not possible to save the segmentation in the SoundScope programme which would have been a great asset if one had had to return to the same word again.

In both Russian and Finnish the longest sounds are vowels. The longest single sounds in Russian are [+stress] vowels the duration of which is 120-200 msec, while the duration of [-stress] vowels is 30-120 msec (Bondarko 1974:112-115). In Finnish the double (long) vowels have the longest durations and they are normally twice as long as the single ones (Lehtonen 1970, Wiik 1965). This kind of information gives us some idea about the durational relationship between different sound segments in words, but the duration of vowels as well as consonants in speech and even single words depends in all cases on the speaking rate.

Speaking rate or articulation rate are generally measured as syllables per second or words per minute in whole utterances where pauses are also included (Laver 1994:158). Since this work concerns isolated words the articulation rate is measured as sounds per second and there are no pauses included. The purpose of measuring the articulation rate was to find out the differences between different subjects, and particularly, whether the Russian subject differed from the Finns.

It is interesting to note that the articulation rate of the Russian reader was quicker than that of FIN1 and FIN2, slower than of FIN3, but almost the same as that of FIN4 in disyllabic words. Where the Finnish speakers are concerned the articulation speed can be dependent on their language skills. Sometimes it may have been effected by the reading skill of the person, although the data was collected in such a way that no one should have had any difficulties in pronouncing the given isolated words. The articulation rate might also be an individual feature independent on the language.

The comparison of the articulation speed both in disyllabic and trisyllabic words (Table 20) proves that the duration of sound segments

(or phonemes) is dependent on the length of the word: the longer the word, the shorter a single sound is. This is a common factor in many languages (Zinder 1979) and it agrees with the results got by Iivonen in Finnish isolated words (Iivonen 1974a and 1974b), although there exists a contrary opinion where the Finnish language is concerned (Lehtonen 1970).

TABLE 20 Articulation rate in pronouncing disyllabic and trisyllabic isolated words (sounds/second)

| | RUS | FIN1 | FIN2 | FIN3 | FIN4 |
|---|---|---|---|---|---|
| Disyllabic words | 7.92 | 6.5 | 7.01 | 8.44 | 7,89 |
| Trisyllabic words | 9.1 | 7.34 | 8.13 | 12 | 11 |

As Table 20 shows, the articulation speed became faster in the trisyllabic words where all the subjects are concerned, but the increasing rapidity of speech was proportionally the same in the pronunciation of the Russian subject and the two Finnish subjects, FIN1 and FN2, (13-16 %). The change was bigger in the pronunciation of FIN3 and FIN4. FIN3 had the fastest pronunciation among all the subject in disyllabic words.

### 5.2.1 Disyllabic words

#### 5.2.1.1 Duration of vowels in disyllabic words

The duration of vowels in Russian disyllabic words was measured in Experiment 2 in detail. The material consisted of isolated Russian words which were read on a tape by a Russian normative speaker (RUS) and four Finnish subjects (FIN1, FIN2, FIN3 and FIN4). Using only one Russian subject as a standard is based on the existence of the literary norm in Russian in which generally one male and one female speaker, representatives of the normative pronunciation, are enough to give reliable information. In this study where only male Finnish subjects are used, a male Russian subject who, as it was proved, represented the the literary norm was enough.

The average duration of the vowels as well as consonants are given in Table 21. The duration values were counted for all segments in the positions which were for the consonants C1, C2 and C3, and for the vowels V1 [+stress], V1 [-stress], V2 [+stress] and V2 [-stress]. The last two positions, have two values each, one for open syllables, i.e. the vowel is in the word-final position, and closed syllables, i.e. the vowel is fol-

lowed by a consonant, C3. The average duration of vowels includes /a/ and /i/ with all their allophones, and the consonant duration includes all types of consonants. The vowels /a/ and /i/ and different consonants are given a more detailed discussion later.

The average duration values of sound segments pronounced by the Russian subject (RUS) show that there is a clear difference in the duration between V [+stress] and V [-stress] in all positions. V1 [-stress] is about two thirds of V1 [+stress]. The word-final lengthening in open syllables is significant in both $V_2$ [+stress] and $V_2$ [-stress], the final lengthening of $V_2$ [-stress] is comparatively bigger. In [+stress] position, the average duration of the vowel in the open syllable is 41,1 % longer than in the closed vowel, and in [-stress] position, i.e. in V2 [-stress], 67 % longer in open syllables. This means that that V2 [-stress] in open syllables is as long as V2 [+stress] in close syllables.

TABLE 21 Average duration (ms) of sound segments in different word positions in Russian isolated disyllabic words pronounced by a Russian normative speaker and four Finnish subjects. C includes all types of consonants and V all allophones of /a/ and /i/

| Position | N | RUS | N | FIN1 | N | FIN2 | N | FIN3 | N | FIN4 |
|---|---|---|---|---|---|---|---|---|---|---|
| $C_1$ | 96 | 112 | 66 | 123 | 94 | 128 | 77 | 74 | 96 | 117 |
| $V_1$ [+stress] | 59 | 181 | 56 | 270 | 59 | 202 | 55 | 165 | 57 | 183 |
| $V_1$ [-stress] | 62 | 114 | 64 | 139 | 62 | 82 | 63 | 80 | 60 | 94 |
| $C_2$ | 135 | 114 | 136 | 142 | 137 | 121 | 135 | 104 | 137 | 108 |
| $V_2$ [+stress], o. syll. | 31 | 199 | 31 | 232 | 31 | 278 | 30 | 244 | 31 | 262 |
| $V_2$ [+stress], cl. syll. | 34 | 141 | 33 | 200 | 34 | 192 | 34 | 179 | 34 | 143 |
| $V_2$ [-stress], o. syll. | 38 | 142 | 30 | 88 | 37 | 139 | 33 | 118 | 38 | 124 |
| $V_2$ [-stress], cl. syll. | 24 | 85 | 24 | 80 | 24 | 102 | 23 | 84 | 24 | 103 |
| $C_3$ | 20 | 95 | 17 | 88 | 20 | 121 | 19 | 104 | 20 | 128 |

The Finnish subjects had the following individual features:

FIN1: The [+stress] vowels were clearly longer than the [-stress] vowels. V1 [+stress] was longer than V2 [+stress] in open final syllables, but V1 [-stress] was considerably longer than V2 [-stress]. The vowels in word-final open syllables were longer than the vowels in closed syllables but only by 16 % and 10 %. In a few words the open final V2 [-stress] was so short and badly seen in the oscillogram that it could not be measured. V1 [+stress] was very long.

FIN2: The V [+stress] was the longest in both syllables. It was twice, or even more, as long as the V [-stress]. Lengthening of the final vowel in open syllables was in V2 [+stress] (45 %) and V2 [-stress] (36 %).

FIN3: The V1 [+stress] was shorter than V2 [+stress]. The [-stress] vowels in all positions were about a half of the duration of V [+stress]. Lengthening of the vowels in final open syllables was in stressed syllables 36,3 % and unstressed 40,5 %.

FIN4: All [+stress] vowels were longer than V [-stress]. V1 [+stress] was about twice as long as V1 [-stress] and V2 [+stress] in open syllables was even a little longer than V2 [-stress] in the same position. Only V2 [+stress] in closed syllables was shorter than the [-stress] counterpart.

The average duration between different speakers vary, as the articulation speed is different as well. Among the average duration of sounds the longest was 278 msec, the average duration of $V_1$ [+stress] read by FIN2, and the shortest was 80 msec, $V_1$ [-stress] read by FIN1 and $V_2$ [-stress] read by FIN3. The average durations could be compared with Finnish. The average duration of Finnish corresponding vowels are: /i/ 95 msec (single), 231 (double), and /a/ 103 (single), 228 (double) (Wiik 1965:115).

Although it was noticed that the knowledge of Russian among the Finnish subjects was different, this result shows that the better language skill of a Finnish person is not seen in the duration ratio of vowels in disyllabic words.

Figure 2 illustrates the comparison of the durational differences of vowels in V1 position in disyllabic words which are seen also in Table 17.

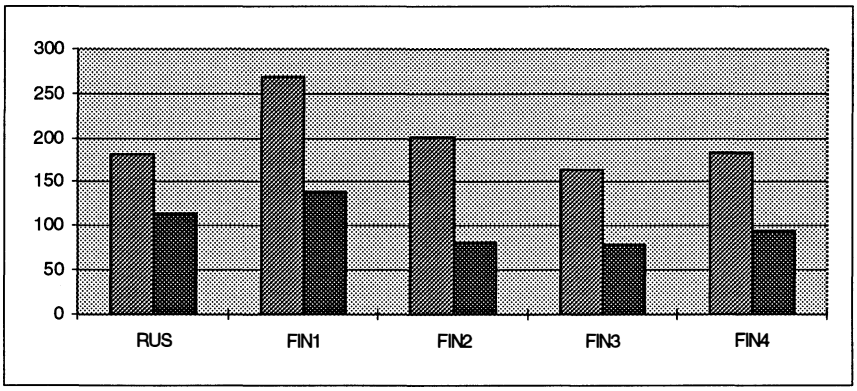


FIGURE 2 Average duration of V1 [+stress] compared with V1 [-stress] in disyllabic Russian words read by a Russian and four Finnish subjects

The figure shows that in the pronunciation of the Russian subject the duration of V [-stress] was much closer to the duration of V [+stress] than in the pronunciation of any Finnish subject. Maximally the duration of V [-stress] was about a half of the duration of V [+stress] (in pronunciation

FIN1 and FIN4). In this case V1 [-stress] means V [-stress1], i.e. the first stage of reduction which is presented by vowels [ʌ], [ɨ] and [ɪ] in our study. The Russian pronunciation shows that the duration is about two thirds of the duration of V [+stress].

Figure 3 illustrates the durational differences of V1 [+stress] to V2 [-stress] in close syllables. This position in Russian means V [-stress2] as it is a position after stress.

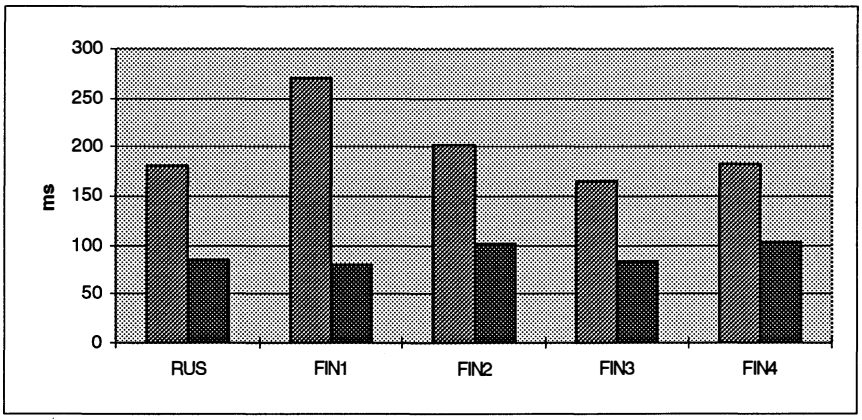


FIGURE 3 Average duration of V1 [+stress] compared with V2 [-stress] in close syllables of disyllabic Russian words read by a Russian and four Finnish subjects

The figure shows that in the pronunciation of the Russian subject the duration of V2 [-stress] was about a half or a little less of the duration of V1 [+stress]. This correlation is not very much different in the pronunciation of the Finnish subjects except for FIN1. In his pronunciation V [-stress] was very much shorter while his V [+stress] was overlong.

The average durations were counted from the duration values of vowels [ɑ], [a], [ʌ], [ə] and [ⁱə] which we consider as the allophones of the phoneme /a/, and [ɨ], [i], [ɨ] and [ɪ] the allophones of /i/. My data includes more material of /a/ than /i/. In Table 16 the two vowel phonemes are compared with each other.

Table 22 shows the durational differences between the different [+stress] and [-stress] allophones of /a/ and /i/.

The table shows that /a/ was in all positions longer than /i/ in the pronunciation of the Russian subject as well as in the pronunciation of FIN1 and FIN3. On average /a/ was longer by 15,4 % than /i/ in the pronunciation of the Russian subject, the biggest difference was in V [+stress] from 16,8 % to 22,7 %. The pronunciation of FIN3 was very much similar to the Russian subject. The allophones of /a/ were longer

on an average by 13,7 % and in position V [+stress] /i/ was longer ranging from 20,4 % to 25,5 %.

TABLE 22 Durational differences between /a/ and /i/ in disyllabic words read by a Russian and four Finnish subjects

| Position | | | N | RUS | N | FIN1 | N | FIN2 | N | FIN3 | N | FIN4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| V1 [+stress] | [ɑ] | [a] | 45 | 197 | 45 | 278 | 46 | 209 | 42 | 171 | 45 | 189 |
| | [ɨ] | [i] | 20 | 163 | 20 | 255 | 21 | 212 | 17 | 142 | 20 | 157 |
| V1 [-stress] | [ʌ] | | 37 | 118 | 34 | 155 | 35 | 84 | 38 | 78 | 37 | 98 |
| | [ɨ] | [ɪ] | 26 | 110 | 25 | 128 | 26 | 78 | 26 | 76 | 26 | 87 |
| V2 [+stress] | [ɑ] | [a] | 19 | 215 | 16 | 249 | 17 | 279 | 18 | 281 | 17 | 280 |
| (op.syll.) | [ɨ] | [i] | 15 | 184 | 16 | 228 | 14 | 272 | 13 | 228 | 15 | 247 |
| V2 [+stress] | [ɑ] | [a] | 21 | 157 | 19 | 177 | 18 | 201 | 20 | 187 | 21 | 147 |
| (cl. syll.) | [ɨ] | [i] | 11 | 128 | 11 | 135 | 11 | 140 | 11 | 149 | 11 | 154 |
| V2 [-stress] | [ʌ] | | 20 | 148 | 16 | 75 | 20 | 140 | 20 | 122 | 20 | 124 |
| (op. syll.) | [ɨ] | [ɪ] | 16 | 126 | 15 | 63 | 16 | 138 | 16 | 120 | 16 | 117 |
| V2 [-stress] | [ə] | [ⁱə] | 15 | 90 | 14 | 87 | 15 | 98 | 15 | 89 | 15 | 102 |
| (cl. syll.) | [ɨ] | [ɪ] | 9 | 84 | 6 | 50 | 9 | 119 | 9 | 81 | 9 | 123 |

As the table shows, apart from FIN3 there was no regularity in the durational differences in the pronunciation of the Finnish subjects. In V2 [-stress] in close syllables FIN2 and FIN4 pronounced [ɨ] and [ɪ] by 17 % longer than [ə]. This result proves that the allophones of /a/ are longer than the allophones of /i/ in disyllabic words as they generally are both in Russian as well as in Finnish.

### 5.2.1.2 Durational ratio of vowels in disyllabic Russian and Finnish words

The duration of sound segments in disyllabic words was studied in two experiments. The first, Experiment 1, was a prestudy which consisted of recordings of three Finnish and two Russian subjects, a male and a female. The experimental material included Russian disyllabic words (N=88) read by the Finns and the Russians as well as Finnish words (N=56) read by the Finns and the Russians. The only vowel segments included in the data were allophones of /a/: [ɑ], [ʌ] and [ə].

Much of the data, Russian as well as Finnish, consisted of minimal pairs, *пара* ['pɑrʌ] (a pair) - *пора* [pʌ'rɑ] (it is time), *Мата* (a female pet name) - *маата* (partitive: land, earth or to lie). In the Russian minimal pairs the place of stress was distinctive while in the Finnish minimal pairs it was the vowel length which was distinctive. The duration of all vowels was measured in EDS programme.

The durational ratios of [+stress] and [-stress] vowels in Experiment 5 are given in Table 18. They have been published in an article (de Silva&Ščerbakova 1998), but the results are discussed here with some additional information and comments.

Table 23 shows that the longest vowel in Russian is V [+stress], [ɑ], which is longer than [ʌ] whose ratio is 0,9 - 1,47. Among [-stress] vowels [ʌ] is longer than [ə], the ratio being 0,95 - 0,63. This was proved by the pronunciation of the natives. V [+stress] is longer in an open word-final syllable than in a closed syllable.

TABLE 23 The durational ratio of vowels in Russian (N=88) disyllabic words read by three Finns and two Russians. The possible models of rhythmic structures are: ' — — and — ' —

| | [ʌ] - [ɑ] — ' — | [ɑ] - [ʌ] ' — — | [ʌ] - [ɑ] +C — ' — | [ɑ] - [ə] +C ' — — |
|---|---|---|---|---|
| Russian words read by natives | 0,90 - 1,47 | 1,27 - 0,90 | 0,95 - 1,19 | 1,39 - 0,63 |
| Russian words read by Finns | 0,81 - 1,75 | 1,56 - 0,89 | - | 1,66 - 0,81 |

In the pronunciation of the Finnish subjects the ratio between [ʌ] and [ɑ] was 0,81 - 1,75, i.e. almost 1:2. That means that the Russian [+stress] vowel is double the duration of V [-stress1] which was more than in the pronunciation of the Russian subjects.

TABLE 24 Durational ratio of vowels in Finnish disyllabic words (N=56) read by three Finns and a Russians (Experiment 4)

| | [ɑɑ] - [ɑ] | [ɑɑ] - [ɑɑ] | [ɑ] - [ɑɑ] | [ɑ] - [ɑ] |
|---|---|---|---|---|
| Finnish words read by natives | 1,78 - 0,82 | 1,44 - 1,33 | 0,95 - 1,91 | 1,10 - 1,09 |
| Finnish words read by a Russian | 1,76 - 0,82 | 1,38 - 1,45 | 0,56 - 1,78 | 0,70 - 1,31 |

As Table 24 shows, in the pronunciation of native Finns the duration of equal vowels, i.e. two short or two long vowels in a [+stress] or [-stress] position of a disyllabic words, was almost the same. They could be given simply with ratios 1:1 and 2:2. The ratios [*aa*] - [*aa*]: 1,44:1,33, and [*a*] - [*a*]: 1,10 and 1,09, show that there is no durational difference between [+stress] and [-stress] vowels. One can simply state that the ratio between a single vowel and double vowel is 1:2, i.e. the double vowels are at least twice as long as the single ones. This agrees with what Wiik and Lehtonen have proved (Lehtonen 1970, Wiik 1965).

In the Finnish disyllabic words read by Russians we notice that the durational ratio [*aa*] - [*aa*] and [*aa*] - [*a*] were similar to the native pronunciation. Nevertheless, when both syllables have a short vowel one of them becomes longer as is seen in the [*a*] - [*a*] ratio: 0,70:1,31. Apart from that, the oscillograms showed that in the pronunciation of the Russian subject [*aa*] was pronounced like two separate vowels with two peaks of intensity unlike the pronunciation of the Finnish subjects (de Silva&Ščerbakova 1998:56).

In Experiment 5 the durational values are somewhat different but mostly similar to the results of Experiment 4. Table 25 shows the durational ratio of vowels in disyllabic words.

TABLE 25 Duration ratio of vowels in Russian disyllabic words pronounced by a Russian (RUS) and Finnish subjects (FIN1-FIN4) (Experiment 5)

| | RUS | FIN1 | FIN2 | FIN3 | FIN4 |
|---|---|---|---|---|---|
| V1 [+stress] | 1,51 | 1,75 | 1,41 | 1,40 | 1,49 |
| V1 [-stress] | 0,90 | 0,92 | 0,57 | 0,68 | 0,77 |
| V2 [+stress], op.syll. | 1,65 | 1,50 | 1,94 | 2,07 | 2,21 |
| V2 [+stress], cl. syll. | 1,20 | 1,30 | 1,34 | 0,52 | 1,16 |
| V2 [-stress1] | 1,13 | 0,57 | 0,97 | 1 | 0,98 |
| V2 [-stress2] | 0,69 | 0,52 | 0,71 | 0,71 | 0,81 |

If we compare the durational ratio in the disyllabic Russian words pronounced by Russians to the result of Experiment 1 (Table 17), we notice that they were to an extent expressed differently but otherwise mostly similar. V1 [+stress] in this experiment was 1,39 when in Experiment 1 it was 1,27 and 1,39. V1 [-stress] ehich in this experiment was 0,88, was 0,90 and 0,95 in Experiment 1. V2 [+stress] in this experiment was 0,6 longer in open syllables and 0,11 longer in closed syllables. V2 [-stress2] was almost the same, 0,63 and 0,65, in both experiments, but between the vowels in position V2 [-stress1], there was a difference of 0,19 which means

that in Experiment 2 (Table 19), the final lengthening was comparatively longer in the [-stress] position.

The similarity of the results proves that in the Russian normative pronunciation the duration of vowels follows the three levelled hierarchy: V [+stress] - V [-stress1] and V [-stress2] although the Russian subjects in Experiment 4 represented the St.Petersburg norm and the subject in Experiment 5 represented the Moscow norm. Apart from that the results of the experiments prove that sentence frame does not affect or has very little effect on the durational hierarchy of Russian vowel system in disyllabic words, as the data of the first experiment included the same words in sentences as well.

Table 20 shows that the durational ratio in the pronunciation of the Finnish subjects is not always similar. In position V1 [+stress] FIN1 pronounced the vowel much longer than the others whose production was close to the Russian. FIN1 also pronounced V1 [-stress] comparatively longer. In his pronunciation, the duration of vowels were concentrated more on the first syllable and the vowels in the second syllable were comparatively shorter, especially V2 [-stress]. Nor did he have the vowel lengthening in the word-final position.

The comparison of the durational ratios of the Finnish subjects in Experiment 4 (Table 24) and Experiment 5 (Table 25) shows that in all positions the ratio values were situated between the values of FIN1 and the other Finnish subjects which always differed from the values of the Russian subject. Thus, all the data analyzed so far proves the fact that Finns categorize duration of vowels to long and short as is done in the Finnish language.

Thus, Experiment 5 as well as Experiment 4 showed that where the pronunciation of native Russians is concerned, the hierarchy of Russian vowel duration in disyllabic words is that the longest vowel is V [+stress]. The next in duration is V [-stress1], i.e. the vowel in the first syllable before stress or in syllables after the [+stress] syllable in a word-final position (open syllables). The duration of this vowel, V [-stress1], is in all cases considerably more than half of the duration of V [+stress]. The shortest Russian vowel in disyllabic words is V2 [-stress] (V [-stress2]) in close syllables. Its duration in the pronunciation of native normative Russian speaker is always less than half of the duration of V [+stress].

This proves that even if we had more Finnish subjects for our investigation, the results would not have changed considerably where durational ratio of vowels in disyllabic Russian words is concerned. Hence, we can consider the results as a proof of Finnish interference in prosody in this particular word structure.

### 5.2.1.3 Duration of consonants in disyllabic words

In Experiment 5 we measured the duration of all consonants as well. Each consonant was measured separately as C [-pal] and C [+pal]. Unfortunately, the analyzed data was not very large, thus the results might not give a complete picture of the topic. Anyhow, some results can be given which in a more detailed investigation can be proved either correct or wrong. We can also compare our calculations with the information we have got in the literature.

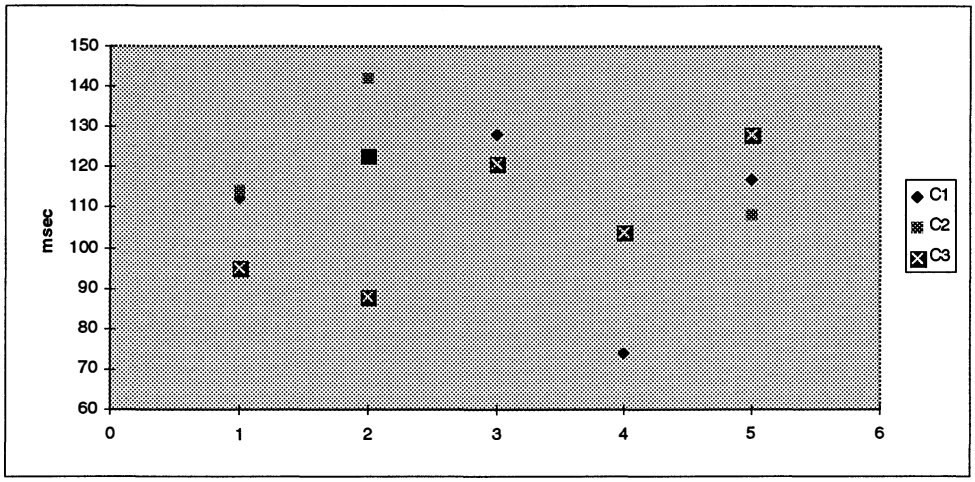


FIGURE 4 Durational differences of consonants in different word positions, C1, C2 and C3, in disyllabic Russian words pronounced by (1) a Russian and four Finnish subjects, (2) FIN1, (3) FIN2, (4) FIN3 and (5) FIN4

If we compare the duration of consonants in different word positions, C1, C2, C3, in the pronunciation of the Russian and Finns it was observed that the Russian subject pronounced C3 shorter than the other consonants which were of the same duration. The duration of the word-final consonant was noticeably shorter than other consonants in the pronunciation of FIN1, and his C2 was comparatively long. FIN 2 pronounced all the consonants almost with the same duration. In the pronunciation of FIN3, C2 and C3 were of the same duration, but his C1 was very short. FIN4 pronounced all the consonants comparatively longer but the positions did not differ much.

Figure 5 shows the Russian consonants pronounced by the native Russian subject in the durational order according to C [-pal]. As the figure shows, the longest consonant is the [+pal] palatoalveolar sibilant [ʃʲ]. It was twice as long as many other consonants. That gives us a basis to mark its length in transcription: [ʃʲ:] (in the figure marked as S). The other

[-voiced] palatoalveolar sibilant [ʃ] (in the figure marked as S) which is [-pal] was considerably shorter than [ʃʲ:], yet it is next in duration. After that come the dental affricate [ts] and the palatoalveolar affricate [tʃʲ] (in the figure marked as tS'). They are given in the figure as if they were a [-pal] and [+pal] pair although they are not. According to Zlatoustova (1981) the affricates are the longest consonants in Russian. But [ʃʲ], unfortunately, is not mentioned in her list.

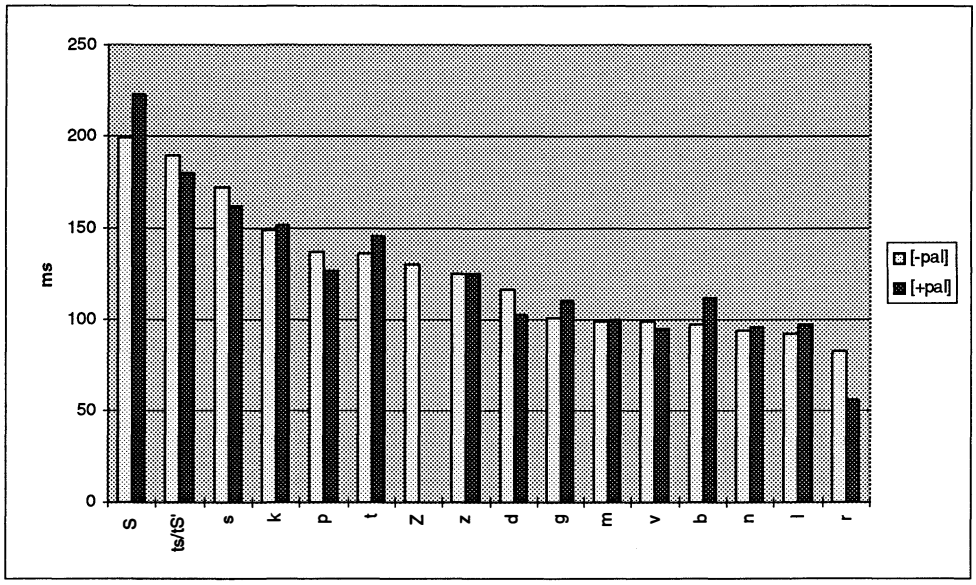


FIGURE 5 Consonant duration in disyllabic Russian words by a Russian normative male speaker

The next consonant in duration, according to my data, is the dental sibilant [s]. The [+voiced] sibilants, the [-pal] palatoalveolar [ʒ] (in the figure marked as Z) and the dental sibilant [z], come after the [-voiced] plosives [p], [t] and [k]. According to Zlatoustova, [z] and [ʒ] occupy the same place, but the [-voiced] fricatives are longer than the plosives in average values although maximally plosives can be very long, even sometimes longer than the affricates (Zlatoustova 1981:21). She includes [f] and [x] to the fricatives which are as long as [s] and [ʃ]. My disyllabic data did not contain these fricatives or [j] which explains why they have not been mentioned.

Figure 5 shows that the shortest consonants in Russian disyllabic words are the sonorants, and the shortest of them are the liquids [ɬ], [r] and [rʲ]. This result agrees with those found by Zlotoustova (1981:17, 21).

It is a well-known fact that the [+pal] consonants are generally longer in duration than [-pal] (Bondarko 1998). But Figure 4 shows that it does not concern all consonant pairs. My result is somewhat similar to the

results given by Kuznetsov (Prosodičeskij stroj russkoj reči 1996:17-18). His experiments included fricatives and plosives. In our experiment the [+pal] plosives besides [pʲ] had longer duration than the [-pal] pair. Apart from them [nʲ] and [lʲ] were longer than the [-pal] pairs. In [rʲ] the shorter duration also included a change in articulation. It is not a tremulant like [r] (Bondarko 1998:66).

Figure 6 shows how the Finnish subjects pronounced the individual Russian consonants in disyllabic words.

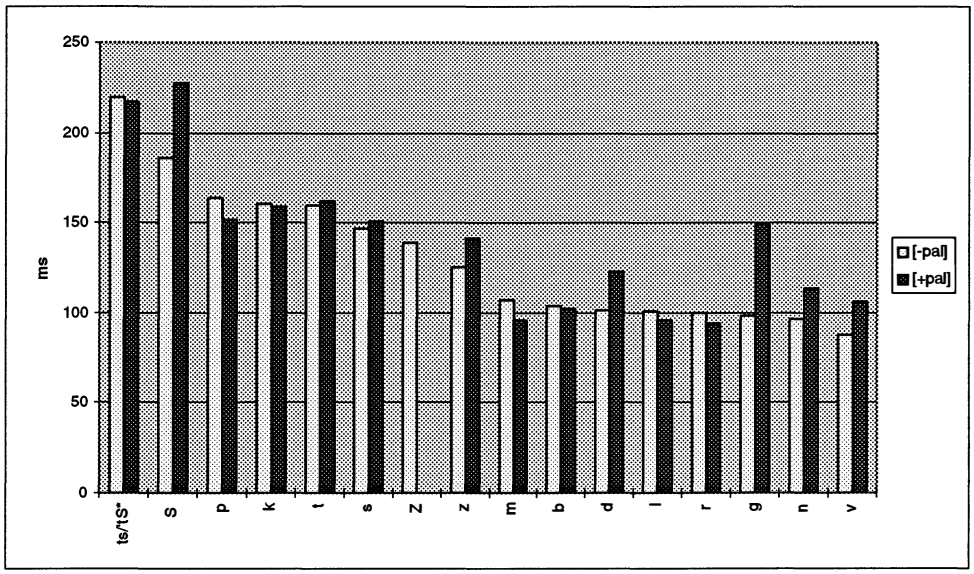


FIGURE 6 Consonant duration in disyllabic Russian words read by Finns. The average intrinsic values of the production of four Finnish subjects

Like in the pronunciation of RUS, the [+pal] palatoalveolar sibilant [ʃʲ:] had the longest duration even in the pronunciation of the Finnish subjects. Next to it were the affricates and the [-voiced] plosives [p], [k], [t], which incidentally, are typical Finnish consonants, too. In Finnish they are the longest single consonants (Lehtonen 1970) as there are no palatoalveolar sibilants or affricates in Finnish. The other sibilants [s], [ʒ] and [z] in the pronunciation of the Finnish subjects followed after the plosives.

The figure shows that in many cases C [+pal] was considerably longer than C [-pal], especially [gʲ] had a very long duration. In the case of [gʲ] it might just be accidental, but where [v], [n] and [d] are concerned, incorrect pronunciation, for example, pronouncing CʲV as CjV, might have been the cause as there were words like *вялый* ['vʲaɫɨj] (faded), *няня* ['nʲanʲɪ] (a nanny) and *дядя* ['dʲadʲɪ] (an uncle), where the orthogra-

phy or the transcription used in Finland confuse the learners of Russian from the very beginning.

Where the position according to the stress is concerned, the results show differences in the pronunciation of our Finnish subjects. According to Zlatoustova, Russian consonants are longer in [+stress] syllables than in [-stress] syllables (Zlotoustova 1981:17). Since she also means CV syllables by this, it means that the consonant before V [+stress] is longer than the consonant after V [+stress]. Our data proved the same thing. The average of the duration of C2 in all words was counted before and after V [+stress]. In the words pronounced by the Russian subject the consonants in position C+V2 [+stress] were 18,7 % longer than in position V1 [+stress] + C. Three Finnish subjects, FIN1, FIN2 and FIN4, also pronounced the consonant in the first position very much longer: FIN1 - 32,5 %, FIN2 - 26,2 % and FIN4 32,8 % longer than in the first position. In the pronunciation of FIN3, C+V2 [+stress] was only 2,3 % longer than in position V1 [+stress] + C.

The duration of consonants might also change, although not as much as the vowel duration, in different phrase positions. However, the material in my research can indicate a lot about the Russian pronunciation of Finns, and because of the simplicity in pronunciation of disyllabic words, no additional problems were caused. Apart from that, all my Finnish subjects read Russian fluently and knew the language quite well. One detail in Figure 5 shows the knowledge of pronouncing as well, namely, the pronouncing of [ʃʲ:] with a long duration with palatalization. If the knowledge of Russian of the subjects was less, there would have been a lot of difficulties in pronouncing consonants and that would have, no doubt, affected the duration as well.

#### 5.2.1.4 Disyllabic rhythmic structures

On the basis of our data of Experiment 5 it is possible to make a model of the possible disyllabic word structures in Russian (Figure 7).
In Figure 7 the first line (1) represents the structure CV[+stress]CV[-stress], the second one (2) is CV[+stress]CV[-stress]C, the third (3) CV[-stress]CV[+stress] and the fourth (4) is CV[-stress]CV[+stress]. The same average values are used for the same position as in C1.

Figure 7 shows that the values of C1 and C2 differ very little. The duration of C3 is a little shorter. All different duration levels of vowels, V [+stress], V [-stress1] and V [-stress3], are represented, but the final lengthening makes V2 [-stress1] in open word-final syllables as long as V2 [+stress] in a closed syllable. Zlatoustova states that this type of durational equality is often possible in Russian speech (Zlatoustova 1981:13).

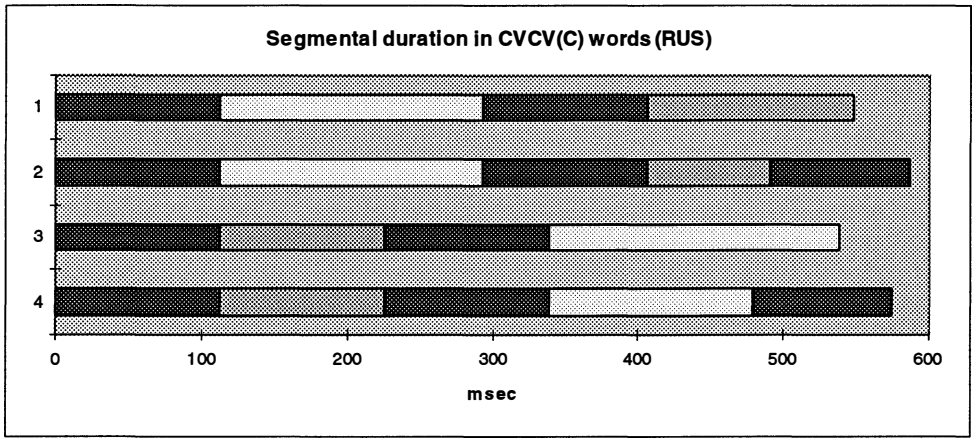


FIGURE 7 Disyllabic Russian 1 CV([+pal])CV, 2 CV([+pal])CVC, 3 CVCV([+pal]) and 4 CVCV([+pal])C word structures in pronunciation of normative Russian speaker

The relative duration value or intrinsic duration (Table 26) makes it possible to compare the relationship in duration of different speakers. In this work the relative duration was counted from the average duration of all sound segments. The values of relative duration of $V_1$ [+stress] in disyllabic words show that the stressed vowel in the first syllable pronounced by the Finnish subjects FIN2 and FIN3 was relatively as long as in the pronunciation of the Russian subject (1,4), but it was very much longer in the pronunciation of FIN1 (1,8).

TABLE 26 Relative duration of Russian sounds in disyllabic words pronounced by a Russian and four Finns

| Position in the word | RUS | FIN1 | FIN2 | FIN3 |
|---|---|---|---|---|
| $C_1$ | 0,7 | 0,8 | 0,9 | 0,7 |
| $V_1$ [+stress] | 1,4 | 1,8 | 1,4 | 1,4 |
| $V_1$ [-stress] | 0,9 | 0,9 | 0,6 | 0,7 |
| $C_2$ | 0,9 | 0,9 | 1,2 | 0,9 |
| $V_2$ [+stress], op.syll. | 1,5 | 1,5 | 1,9 | 2,1 |
| $V_2$ [+stress], cl. syll. | 1,1 | 1,3 | 1,3 | 1,5 |
| $V_2$ [-stress], op.syll. | 1,1 | 0,5 | 1 | 1 |
| $V_2$ [-stress], cl.syll. | 0,7 | 0,6 | 0,7 | 0,7 |
| $C_3$ | 0,7 | 0,6 | 1,2 | 0,9 |

The Russian speaker and one Finnish speaker FIN1 had the same relative duration where the unstressed vowel in the first syllable, $V_1$ [-stress], is concerned (0,9), while the other Finnish subjects pronounced it shorter

(0,6 and 0,7). The pronunciation of $V_1$ [-stress] by FIN1 shows that the duration of a Russian vowel in the first stage of reduction is similar to the duration of a single vowel in Finnish in a similar position.

Comparison with the relative duration of stressed and unstressed vowels shows that the Finnish subjects made a clear difference in duration between stressed and unstressed vowels, i.e. they divided the vowels into long and short, where the long one is the opposite of the short being double. The differences between their relative duration can be simplified:

RUS: $V_1$ [+stress] : $V_1$ [-stress] = 1.4:0.9 > 1.5:1
FIN1: $V_1$ [+stress] : $V_1$ [-stress] = 1.8:0.9 > 2:1
FIN2: $V_1$ [+stress] : $V_1$ [-stress] = 1.4:0.6 > 2:1
FIN3: $V_1$ [+stress] : $V_1$ [-stress] = 1.4: 0.7 > 2:1

The simplification shows that the stressed vowel pronounced by the Russian was comparatively shorter than the long vowel pronounced by the Finns. The negative transfer of Finnish language obviously affected in such a way that the Finnish subjects pronounced short and long vowels where the long vowel was twice as long as the short vowel.

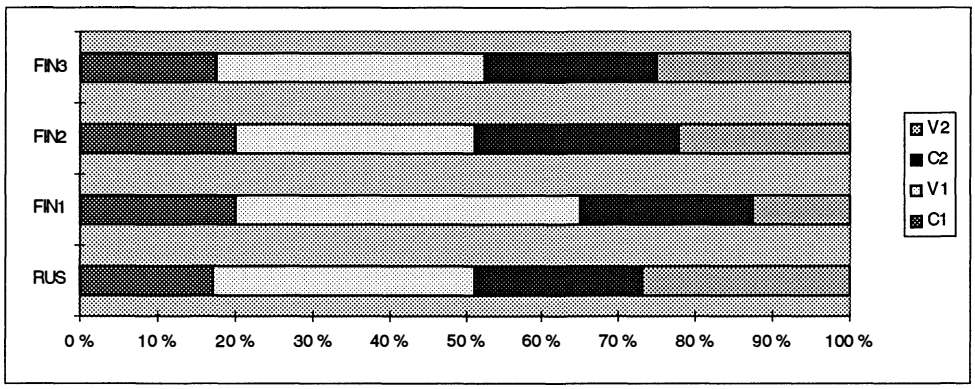


FIGURE 8 Ratio of segment duration in disyllabic Russian words with V1 [+stress] and an open syllable V2, pronounced by a Russian and three Finnish subjects

Where the relative duration of $V_2$ is concerned, the difference between the values of the Russian speaker and the Finnish speakers is similar to the values of $V_1$. The relationship between the stressed and unstressed vowels remains the same: RUS 1.5:1 and Finns 2:1. As the lengthening of the word-final vowel in an open syllable is a universal phenomenon, it seems to concern both Russian and Finnish. It is obvious in the pronunciation of all the subjects in every other case with the exception of $V_2$ [-stress] pronounced by FIN1. The lengthening of the final vowel in an open syllable by other Finns was comparatively more than by the Russian.

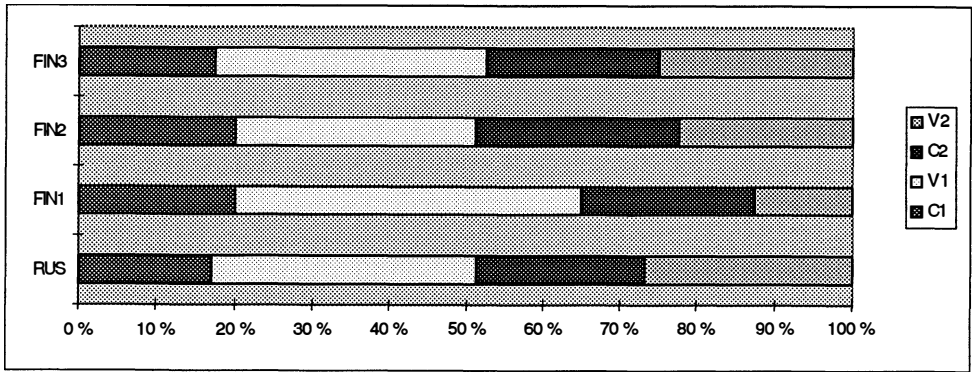


FIGURE 9 Ratio of segment duration in disyllabic Russian words with an open syllable CV2 [-stress], pronounced by a Russian and three Finnish subjects

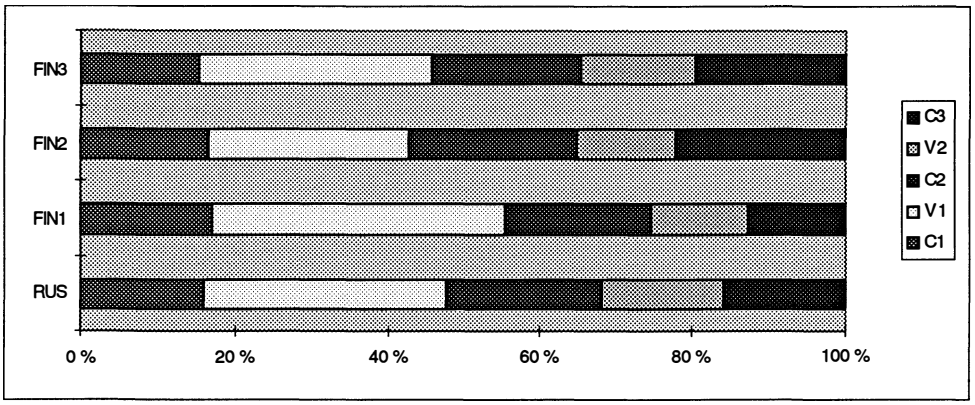


FIGURE 10 Ratio of segment duration in disyllabic Russian words with V1 [+stress] and a close syllable C2V2, pronounced by a Russian and three Finnish subjects

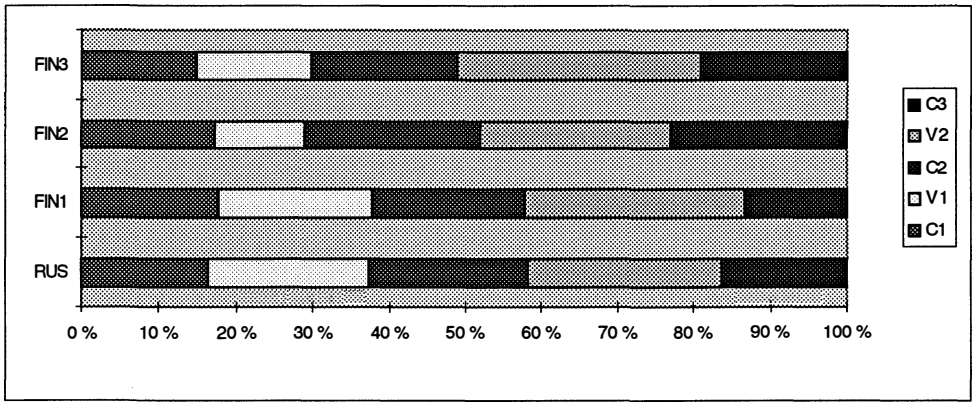


FIGURE 11 Ratio of segment duration in disyllabic Russian words with a close syllable C2V2 [+stress], pronounced by a Russian and three Finnish subjects

Figure 11 shows that the correlation between V [+stress] and V [-stress] in the pronunciation of the Finnish subjects was not the same as in the pronunciation of the Russian subject. FIN1 pronounced V [+stress] too long except the position V2 [+stress] in open syllables. This was the same in the case of FIN3. On the contrary, the V1 [-stress] in their pronunciation was too short. A characteristic feature of FIN2 was the longer duration of consonants.

### 5.2.2 Trisyllabic words

#### 5.2.2.1 Duration of vowels in trisyllabic words

The duration of vowels in disyllabic words has already been discussed in this work. In Experiment 2 we measured the vowel in trisyllabic words (N=108) as well. The same subjects, RUS - a native Russian male subject whose pronunciation we have earlier proved to represent the normative Russian pronunciation, FIN1 - FIN4 - Finnish male students of Russian, read the isolated Russian trisyllabic words.

Table 27 shows the average duration of vowel /a/.

TABLE 27 Average duration (ms) of vowels [*a*] and [a] (V [+stress]), [ʌ] (V [-stress1]), [ə] and [ⁱə] ([-stress2]) in Russian trisyllabic words

| Position in the word | N | RUS | FIN1 | FIN2 | FIN3 | FIN4 |
|---|---|---|---|---|---|---|
| V1 [+stress] | 23 | 176 | 269 | 196 | 173 | 193 |
| V1 [-stress1] | 19 | 115 | 119 | 70 | 63 | 87 |
| V1 [-stress2] | 20 | 78 | 123 | 76 | 69 | 79 |
| V2 [+stress] | 22 | 184 | 264 | 224 | 190 | 178 |
| V2 [-stress1] | 16 | 109 | 112 | 88 | 66 | 92 |
| V2 [-stress2] | 21 | 77 | 92 | 82 | 92 | 88 |
| V3 [+stress], op.syll. | 12 | 192 | 341 | 305 | 247 | 277 |
| V3 [+stress], cl. syll. | 13 | 155 | 184 | 198 | 194 | 140 |
| V3 [-stress1], op. syll. | 19 | 108 | 76 | 123 | 95 | 112 |
| V3 [-stress2], cl. syll. | 14 | 68 | 79 | 93 | 81 | 85 |
| All sounds | 179 | 109 | 136 | 123 | 83 | 90 |

As Table 20 showed the articulation speed of all the subjects was higher in trisyllabic words than in disyllabic words. Thus the articulation rate

changes according to the length of the structure, which is well known. In my case, the increase of the articulation speed was not that natural as I have used subjects whose mother tongue is not Russian. A longer rhythmic structure can be more difficult which might result in the articulation movements being slower.

Figures 12 and 13 show the duration of /a/ in different stress positions in the pronunciation of a normative Russian speaker (Figure 12) and the Finnish subjects (Figure 13).

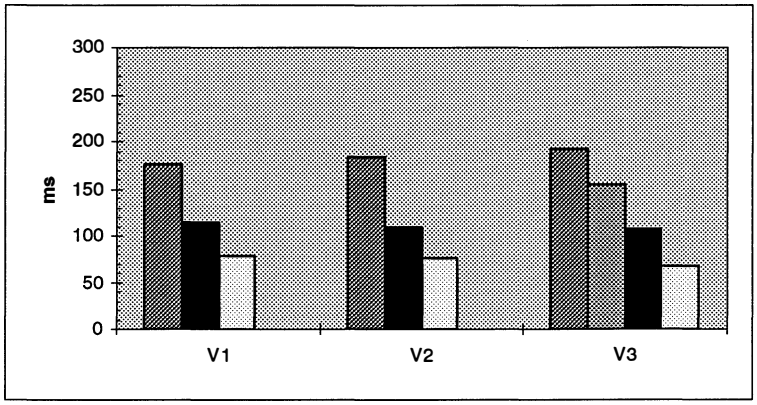


FIGURE 12 Duration of vowel /a/ in positions V [+stress] (=gray), V [-stress1] (=black and light grey) and V [-stress2](=white) in pronunciation of the Russian subject

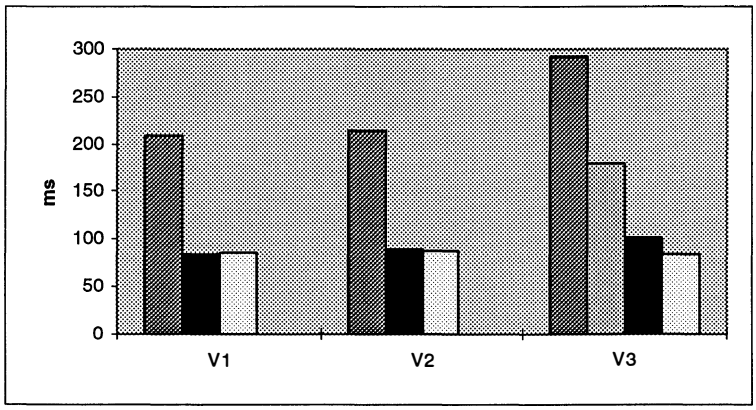


FIGURE 13 Duration of vowel /a/ in positions V [+stress] (=grey), V [-stress1] (black and light grey) and V [-stress2] (=white) in pronunciation of the Finnish subjects (average)

Vowel [*a*]/[a] is the longest vowel in Russian (Kižnjajeva 1975:15). In Finnish also /a/ is one of the longest (Lehtonen 1970, Wiik 1965, Karlsson 1983). In Russian /a/ is the only open vowel which explains the reason

why it is undoubtedly the longest, but in Finnish there is another open vowel /æ/ which could be longer or at least as long as /a/. Wiik has calculated the average duration of single and double vowels and has got the same duration 103 ms for both single /a/ and /æ/, while they are the shortest among the double vowels (Wiik 1965:115).

In the figures 12 and 13 the first column in each position shows the [+stress] vowel. In the last position, $V_3$ , the first one shows the [+stress] vowel in open syllables and the lighter grey column $V_3$ [+stress] in closed syllables. The darkest column in the middle shows [ʌ] (V [-stress1]) which is always considerably shorter than V [+stress]. The white column represents [ə] (V [-stress2]) which is normally the shortest vowel.

This data proves that the pronunciation of the Russian subject represented the literary norm of Russian Moscow pronunciation which includes the hierarchy of the three different stages in duration of vowels. It also proves that V [-stress] in word-final position in an open syllable is equal to [ʌ] while the [-stress] vowel in a closed syllable is [ə], as it should be. The durational hierarchy is clearly seen in vowel /a/, but the situation is a little different where /i/ is concerned.

My results do not fully agree with the first calculations given for Russian vowel duration in trisyllabic words by Potebnja (1866:66) and which are still quoted. According to Potebnja the vowel hierarchy can be expressed by numbers 3, 2 and 1, where 3 means the duration of the [+stress] vowel, 2 the duration of V [-stress1] and 1 the duration of V [-stress2].

TABLE 28 Average duration (ms) of vowels [i] and [i] (V [+stress]), [ɪ] and [ɪ] (V [-stress1] and V [-stress2]) in Russian trisyllabic words

| Position in the word | N | RUS | FIN1 | FIN2 | FIN3 | FIN4 |
|---|---|---|---|---|---|---|
| V1, V2 [-stress1] | 13 | 86 | 101 | 74 | 70 | 87 |
| V1, V2 [-stress2] | 10 | 66 | 87 | 63 | 65 | 62 |
| V1 [+stress] | 8 | 152 | 251 | 210 | 151 | 163 |
| V2 [+stress] | 12 | 132 | 211 | 175 | 156 | 156 |
| V3 [+stress], op.syll. | 6 | 169 | 242 | 244 | 227 | 234 |
| V3[+stress], cl. syll. | 6 | 120 | 145 | 169 | 159 | 111 |
| V3 [-stress1], op. syll. | 10 | 107 | 63 | 126 | 77 | 97 |
| V3 [-stress2], cl. syll. | 6 | 67 | 97 | 107 | 72 | 65 |

Table 28 as well as Figure 14 show that /i/ had two stages of reduction in the pronunciation of the Russian subject. The durational differences were not, however, as clear as in /a/. According to this data, the difference be-

tween the two reduction levels, V [-stress1] and V [-stress2] is less than in /a/. This result might have been a little different if I had counted [i̬], [ɨ̬] and [i], [ɪ] separately.

The vowel phoneme /i/ was a little different in the pronunciation of the Finnish subjects. One can say that the Finns differentiate the different stages of stress in /i/. The V [-stress1] has a longer duration than V [-stress2]. Figure 14 illustrates this difference. In the pronunciation of FIN3 the difference was very minimal. The [+stress] vowels [i̬] and [i] were comparatively longer in the pronunciation of all the Finnish subjects, and their duration was double or more than the duration of V [-stress], except in the pronunciation of FIN4. His pronunciation was closest to the pronunciation of the Russian subject.

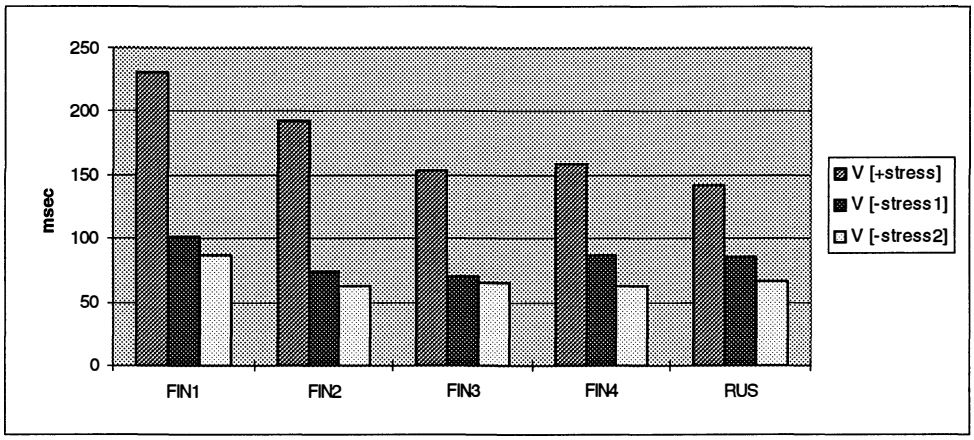


FIGURE 14 Pronunciation of i-vowels in different stress positions in trisyllabic words pronounced by a Russian normative speaker and four Finns: V [+stress] (=grey), V [-stress1] (=dark grey) and V [-stress2] (=white)

In some cases V [+stress] might have been too long in the pronunciation of the Finnish subjects because of the difficulty encountered in the pronunciation of [i̬]. As mentioned earlier, it is the most difficult vowel for Finns to pronounce. It is also obvious from the recordings of similar words like *высказав* ['viskəzəf] (after stating), that it needed more effort in pronouncing.

The data calculated shows clearly that /i/ was in most positions shorter than /a/ (<a). Table 29 shows the positions and percentages in trisyllabic words. A similar tendency was found in the disyllabic words. The table (Table 29) shows that in the pronunciation of the Russian subject, /i/ was longer than /a/ only in position $V_3$ [-stress], i.e. /a/ is regularly longer than /i/ in Russian pronunciation. FIN1 pronounced the [+stress] /a/ in positions $V_2$ and $V_3$ much longer than /i/ while in the

other positions the difference was not that big. On the basis of this data it is possible to come to the conclusion that /a/ is generally longer in duration and especially so in [+stress] syllables. The biggest difference between /a/ and /i/ was in $V_2$ [+stress] in the pronunciation of all subjects but FIN4.

The duration of vowels of the trisyllabic words in the pronunciation of all the Finnish subjects differed from the pronunciation of the Russian subject. Figure 13 gives the average values of the vowel duration in the pronunciation of the Finnish subjects. Instead of two different stages of reduction of V [-stress] there was only one in the pronunciation of the Finnish subjects. Both stages were equally short. Some difference is seen only in $V_3$ [-stress] where the vowel in the open syllable was longer than in the closed syllable. Apart from that, $V_3$ [+stress] significantly differed in the closed syllable from the one in the open syllable, i.e. the final lengthening is comparatively longer. On the other hand, the word-final consonant was longer than other consonants in the pronunciation of FIN2-FIN4.

TABLE 29 Duration of /i/ in comparison with /a/ in trisyllabic words. All [-stress] vowels are counted together

| | $V_1$ [+stress] | $V_1$ [-stress] | $V_2$ [+stress] | $V_2$ [-stress] | $V_3$ [+stress] | $V_3$ [-stress] |
|---|---|---|---|---|---|---|
| RUS | <a 15,2 % | <a 12,4 % | <a 29,4 % | <a 9,9 % | <a 4,7 % | >a 12 % |
| FIN1 | <a 7 % | <a 7,8 % | <a 25,3 % | <a 0,5 % | <a 39,8 % | <a 5 % |
| FIN2 | >a 7 % | >a 9,3 % | <a 28 % | <a 6,4 % | <a 16,5 % | >a 16,8 % |
| FIN3 | <a 14,2 % | >a 3,5 % | <a 25,5 % | >a 4,3 % | <a 11,9 % | <a 11,1 % |
| FIN4 | <a 18 % | >a 7,1 % | <a 14 % | <a 3,1 % | <a 9,4 % | <a 1,9 % |

Obviously, only two different stages of duration of vowels are valid for Finns as the result of interference of Finnish language. The pronunciation of FIN1 shows that he associates the Russian stress with very long, or perhaps overlong, duration. Both [-stress] vowels in the first syllable, as well as in the third syllable, are of equal length. $V_2$ [-stress1] is slightly longer than $V_2$ [-stress] in the second syllable. In all positions the stressed vowels are more than twice as long as the unstressed vowels. This also proves that long vowels can be lengthened to a certain extent (Lehtonen 1970:146 ).

In trisyllabic words I also had the possibility of comparing the duration of V [-stress2] in syllables preceding the [+stress] syllable (предударные слоги) and syllables following the [+stress] syllable (заударные слоги). According to Verbickaja, the duration of V [-stress2] in these positions might differ in such a way that V [-stress2] is shorter after stress (Verbickaja 1976:50). The duration values of /a/ in Table 21 show that in the pronunciation of the Russian subject this really happened. The difference between V1 [-stress2] and V2 [-stress2] was minimal, but V3 [-stress2] was already 10 ms shorter in the average value. But the values of /i/ (Table 23) do not show a similar tendency.

### 5.2.2.2 Duration of consonants in trisyllabic words

Segmentation always includes difficulties. Firstly, the boundaries between vowels and sonorants are difficult to define. Secondly, the duration of such sounds as voiceless plosives /p/, /t/ and /k/ was not possible to measure in the beginning or at the end of the words. Thirdly, in the signals produced by Finns [+voiced] plosives /b/, /d/ and /g/ in the speech of Finns were not pronounced with voice and in some cases, for example, the nasal /n/ or labial /v/ were only partly voiced.

TABLE 30 Average duration (ms) of consonants and articulation rate in trisyllabic words pronounced by a Russian and four Finns

| Position in the word | RUS | FIN1 | FIN2 | FIN3 | FIN4 |
|---|---|---|---|---|---|
| $C_1$ | 107 | 111 | 115 | 77 | 109 |
| $C_2$ | 102 | 155 | 117 | 100 | 102 |
| $C_3$ | 112 | 137 | 128 | 108 | 101 |
| $C_4$ | 107 | 86 | 153 | 116 | 124 |
| All consonants | 109 | 136 | 123 | 83 | 90 |

The average durations of subjects show the following individual differences in duration of consonants:

RUS: The consonants in all positions had similar duration which was not far from the average duration of all sounds.

FIN1: The average duration of consonants was different in all positions. The word-final consonant was very short compared to the others. The consonants in the word-medial positions were the longest.

FIN2: The word-final consonant had the longest duration, C3 was the next, while C1 and C2 had a similar duration.

FIN3: The word-initial consonant, C1, was considerably shorter than the consonants in the other positions. The word-final consonant had the longest duration.

FIN4: C1, C2 and C3 have similar duration, but the word-final consonant is much longer.

Figure 15 illustrates the duration of consonants in different positions in the word.

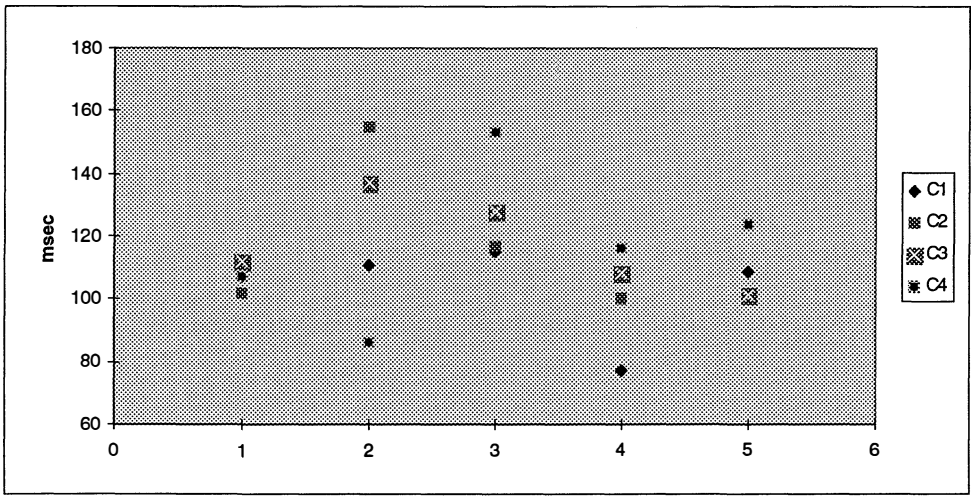


FIGURE 15 Distribution of duration values of Russian consonants according to the position in trisyllabic words read by (1) a Russian, (2) FIN1, (3) FIN2, (4) FIN3 and (5) FIN4

The figure shows clearly how close the durational values of the consonants in different positions were in the pronunciation of the Russian subject. The Finnish subjects pronounced the consonants in all positions with different duration, except the duration of C2 and C3 in the pronunciation of FIN4. There can be many reasons for this result, but generally in Russian, duration of consonants does not seem to change according to the position in the word. There are differences in duration of individual consonants, as we can see below. In this result, the individual differences as well as the influence of the place of stress are eliminated as all positions include different consonants in the same proportion, as well as the stress positions.

The durational differences of the Russian consonants, [-pal] as well as [+pal] in trisyllabic words pronounced by the Russian subject are seen in Figure 16 and by the Finnish subjects in Figure 17. If we compare the durational order of the consonants in disyllabic words (Figure 5) we no-

tice that the order from the longest [-pal] pair to the shortest has changed a little.

The palatoalveolar sibilant [ʃ] has changed vis a vis [ʃʲ:] as the dental affricate [ts] vís a vís the palatoalveolar affricate [tʃʲ]. The order of consonants in trisyllabic words supports the results of Zlatoustova according to which the affricates are the longest consonants in Russian.

In the pronunciation of the Russian subject the duration of the nasals, [m], [mʲ], [n], [nʲ] in different positions did not vary very much. The longest consonants appeared in the word-final and word-initial positions. The position before or after V [+stress] did not cause any noticeable differences in the duration of the nasal and lateral consonants. Nor did the duration of the [-pal] and [+pal] nasals differ significantly in the pronunciation of the Russian subject.

The average duration of [m] was 99 ms in disyllabic words and 97 ms in trisyllabic words, [mʲ] - 100 ms in disyllabic words and 96 ms in trisyllabic words, [n] 94 ms in disyllabic words and 96 in trisyllabic words and [nʲ] 96 ms in disyllabic and 102 in trisyllabic words. The different relationship of the durations of [nʲ] in disyllabic and trisyllabic words can be due to the type of examples used in this research, namely, among the trisyllabic words there were more examples where the sound was in a word-initial position. Another reason could be that [nʲ] becomes more prominent in a longer structure.

The average duration of the laterals, [ɬ] and [lʲ] in disyllabic words was 92 ms and in trisyllabic words 86 ms, and of the lateral [lʲ] in disyllabic words 97 ms and in trisyllabic words 85 ms. The noticeable difference in the duration of [lʲ] in disyllabic and trisyllabic words is due to the shorter value of [lʲ] in position V [+stress] + C.

The tremulant [r] had longer average duration in the disyllabic words (83 ms) as well as in the trisyllabic words (85 ms) than [rʲ] whose average durational values were 59 ms in the disyllabic words and 56 in trisyllabic words. This is due to the fact that [rʲ] is often pronounced as a short glide between vowels.

The [-voiced] plosives [p], [t] and [k] were longer in duration than the nasals and laterals. Longest of them is [k] whose average duration in disyllabic words was 149 ms and 142 in trisyllabic words, [kʲ] was a little longer, 152 ms, in disyllabic words and slightly shorter in trisyllabic words, 139 ms. The average duration of [p] in disyllabic words was 137 ms and [pʲ] was 10 ms shorter, in trisyllabic words the average duration of [p] was only 110 ms and [pʲ] was longer, 118 ms. The average duration of [t] in disyllabic words was 136 ms and in trisyllabic words 116 ms, the plosive [tʲ] accordingly was 146 ms in the disyllabic words as well as in the trisyllabic words. In other words the palatalization process is seen as a longer duration in the dental plosive.

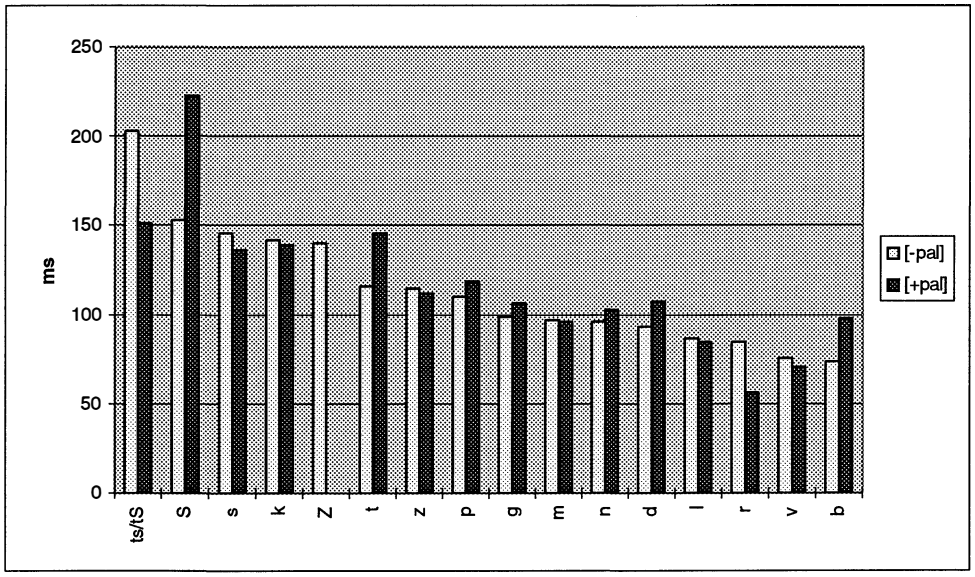


FIGURE 16 Consonant duration in Russian trisyllabic words read by a Russian

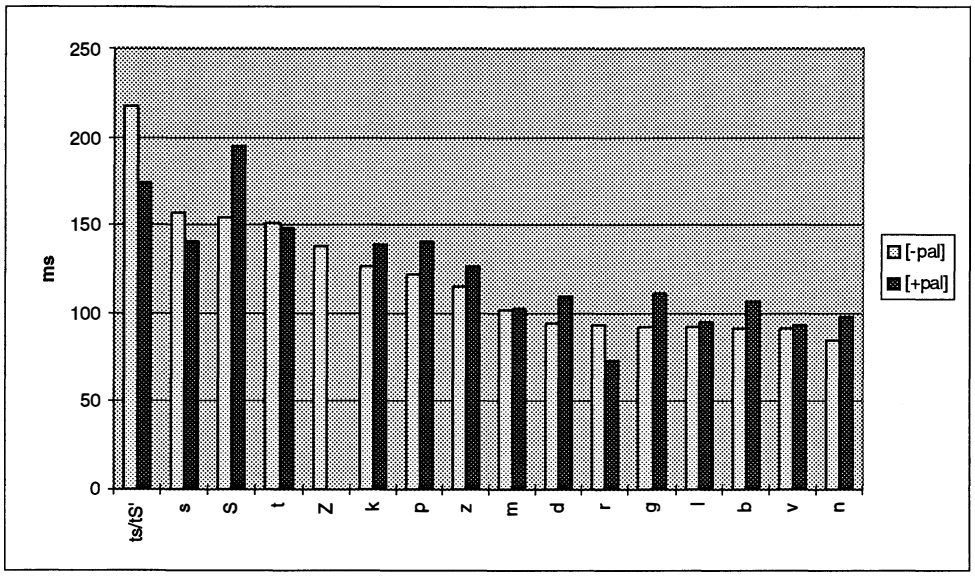


FIGURE 17 Consonant duration in Russian trisyllabic words read by four Finns

While the [-voiced] plosives were longer than the nasals and laterals, the [+voiced] plosives were not always so long. The average duration of [b] in the disyllabic words was 97 ms and in the trisyllabic words only 73 ms. The palatalization effect was seen in [$b^j$] the same way as in [$p^j$], the [+pal] plosive was considerably longer. In the disyllabic words the aver-

age duration of [bʲ] was 112 ms and in the trisyllabic words 98 ms. The average duration of the [+voiced] dental plosive [d] was 116 ms in the disyllabic and 93 ms in trisyllabic words, and the average duration of the [+pal] dental plosive [dʲ] was 103 ms in the disyllabic and 107 ms in the trisyllabic words. A similar effect of palatalization as in [pʲ], i.e. C [+pal] was longer in duration, was seen in both cases but more obviously in the trisyllabic words. The average duration of the [+voiced] velar plosive [g] in the disyllabic words was 101 ms and in the trisyllabic words 99 ms. Its [+pal] counterpart had an average duration of 110 ms in the disyllabic and 106 ms in the trisyllabic words.

The sibilants have often longer duration than other consonants. The palatoalveolar [+pal] sibilant [ʃʲ:] is the longest sound of the Russian sound system. This was proved in this data as well. In the pronunciation of the Russian subject the average duration of [ʃʲ:] was 223 ms in the disyllabic words and 206 in the trisyllabic words. The [+voiced] palatoalveolar sibilant [ʒ] was the shorter with the average duration of 130 ms in disyllabic and 140 in the trisyllabic words, while the [-voiced] palatoalveolar sibilant [ʃ] had the average duration of 199 in the disyllabic and 153 ms in the trisyllabic words.

Of the dental sibilants, [s], [sʲ], [z] and [zʲ], the [-voiced] [-pal] [s] was the longest with the average duration of 172 ms in the disyllabic and 146 ms in the trisyllabic words. The [+pal] pair of it, [sʲ], was by 10 ms shorter in both types of words. The [+voiced] dental sibilants [z] and [zʲ], were shorter, being of equal duration of 125 ms in the disyllabic words. In the trisyllabic words the C [-pal] was only by 3 ms shorter than C [+pal].

The dental affricate [ts] was surprisingly long, having the average duration of 203 ms in the trisyllabic words (there were no such sounds in the disyllabic words). Most of the data including this sound was in position V [+stress] + $C_{ts}$. The palatoalveolar affricate [tʃʲ] had the average duration of 180 ms in the disyllabic words and 151 ms in the trisyllabic words.

The consonants [f], [x] and [j] appeared only in 2-3 words and their duration varied a lot. Apart from that, [j] was very difficult to measure between vowels. Of the fricatives the labiodental spirant [v] had the average duration of 99 ms in the disyllabic words and 76 ms in the trisyllabic words, and [vʲ] - 95 ms in the disyllabic words and 70 ms in the trisyllabic words.

As Figure 17 shows, the pronunciation of the Finnish subjects differed from the pronunciation of the Russian. In many cases the Finns pronounced C [+pal] longer than the Russian subject. Where [zʲ], [nʲ] and [pʲ] are concerned the reason is that they added /j/ between C and V. A clear difference is also seen in the velar plosives.

### 5.2.2.3 Trisyllabic rhythmic structures

In the trisyllabic Russian words each of the syllables can be [+stress]. The word stress changes the ratio of vowel duration, but affects very little the consonants.

Where vowel duration is concerned, the [-stress] syllables have two possible stages of stress as we have shown with the stress models earlier. Generally in Russian the [-stress] syllables as well as [-stress] vowels are counted from the [+stress] syllable. Thus V [-stress1] appears in the first syllable before stress, in the first pre-stressed syllable, and in one case after stress, in a post-stress syllable: in an open word-final syllable. This syllable, as we have mentioned earlier, has been proved to have the same stage of reduction as pre-stressed syllables (Verbickaja 1976, Bondarko 1981, 1998), although it was traditionally treated as any other post-stressed syllable (Avanesov 1984). In the second, third etc. pre-stressed syllables as well as in all the other post-stressed syllables, besides the open word-final syllable, the vowel becomes V [-stress2].

Table 31 and Figures 18-20 show the durational ratio of vowel /a/ and consonants in different rhythmic structures.

TABLE 31 Relative duration of vowel /a/ and consonant segments in trisyllabic words.

| Position | RUS | FIN1 | FIN2 | FIN3 | FIN4 |
|---|---|---|---|---|---|
| $C_1$ | 1 | 0.8 | 0.9 | 0.8 | 1 |
| $V_1$ [+stress] | 1.6 | 1.7 | 1.9 | 1.9 | 1.8 |
| $V_1$ [-stress1] | 1.1 | 0.8 | 0.7 | 0.7 | 0.8 |
| $V_1$ [-stress2] | 0.7 | 0.8 | 0.7 | 0.8 | 0.8 |
| $C_2$ | 0.9 | 1.1 | 0.9 | 1 | 0.9 |
| $V_2$ [+stress] | 1.6 | 1.7 | 1.8 | 1.7 | 1.6 |
| $V_2$ [-stress1] | 1 | 0.7 | 0.7 | 0.6 | 0.8 |
| $V_2$ [-stress2] | 0.7 | 0.6 | 0.7 | 0.7 | 0.8 |
| $C_3$ | 1 | 1 | 1 | 1.1 | 0.9 |
| $V_3$ [+stress], op. syll. | 1.7 | 2 | 2 | 1.9 | 2.2 |
| $V_3$ [+stress], cl. syll. | 1.3 | 1.5 | 1.5 | 1.6 | 1.4 |
| $V_3$ [-stress1] op. syll. | 1 | 0.7 | 0.8 | 0.8 | 0.9 |
| $V_3$ [stress2] cl. syll. | 0.6 | 0.7 | 0.6 | 0.7 | 0.8 |
| $C_3$ | 1 | 0.6 | 1.2 | 1.1 | 1.2 |

As we know, the main parameter of the Russian word stress is duration. As has already been found out earlier in this study, the ratio between V [+stress1] : V [-stress1] : V [-stress2] in Russian disyllables is 1,4-1,5:0,9:0,6-0,7. According to the reduction rules the same ratio should remain in other type of rhythmic structures as well.

The data given in the table shows that the ratio of vowel duration counted from the pronunciation of the Russian subject was: 1,6:1,1:0,7 taken from the first syllable, i.e. similar to the one in the disyllables. The second syllable had almost the same ratio: 1,6:1:0,7. Even the last syllable was almost similar though the final syllable lengthening caused changes.

The durational ratio of the vowels in the pronunciation of the Finnish subjects shows the same as the result of the disyllabic words: there was only one stage of reduction and V [+stress] was also comparatively long. Figure 18 indicates this same phenomenon.

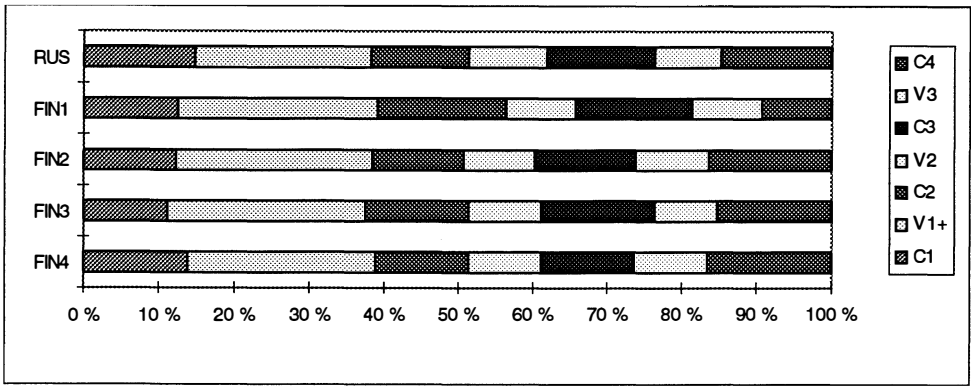


FIGURE 18 Ratio of segment duration in trisyllabic Russian CVCVCVC words where V1 is [+stress] pronounced by a Russian and four Finns

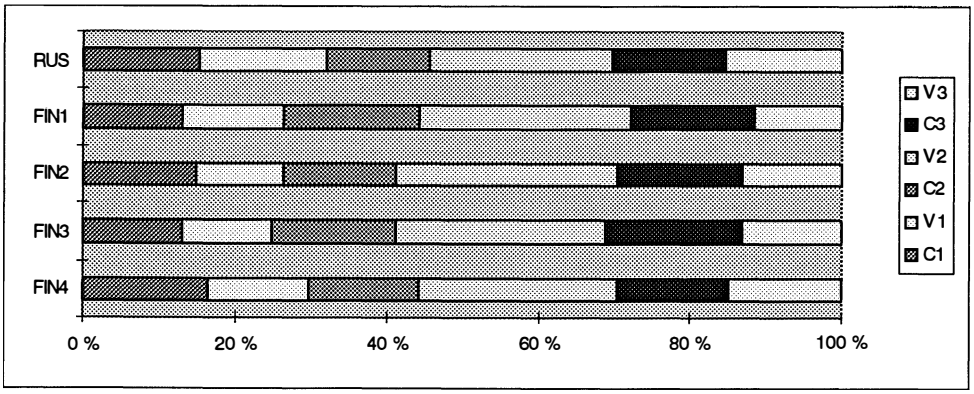


FIGURE 19 Ratio of segment duration in trisyllabic Russian CVCVCV words where V2 is [+stress] pronounced by a Russian and four Finns

The relative duration of $C_1$ was most similar among all subjects. Its value, 0,9, in words pronounced by the native speaker was the same in words pronounced by one Finn, FIN2. But $C_1$ pronounced by FIN1 was a little shorter (0,7), the shortest being the value of FIN3. By comparing the values of other consonants it is not possible to state that FIN3 generally pro-

nounced consonants shorter than others, but in his pronunciation some consonants were measured shorter than others in the word-initial position due to the lack of voice as in sonorants.

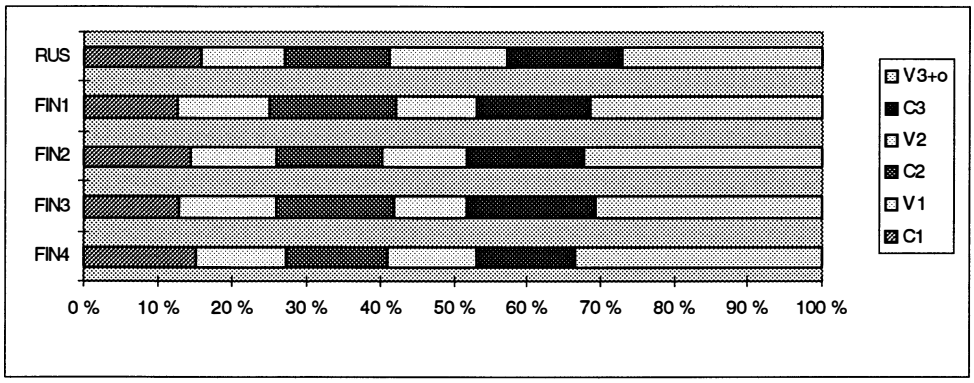


FIGURE 20 Ratio of segment duration in trisyllabic Russian CVCVCV words where V2 is [+stress] pronounced by a Russian and four Finns

Where the whole rhythmic structure (phonetical word) is concerned, the incorrect ratio of vowel duration combines with differences in consonant durations. This alone might not cause misunderstanding in the Russian speech of Finns, but if a wrong place of stress is added to this, it would definitely lead to misundertanding.

### 5.2.3 Vowel duration in quadrisyllabic words

Quadrisyllabic Russian and Finnish words were studied in Experiment 3 from the point of view of vowel duration (de Silva & Ščerbakova 1988). In quadrisyllabic words, one syllable is [+stress] and the other three [-stress]. In each word there is at least one V [stress1] which is in the first pre-stress syllable. Unless the word has an initial vowel or an open final syllable all the other vowels are in position V [-stress2]. The experiment included isolated words as well as the same words in sentences, but the comparison made in this experiment was solely on the pronunciation of the isolated words as all the other data consisted of them.

There were two native subjects who read the quadrisyllabic Russian words and the relative duration values were counted from both. Four types of quadrisyllabic words were analyzed. Each of them had the stress on a different syllable. All vowels in the words were allophones of /a/ and all consonants were [-pal].

Table 32 shows the durational ratio in quadrisyllabic words.

TABLE 32 Durational ratio in quadrisyllabic Russian words read by two native Russians

| Rhythmic model | Ratio | Examples |
|---|---|---|
| '— — — —<br>*a* - ə - ə - ʌ | 1,44 : 0,54 : 0,78 : 1,52 | *баловала* ['bałəvəłʌ] (spoiled) |
| —' — — —<br>ʌ - *a* - ə - ʌ | 0,85 : 1,16 : 0,68 : 1,32 | *заказана* [zʌ'kazənʌ] (reserved) |
| — —' — —<br>ə - ʌ - *a* - ʌ | 0,61 : 0,98 : 1,21 : 1,30 | *самовара* [səmʌ'varʌ] (gen. of a samovar) |
| — — —' —<br>ə - ə - ʌ - *a* | 0,56 : 0,65 : 1,13 : 1,70 | *колокола* [kəłəkʌ'ła] (bells) |

Table 32 shows that the same three-levelled hierarchy of duration as in trisyllables between vowels V [+stress] - V [-stress1] - V [-stress2] remained in quadrisyllabic words. The longest was V [+stress] in all syllables, the ratio being 1,16 - 1,44 in word-medial positions. The biggest duration value of V1 [+stress], V2 [+stress] and V3 [+stress] was in the first syllable. The final lengthening made the ratio of V4 [+stress] 1,70 in the word-final position.

The table also shows that V [-stress1] was always longer than V [-stress2], the ratio being 0,85 - 1,13 in word-medial positions. The longest of V1 [-stress1], V2 [-stress1] and V1 [-stress1] was in the third syllable. The final lengthening made the ratio 1,30 - 1,52. The ratio of V [-stress2] is 0,54 - 0,78. The longest was V3 after another V [-stress2].

Table 33 shows vowel duration in the pronunciation of Finns.

TABLE 33 Vowel duration in quadrisyllabic Russian words in pronunciation of Finnish subjects

| Rhythmic model | Ratio | Examples |
|---|---|---|
| '— — — —<br>*a* - ə - ə - ʌ | 2,21 : 0,69 : 0,76 : 0,76 | *баловала* ['bałəv əłʌ] (spoiled) |
| —' — — —<br>ʌ - *a* - ə - ʌ | 0,89 : 2,15 : 0,54 : 0,62 | *заказана* [zʌ'kazənʌ] (reserved) |
| — —' — —<br>ə - ʌ - *a* - ʌ | 0,93 : 0,81 : 1,37 : 0,92 | *самовара* [səmʌ'varʌ] (gen of a samovar) |
| — — —' —<br>ə - ə - ʌ - *a* | 0,92 : 1,07 : 0,82 :1,88 | *колокола* [kəłəkʌ'ła] (bells) |

The pronunciation of the same Russian quadrisyllabic words by Finnish subjects (Table 33) shows that V [+stress] was double or more than double V [-stress] in V1 (2,21), V2 (2,15) and V4 (1,88), but in V3 the difference in duration was not that great (1,37). In this case the word 'samovar' would have been the best known word to the Finnish subjects. There was no final lengthening in V [+stress] as V4 [+stress] was even shorter than the others.

In all positions V [-stress1] and V [-stress2] had a similar duration. V [-stress1] had a ratio 0,76 - 0,92 and V [-stress2] 0,54 - 1,07, i.e. V [-stress2] had more variation. In V [-stress1] there was no final lengthening as such although V4 [-stress] was a little longer.

This result, as well as the results of the disyllabic and trisyllabic words, shows that the three stages of vowel duration are the same in the normative Russian pronunciation irrespective of the length of the word. The only time when the hierarchy gets disturbed is in V [-stress1] in word-final position where, due to the final lengthening, its duration can be more than that of V [+stress]. The same results have been reached, for example, by Zlatoustova (1961) and Verbickaja (1976). On the other hand, in the Russian pronunciation of Finns, the vowel duration consisted of two stages: short and long where the long duration was generally twice or more the short one. This again proves that the interference of the mother tongue in vowel duration is quite clear.

## 5.3 Quality features of segments in Russian

With the help of spectral analysis both the quality of vowels as well as consonants can be studied in detail. In this study along with the vowel quality two typical features of the Russian consonant system were studied, namely, palatalization and labialization, both of which affect the quality of vowels. Apart from that, attention was paid to the explosion burst and VOT of plosives which can include additional information about palatalization.

The spectral analysis in this study was done with the intention of answering the following questions:

1) How do the vowels differ in the pronunciation of the Russian and the Finnish subjects?
2) How is the palatalization of consonants or the lack of it seen in the spectra?
3) Is the labial coarticulation seen in the pronunciation of the Russian and the Finnish subjects the same way?

### 5.3.1 Quality of vowels

The formant structure, or F-pattern, of vowels gives information of the vowel quality. The formants of sounds, i.e. the area of concentration of energy in the spectrum of the sound segment involved, is connected with the features of articulation as the F-pattern is the set of resonance frequencies of the vocal tract (Fant 1970:209). In vowel study three formants, $F_1$, $F_2$ and $F_3$, give the necessary information, but $F_1$ and $F_2$ are considered as more important than $F_3$ from the point of recognizing a vowel. They are generally seen as sufficient for stating the acoustic relations (Fant 1970, Bondarko 1974). The $F_3$ value can be predicted from the $F_2$ value (Iivonen 1988:39) and it contains individual features of pronunciation (Aulanko 1997) .

The frequency of $F_1$ is connected with the openness of the vowel, and the frequency of $F_2$ - with the frontness and backness of the vowel, i.e. the maximal closeness of a vowel indicates the lowest frequency of $F_1$ and the maximal frontness means the highest possible frequency of $F_2$ , just as the maximal openness indicates the highest frequency of $F_1$ and the maximal backness the lowest $F_2$. These tendencies are universal, i.e. relevant in any vowel system. Nevertheless, the concrete characteristics of formants (their frequency, intensity, the way they change in time dimensions from the beginning to the end of the vowel) depend on many factors.

Vowels can be shown as formant charts. The point signifying a particular vowel on a formant chart does not, however, give a full picture of the phonological and phonetical characteristics of a vowel because many other factors might affect the vowel quality. Altogether, many different factors affect the place of the vowel in a formant chart. Factors affecting the formants can be divided into the following categories (Iivonen 1988:39):

1. Paradigmatic factors, i.e. the distinctive quality and features, such as closeness/openness (vertical position), frontness/backness (horizontal position), tenseness/laxness (peripherization/centralization), nasalization and other phonological features.
2. Syntagmatic factors (environment), i.e. allophones as a result of context and coarticulation.
3. Range of clearness, i.e. stressed/reduced and clearness/unclearness in articulation.
4. Idiolectic and sociolectic voice qualities, i.e. voice quality and the basis of articulation.
5. Structural properties of articulation organs and other automatic factors, i.e. the length and tightness of the vocal tract.
6. Incidental factors.
7. The way of measuring the formants.

All factors were not considered in the current study. I concentrated on finding out the differences which existed in the pronunciation of the Russian normative speaker and the four Finnish subjects where the two vowel phonemes /a/ and /i/ were concerned. The basic analysis was done on the Russian material, but for comparison the equivalents of the same vowels in Finnish comparison words have been measured. In this data all the three formants of vowels [*a*], [a], [ʌ], [ə], [ⁱə],[i], [ɨ], [ɪ] and [ɨ] were measured in three places. In the beginning of the initial part, in the medial part and in the final part of the vowel.

### 5.3.1.1 Basic quality of /a/ and /i/

When the formant structure of the Russian vowels is studied it is common to measure the formants in three places, i.e the vowel is divided into three parts:

1) The initial part, i.e. the *first transitional part*, TP1, (первый переходный участок) of a vowel which shows the coarticulatory influence of the preceding consonant. The most obvious and at the same time the most important coarticulation is palatalization which plays a significant role as a part of the phonological and phonetical system of the Russian language. But, as in any language, the labial coarticulation is always evident as well.

2) The medial part of a vowel (стационарный участок) which can be called the *stationary part* (SP), or a typical part and a *steady part*. SP is the part of a vowel where $F_1$ and $F_2$ do not have changes and where their values are maximally close to the values in isolated pronunciation (Bondarko 1977:68), in other words, to know the real quality of vowel without the influence of the environment and its situation in the triangle of the cardinal vowels one has to measure the formants in SP (Bondarko 1981:64).

3) The final part, i.e. the *second transitional period*, TP2, (второй переходный участок) of a vowel starts from the end of SP and continues from the end of the vowel to the next consonant or, in the word final position, to the end of the word. TP2 shows the coarticulary influence of the following consonant.

The acoustic studies have proved that the quality of the Russian vowels, especially V [+stress] but also V [-stress] changes a lot during the time dimension (Bondarko 1960,1981, Kuznetsov 1997, Šerstinova 1987). Each TP includes one or more different stages depending on the environment. So, for example, between two [+pal] consonants, in $C^jVC^j$ position, [a] ([+stress]) might even consist of up to 18 stages which by quality are like different short vowels (Bondarko 1981:70). The shortest SP is be-

tween two [+pal] consonants where, according to Bondarko, it is only 25 % of the duration of [a], and in [i], SP was 43 % (Bondarko 1960:102).

Although the SP is a kind of 'nucleus' of a vowel not all vowels have it. Most of the [+stress] vowels have SP. In connected and spontaneous speech, the presence and length of SP is dependent upon the speech rate (Agafonova et al. 1974:34-36). Because of the shortness of duration, [-stress] vowels often miss SP (Bondarko 1974:16), in which case, instead of the term SP, one can use a term connoting 'central part' (центральная часть) which means the part between the transitional periods, TP1 and TP2 (Kuznetsov V.B.1995:85).

When analyzing this data I have tried to find the SP of vowels and measure the formants in the middle of SP. The task of finding the place of SP in the F-patterns was not generally a difficult task, but in some cases where there was a C [+pal] on one side of the vowel and C [+pal] or C [+lab] on the other side, the task was more difficult, as then $F_2$ probably would fall or rise in the movement all the way.

The vowel /*a*/ has five different allophones which can be phonetically marked with different signs or combinations of signs. All of them have their own quality which should come out clearly in the formant values in SP. The allophones of the phoneme /a/ are:

V [+stress] [*a*] (after C [-pal]): *дал* ['d*a*ł] (he gave),
[a] (after C [+pal]): *сядь* ['sʲatʲ] (imper. sit down)

V [-stress1] [ʌ] (after C [-pal]): *дала* [dʌ'ł*a*] (she gave)

V [-stress2] [ə] (after C [-pal]): *тамада* [təmʌ'd*a*] (toast master)
[ⁱə] (after C [+pal]): *занята* ['z*a*nʲⁱətʌ] (occupied)

Nevertheless, I used more detailed division of the [+stress] allophones of /a/, since the purpose was to study the labial coarticulation of the preceding consonant on the vowel as well. Thus, both allophones, [*a*] and [a], were represented by two different variations depending on the fact whether the previous consonant was [-lab] or [+lab]:

V [+stress] 1) [*a*], in position C [-pal] [-lab]+V: *дал* ['d*a*ł] (he gave),
2) [a], in position C [+pal] [-lab]+V: *сядь* ['sʲatʲ] (imper. sit down),
3) [*a*], in position C [-pal] [+lab]+V: *мал* ['m*a*ł] (too small),
4) [a], in position C [+pal] [+lab]+V: *мял* [mʲał] (crumled)

As mentioned earlier, /*a*/ varies more than any other Russian vowel from the acoustical point of view (Kuznetsov 1997:160). The 'ideal variant'

of the main allophone [*a*] [+stress] appears in words after C [-pal] [-lab] and before C [-pal] [-lab]. In this position, CVC, the F-patterns should not have any significant changes from the beginning to the end of the vowel. All the three formants are comparatively close to each other (a compact vowel), i.e. $F_1$ is high, $F_2$ and $F_3$ are low. If the preceding or following consonant is [+lab], the $F_2$-pattern goes down on the side of C [+lab]. These are the most obvious changes which are both clearly seen in $F_2$-pattern, but there can be other smaller changes as well, where after dental /t/ $F_1$-pattern is slightly lower and $F_2$-pattern a little higher in TP than in SP (Kuznetsov 1997:162).

The other [+stress] allophone of /*a*/, [a], automatically indicates that it is preceded by C [+pal], i.e. it is in position $C^jV(C)$ or $C^jVC^j$. Thus, its $F_2$-pattern starts with a higher frequency. Depending on how strongly $C^j$ is palatalized, $F_2$ may rise as high as in [i]. The period of TP on the side of C [+pal] is also called the i-transition. Apart from the higher frequency of $F_2$, a lower value of frequency of $F_1$, which resembles the value of [i], is typical for i-transition. The formant structure in SP of the vowel [a] [+stress] should be similar to the one of [*a*], but it may have a lower $F_1$ frequency and higher $F_2$ frequency, i.e. it is more close and more front. In connected speech with the different frequency values of F-patterns during the time dimension, the quality of [a] changes significantly, as can be seen in the research of Kuznetsov where it was identified as [ɛ] and [æ] in many cases (Zlatoustova 1982:44, Kuznetsov 1997:170-171).

The word final position in an open syllable for V [-stress1] after C [-pal] and C [+pal] is generally less reduced than the vowel in a closed syllable. Thus, for /a/ in a position C [-pal] + V [-stress] we use the [-stress1] allophone, [ʌ] (*занято* ['zanʲiətʌ] occupied), but after C [+pal] ($C^jV$), for example, *няня* ['nʲanʲɪ] (an aunt), the situation is not quite clear. The sound is generally similar to [ɪ], as in the position of the middle of a phonetical word. Irrespective of this, its quality can change to more back and more open during the final lengthening. Sometimes it has even been given its own transcription sign in Russian phonetical literature ([ɑ]). Anyway, in accordance with the spectral characteristics, as it is noticed in the pronunciation of many people, it is close to [ɪ] (Verbickaja 1976:52). In research of a less specialized nature it is considered as any post-stress vowel after C [+pal], [ə] (Avanesov 1984, Jones & Ward 1969). This data will show on its own what phonetical sign is better to use.

The division of the phoneme /a/ in position V [+stress] into four allophones was done on the basis that C [+pal] and C [+lab] affect the F-patterns. It is known that the palatal coarticulation of C [+pal] is seen in the higher frequency of $F_2$ in TP of the vowel and that the coarticulation of C [+lab] is seen as a lower frequency of $F_2$. The lower frequency of $F_2$ after C [+lab] is most obvious where Russian /*a*/ is concerned before or

after C [+lab] [-pal] (Bondarko 1974:16). This was clearly seen in the results of the experiments conducted. After C [+pal] $F_2$ rises in any case whether the consonant is [-lab] or [+lab].

The phoneme /i/ is represented by different allophones in the same type of positions and environments as /a/:

V [+stress] 1) [ɨ], in position C [-pal] [-lab]+V: *сын* ['sɨn] (a son),
2) [i], in position C [+pal] [-lab]+V: *лить* [lʲitʲ] (to pour)
3) [ɨ], in position C [-pal] [+lab]+V: *быть* [bɨtʲ] (to be)
4) [i], in position C [+pal] [+lab]+V: *пить* ['pʲitʲ] (to drink)

V [-stress] 1) [ɨ] (after C [-pal]): *рады* ['radɨ] (happy), *дамы* ['damɨ] (ladies)
2) [ɪ] (after C [+pal]): *пяти* [pʲɪ'tʲi] (of five), *дяди* ['dʲadʲɪ] (uncles)

Generally [i] (position C [+pal] + V) is considered as the basic allophone of /i/. Its F-patterns include a low frequency value of $F_1$ and a high frequency of $F_2$, i.e. it is a diffuse vowel and from the point of view of articulation it is [+close] and [+front]. The vowel [ɨ] (position C [-pal] +V) is a central (medial) vowel but, as mentioned earlier, by nature it is a diphthong resembling [i] at the end. That means acoustically that the $F_2$-pattern rises at the end.

Russian vowels [i] and [ɨ] do not have qualitative reduction, only quantitative, i.e. the [-stress] vowels are similar in quality but shorter than the [+stress] vowels. Nevertheless, the formant patterns can be slightly different. The problem in this study was that there are not many [ɨ] vowels in the data, so I have considered them as the same vowel with the corresponding V [+stress].

As mentioned earlier, the representatives of the St.Petersburg phonological school consider the two types, /i/ and /ɨ/, as different phonemes. But as we can see from the allophones they are all in complementary distribution, namely that [i] and [ɪ] appear after C [+pal] and [ɨ] and [ɨ] after C [-pal], so in this research they have been considered as allophones of the same phoneme /i/.

The vowel [ɪ] ([-stress]) includes sounds which correspond to letters *е*, *а* and *я* in unstressed position after C [+pal], for example, *лети* [lʲɪ'tʲi] (imper. fly), *часы* [tʃʲɪ'sɨ] (a clock), *пяти* [pʲɪ'tʲi] (of five), i.e. if the same syllable in another grammatical form is [+stress], the vowels would be /e/ and /a/. This type of pronunciation is called 'ikanje'. The same fact concerns [ɨ]. In this data there were [ɪ] sounds originating from *е* and *а*, but there were no such [ɨ] sounds.

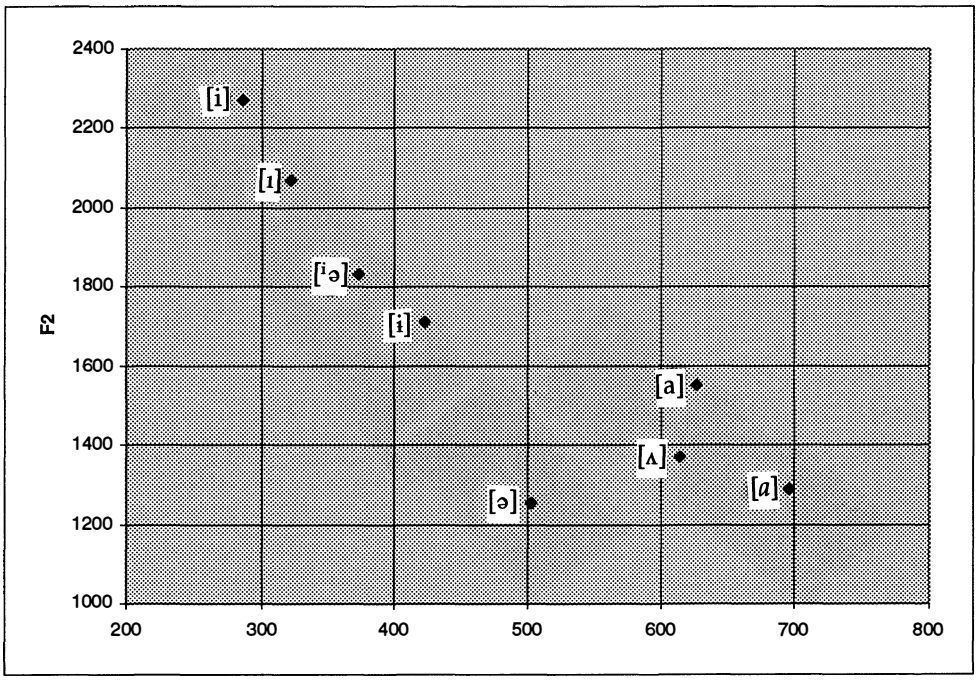


FIGURE 21 Average $F_1$ and $F_2$ frequency values (Hz) of SP of Russian vowels [i], [i], [ɪ], [iə], [a], [a], [ʌ], [ə] in pronunciation of RUS1

The formant 'chart' (Figure 21) is based on the average formant values in SP of the mentioned allophones of /a/ and /i/. In the chart [i] is [+front] and [+close]. Next to [i] is [ɪ] which is more open and less front. The vowel [i] is [-front] and [-back] which are its normal features, but in this chart it is [-close] as well which corresponds mainly to the results given by Bondarko (Bondarko 1981:66). Generally [i] is considered as [+close] ([+high]). Where the quality is concerned, the [-stress] allophone [ɪ] was counted together with [i].

The [+stress] allophone of /a/ after C [-pal], [a], was a [+back] vowel in this data which differs from the claim of some Russian phoneticians who consider it to be [-back] (Ščerba 1983, Matusevič 1976, Avanesov 1984). The Russian subject in this experiment showed that [a] (position after $C^j$) is more close, i.e. the frequency of $F_1$ was lower, and more front than [a], i.e. the frequency of $F_2$ was higher. The $F_2$ frequency of [a] in the pronunciation of the Russian subject was high compared with the value given by Fant 1070 Hz (Fant 1970:118) or Zlatoustova (1962:16), but it fits to the phonemic boundaries of [a] given by Bondarko which exceeds 1500 Hz (Bondarko:1981:66). $F_2$ of [a] in this data, i.e. after C [+pal], exceeded the values given by Bondarko, i.e. it was more front.

The allophone of /a/ in position [-stress1] after C [-pal], [ʌ], is more front than [*a*] an [a]. Where the closeness is concerned, it is closer than [*a*] but more open than [a].

The vowel which appears in position C [+pal] + V [-stress2], [ⁱə], is more like [i]. It is as short as [ə] and the preceding consonant has maximal influence on it, i.e. the palatal coarticulation is strong. For this reason the vowel, for example in this data, is closer to the allophones of /i/ and is included in the table of the allophones of /i/. Thus, it can be considered as an allophone of /i/. The allophone of /a/ in the same stress position but after C [-pal] is in this chart the most open medial, [-front] and [-back], vowel. Thus, this chart gives a foundation to have two different allophones for V [-stress2], one after C [-pal], [ə], and another after C [+pal], [ⁱə].

The allophone of /a/ in position C [-pal] + V [-stress2] is [ə] and in position C [+pal] + V [-stress2] is [ⁱə]. The first one should occupy a central position among the Russian vowels, i.e. it should have a lower value of $F_1$ and a higher value of $F_2$ than [*a*]. As mentioned earlier, the vowel [ə] is a very short sound, so the coarticulation of the adjacent consonants have a heavy effect on it and its quality changes accordingly. In this data in the pronunciation of RUS the average frequency of $F_1$ of [ə] was lower, i.e. this vowel was closer than [*a*], but the average frequency of $F_2$ was even a little lower, i.e. this vowel was not more front.

In general my results gave the same differences in $F_1$ and $F_2$ values of the Russian vowels concerned as they are given by Zlatoustova on the basis of male voices (a tenor and a baritone), although she used connected speech as well (Zlatoustova 1962).

The $F_1$, $F_2$ and $F_3$-patterns show in the TP1 the coarticulation of the preceding consonant, in the TP2 the coarticulation of the following consonant and in the SP the real quality of the vowel. The frequency values of $F_1$ and $F_2$ in different parts of the vowel are connected with the articulation movements during the pronunciation of the vowel concerned. Thus, the lower the frequency of $F_2$ is, the higher the tongue is, i.e. the vowel is more close and, vice versa, the higher the frequency of $F_1$ is, the more back the tongue rises and vice versa. The Russian [*a*] basically had a high $F_1$ and a low $F_2$ which should be seen in the SP. Palatalization of the neighbouring consonant lowers the $F_1$-pattern and rises the $F_2$-pattern and its labialization lowers the $F_2$-pattern.

### 5.3.1.2 Vowel quality as produced by Finns

The formant chart (Figure 22) gives the average $F_1$ and $F_2$ values in the SP of all the allophones of /a/ and /i/ in the pronunciation of the Finnish subjects. The comparison of this chart with the chart of the pronunciation

of the Russian subject (Figure 21) shows that all the allophones of /i/, including [ⁱə], were more similar to each other in the pronunciation of the Finnish subjects than in the pronunciation of the Russian subject. And the allophones of /a/ were even more similar to each other.

This result shows that the Finnish subjects have learned the Russian 'ikanje' well. Otherwise, the quality of [ɪ] would have been further from [i], i.e. more open. But, on the other hand [i] was less front and less high than in the pronunciation of the Russian subject. The vowel [i] was higher in the pronunciation of the Finnish subjects.

All the allophones of vowel /a/ are in the same region of the formant chart of the pronunciation of the Finnish subjects. That means that [ə] has almost no qualitative reduction, the vowels [ɑ] and [ʌ] were very close to each other and [a] was not significantly different from them. In other words, there is no question of this vowel getting closer to Finnish [æ].

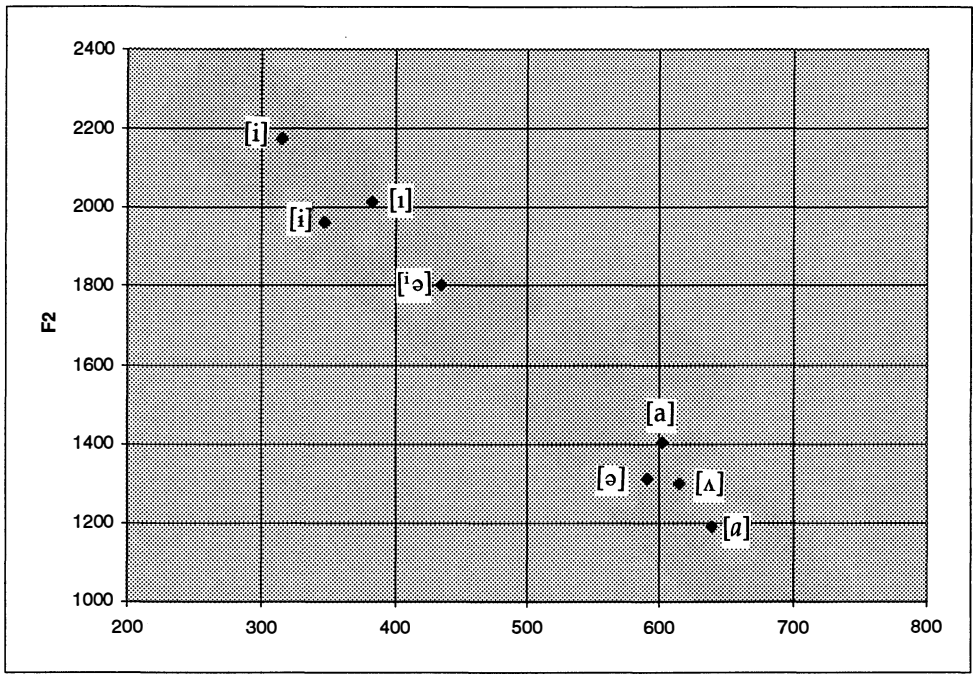


FIGURE 22 Average $F_1$ and $F_2$ frequency values (Hz) of SP of Russian vowels [i], [i], [ɪ], [ⁱə], [ɑ], [a], [ʌ], [ə] in pronunciation of the Finnish subjects.

Table 34 shows the differences in the allophones of /a/ in the individual pronunciation of the Finnish subjects compared with the Russian. The table shows that all other Finns but FIN4 pronounced [ɑ] more front and FIN 2, FIN3 and FIN4 pronounced it lower than the Russian subject. FIN2

and FIN3 pronounced [a] more front and lower than the Russian subject. FIN4 pronounced it higher and more front than the Russian. Vowel [ə] was more back in the pronunciation of all the Finnish subjects, but higher in the pronunciation of FIN1 and FIN4 but there was not much difference in the highness of [ə] between the other Finns and the Russian.

In the pronunciation of the Finnish subjects [a] was also closer and more front than [*a*]. The change of $F_2$ was +420 Hz, which was even more than in the pronunciation of RUS. This could be explained by stronger palatalization of the preceding or following consonants produced by these two subjects.

In the pronunciation of RUS the [-stress1] allophone of /a/, [ʌ], was closer and almost as back, i.e. the frequency of $F_1$ was by 81 Hz less and the frequency of $F_2$ is by 79 Hz more. The vowel [ʌ] was more front in the pronunciation of FIN2 and FIN3 but more back in the pronunciation of FIN1 and FIN4. The average values of $F_1$ and $F_2$ of [ʌ] in the pronunciation of all the four Finnish subjects were very similar to the values in the pronunciation of the Russian subject

TABLE 34 The average values (Hz) of the frequencies of $F_1/F_2$ in SP of all allophones of vowel /a/

| | [*a*] | [a] | [ʌ] | [ə] |
|---|---|---|---|---|
| RUS | 696/1290 | 627/1550 | 615/1369 | 502/1255 |
| FIN1 | 684/1294 | 625/1449 | 652/1392 | 624/1401 |
| FIN2 | 577/1083 | 537/1160 | 515/1178 | 521/1246 |
| FIN3 | 595/1168 | 575/1350 | 602/1270 | 589/1248 |
| FIN4 | 702/1224 | 673/1644 | 692/1353 | 627/1356 |
| Average of the Finns | 639/1192 | 602/1401 | 615/1298 | 590/1312 |

In Finnish the $F_2$ frequency of a short [*a*] is on an average 1345 Hz and for a long [*aa*] 1240 Hz (Wiik 1965:57). My results contain similar information, namely, that [*a*] [+stress] which is longer had lower and [ʌ][-stress] which is shorter had higher frequency values. The table shows that the highest value of $F_2$ was after C [+pal] in [a]. But that does not make it similar to Finnish [æ] whose $F_2$ is 1825 Hz (a short vowel) and 1840 (a long vowel) (Wiik 1965:57).

The $F_1$ and $F_2$ patterns in the SP of short and long vowel /a/ were measured in some Finnish comparison words (N=10) (see Appendix) read by all the five subjects, and they showed that in the pronunciation of the Russian subject, the formant frequencies of [*a*] were (799/1268) higher than the frequencies of [*a*] ([+stress]) in Russian, and $F_1$ as well as $F_2$ of [*aa*]

were again higher by 100 Hz. But in the pronunciation of the Finnish subjects the frequencies of [*a*] were by 5-48 Hz ($F_1$) and by 27-200 Hz ($F_2$) lower than the corresponding values of [*aa*]. The short vowel [*a*] in the pronunciation of the Finnish subjects was similar to the Russian [*a*]. The value of $F_1$ was in average 42,5 Hz different and the value of $F_2$ was in average 56 Hz different. This result shows that the Finnish [*a*] does not differ much from its equivalent in Russian in position C [-pal] + V [+stress].

The formant chart (Figure 22) shows that all the allophones of /*a*/ in the pronunciation of the Finns were very similar where $F_1$ and $F_2$ patterns are concerned. In the pronunciation of the Russian subject all four allophones of /a/ differed clearly from each other. This shows that the Finnish subjects produced in all cases a vowel which was similar to Finnish /a/. This data does not support the suggestion that [a] which appears in position $C^jV(C)$ or $C^jVC^j$ could be interpreted by Finns as [æ].

As mentioned earlier, the two allophones of /i/, [ɨ] and [i], are in complementary distribution in such a way that [ɨ] appears only after C [-pal] and [i] after C [+pal]. Thus, their correct pronunciation includes the differentiation of [-pal] and [+pal] consonants. As we know, there is no opposition [-pal]/[+pal] in the Finnish consonantal system, i.e. all consonants are closer to [-pal]. Palatalization which appears in the allophones of a few Finnish consonants (the velar plosives before [i]) in standard Finnish (Wiik 1981:77) is not very strong. There is also no central vowel [ɨ] in Finnish even after C [-pal]. So the Russian [ɨ] and [ɪ] have the same equivalent in Finnish as the Russian [i] and [ɪ].

On the basis of the table (Table 35) it is possible to compare the quality of the vowel /i/ in the pronunciation of the Finnish subjects and RUS. As mentioned earlier, the equivalent to /a/ in position [-stress2] after C [+pal] which is a very short reduced vowel is closer to /i/ than to /a/ because of the palatal coarticulation. Thus, the measurements of its frequencies of $F_1$ and $F_2$ are given in this table.

As Table 35 shows, on average [i] was in the pronunciation of RUS slightly more close and more front than in the pronunciation of the Finns (see the formant chart). The Finnish subjects as well as the Russian pronounced [i] as V [+front].

The table shows that FIN1 pronounced all these allophones more high than the Russian subject and in his pronunciation [ɨ] was almost as high as [i] but more central. In the pronunciation of all the Finnish subjects [i], [ɪ] and [$^i$ə] were less front than in the pronunciation of the Russian subject, but the level of $F_2$, i.e. the highness, varied from one person to another. The chart (Figure 22) and the table (Table 35) show that the Finnish subjects, except FIN1, did not distinguish [ɨ] and [i] clearly.

TABLE 35 The average values (Hz) of the frequencies of $F_1/F_2$ in SP of vowels [ɨ], [i], [ɪ] and [ⁱə].

| | [ɨ] | [i] | [ɪ] | [ⁱə] |
|---|---|---|---|---|
| RUS | 422/1711 | 286/2270 | 322/2069 | 373/1833 |
| FIN1 | 346/2369 | 290/2415 | 437/2230 | 485/1915 |
| FIN2 | 305/1569 | 296/1991 | 362/1280 | 387/1545 |
| FIN3 | 326/1956 | 335/ 2107 | 301/ 2055 | 440/1833 |
| FIN4 | 416/2045 | 354/2269 | 390/2116 | 430/1908 |
| Average of the Finns | 349/1984 | 318/2195 | 368/2014 | 423/1806 |

Generally [ɨ] is seen as the most difficult Russian vowel for Finnish learners of Russian as there is no central vowel [ɨ] in Finnish, even after C [-pal]. Table 35 shows that in the pronunciation of FIN1 the $F_1$ and $F_2$ of the [+front] [i] and [-front] [ɨ] were close to each other. Vowel [ɨ] in the pronunciation of FIN2 and FIN3 is as close as [i] but more back, especially in the pronunciation of FIN2. FIN4 pronounced [ɨ] more back and a little more open than [i]. But the difference between [ɨ] and [i] was not that clear in the pronunciation of the Finns as it was in the pronunciation of the Russian subject.

Vowel [ɪ] which is the [-stress] allophone of /i/ after C [+pal] was a little more open ($F_1$ - higher) and more back ($F_2$ - lower) than [i] in the pronunciation of the Russian subject. In the pronunciation of FIN3 [ɪ] was closest to [i]. In the pronunciation of FIN2 it was a little more open but considerably more back. Where the pronunciation of the other two Finns was concerned [ɪ] differed from [i] with more open and more back quality, in a similar way as in the pronunciation of the Russian subject.

Another variation of [ɪ] appeared in word final position after C [+pal] where [ɪ] [-stress] alternated with [a] [+stress]. In the pronunciation of RUS it was more open than [ɪ] but closer than [ʌ], its $F_1$ being in SP 520 Hz, and more front than [ʌ] but more back than [ɪ], its F2 being 1750 Hz. According to this data it would be possible to mark it with a separate transcription mark as it is sometimes done.

In the Finnish comparison words the Russian subject pronounced the short [i] (292/2383) as well as the long [ii] (274/2434) more front and higher than the Finns (in average 343/2140 and 306/2219). The frequency values show that [ii] in the pronunciation of the Russian subject as well as of the Finns was more front and more high than [i]. This result also proves that [i] is higher and more front than the Finnish equivalent.

This data proved that in the pronunciation of the Russian subject vowel /a/ had two different [+stress] allophones as well as two [-stress] allophones which differed from each other in quality. In the pronunciation of the Finnish subjects all the allophones of /a/ were more similar. The other vowel sounds in this data also differed from each other in the pronunciation of the Russian subject, but were that much close to each other in quality that they can be considered as allophones of /i/. This concernes [$^{i}$ə] as well. In the pronunciation of the Finns the i-sounds were even more close to each other. Thus, the difference between [i̯] and [i] was not that clear.

### 5.3.2 Palatalization of consonants

#### 5.3.2.1 Palatal coarticulation

Palatalization in Russian is one of the most important consonant categories. Though being a consonant property, its acoustic investigation cannot be done without vowel study as the most obvious sign of palatalization is the rise of the second formant on the side of C [+pal].

In Figure 23 the $F_2$-pattern of [i] shows the tongue position after C [+pal] which should be the same in the beginning of any vowel in this position as the sign of palatalization. As generally, the $F_2$-pattern of [i̯] differs from the pattern of [i] in TP1 and SP, but becomes similar to it in TP2. This refers to the diphthong like quality of [i̯]. The falling pattern of SP2 in [i] shows that C2 or C3 after [i] is [-pal].

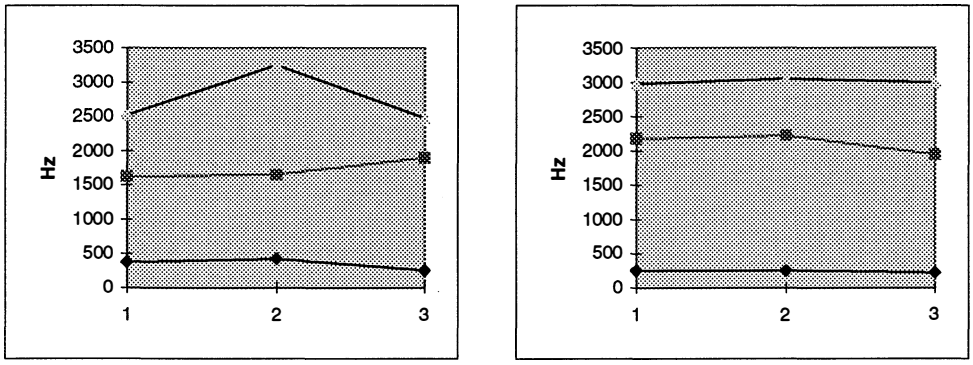


FIGURE 23 F-patterns of [i] (after C [-pal] [-lab]) (left) and [i] (after C [+pal] [-lab]) (right) in Russian disyllabic words pronounced by a native (RUS)

The figure shows that the $F_1$-patterns in both pictures are similar. The ratio between the lowest and highest frequencies of $F_1$ in different points,

in the initial (in the beginning of the TP1), medial (in SP) and final (at the end of the TP2) points, is maximally 79-108 Hz. Anyhow, on this frequency level that is enough to differentiate [ɨ] and [i] in closeness, i.e. [i] is more close.

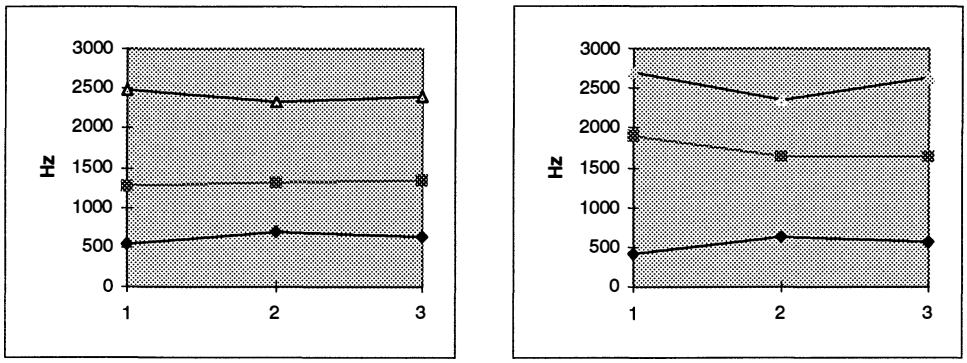


FIGURE 24 F-patterns of [*a*] (after C [-pal] [-lab]) (left) and [a] (after C [+pal] [-lab]) (right) in Russian disyllabic words pronounced by a native (RUS)

The analysis of the TP (transitional parts) in disyllabic and trisyllabic words showed clearly the effect of palatalization on the $F_2$ patterns of [a], i.e. the frequency of $F_2$ in TP1 of [a] starts higher. The coarticulation effect was measured as a rise or fall of the value of $F_2$ frequency compared with the frequency measured in the SP. The quality of the following consonant was not specially taken into consideration, but the $F_2$-pattern of [a] in Figure 26 obviously shows that there have been more [+pal] consonants after it. The figures 23 and 24 illustrate the vowels only in disyllabic words, but a similar tendency was found in trisyllables.

On the basis of the pronunciation of the Russian subject (RUS) the following conclusions can be made:

1) The [-pal] dental plosives, /t/ and /d/, and dental sibilants, /s/ and /z/, had the least effect on the following vowel. After these consonants the maximal changes in the $F_2$ pattern were: 86 Hz lower than the SP value and 49 Hz higher than it. The sibilants lowered the value and the plosives raised it.

2) The [-pal] dental and alveolar sonorants /n/, /ɬ/ and /r/ lowered the frequency of $F_2$ by 215 Hz and raised it by 84 Hz. The lowest value was after /ɬ/, and the highest value, after /n/.

3) The [-pal] palatoalveolar sibilants /ʃ/ and /ʒ/ as well as the velars /k/ and /g/ made the frequency of $F_2$ go down, the range being from 43 to 215 Hz.

4) All [+pal] consonants, including C [+lab], made the $F_2$ frequency rise by 200-500 Hz, the most common rise was over 300 Hz. It

happened to all types of consonants. Sonorants /mʲ/ and /nʲ/ had the most abrupt change, on an average 516-545 Hz. This could be evidence of the fact that the degree of palatalization of these consonants is higher.

A clear difference is seen in $F_2$-patterns between the two main allophones [ɨ] and [i] in the pronunciation of the Russian. $F_2$ of TP1 and SP of vowel [ɨ] was considerably lower than of vowel [i]. That means that [i] was more front than [ɨ]. The figure also shows that in TP2 $F_2$-pattern of [ɨ] rises to the same level as the $F_2$-pattern of [i]. This shows the other part of the diphthong like vowel. The $F_2$-pattern is sloping down at the end of [i] in the third and fourth picture, and this can mean that most part of the following consonants in this data were [-pal].

The average $F_2$-pattern is different in [+stress] allophones of /*a*/, as the figure shows. The palatal coarticulation, i.e. a rise of the frequency of $F_2$ after C [+pal], as well as the labial coarticulation, i.e. a fall of $F_2$ after C [+lab], were noticeable. The differences in the individual values in the beginning of TP1 were significant: the highest frequency after C [+pal] [-lab] (1924 Hz) was 747 Hz higher than the lowest frequency after C [-pal] [+lab] ( Hz 1177 Hz). The figure also shows that the labial coarticulation is obvious after C [-pal], while C [+pal] [+lab] $F_2$-pattern is high and the palatal coarticulation is greater. The palatalization of the following consonant was not taken in consideration, but the figure shows that in 1) and 2) C [+pal] is more common among the following consonants as there is a rise of $F_2$-pattern in TP2.

The analysed data consisting of disyllabic and trisyllabic words proved that the rise of the frequency of $F_2$-pattern because of the neighbouring C [+pal] in TP was from 100-500 Hz, most common being the rise of 200-300 Hz. Although the influence of the preceding consonant is greater than the influence of the following consonant, the palatal coarticulation can be seen in TP2 as well. There was a difference between the rates of TP1 and TP2. The raising range must be due to the degree of palatalization.

Analysis of the pronunciation of the Russian subject also proved that all C [+pal] raise the frequency of $F_2$ of the neighbouring vowel. The analysis of the disyllabic words proved that the effect of C [+pal] on the following vowel is more than on the preceding vowel which corresponds with the general opinion given in literature. But when the trisyllabic words were included in the analysis, there was no clear difference between the frequencies of $F_2$ in $C^jV$ and $VC^j$ positions. It appeared that in the pronunciation of the Russian subject more often the highest frequency values were in disyllabic words and in $C^jV$ position.

Generally the rise of $F_2$-pattern has to be connected to the degree of palatalization which is very difficult to estimate. But it is obvious that, for example, other consonants palatalize more than others even in the

speech of natives. The fact that the frequency value of $F_2$ rose higher in TP of the vowels after /mʲ/ and /nʲ/ than after other consonants could be a proof of stronger palatalization. But then a question arises: why does the $F_2$-pattern rise as much after /lʲ/? However, then we should remember that after /ɬ/ the frequency of $F_2$ was comparatively lower. In a deeper study of this matter, it might be necessary to compare the values after both components of the [-pal] and [+pal] pairs.

The rise of $F_2$-pattern in the pronunciation of FIN1, FIN2 and FIN3 was in many cases more than in the pronunciation of RUS. Nevertheless, this does not mean that palatalization in their pronunciation is stronger but they pronounced [j] between the consonant and the vowel, i.e. for example, [mʲa] > [mja], [tʲa] > [tja]. It shows the influence of orthography. In this case the question was about vowel /a/ [+stress] which means that in position CʲV the corresponding letter is *я*. The transcription mark in text books and dictionaries for it is '*ja*' as well as '*ju*' for '*ю*'. From the very beginning of learning Russian language, as the learning process means reading as well, the letter as well as the transcription give an impression of the different phonological structure in this case.

In the pronunciation of FIN1 there were two clear cases, [lʲ] and [rʲ], and one almost clear, [mʲ], showing that C concerned was not [+pal] nor was it followed by [j], as it should have been. The average rise of the $F_2$-pattern of V after [lʲ] and [rʲ], was from 400 to 700 Hz less than after other consonants in this position and after [mʲ] from 200 to 500 Hz less. In two individual cases in the pronunciation of FIN1, the frequency of $F_2$-pattern after [lʲ] was even lower than in SP.

#### 5.3.2.2 Labial vs. palatal coarticulation

The analysis of the TP1 in disyllabic and trisyllabic words showed a clear effect of labialization on the $F_2$ patterns of [*a*] and [ɨ]. This can be seen in Figure 25.

In the pronunciation of RUS the labial coarticulation is clearly seen in the lower values of the $F_2$-pattern of V after C [+lab]. It was obvious after all [-pal] labials, /b/, /p/, /m/, /f/ and /v/. The $F_2$-pattern of V was from 122 to 329 Hz lower in TP1 of the vowel than in SP. When C [+lab] was [+pal] no labial coarticulation was seen, but the $F_2$-pattern of V after C [+lab] [+pal] rose as much as after all other [+pal] consonants and where /mʲ/ was concerned, even more, as was mentioned earlier.

The labial coarticulation of the following consonant (VC [+lab]) in the pronunciation of the Russian caused descending of the $F_2$-pattern of V from 43 to 258 Hz. On the basis of this it is possible to claim that the influence of the preceding consonant is greater.

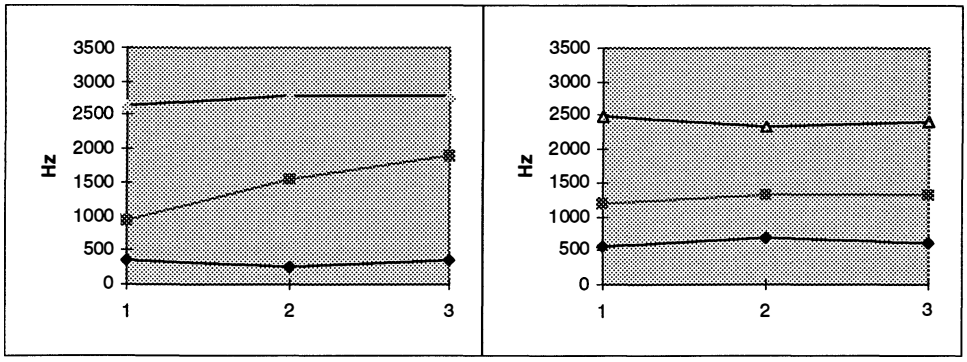


FIGURE 25 Labial coarticulation in [i] (left) and [a] (right) after C [-pal] [+lab] in the pronunciation of RUS

In the pronunciation of the Finnish subjects the labial coarticulation appeared in a similar way, the $F_2$-pattern of V after C [+lab] descended in their pronunciation in the following proportion: FIN1 - from 86 to 344 Hz, FIN2 - from 86 to 431 Hz, FIN3 - from 64 to 259 Hz and FIN4 - from 57 to 172 Hz. Thus, the labial coarticulation was weaker in the pronunciation of FIN4.

As is known, the labial coarticulation is a universal process. According to Wiik, the effect of C [+lab] on the $F_2$-pattern of V in Finnish it is stronger when V is [+back] than when it is [+front] (Wiik 1984:120-121). Wiik's data consisted of vowels between the same C [+lab]. The labial coarticulation in Russian is seen in the $F_2$-pattern of the adjacent vowel only when C is [-pal] as palatalization eliminates the effect of labialization. This can be seen in Figure 26.

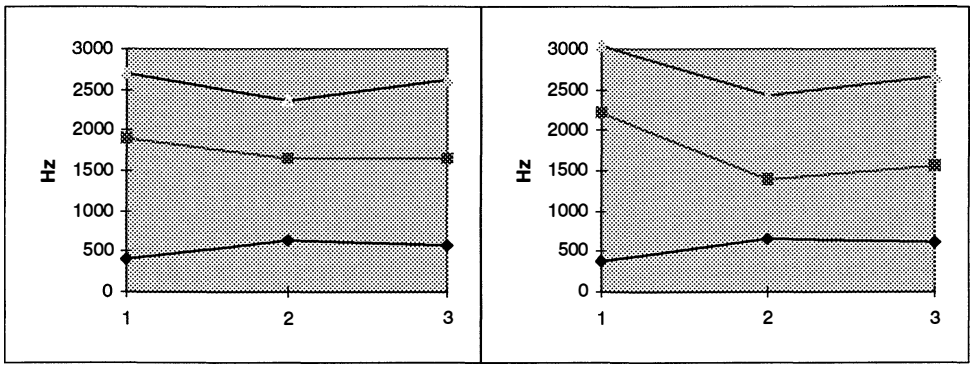


FIGURE 26 F-patterns of [a] in position after C [+pal] [+lab] in the pronunciation of RUS (left) and by FIN1 (right)

The $F_2$-pattern after the labial consonants in Russian can thus be used as a parameter of palatalization more reliably than after other consonants. In

other words, by following the $F_2$-pattern of vowels in labial environment of C [-pal] and C [+pal] in pronunciation of the Finnish subjects we can see whether C [+lab] is palatalized.

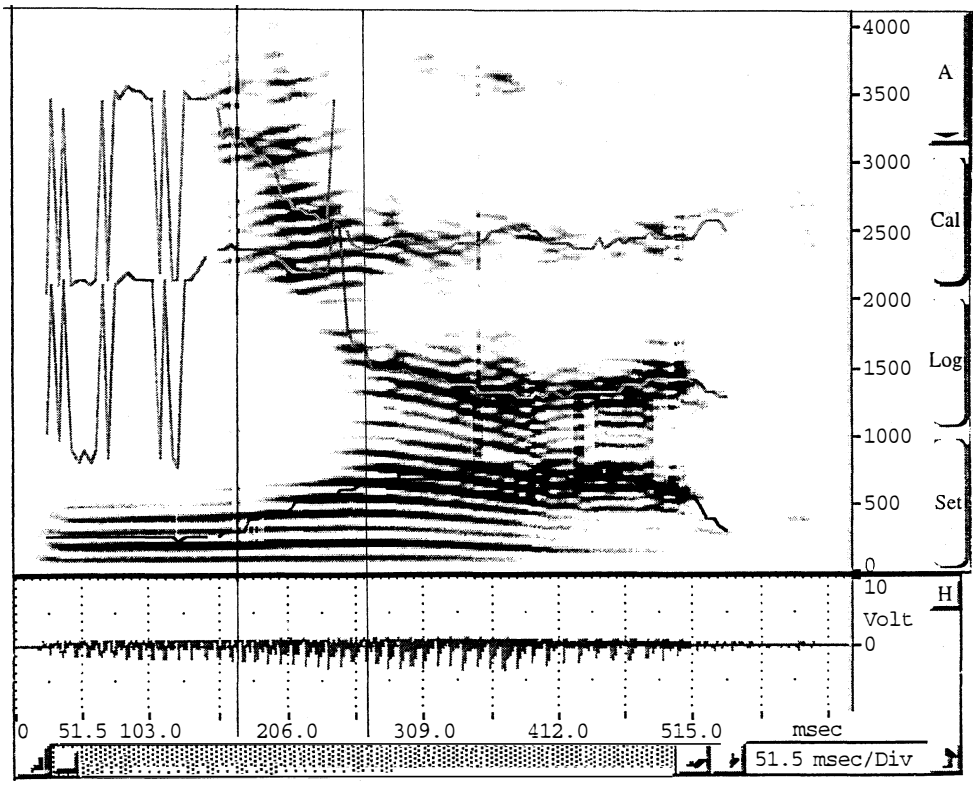


FIGURE 27 Sonogram of word *мяли* [mʲalʲi] in pronunciation of FIN1

Where the Finnish subjects were concerned, in their pronunciation the value of $F_2$ of [a] was always higher after C [+pal] than in the SP in this experiment. As can be seen in Figure 27, in the case of [a] the material can be misleading due to the orthographic factors mentioned above, namely, the letter *я* which is written after C [+lab]. But, when [i] or [i] followed C [+lab], $F_2$-pattern of these vowels was a good indicator of palatalization or the lack of it. In the pronunciation of FIN1 in syllables like [mi] $F_2$-pattern in TR1 of [i] was falling by 60-70 Hz, but in [mʲi] rising by 87-173 Hz, i.e. there was no palatalization in [m]. In the pronunciation of FIN2, FIN3 and FIN4 in syllables like [mi] the pattern was generally rising in TP1, but where the syllables like [mʲi] were concerned, the pattern was either level or rising. The rising $F_2$ -pattern in this case indicated that the palatalization of the consonant was lacking and the level $F_2$-pattern that the palatalization was not strong enough.

### 5.3.2.3 Spirantization of plosives and VOT

The explosion, i.e. stop burst, is a typical phenomenon of stop consonants (stops) but used especially for oral stops which are also called plosives. The medial phase of plosives is characterised by a stricture of complete oral closure made by the active articulator against the passive articulator. When the oral closure is released, the compressed air escapes with a small explosion. Generally, after the release of the stop closure there is a voiceless interval before the voicing of the next vowel starts. This time period is called VOT (Voice Onset Time).

From the point of view of palatalization, VOT, the interval between the release of the stop closure of the plosives, as well as the gap between the preceding vowel and the explosion burst as in a word final plosive, is an important factor. Palatalization means a change in the articulation of the plosives: the stop burst happens earlier than in non-palatalized consonants, i.e. VOT is longer, and the stricture changes into a fricative phase. This process is called spirantization (Bhat 1974, Zinder 1979) or, sometimes, affricatization (Zinder 1979).

In most cases, the release of the stop closure of plosives, /p/, /t/, /k/, as well as the affricates, /ts/ and /tʃʲ/, can be in the spectra and can thus be measured in SoundScope oscillogrammes in all positions. VOT was measured in the word initial and middle positions of the plosives. When the plosives were in the word final position, the time of the release of the stop closure was measured from the end of the preceding vowel.

TABLE 36 Average VOT and time of explosion of [-voiced] plosives (ms) measured from the beginning of the next vowel and the end of preceding vowel ([+pal]/[+pal])

| | RUS | FIN1 | FIN2 | FIN3 | FIN4 |
|---|---|---|---|---|---|
| VOT | 29/48 | 23/23 | 26/49 | 23/31 | 20/80 |
| Release of closure in word final position | 96/71 | 133/127 | 116/124 | 131/125 | 100/72 |

Where [-voiced] plosives are concerned, there was no difficulty to measure the VOT and the time of the burst, but in many cases, especially in production of the Finnish subjects, VOT could not be measured in [+voiced] plosives. As known, there are no [+voiced] obstruents in word final position in Russian.

The results (Table 36) show that:

1) in word initial and medial positions the fricative period of the plosives was longer in soft consonants than in hard consonants in the pronunciation of the Russian subject (RUS);
2) FIN1 and FIN3 had no difference between the palatalized and non-palatalized consonants. The explosion started a little later in the non-palatalized consonants in the word final position.
3) FIN2 had a difference between [-pal] and [+pal] consonants in word initial and medial position but not in the word final position.
4) There was a remarkable difference in the time of explosion between hard and soft consonants in the pronunciation of the Finnish subject FIN4.

There were differences in VOT between individual consonants. In the pronunciation of the velar plosive by RUS the VOT was longest (25-50 ms), but the difference between [-pal] and [+pal] consonants was minimal. The dental plosive [t] had an medium duration of VOT, but the difference between [t] and [tʲ] was maximal. The labial plosive [p] had the shortest fricative period, which did not grow very much with palatalization.

According to Lehtonen, the voiceless interval between explosion and the vowel (VOT) in Finnish is 'very short': 30-50 msec, because of the lack of aspiration (Lehtonen 1970:51). In Russian, according to Bondarko, the explosion of [-pal] plosives is 15-35 msec (Bondarko 1974:12). The data analyzed for this research shows that VOT can be even shorter. This was mostly the case in the pronunciation of the Finnish subjects.

These results show that there is a clear difference in VOT values and the duration of closure between [-pal] and [+pal] plosives in Russian. This was proved by the pronunciation of the Russian subject. Where the Finnish subjects are concerned, the differences between [-pal] and [+pal] plosives in the pronunciation of FIN4 were even greater than in the pronunciation of the native speaker. This together with the rising $F_2$-contour show that his palatalization was very strong.

## 5.4 Fundamental frequency

The fundamental frequency pattern shows the melody of a rhythmic structure, which in our study is a single word. The melody of words changes, for example, in different phrase positions, but the pronunciation of an isolated word may be used as the basic model (эталонная схема) of the word melody (Prosodičeskij stroj russkoj reči 1996:41). The role of stress in Russian word melody is in the central place, as Zlatoustova states (Zlatoustova 1961:18). There are other factors as well which affect

the height of the tone on a particular vowel, for example, the vowel quality and the context, i.e. the quality of the preceding and following consonants.

The movement of $F_0$-pattern can be significant for duration of vowels as well. According to Lehiste, when applied to the whole sequence, it plays a significant role in distinguishing between different quantities (Lehiste 1996:231). Some other phoneticians also consider $F_0$ to give information about duration particularly in Finnish and Estonian (Vihanta 1988, Eek 1986, Engstrand&Krull 1994).

The peak of $F_0$ pattern also gives information about vowels. It has been proved that, for example, the Swedish and Finnish dialects differ in location of the $F_0$ peak in time dimension (Wiik 1988). According to Wiik, the place of the peak is dependent on the word structure, but the late peak can mean a calmer way of speaking where one is stretching the vowels as a sign of boasting of something (Wiik 1988:222). In this research, the time of peak was not studied or measured, but the shape of the $F_0$ patterns of disyllabic words shows that the later peak is obvious in the pronunciation of RUS which really could be a sign of certainty on the part of the subject.

The question about the behaviour of $F_0$ as a potential correlate of quantity has been brought up already in the 1940's by Durant (Vihanta 1988:13). He suggested that the level or rising tone is typical for a short vowel and falling tone is typical for a long vowel. But, for example, Lehtonen (1970) found no proof of $F_0$-pattern falling in long Finnish vowels. Aulanko (1985) found out that there is no significant difference in the $F_0$-patterns of long and short vowels though falling is more obvious in long vowels. Vihanta, however, proved that the opposition short/long in speech of Finns systematically includes differences in $F_0$ pattern of individual words even in different prosodic structures (Vihanta 1988:33). He also states that there is no difference, for example, between half-long and long /a/ (Vihanta 1988:21).

By analysing the movements of $F_0$ -patterns both in disyllabic and trisyllabic words I have tried to find out whether in Russian the durational differences between V [+stress] and V [-stress] are seen in the pattern of the fundamental frequency. Apart from that, an attempt was also made to find out how the word melody of the Russian pronunciation of the native differs from the pronunciation of the Finnish subjects.

### 5.4.1 $F_0$ as a correlate of vowel duration

The movement of $F_0$ pattern of each vowel was measured in 2-4 places according to its shape. Thus, a vowel could have four different types of shape:

1) The pitch pattern has one direction: falling, rising or level (measuring points 1 and 4).

2) The pitch pattern changes the direction once: rising-falling, falling-rising and falling level. The peak in rising falling was used as my basis of estimation. It could be more towards the beginning (measuring point 2) or more towards the end (measuring point 3) of the duration of the vowel.

3) The last type represents the patterns which show changes in two different places: rising-level-falling, rising-falling-rising-falling, falling-rising-falling, falling-level-rising.

In Figures 28 and 29 the fundamental frequency of FIN1 is compared with the pronunciation of the Russian subject.

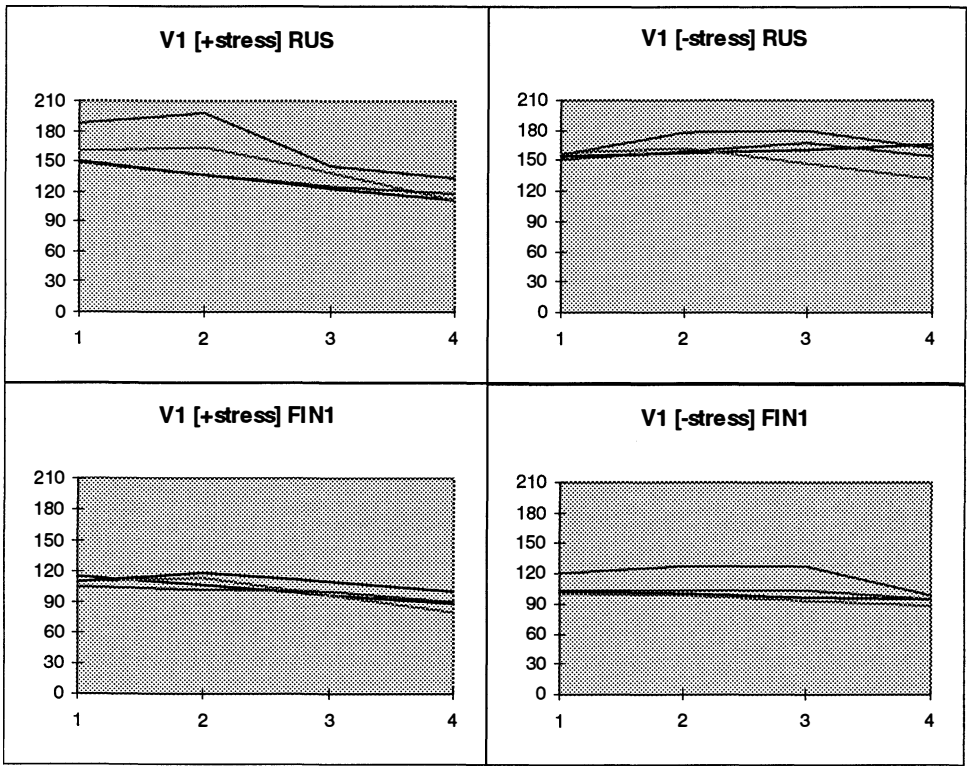


FIGURE 28 The movements of $F_0$-patterns of V1 [+stress] and [-stress] in disyllabic words in pronunciation of a Russian normative speaker (left) and a Finnish subject (right)

All the four curves are represented in Figures 28 and 29, but often the differences between the curves are minimal and cannot be clearly differentiated. The peaks or their place were not specially measured. The figure shows the main directions. This is a simplified picture, as the $F_0$-pattern consists of contour with constant small changes in the frequency.

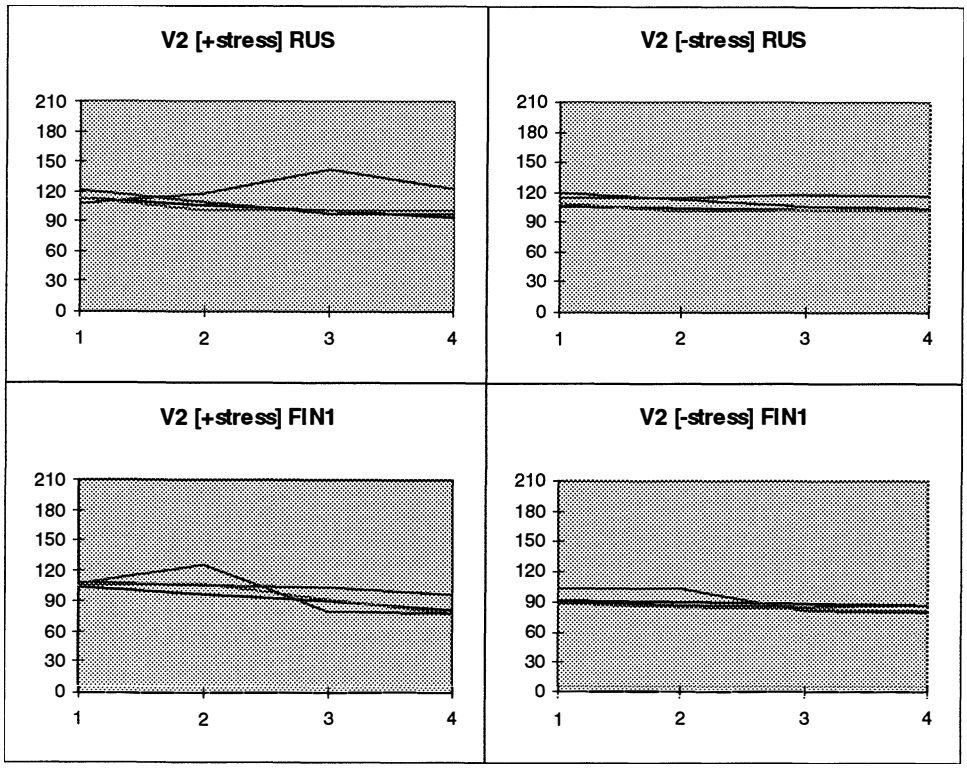


FIGURE 29 Average movements of $F_0$-patterns of V2 [+stress] and [-stress] in disyllabic words in pronunciation of a Russian normative speaker and a Finnish subject

The $F_0$ patterns in different positions of the disyllabic words in pronunciation of the Russian and one Finnish subject (FIN1) are given in Figure 26. One Finnish subject is sufficient to give an idea as to how the patterns differ. On an average, the $F_0$ patterns of FIN2 and FIN3 were even more level.

The figure shows that $F_0$ of V [+stress] in the pronunciation of the Russian subject as well as the Finnish subject was more falling than in V [-stress]. Could it be interpreted as a proof of V [+stress] being V [-stress]? However, the pattern is first rising in the pronunciation of the Russian subject.

RUS had a higher voice, so the pattern of the vowel started in a higher pitch. In V [+stress] as well as in V1 [-stress] the pattern was rising-falling or rising, but in the second [-stress] syllable, the pattern was falling. In the figure of the pronunciation of RUS all the four different types of the $F_0$-pattern are seen. Type 4 was the most rare, for example in V1 [+stress] 3,2 % of all and in V2 [+stress] 1,6 %. In $V_2$ [-stress] all types were nearly the same.

Individual sonograms give a clearer picture of the patterns. Sonogram (Figure 30) shows how clearly the $F_0$-pattern of V1 [+stress] first rises and then falls while in V2 [-stress] the fall is weaker.

In the pronunciation of FIN1 the pitch pattern type 4 is extremely rare (0,9 %). There is no significant difference between types 1-3. The most common types of patterns are type 1 in $V_1$ [-stress] (66,1 %) and 2 in $V_1$ [+stress] (59,7 %).

The movements of $F_0$ patterns in the disyllabic words pronounced by the Finnish subjects is on average falling, though it can be first rising, the falling is in V [+stress] from 43 to 9 Hz and in V [-stress] from 3 to 1 Hz. The falling shape in pitch pattern may prove the difference in duration between the stressed and unstressed vowels. Sonogram (Figure 30) shows the $F_0$ pattern of one disyllabic word in the pronunciation of FIN2.

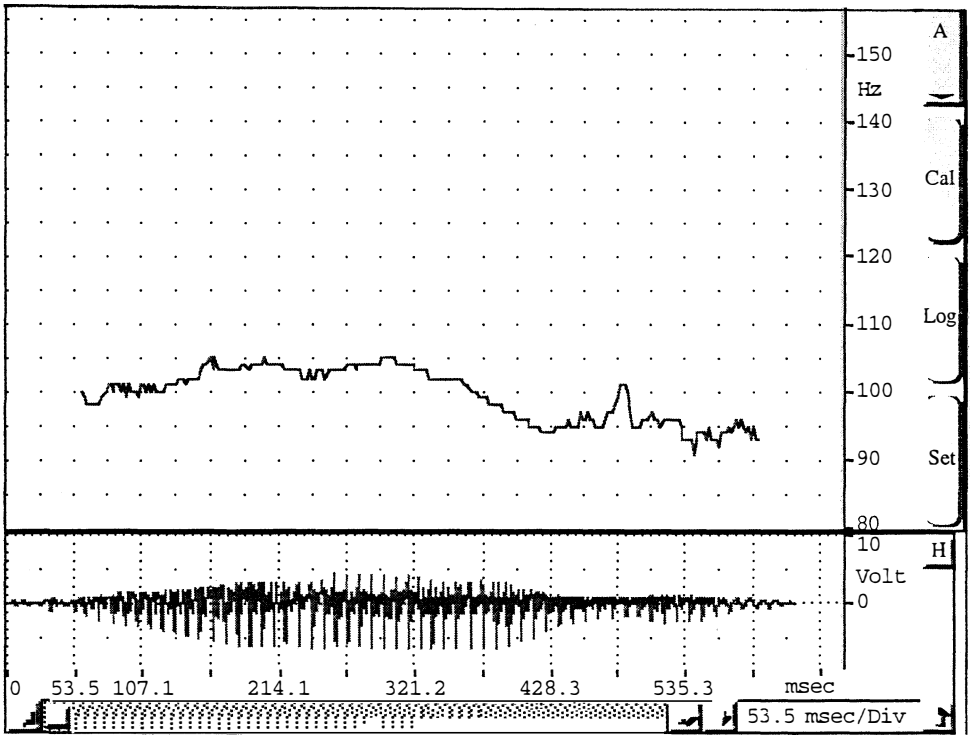


FIGURE 30 $F_0$-pattern of a disyllabic Russian word ['mʲalʲɪ] with V1 [+stress] pronounced by FIN2

There was a difference in the $F_0$-patterns of [+stress] vowels between the Russian and Finnish subject. In V1 [+stress] $F_0$-pattern in the pronunciation of the Russian subject was first slightly rising and then falling about 80 Hz (Figure 30), but in the pronunciation of the Finnish subject all changes in the pattern happened within 10 Hz. Table 37 gives the falling movements of the $F_0$-patterns in Hz.

Table 37 Difference between the starting and ending value of $F_0$-patterns in trisyllabic words (Hz)

| | RUS | FIN1 | FIN2 | FIN3 | FIN4 |
|---|---|---|---|---|---|
| $V_1$ [+stress] | -52,5 | -24,6 | -9,8 | -12,8 | -16,6 |
| $V_1$ [-stress1] | +19,2 | -3,8 | -4,9 | -3,2 | -3 |
| $V_1$ [-stress2] | +7,4 | -1,9 | -5,7 | -4,8 | -4,2 |
| $V_2$ [+stress] | -32 | -28,3 | -11,2 | -9,6 | -19,7 |
| $V_2$ [-stress1] | -19,3 | -6,9 | -4,5 | -2,4 | -5,6 |
| $V_2$ [-stress2] | -11,3 | -9,4 | -6 | -7,4 | -6,6 |
| $V_3$ [+stress] | -17,4 | -21,5 | -9,7 | -14,5 | -16,7 |
| $V_3$ [-stress1] | -12,6 | -7 | -6 | -6,2 | -2,5 |
| $V_3$ [-stress2] | -9,9 | -9,6 | -4,5 | -9,6 | -1,4 |

Table 37 shows that $F_0$ patterns and duration of vowels have a connection: the longer the vowel is, the bigger the fall in $F_0$-pattern. It is obvious in the pronunciation of all the subjects that in V [+stress], the fall of the fundamental frequency is more than in V [-stress].

The fundamental frequency pattern in the average calculation is falling towards the end of the word, i.e. it follows the process of declination. Declination means that individual pitch values tend to become progressively lower through the course of an utterance (Iivonen et al. 1987, Laver 1994:155). But in isolated words, it very often rises at the end of the word which means that different words were here like a list.

It is known that each vowel has an intrinsic frequency according to its quality which generally means that the higher the vowel is, the higher the $F_0$ . This is due to the physiological characters of vowels (Iivonen 1978, Aulanko 1985, Aaltonen et al. 1988). The same fact was proved by Zlatoustova where Russian is concerned (Zlatoustova 1961:19).

It is not difficult to observe that, for example, $F_0$ of /a/ is lower than $F_0$ of /i/ in many cases in my data as well. In the pronunciation of the Russian subject in position V [+stress] of trisyllabic words $F_0$-pattern of /i/ was higher in V1 and V2, in V3 it was similar to /a/ in all measuring points. In position V2 [+stress] the differences of values was not very significant (4, 1 and 3 Hz), but in position V2 [+stress] /i/ had higher $F_0$ values by 12,2-6,8 %.

In the disyllabic words the $F_0$-pattern was higher on average in the beginning and middle (3,6-6,2 %) of the vowel, but lower by 1-3 % at the end. In disyllabic words and trisyllabic words the $F_0$-pattern of /i/ also had more changes than the pattern of /a/. This is illustrated in Spectrogram (Figure 32) where V1 [+stress] is /i/.

Some of the differences between the $F_0$ contours of vowels /a/ and /i/ can also be due to the neighbouring consonants, but that was not an aspect studied in this data.

Thus, this study has yielded some further proof to the argument that the fundamental frequency pattern has some connection with duration as the values of $F_0$ changes follow the hierarchy of the duration of vowels in different positions in the pronunciation of RUS. The biggest changes in $F_0$ happen in $V_1$. The pattern of $V_1$ [+stress] falls in average 52,5 Hz. The pattern of $V_1$ [-stress1] as well as the pattern of $V_1$ [-stress2] rise. The rise in the pronunciation of this Russian subject might be his individual pronunciation feature (Table 37), $V_2$ [+stress] falls, but not to the extent as $V_1$ [+stress]. The falling range of $V_2$ [-stress1] and $V_2$ [-stress2] follow the same portion as the durational differences between these vowels (Figure 36). The same proportion is repeated in the $V_3$ as we can see in Spectrogram (Figure 37).

Aulanko had a similar result in the speech of a male subject (Aulanko 1985:45), but my data pronounced by the Finnish subjects does not always prove that the $F_0$-pattern of long vowels falls more than the $F_0$ of a short vowel. That could be seen in Russian opposition of V [+stress] and V [-stress]. Thus, I am not fully convinced that the $F_0$-patterns give information about vowel duration.

### 5.4.2 Word melody

The melody of Russian words has been acoustically investigated by Zlatoustova (1961) and Nikolajeva (1977). Their data includes isolated words as well. Nikolajeva concentrates on analysis of intensity changes which, from our point of view, is not that important, but Zlatoustova analyzes the melody contours as well. Other works about Russian prosody, for example, Svetozarova (1984, 1986), investigate words as a part of longer intonation units in continuos speech or spontaneous speech.

Figure 32 shows that the $F_0$-pattern of V1 [+stress] starts high, at times very high. Then the pattern follows a falling or rising-falling contour. The cases a with falling contour are in majority, 54,8 % of all. V2 [-stress] is either falling, falling-level, level, rising-level or rising, but all the changes are minimal.

As mentioned earlier, the isolated words form one rhythmic structure which consists of one intonation unit. Each word represents a complete utterance. There are different possibilities to pronounce an utterance: a neutral intonation of finality (интонация точки), intonation of 'approval' (утверждения), intonation of 'naming' (назывности) and intonation of 'listing' (перечисления) (Zlatoustova 1961).

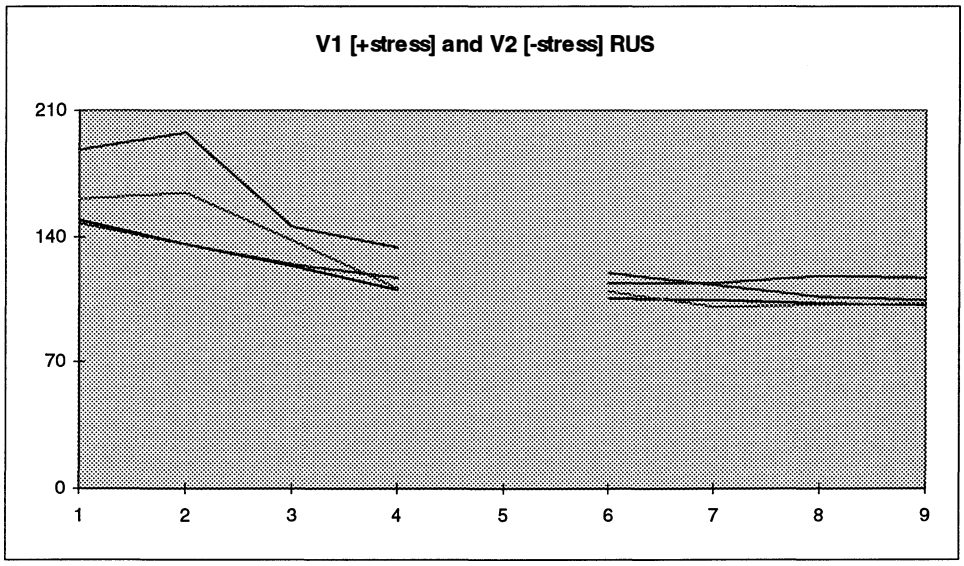


FIGURE 31 Four average melody curves of disyllabic Russian words with V1 [+stress] pronounced by a Russian subject

According to Zlatoustova the neutral intonation of finality in Russian disyllabic words V1 [+stress] has a lower tone than V2 [-stress] or, what is more rare, the same height of tone, but if the utterance is pronounced as a statement, the tone rises and the rising, rising-falling and level types of melody are more common. Where V2 [-stress] is concerned, according to Zlatoustova, in the neutral intonation there is a rising contour, but the rising can be minimal or even more, and it is most common, but in a statement the rising becomes more (Zlatoustova 1961:7). Thus, our Russian subject pronounced this rhythmic structure more like a statement where V1 [+stress] is concerned. Where V2 [-stress] is concerned the most common contour is level (75,8 %) and the two types of rising contours (a falling-rising and rising-level) are 21 % of all cases.

Spectrogram (Figure 32) represents maximal changes in the $F_0$-pattern of a disyllabic word with V1 [+stress]. The rising-falling contour is very clear, as well as the falling contour of V2 [-stress]. In some words the contour of V2 [-stress] was rising.

Figure 33 shows the same rhythmic structure, V1 [+stress] - V2 [-stress] in the pronunciation of a Finnish subject (FIN2). All types of the contour are very similar. The pattern of V1 [+stress] is falling, falling-level or level-falling, but the changes in the last two types are minimal, as the figure shows. The pattern of V2 [-stress] starts from the same level where V1 finishes and continues level in most cases (67,7 %), level-falling, rising falling or falling-rising-falling with minimal changes. The last type includes only 1,7 % of all cases.

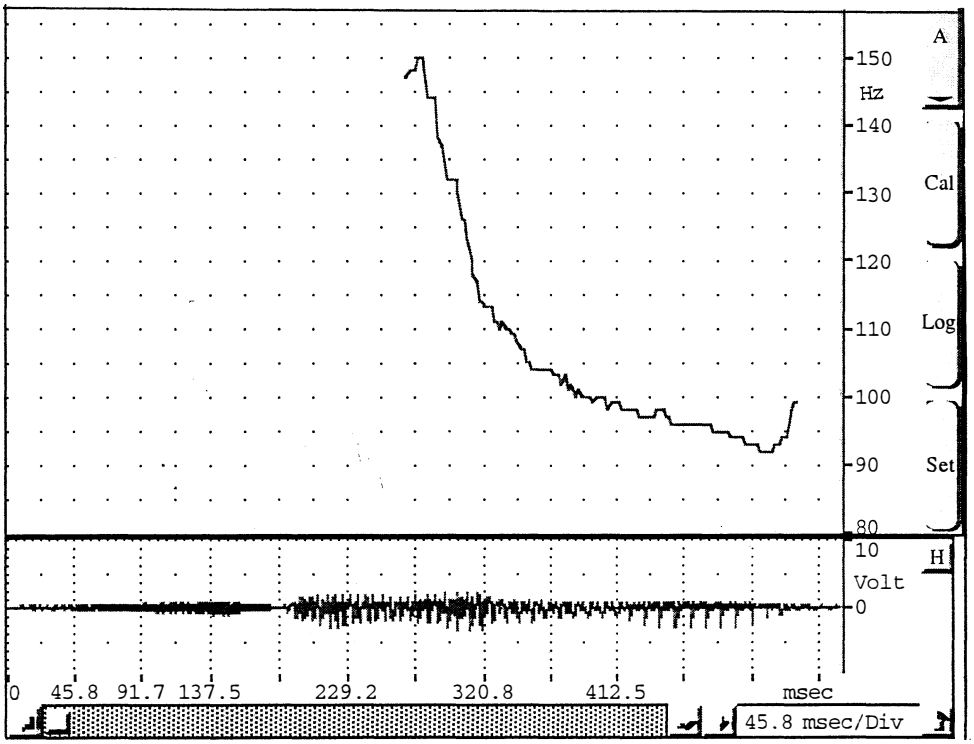


FIGURE 32 $F_0$-pattern of a disyllabic Russian word [sinʌ] with V1 [+stress] pronounced by RUS

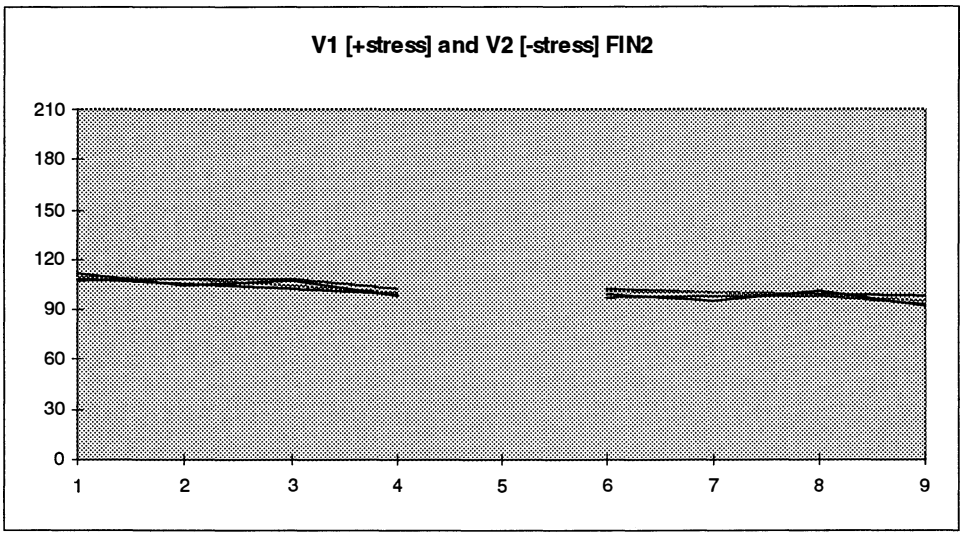


FIGURE 33 Average melody curves of disyllabic Russian words with V1 [+stress] pronounced by a Finnish subject

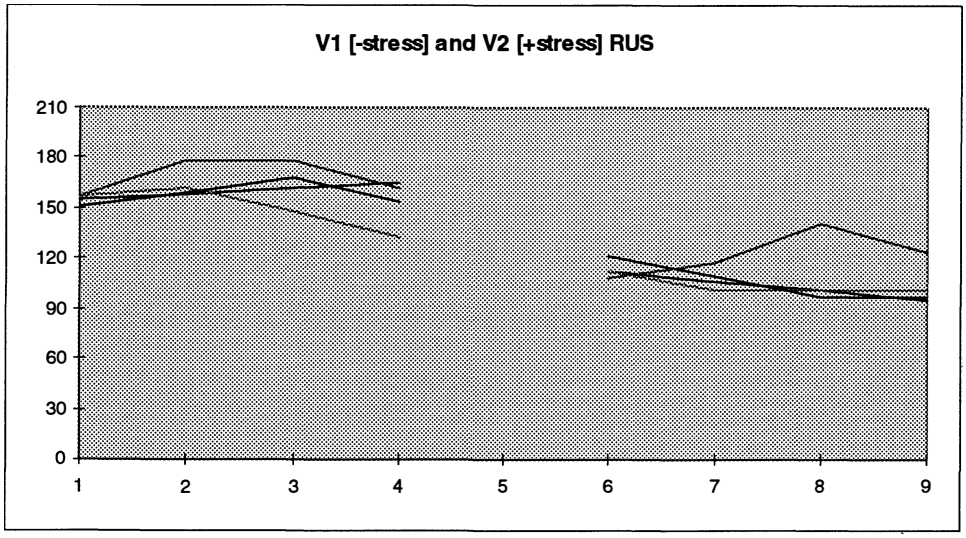


FIGURE 34 Four average melody curves of disyllabic Russian words with V2 [+stress] pronounced by a Russian subject

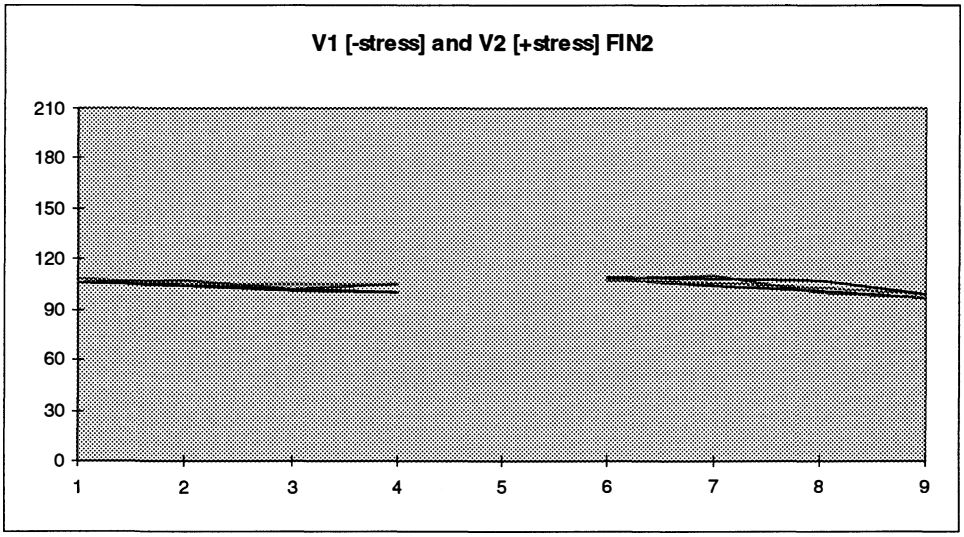


FIGURE 35 Average melody curves of disyllabic Russian words with V2 [+stress] pronounced by a Finnish subject

In the other possible disyllabic structure, V1 [-stress] - V2 [+stress], in the pronunciation of the Russian subject (Figure 34) the $F_0$-pattern of V1 [-stress] is higher than the pattern of V2 [+stress] having rising, rising-falling, rising-level-falling contour. The rising contours are in majority (75,8 %). My result follows the neutral melody pattern given by Zlatous-

tova: V1 [-stress] is higher than V2 [+stress], although she gives a possibility of them being on the same tone level, but the rising contour of V1 makes the utterance sound like a statement (Zlotoustova 1961:8).

The $F_0$-patterns of the disyllabic words with V2 [+stress] (Figure 35) show again that changes in the patterns are minimal, all types are very similar. The pattern of V1 [-stress] is level, falling or level-falling. The pattern of V2 [+stress] starts a little higher than where V1 ends and it is falling or level-falling.

The average patterns of the three types of Russian trisyllabic rhythmic structures, V1 [+stress] - V2 [-stress] - V3 [-stress], V1 [-stress] - V2 [+stress] - V3 [-stress], V1 [-stress] - V2 [-stress] - V3 [+stress], in pronunciation of the native subject are illustrated in Figure 36.

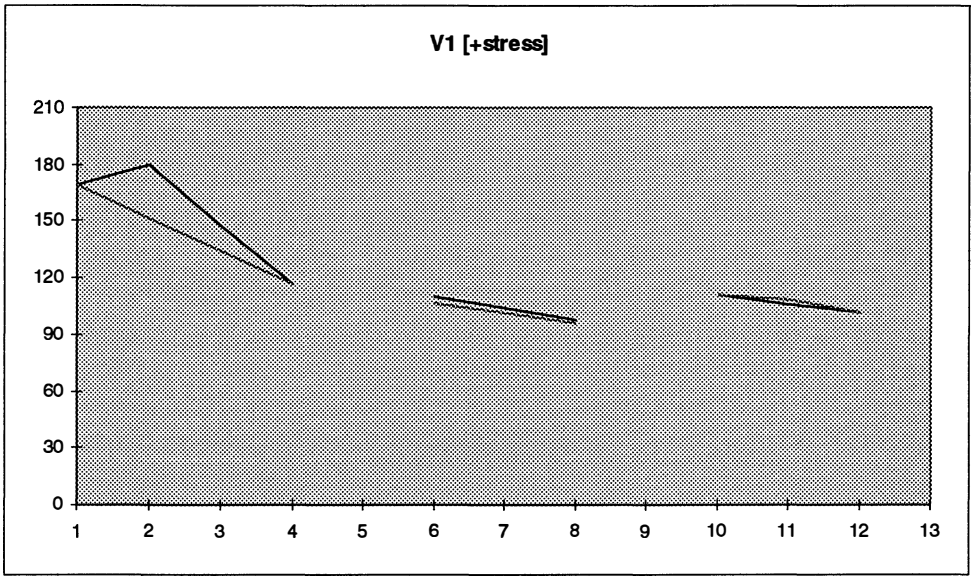


FIGURE 36 Average melody curves of trisyllabic Russian words with V1 [+stress] pronounced by a Russian subject

As shown in Table 37, the tone goes down significantly in V [+stress] in all positions. The same concerns V [-stress] in post-stress positions and in the first pre-stress syllable, while V1 [-stress] always has a rising contour.

In the structure V1 [+stress] - V2 [-stress] - V3 [-stress] (Figure 37) we can see that the $F_0$-pattern of V1 [+stress] is either falling (48 %) or rising-falling (52 %). The pattern of V2 starts a little lower and has a falling contour. As we know this is the shortest vowel. The pattern of V3 starts a little higher than where V2 ends and it has a falling contour. According to Zlatoustova (1962:10), the falling rising contour is typical to V1 [+stress], but she suggests level and rising contour as well in the neutral

pattern, but the rising-falling contour of the whole word generally gives it the meaning of a statement.

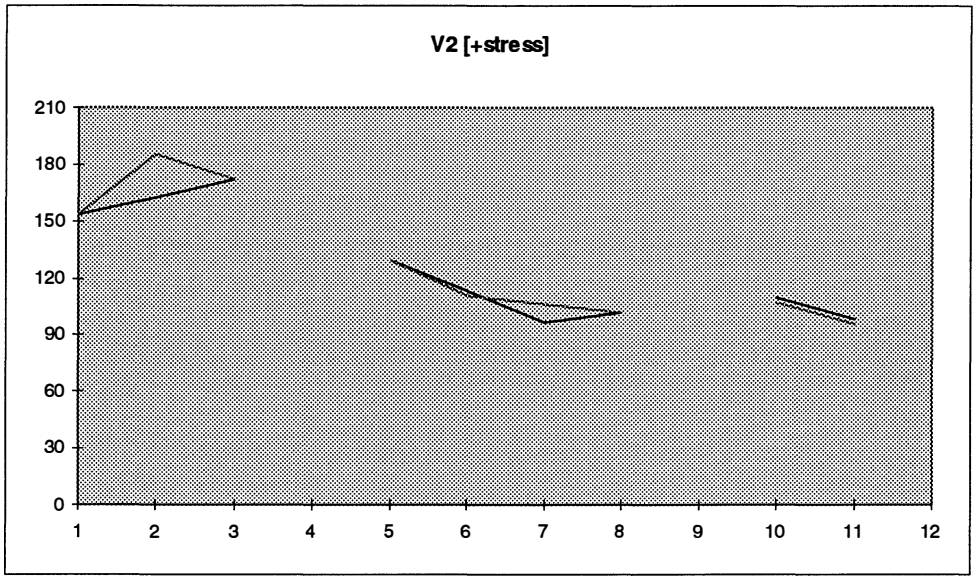


FIGURE 37 Average melody curves (Hz) of trisyllabic Russian words with V2 [+stress] pronounced by a Russian subject

In the structure with V2 [+stress] (Figure 37) the pattern of V1 [-stress] has rising or rising-falling contour in all cases. The pattern of V2 [+stress] is falling or falling-rising (only about 4 %) which starts lower than where V1 ends, and V3 [-stress] a falling contour which starts higher than the end of V2. According to Zlatoustova, this structure as a whole with a rising-falling contour cannot represent a neutral melody (Zlatoustova 1961:12). Thus it is like a statement. The same concerns the following structure with V3 [+stress].

In the structure with V3 [+stress] the contour starts with rising and rising falling patterns of V1. The pattern of V2 starts from the same level where V1 ends and it has a level-falling or falling contour. The pattern of V3 [+stress] starts much lower than where V2 ends and it is falling or falling-rising. As mentioned earlier, this melody contour of the whole word represents the melody of a statement with the exception that the rising tone towards the end V3 means a listing melody (Zlatoustova 1961:12).

In the word final position the contour was in this data rising or falling (in Zlatoustova's experiments this is always rising). That is generally a feature of the listing intonation. The intonation of finality means a falling contour (Bryzgunova 1977, Svetozarova 1982).

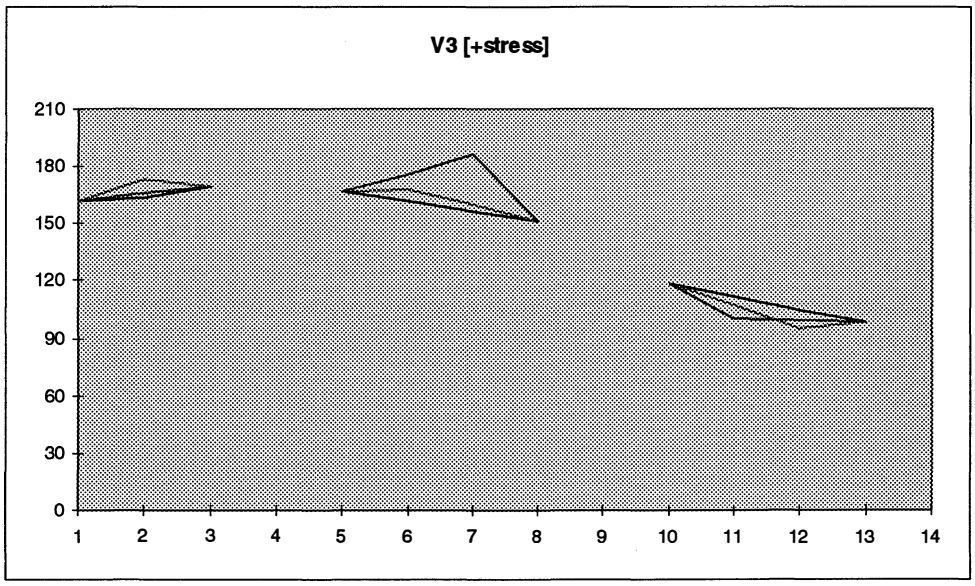


FIGURE 38 Average melody curves of trisyllabic Russian words with V3 [+stress] pronounced by a Russian subject

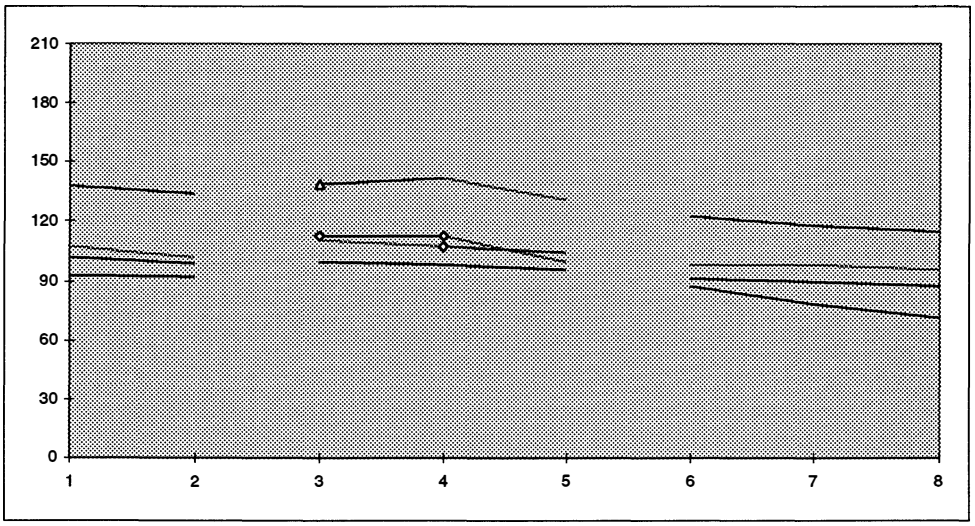


FIGURE 39 Average melody curves (Hz) of trisyllabic Russian words with V2 [+stress] pronounced by four Finnish subjects

The pronunciation of the Finnish subjects shows that the $F_0$-patterns of the whole trisyllabic words is different from the pronunciation of the Russian subject in V [+stress] as well as in V [-stress]. Firstly, in the pre-stressed syllables $F_0$-pattern was not generally rising. Secondly, the movement in

the beginning of V [+stress] the pattern was weaker. Even when it was rising, the rising of it was not very significant. Thirdly, V2 [+stress] started higher, while in the pronunciation of the Russian subject it started lower. Generally the patterns in the pronunciation of the Finnish subjects were more level than in the pronunciation of the Russian subject which obviously is interference of a sign of Finnish language.

# 6 DISCUSSION

## 6.1 Durational differences in Russian and Finnish

The results of the interaction of Russian and Finnish phonetical systems are seen in many durational differences in the pronunciation of the native and non-native speakers. The non-native-like duration of vowels and consonants which Russian speakers produce when speaking Finnish causes interference in the phonological level which means the under-differentiation of phonemes, since the distinction between short and long vowels and consonants is a phonologically distinctive feature in Finnish.

The incorrect duration of V [-stress] in the Russian pronunciation of Finns, whether it be shorter or longer, causes interference on the prosodic level disturbing the rhythmic structure. It is not an example of phonological interference as such. Nevertheless, the duration of vowels becomes phonologically distinctive even in Russian when the place of stress is confused in such words like *дóма* ['domʌ] ('of a house' or 'at home') - *домá* [dʌ'ma] ('houses') or *атлас* ['atɬəs] (a collection of maps) - [ʌ'tɬas] (shine of silk).

The duration of Russian consonants pronounced by Finns also causes interference on the prosodic level although it does not play a phonologically distinctive role in Russian. Generally the pronunciation of Russian consonants by Finns represents a large field of phonetical interference.

One purpose of this study was to find out whether the durational hierarchy of Russian vowels is realized in the pronunciation of a Russian subject and to compare it with the pronunciation of Finns.

### 6.1.1 Durational hierarchy of Russian vowels

It is commonly accepted that the Russian vowels have two stages of reduction which involve durational changes but which in many cases involve qualitative changes as well. Durational differences have been studied acoustically (Zlatoustova 1962 and 1981a, Bondarko 1981 and 1998, Bondarko&Verbickaja 1973, Verbickaja 1979 and 1997). The previous studies as well as my investigation proved that the three leveled hierarchy of durational ratio exists in Russian rhythmic structures, namely, V [+stress] which is the longest, V [-stress1] which represents the first stage of reduction where V is shorter than V [+stress] but longer than V [-stress2], and V [-stress2] which represents the second stage of reduction with the shortest possible duration. In this study, the three leveled hierarchy of Russian vowel duration was tested in disyllabic, trisyllabic and quadrisyllabic words where the stress falls on different syllables.

A typical example of having all the durational levels in one word is a trisyllabic structure where the stress falls on the third syllable. In this case, the vowel of the first syllable represents V [-stress2] and the second syllable vowel V [-stress1]. This data proved that in the pronunciation of the Russian normative speaker, the two different stages of reduction are clearly different in duration. The relative duration of V [-stress2] was 0,6 - 0,7, i.e. 60 - 70 % of the duration of an average sound segment, and the relative duration of V [-stress1] 0,9 - 1, i.e. it was equal or almost equal to an average segment. The relative duration of V [+stress] was 1,4 - 1,6. Percentage wise, one can state that V [+stress] is 34-37 % longer than V [-stress1] and 55-56 % longer than V [-stress2].

This data also proved that the values of relative duration of V1 and V2 in disyllabic words show that the same hierarchy remains between V [+stress] and V [-stress], which in V1 and V2 in open syllables means V [-stress1]. The same correlation between V [+stress], V [-stress1] and V [-stress2] remained in the quadrisyllables as well.

The above values were counted for both vowels /a/ and /i/. In the comparison between them, /i/ appeared to be shorter in all positions with the exception of V3 [-stress1]. Although my data consisted mostly of isolated words which were read by one Russian subject, comparison with the earlier acoustic studies which include, among others, disyllabic and trisyllabic words as well as the results of quadrisyllabic words in different phrase positions (de Silva&Ščerbakova 1998), the durational hierarchy remains very much the same in both connected as well as spontaneous speech. Nevertheless, it has been noticed by the above mentioned authors that V [-stress1] might have longer duration which means that its duration can be as long or even longer than the one of V [+stress].

Apart from the stress position in the word, the duration of vowels can be dependent on the consonant context as well. It has been suggested that, for example, C [+pal] makes the subsequent vowel shorter (Zlatoustova 1962). That kind of effect was not found in this study and the influence of the quality of different types of consonants on the vowel duration was not included in this research.

### 6.1.2 Finnish interference in Russian vowel duration

In the Finnish language, the double (long) vowels are about twice as long in duration as single (short) vowels, i.e. the Finnish system divides vowels into two categories where duration is concerned. This data proved the same point that in pronouncing Russian, the Finnish subjects had, on the one hand, long and sometimes even very long vowels which appeared in position V [+stress] and, on the other hand, very short vowels, but the medium duration was missing. Thus the vowels in positions V [-stress1] and V [-stress2] were of the same duration, as seen in Figure 38.

The figure also shows the difference between the Finnish subjects. FIN1 and FIN3 pronounce V1 which is in position V [-stress2] with longer duration than V2 which is in position [-stress1]. This could be due to the first syllable being [+stress] in Finnish. FIN2 and FIN4 pronounce both V [-stress] with almost the same duration.

The fact that the V [+stress] is pronounced very long, by FIN2 and FIN3 is due to the fact that the double vowels in Finnish are pronounced very long compared with Russian [+stress] vowels. The ratio between single and double vowels in Finnish is average wise 1:2,2 (Lehtonen 1970, Wiik 1965).

Finally, the interference of the Finnish durational system appears in two ways. Firstly, the duration of all [-stress] vowels is the same in the Russian pronunciation of the Finnish speakers though there should be a longer duration of V [-stress1] and a shorter duration of V [-stress2]. This result is completely opposite to the common way of thinking that Finns do not know how to reduce Russian vowels as the answer is that they use too strong a reduction in V [-stress1]. Thus, the Finnish subjects make only one distinction in vowel duration.

### 6.1.3 Durational distribution of consonants

The duration of Russian consonants in this work was studied in three stages: firstly, in different word position as C1, C2, C3 (and C4), secondly, from the point of view of palatalization and, thirdly, from the point of view of intrinsic duration of different consonants depending on the place and manner of articulation. As we know, there are so few double conso-

nants in Russian that the duration of single consonants vis a vis double consonants has no meaning in the Russian phonetical system. The purpose of this study was to find out whether the duration of the Russian consonants in the pronunciation of the Finnish subjects differs from the duration of the same consonants in a similar position by the Russian subject.

When the average of all the consonants was counted, the values of the native Russian subject proved that the consonants have similar duration in different positions of a word as C1, C2, C3 (and C4). In other words, the duration of consonants in all positions was the same or very close to the average value of all the sounds, for example, in trisyllables pronounced by the Russian subject. In the pronunciation of the Finns, in contrast, the duration of consonants varied significantly in different positions. Each Finnish subject had their own distribution, which was most notable in the pronunciation of FIN1. The distribution of duration in different positions did not give any definite idea as the order was different, for example, C4 was the shortest of all consonants in the pronunciation of FIN1 but the longest in the pronunciation of FIN2 (Figure 37).

It has been suggested that the C [+pal] is generally longer than the C [-pal] counterpart (Bondarko 1981 and 1998). According to my investigation, in the pronunciation of the Russian subject the consonant pairs C [-pal] and C [+pal] did not have significant difference in duration in different word position. Nevertheless, where some individual consonant pairs, C [-pal] and C [+pal], are concerned there were a few examples, where C [+pal] was longer: /p - pʲ/, /b - bʲ/, /t -tʲ/, /d - dʲ/, /g - gʲ/ (/k - kʲ/ in disyllabic words only) and /n - nʲ/.

The investigation of the consonantal duration in the pronunciation of the Finnish subjects also substantiated that the [-voiced] [-pal] plosives /p/, /t/, /k/ and the dental affricate /ts/ were longer by 10-35 % after V [+stress] than in other positions. It was seen regularly in the pronunciation of all the Finnish subjects. The [+pal] plosives as well as other consonants were not that regularly long in this position. This phenomenon can be due to a common Finnish rhythmic structure -CVVCC- where a long vowel is followed by a geminate. Voiceless plosives are common sounds in Finnish.

Quite an opposite change was seen in /rʲ/ which was 32 % longer than /r/ in the pronunciation of the Russian subject which agrees with the statement of Bondarko (Bondarko 1998:66). This can explain the fact that /rʲ/ is often pronounced as a flap which is possible in VCV position. The longest Russian vowel was /ʃʲ:/ with a relative duration value of 2, i.e. it was twice as long as an average sound segment. Its long duration is most probably due to palatalization, if not wholly at least partly. It also

has a long historical background of being longer than other single sound segments.

In the pronunciation of the Finns the [+pal] consonants were more often longer than C [-pal]. In many cases such consonants as /pʲ/, /tʲ/,//zʲ/, /nʲ/ C [+pal] can be longer because of the incorrect palatalization where instead of palatalizing the consonant concerned Finns pronounce /j/ between the vowel and consonant, for example, [pja], [tja], [dja] instead of [pʲa], [tʲa], [dʲa]. It happens commonly before [a] [+stress]. This type of pronunciation was typical to FIN1, and his [+pal] consonants were longest, sometimes over 300 ms even in his pronunciation of trisyllables.

## 6.2 Quality differences of Russian and Finnish

### 6.2.1 Quality of vowels /a/ and /i/

Because of the palatalization of the consonants in Russian which strongly affect the formant structure of vowels, the real quality of the vowels appear in the SP. Thus the formant chart (Figure 21) is based on these values while the formant frequencies in the beginning of the TP1 and at the end of the TP2 show the possible coarticulations.

According to my results which agree with the literature written about this aspect, the main [+stress] allophone [i] which appears in position CʲV is the closest and most front vowel in the pronunciation of the native Russian. The other [+stress] allophone of /i/, [ɨ], had a lower $F_2$ and a higher $F_1$.

The [-stress] allophone of /i/, [ɪ], is situated between vowels [i] and [ɨ] in the chart. This [-stress] allophone of /i/ is also the result of the so called 'ikanje' which means that /a/ and /e/ in certain [-stress] positions change and become /i/ like, for example, *лес* [lʲes] (nominative sg.: a forest) - *леса* [lʲɪ'sa] (nominative pl.: forests), *пять* [pʲatʲ] (nominative: five) - *пяти* [pʲɪ'tʲi] (genetive: five). My results of the pronunciation of the normative Russian speaker also showed that 'ikanje' appears in the word final position as well, which means that no other transcription mark would be necessary for this position as has been suggested by some Russian phoneticians (Matusevič 1976:103, GRJ 1970:25). On the basis of this data, it is also obvious that [ɪ] has the same quality in positions V [-stress1] and V [-stress2].

This investigation proved that, where this Russian subject is concerned, there are two different allophones of /a/ in position [-stress2], one after C [-pal] and another after C [+pal]. But since IPA has only one sign for schwa, [ə], I have used that one in position after C [-pal] and [ⁱə]

in position after C [+pal] as this sound is very close to [i] and [ɪ]. It is clearly seen in the formant chart, how far these sounds are situated from each other.

Vowel [*a*] is the most open as well as most back vowel. On the basis of this data it could not be considered as a medial as many phoneticians have done. The [-stress] allophone of /a/, [ʌ] was more front than [*a*]. It also appeared that in the word final [-stress] position after C [-pal] the quality of /a/ is the same as in other syllables in position [-stress1] that is [ʌ]. The other [+stress] allophone of /a/, [a], was more close and more front than [*a*] and [ʌ].

In the pronunciation of the Finnish subjects the quality differences between [*a*], [a], [ʌ] and [ə] were minimal, while the qualitative reduction of /a/ was present in position V [-stress1] after C [+pal], [ɪ] ('ikanje'), and in position after C [+pal], [ə].

On the basis of the pronunciation by non-natives of two vowel phonemes, /a/ and /i/, which are in opposition only in [+stress] position, the question about phonological interference does not arise. Nevertheless, where the allophones of /a/ as well as /i/ in [+stress] positions are concerned, phonetical interference as an under-differentiation appeared in both vowels. Namely, the vowels [*a*] and [a] were alike in the pronunciation of the Finnish subjects (Figure 21) and vowels [ɨ] and [i] were closer to each other in the pronunciation of the Finnish subjects than in the pronunciation of the Russian subject, although in my opinion, the Finnish subjects pronounced [ɨ] quite well.

### 6.2.2 Palatalization of consonants

The palatalization of Russian consonants appeared acoustically in the $F_2$-patterns of vowels, namely, in the TP. Because of the Russian syllable structure of the transitional parts, only the TP1 was followed. In the pronunciation of the Russian subject, the TP1 was falling towards the SP, i.e. the frequency was highest in the beginning of the SP1. Whereas in the pronunciation of the Finnish subjects, the same type of movement in the $F_2$-patterns was found. Sometimes the frequency noted was in the beginning of the SP1 where it was even higher than in the pronunciation of the Russian subject. Nevertheless, the high value of $F_2$ in the beginning of the SP1 was not always a result of correct palatalization of the consonant concerned but due to the incorrect interpretation of the ortographic sign, as $C^jV$ was pronounced as CjV as, for example, pronouncing [mja] instead of [mʲa] in word *мяли* (rumbled).

The above mentioned example means phonological interference of over-differentiation. Another type of phonological interference is due to the lack of palatalization of consonants in the pronunciation of Finns. This

is due to the under-differentiation of the [-pal] and [+pal] consonant phonemes and it can cause misunderstanding in many minimal word pairs in Russian.

The $F_2$-pattern of the vowels after C [+lab] appeared, however, to be a more reliable sign of palatalization or its lack, or even of its rate in the pronunciation of Finns. That is because labialization being a universal phenomenon and one of the most widely found secondary consonantal articulation (Ladefoged&Maddieson 1996:356), appears in Finnish as well, and it can be proved acoustically the same way, namely, that the frequency of $F_2$ is lower when the vowel adjoins C [+lab]. But since the palatal coarticulation is stronger than the labial one in Russian, only the palatal coarticulation is seen in the $F_2$-pattern of the adjacent vowel after C [+pal] [+lab]. Thus, it was possible to estimate the lack of palatalization or the stage of it in the $F_2$-pattern of the vowels in the above mentioned position in the pronunciation of the Finnish subjects.

A third acoustic sign of palatalization which solely concerns oral plosives, especially C [-voiced], in Russian, is VOT and, in the word final position, the timing of explosion burst. Generally VOT is very short in [-pal] plosives (p, t, k) but considerably longer in C [+pal] being somewhere half between the affricates and [-pal] plosives. The short period of time before the voicing of the next vowel or a long temporal gap in a word final position before the burst of the plosive in Russian plosives pronounced by the Finnish subjects indicated that palatalization is missing.

## 6.3 Role of $F_0$-pattern in word prosody

Some of the differences of the Russian and Finnish word prosody are seen in the movements of the fundamental frequency pattern. The $F_0$-pattern was studied for two purposes, firstly, as a possible sign of vowel duration and, secondly, to find out the differences in word melody in the pronunciation of the Russian and Finnish subjects.

In a sense, the fundamental frequency pattern was significant for the duration of vowels, namely, its falling movement was more in V [+stress] and less in V [-stress]. Nevertheless, this data did not fully prove the claim that vowels whose duration is long have a falling pattern and vowels whose duration is short have a level pattern (Vihanta 1988). The falling movement of the fundamental frequency patterns of vowels in the pronunciation of the Russian subject was greater than in the patterns of the Finns, but in general the movements were greater as the word melody differs.

The study of $F_0$-patterns showed that in the pronunciation of the Russian subjects, the only rising patterns were in positions V [-stress2]. In

position V [-stress1] before V [+stress], $F_0$ pattern was falling and in position after V [+stress] it was rising, but sometimes slightly rising at the beginning and then falling. When the vowel was in [+stress] position, the pattern was first falling and then rising.

The $F_0$ patterns in the pronunciation of the Finnish subjects were generally more level compared with the Russian subject. In position V [+stress], the pattern was initially level and then descending or slowly descending from the beginning to the end. In other positions $F_0$ patterns were level or, generally at the end of a word slowly descending. The most level $F_0$ patterns were in the pronunciation of FIN3.

In the pronunciation of the Russian subject, the $F_0$-patterns of single vowels were:

1) Rising in V1 [-stress], most clearly in trisyllabic words, but sometimes in disyllabic words as well.

2) Rising-falling in V1 [+stress] in most trisyllabic words, but in some disyllabic words as well.

3) Falling or falling-level in V2 [+stress] and V3 [+stress] in trisyllabic words.

4) Falling pattern in V2 [-stress] and V3 [-stress] but in the word final syllable as a sign of listing intonation, rising pattern is possible

The $F_0$-patterns of the Finnish subjects were on average falling in all positions and showed less changes (Figure 35), i.e. their pronunciation was more level where word melody is concerned.

Where the Russian pronunciation of the native is concerned, the result shows that the biggest changes in the values of $F_0$-patterns are in V [+stress] which are the longest vowels.

## 6.4 Conclusion

As mentioned earlier, phonetics plays a great part in foreign language learning. Unfortunately, as Iivonen states, too little attention has been paid to phonetics in foreign language acquisition in Finland compared with morphology, syntax and lexicon (Iivonen 1998:15). It has been realized only lately that often a good knowledge of a foreign language does not yield the best result when, for example, the pronunciation is not good. This question has been noticed where the knowledge of English in Finland is concerned although the tradition of teaching English was quite long and the differences in vowel duration and quality were noticed by Wiik as early as in the 1960's (Wiik 1965).

Each language has its specific features, and the difficulties they cause are not the same to speakers of different languages. Thus, teaching Russian phonetics to a Finnish learner needs a different approach and dif-

ferent material from, for example, teaching Russian to an Englishman. In the same way, the teaching of Finnish phonetics to a Russian needs a different approach from teaching Finnish to a Swede. In each case contrastive studies of the particular phonetical systems are needed.

In teaching phonetics to a foreign language learner, the correct pronunciation of single sound segments is important. Since many consonants in the Russian system are completely new for Finns, it is important at an early stage to teach the correct pronunciation of individual sounds especially in the case of some consonants such as the palatolaveolar sibilants and affricates. At the same time it is as important to learn a 'new' pronunciation of the consonants which have equivalents in Finnish like, for example, [t d s n ɬ x], without mentioning the [+voiced] and [+pal] consonants. At the very outset, the phonological oppositions which are different should be taught (de Silva 1997). Where vowels are concerned, the 'akanje' and 'ikanje' of the reduced vowels are important for any foreign learner of Russian but vowel [ɨ] ([+stress] and [-stress]) play a significant role as well. Research on Finnish pronunciation and teaching material already exist where the Russian segmental level is concerned (Baranovskaja 1982, Ljubimova 1988, Mäkilä & de Silva 1996).

As important as the segmental level, is the teaching of prosodic features of Russian to Finns. However, no contrastive study has so far been done about Russian and Finnish prosody. Thus, this investigation is the first to give some theoretical basis for teaching Russian rhythmic structure of words, word prosody, Finns the stress system with vowels in positions V [+stress], V [-stress1] and V [-stress2] as well as consonants in positions C1, C2, C3 and C3, and word melody. It has been also noticed that the duration of vowels includes some quality changes, similarly as the consonant duration can involve quality features, such as intrinsic duration and palatalization or the lack of it. The present study proves that special methods are needed to teach Russian word prosody to Finns. This is natural since the quantity distinctions work in a different way in Finnish than, for example, in the Indo-European or many Asian and African languages whose speakers form the majority of the learners of Russian as a foreign language. Although a lot of contrastive investigations and materials for teaching Russian phonetics abound in Russia, this particular aspect has not been duly emphasized.

The actuality of comparative studies of the sound systems of the native tongue (L1) and the target language (L2) has been recognized among phoneticians around the world. This was proved by the amount of papers in the sections of second language acquisition in the 14th world congress of phonetics ICPhS99 in San Francisco during the first week of August 1999 (Abstracts of Papers ICPhS 1999).

## 6.5 Future plans

The data of the present study included mostly disyllabic and trisyllabic isolated words. Thus the next item of research would be to study the same rhythmic structures in longer utterances and spontaneous speech. The material has already been taped and awaits future analysis. Secondly, a project plan to study the intonational system of Russian has already been made with a group Russian and Finnish colleagues. After the successful conclusion of the above mentioned research plans it will be possible to create teaching material on Russian word prosody and intonation for Finns.

Investigation of Finnish prosodic system (perception and production) for the purpose of teaching Finnish to Russian speakers should be done as soon as possible. Finnish intonation vís a vís Russian is also included in the above mentioned project. In teaching Finnish phonetics to any foreigner, in this respect as important a feature to Russians as well, a fundamental problem is the quantitative change of sound segments. As was seen in Experiment 3 of this study, a long vowel for a Russian means V [+stress] and the Russian subjects produced long vowels as two different vowels. The study of Finnish word prosody should also include investigations of consonant quantity as the duration of consonants in Russian is not distinctive and the appearance of the long consonants is comparatively rare. Although the theoretical background has already been given by Lehtonen (Lehtonen 1970), it needs more thorough investigation and special application for Russian speakers.

The most important would be the production of practical exercises especially meant for Russians which can be used, for example, in language laboratories. The motivation of Russian speakers residing in Finland to learn Finnish pronunciation is very high as the majority has come to Finland for permanent residence and often they do not want to have their background to be heard in their pronunciation. Apart from that, incorrect production of durational distinctions of Finnish by foreigners also reflects in their writing which may even cause a false estimation of the said person's capacity to learn Finnish properly.

In conclusion one can say that this present study proves the ever increasing importance of teaching phonetics as a part of foreign language acquisition. In this respect it can be mentioned that of the four subjects in Experiment 5, the pronunciation of FIN4 was closer to the native Russian in many aspects, especially as he had studied phonetics longer than the other three subjects involved in the experiment.

# РЕЗЮМЕ

## Введение

Цель данного исследования сопоставить русские и финские акцентно-ритмические структуры двух, трех- и четырехсложных слов. В первую очередь исследуется длительность ударных и безударных гласных в этих словах со слоговой структурой CVCV(C), CVCVCV(C) и CVCVCVCV(C). Кроме того исследованы длительности согласных, измерены формантные значения гласных, определены типы движения мелодических кривых. Анализ проделан на основе описания фонетических и фонологических систем русского и финского языков, которые описаны в первой главе. В ходе работы выясняется какова интерференция финского языка как родного в анализируемых явлениях.

В финском языке различные звуковые сегменты, гласные так же как и согласные, имеют две фонологически различительные долготы: они могут быть краткими и долгими. Однако, это различие в системе гласных не связано с местом словесного ударения, а ударные так же как и безударные гласные могут быть и краткими и долгими. Притом в финском языке ударение всегда падает на первый слог. В отличие от финского, в русском языке долгота гласных связана с ударением именно так, что ударные гласные самые долгие, а все безударные гласные редуцированы, т.е. они короче ударных. Кроме того, в русском языке есть две степени редукции. Таким образом, русские гласные находятся в трехступенчатой иерархии: ударные гласные, безударные гласные первой степени редукции и безударные гласные второй степени. Притом долгота гласных является главным параметром ударения. Кроме долготы гласных, акцентно-ритмическая структура слова в некоторой степени зависит от согласных.

Говоря о длительности звуковых сегментов надо также учесть их качество. В данной работе исследуется качество самих гласных по формантной структуре в стационарной части и дается небольшое

сравнение с качеством финских соответствующих кратких и долгих гласных. Как известно, в русском языке качество гласных сильно зависит от согласного окружения, которое наиболее ярко проявляется в противопоставлении твердых и мягких согласных (в фонологической оппозиции палатализации). Тем короче гласный, чем больше влияние окружающих согласных. Так, например, редуцированные гласные (особенно [ə]), второй ступени редукции могут иметь самое разное качество. Лабиализация окружающих согласных тоже влияет на качество соседнего гласного, но ее влияние в русском языке обнаруживается только после твердых согласных. Лабиальная коартикуляция так же как и палатализация согласного видны в переходной части соседнего гласного. В палатализации согласных и в ее влиянии на качество гласных так же как и ее отсутствие в русском произношении финнов может проявляться в разных видах интерференции родного языка. Кроме палатализации существуют различия между русской и финской системой согласных, как например, качество самих согласных и отсутствие в финском языке некоторых согласных.

## Материал

В процессе работы были проведены 6 экспериментов. Два первых предварительных эксперимента были сделаны для выяснения вопроса, как студенты-финны определяют место ударения в русском языке. В первом эксперименте студенты (N=35), изучающие русский язык, определили ударение в словах двух текстов (N=237). Во втором эксперименте финские студенты (N=36) определили ударение на слух в словах (N=61), начитанных на пленку носителем русского языка. Третий эксперимент был сделан для того, чтобы выяснить, как русские студенты, не знающие финский язык воспринимают долгие и краткие гласные в финском языке. В нем русские студенты (N=28) "отмечали ударение" в финских словах (N=42), прочитанных носителем финского языка. Четвертый эксперимент - акустический анализ двухсложных русских (N=86) и финских (N=84) слов, прочитанных изолированно и в контексте, носителями как русского (N=2) так и финского (N=3) языков. В нем измерялись длительности гласного /a/ во всех позициях. Пятый эксперимент, который составляет основной материал для данного исследования, состоит из двух- и трехсложных изолированных русских слов (N=237), прочитанных на пленку эталонным русским диктором, представителем московской произносительной нормы, и четырьмя финскими дикторами, студентами изучающими русский язык в университете, и финских слов (N=10) для сравнения. Измерялись длительности гласных /a/ и /i (i)/ во всех позициях Все финские информанты свободно говорили по-русски. Все дикторы в пятом эксперименте мужчины в возрасте от 21 до 30 лет. Шестой эксперимент заключил четырехсложные русские (N=18) и финские (N=9) слова, прочитанные изолированно и в контексте, русскими и финскими дикторами.

## Результаты

Первые два эксперимента показали, что финны опрелеляют место ударения в русских словах неплохо и что интерферирующее влияние финского языка на русский язык сказывается в том, что болышинство неправильных ответов связано с началом слова. Третий эксперимент показал, что, как правило, длительность гласного в финском языке чаще всего указывала на ударение для русского слушателя.

Результаты четвертого, пятого и шестого экспериментов показали, что в русских словах в речи носителей русского и финского языков длительность ударного гласного больше длительности безударных. По длительность гласные безударных слогов в речи носителей русского языка разделила безударные гласные на две группы, на гласные первой степени редукции (первый предударный слог и конец слова) и на гласные второй степени редукции. Соотношение относительной длительности ударных, безударных первой степени редукции и безударных второй степени редукции в произношении русского диктора было: 1,4-1,6: 0,9-1: 0,6-0,7. Но в русских словах у носителей финского языка определялись только две разные длительности так же как и финском, долгие и краткие, т.е. по длительности не различались две степени редукции. Притом, соотношение относительных длительностей ударных и безударных гласных было 2:1, что приблизительно соответсвует данным по финскому языку в нашем материале о долгих и кратких согласных. Кроме того, часто в их произношении сильно удлинялись ударные гласные.

Кроме длительности гласных, на материале пятого эксперимента были измерены длительность согласных. Результаты показали, что в произношении носителя русского языка длительность согласных не зависит от положения в слове (C1, C2, C3, C4), но в произношении финнов длительность согласных сильно варьируется в зависимости от положения в слове. Однако, в рамках данного исследования невозможно точнее определить закономерности этого явления. Вопрос о зависимости длительности согласных от места ударения тоже требует дальнейших исследований. Что касается длительности твердых и мягких согласных в произношении носителя русского языка, во многих случаях мягкие согласные имели бóльшую длительность, но на основе данного материала нельзя сказать, чтобы мягкие согласные всегда имели бóльшую длительность. В произношении же носителей финского языка мягкие согласные особенно перед ударным /a/, где гласный пишется буквой *я*, вместо двух фонем произносится три звука, CjV. В произношении финнов некоторые согласные как, например, смычные согласные /p t k/ и зубная аффриката /ts/, имели бóльшую или меньшую длительность чем в произношении носителя русского языка. Такие случаи можно объяснить интерференцией родного языка.

В словах, использованных в пятом эксперименте, был проведен анализ формантной структуры гласных [*a*], [a], [ʌ], [ə] ([ъ]), [$^{i}$ə] ([ь]), [ɨ], [i], [ɪ] и произношение финских дикторов сравнивалось с произно-

шением эталонного русского диктора. Обнаружилось, что в произношении носителей финского языка формантные структуры гласных [*a*], [а], [ʌ], [ə] ([ъ]) были близки друг к другу, так же как и формантные структуры гласных [ɨ], [i], [ɪ], [ʲə] ([ь]), т.е. на формантной карте образовались две группы гласных. Обе группы занимали значительно меньше места на карте чем эти же гласные в произношении эталонного русского диктора. Данный анались также показал, что в произношении русского диктора [ʲə] ([ь]), редуцированный гласный второй степени редукции после мягкого согласного, вполне может считаться аллофоном /i/.

В пятый эксперимент входит также анализ мягкости согласных (палатализации) и финская интерференция в ней. Результаты показали, что мягкость согласных или ее отсутствие яснее всего проявляется в формантной структуре гласного, особенно после губного согласного. Когда губной согласный твердый $F_2$ следующего гласного ниже в переходном периоде после согласного, чем в стационарной части, а когда согласный смягчается признака лабиальности нет. Это явление ярко видно в гласных [ɨ] и [i]. Таким образом, когда надо исследовать палатализацию согласных, можно использовать /i/ и губные согласные вместо, например, /a/, при котором могут появляться определённые трудности, о которых уже говорилось. Кроме формантной структуры гласных мягкость согласных или ее отсутствие можно обнаружить в длительности незвучного периода (VOT) при размыкании смычки у взрывных согласных. Наш эксперимент показал, что незвучащий период продолжается долго, когда согласный является мягким. Такое явление было типично в произношении эталонного русского диктора и, например, у того финского диктора, который владел лучше русским языком.

В пятом эксперименте во всех словах был так же измерен основной тон. В его движении в произношении носителя русского языка и в произношении носителей финского языка были существенные различия. Мелодических контурах русского слова в произношении носителя языка отличалась от мелодии слова в произношении всех финских дикторов в более резких движениях тона: в предударной части вверх, а в ударной части вниз. А если ударная часть в начале, то тон сначала повышается и потом понижается. Данный материал не дал ярких доказательств о том, что длительность гласного проявляется в большем падении основного тона, особенно в произношении носителей финского языка.

## Заключение

Данная работа доказала, что интерференция родного языка в русском произношении носителей финского языка сказывается в акцентно-ритмической структуре русских слов, в неправильной длительности гласных первой ступени редукции, в различных степенях длительности согласных в зависимости от позиции в слове, в длительности самих, как

мягких, так и твердых согласных. Кроме того, интерференция финского языка обнаруживается в гласных в стационарной части так, что финны недостаточно различают разные оттенки ударных и безударных /a/ и /i (i)/, а особенно первая переходная часть гласных после губных согласных является доказательством присутствия или отсутствия палатализации. Мелодические контуры слов в произношении финнов тоже показывают интерференцию более ровной финской мелодики.

# YHTEENVETO

## Johdanto

Tämän kontrastiivisen tutkimuksen tarkoitus on suomen ja venäjän kaksi-, kolme ja nelitavuisten sanojen rytmisten rakenteiden vertaileminen. Ensisijaisesti työssä tarkastellaan painollisten ja painottomien vokaalien kestoa CVCV(C), CVCVCV(C) ja CVCVCVCV(C) -tyyppisissä sanarakenteissa. Lisäksi tutkitaan konsonanttien laatua ja kestoa sekä mm. palatalisaation vaikutusta niihin, vokaalien laatua formanttiarvojen avulla ja perussävelen ($F_0$) käyriä yksittäisten vokaalien keston ja sanansisäisen sävelkulun kannalta. Tutkimuksen teoriataustana ovat venäjän ja suomen foneettiset ja fonologiset järjestelmät, jotka kuvataan ensimmäisessä luvussa. Tutkimuksessa perehdytään myös siihen, millaista negatiivista interferenssiä suomen kielen foneettinen järjestelmä aiheuttaa suomalaisten venäjän opiskelijoiden ääntämisessä mainittujen seikkojen ollessa kyseessä. Tutkimuksen tavoitteena on vertailla suomen ja venäjän kielten äännejärjestelmien ominaisuuksia ääntämisen opetuksen tarpeita silmälläpitäen.

Suomessa äännesegmenteillä, sekä vokaaleilla että konsonanteilla, on kaksi fonologisesti merkittävää sanapainosta riippumatonta kvantiteettia: lyhyt ja pitkä. Lisäksi suomessa sanapaino on aina ensimmäisellä tavulla. Venäjässä sanapainon paikka on vapaa ja sen pääasiallisin tunnusmerkki on vokaalin kesto. Venäjän vokaalit muodostavat kolmiportaisen kestojärjestelmän niin, että painolliset vokaalit ovat pitempiä kuin painottomat ja painottomilla vokaaleilla on kaksi reduktioastetta. Sanan rytminen rakenne on jossain määrin myös riippuvainen konsonanteista.

Äännesegmenttien kestoon liittyy aina myös laadullisia eroja. Siksi tässä tutkimuksessa perehdytään myös vokaalien laatuun formanttirakenteiden avulla. Tarkastelun kohteiksi valittiin kaksi venäjän vokaa-

lifoneemia /a/ ja /i/, sillä ne ovat keskeisiä venäjän äännejärjestelmässä. Tässä työssä foneemi /i/ käsittää myös allofonit [i] ja [ɪ], mikä on moskovalaisen fonologisen koulukunnan käsitys (viisi vokaalifoneemia), kun taas pietarilaisen koulukunnan tulkinnan mukaan [i] ja [i] ovat eri foneemeja (kuusi vokaalifoneemia). Vokaalien laatu saadaan mitattaessa formanttiarvot vokaalin keskeltä. Konsonanttien vieressä koartikulaatio aiheuttaa formanteissa transitioita, joista selvimpiä ovat palatalisaation ja labialisaation aiheuttamat transitiot $F_2$-käyrässä: palatalisaatio näkyy korkeampana ja labiaalisaatio alempana arvona. Venäjässä on todettu ympäröivien konsonanttien vaikuttavan suuresti vokaalien laatuun, ja varsinkin palataalistuneen konsonantin vaikutus viereisen redusoituneen vokaalin [ə] laatuun on huomattava. Venäjän kielen konsonanttien labialisaatio näkyy vokaalin $F_2$:n matalampana arvona vain palataalistumattomien konsonanttien jäljessä ja edessä. Suomalaisille venäjän kielen palatalisaatio ja monet muut konsonanttijärjestelmän eroavuudet tuottavat usein vaikeuksia, ja ääntämisessä voi esiintyä suomen kielen aiheuttamaa negatiivista interferenssiä.

## Koemateriaali

Tässä työssä käsitellään kuuden kokeen tuloksia kuitenkin niin, että yksi koe (Experiment 5) käsittää suurimman osan tutkimuksesta. Kahden ensimmäisen esikokeen tarkoitus oli selvittää, miten suomalaiset venäjän kielen opiskelijat hahmottavat ja kuulevat sanoissa sanapainon. Ensimmäisessä kokeessa opiskelijat merkitsivät painot kahden tekstin sanoihin (N=237) (ks. Appendix). Toisessa kokeessa he merkitsivät vastauslomakkeeseen painon paikan natiivin lukemiin sanoihin (N=61) kuulemansa perusteella. Koepaikkana käytettiin kielistudiota. Kolmannessa kokeessa, jossa venäläiset opiskelijat kuulivat nauhalta kielistudiossa suomalaisen lukemat sanat (N=42), tutkittiin sitä, miten venäläiset kuulevat suomen kestoerot ja missä he kuulevat painon suomen kielen sanoissa. Neljäs koe käsitti kaksitavuisten kahden venäläisen ja kolmen suomalaisen lukemien venäjän (N=86) ja suomen (N=84) sanojen akustisen analyysin. Sanat oli luettu ensin irrallisina ja sitten lauseissa. Sanoista mitattiin vokaalin /a/ kestot kaikissa asemissa. Viides koe sisälsi irrallisia venäjän kielen kaksi- ja kolmitavuisia sanoja (N=237) ja lisäksi suomen kielen sanoja (N=10) vertailua varten. Vokaalien kesto- ja laatuvertailussa käytettiin vokaalifoneemeja /a/ ja /i/. Koehenkilöinä olivat neljä suomalaista miesopiskelijaa, jotka puhuivat sujuvasti venäjää, ja venäläinen nuori mieshenkilö, jonka ääntäminen edusti moskovalaista kirjakielen normia. Kuudes koe sisälsi venäläisten (N=18) ja suomalaisten (N=9) koehenkilöiden

irrallaan ja lauseissa lukemien nelitavuisten sanojen analyysin, jossa mitattiin vokaalien kestot.

## Tulokset

Kaksi ensimmäistä koetta osoittivat, että suomalaiset havaitsevat venäjän kielen sanapainon melko hyvin, mutta suomen kielen negatiivinen interferenssi ilmenee niin, että suurimmassa osassa vääriä vastauksia paino merkittiin aiemmalle tavulle sanassa kuin se oli. Kolmas koe osoitti sen, että venäläinen kuulija, joka ei tunne suomen äännejärjestelmää, pitää yleensä painollisena sitä tavua, jossa on pitkä vokaali.

Neljännen, viidennen ja kuudennen kokeen tulokset osoittivat sen, että natiivien ääntämissä venäjän kielen sanoissa painollinen vokaali on aina kestoltaan muita pitempi. Muiden vokaalien kesto sekä kaksi-, kolmi- että nelitavuisissa sanoissa noudattaa kolmiportaista järjestelmää, jossa painollisen vokaalin suhteellinen kesto on 1,4-1,6, ensimmäisen asteen redusoidun vokaalin 0,9-1 ja toisen asteen redusoidun vokaalin 0,6-0,7. Suomalaisten koehenkilöiden ääntämissä venäjän kielen sanoissa oli havaittavissa ainoastaan kaksi vokaalien kestoa: painollinen vokaali oli pitkä, jopa ylipitkä, ja painottomat vokaalit eri asemissa olivat suunnilleen samanpituisia ja hyvin lyhyitä. Niiden kestoarvot olivat lähempänä toisen asteen kuin ensimmäisen asteen redusoidun vokaalin kestoa, toisin sanoen, suomalaiset koehenkilöt eivät erottaneet kahta reduktioastetta. Painollisten ja painottomien vokaalien suhdeluvuksi saatiin lähes tarkalleen 2:1, mikä vastaa suomen kielen pitkän ja lyhyen vokaalin välistä eroa.

Vokaalien keston lisäksi viidennessä kokeessa mitattiin konsonanttien kestot. Tulokset osoittavat, että venäläinen natiivi ääntää konsonantit sanan eri asemissa (C1, C2, C3, C4) yhtä pitkinä, mutta suomalaisten koehenkilöiden tuotoksissa konsonanttien kestot vaihtelivat suuressa määrin. Tämän materiaalin puitteissa ei kuitenkaan voida tarkemmin määritellä asemia, joissa konsonantin kesto olisi pitempi tai lyhyempi, sillä eri koehenkilöiden tulokset erosivat selvästi toisistaan. Mitä tulee palataalistumattomien ja palataalistuneiden konsonanttiparien kestoon, monet palataalistuneet konsonantit olivat natiivin ääntäminä kestoltaan pitempiä kuin vastaavat palataalistumattomat. Sama koskee suomalaistenkin koehenkilöiden tuloksia, tosin venäläisen ja suomalaisten välillä oli eroja. Eräissä tapauksissa foneemidistinktion väärästä tulkinnasta johtuen suomalaiset koehenkilöt lisäsivät palataalistettavan konsonantin ja vokaalin väliin j-äänteen ($C^jV$ > CjV) varsinkin painollisen [a]:n edellä, kun sitä vastaava kirjainmerkki oli *я*. Tällöin konsonantti tai vokaali, tai molemmat, luonnollisestikin pidentyvät. Yksittäisistä konsonanteista

selvimmin erosivat kestoltaan venäläisen ja suomalaisten ääntäminä klusiilit [p t k] ja dentaaliaffrikaatta [ts], jotka suomalaiset äänsivät pitempinä.

Viidennen kokeen koemateriaalista tutkittiin /i/ ja /a/ ([ɑ], [a], [ʌ], [ə] ([ъ]), [ⁱə] ([ь]), [ɨ], [i], [ɪ]) vokaalien laatua mittaamalla $F_1$:n ja $F_2$:n arvot vokaalin keskellä (ST) ja pyrittiin selvittämään erot venäläisen koehekilön ja suomalaisten koehenkilöiden tuottamien vokaalien laadussa. Tuloksista kävi ilmi, että suomalaiset äänsivät varsinkin /a/:n mutta myös /i/:n allofonit hyvin samalla tavalla, joten formanttikartalle syntyi kaksi äänneryhmää, joiden käsittämät alueet olivat pienemmät kuin venäläisen tuottamien vokaalien alueet formanttikartalla. Venäläisen koehenkilön ääntämisestä voitiin myös havaita, että vokaali [ⁱə], joka on toisen asteen redusoitu vokaali ja alunperin /a/:n allofoni, erottuu selvästi i-mäisyydellään, joten sitä voidaan pitää /i/:n allofonina.

Viidennessä kokeessa analysoitiin myös palatalisaatiota ja suomalaisten tuottamia konsonantteja. Palatalisaation tunnusmerkki on vokaalin i-transitio konsonantin vieressä, esimerkiksi, /a/:n ollessa kyseessä. Tässä kokeessa havaittiin, että varmin palatalisaation tunnusmerkki on vokaalin transitio labiaalikonsonantin vieressä, jolloin myös /i/:n edellä tai jäljessä olevan konsonantin palatalisaatio voidaan havaita. Tätä tunnusmerkkiä voidaan käyttää varsinkin analysoitaessa ei-natiivien puhetta, josta konsonantin palatalisaatio voi puuttua. Vokaalien formanttirakenteen lisäksi palatalisaation tai sen puuttumisen voi havaita klusiilien eksploosioon liittyvästä VOT-arvosta (voice onset time) ja eksploosion alkamishetkestä. Sekä venäläisen koehenkilön että parhaiten venäjää ääntävän suomalaisen koehenkilön tuotoksista kävi ilmi, että VOT-arvo on palataalistuneilla konsonanteilla huomattavasti suurempi.

Perussävelkäyrää tutkittiin viidennessä kokeessa vokaalien keston ja sanojen sävelkulun kannalta. Tukea sille väitteelle, että $F_0$-käyrä sinänsä osoittaisi vokaalien kestoeroja, ei ollut havaittavissa. Perussävelessä havaittiin selviä eroja venäläisen koehenkilön ja suomalaisten tuotosten välillä. Sanojen sävelkulkukäyrät olivat venäläisen ääntämisessä vaihtelevampia kuin suomalaisten ääntämisessä. Yleisesti venäläisen tuottamissa sanoissa sävelkulku sanan alussa oli selvemmin nouseva.

## Loppulause

Tämä tutkimus osoitti, että suomalaisten venäjän kielen ääntämisessä äidinkielen negatiivinen interferenssi ilmenee sanojen rytmirakenteessa. Interferenssinä voidaan pitää vokaalien ensimmäisen reduktioasteen keston puuttumista, konsonanttien kestovaihteluja sanan eri asemissa sekä palataalistumattomien ja palataalistuneiden konsonanttien erilaista kes-

toa verrattuna natiivin ääntämiseen. Lisäksi suomen kielen vaikutus on havaittavissa vokaalien laadussa niin, etteivät suomalaiset erota vokaalien /a/ ja /i/ allofoneja riittävästi eivätkä aina palataalista konsonanttia, mikä on nähtävissä erityisesti labiaalikonsonanttien jälkeisen [i]:n ja [ɨ] transitiossa. Vokaalin [a] transitio palataalistuneen konsonantin jälkeen ei aina ole riittävä todiste palatalisaatiosta, koska sen voi aiheuttaa myös väärä foneemijako. Suomalaisten koehenkilöiden ääntämien sanojen sävelkulku on myös osoitus äidin kielen negatiivisesta interferenssistä.

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# APPENDIX

## Experiment 1

### АНГАРА

В огромное озеро Байкал впадает много рек, а вытекает только одна река Ангара. Легенда говорит, что у старика Байкала было много сыновей и только одна дочь - красавица Ангара. Ничего не жалел для нее старик Байкал. Все богатства, которые приносили Байкалу сыновья, он отдавал красавице Ангаре.

А другая легенда говорит, что красавица Ангара горячо полюбила богатыря Енисея и ушла к нему из родного дома. Вот почему впадает Ангара в могучую сибирскую реку Енисей, вот почему несет она к нему через многие километры свои воды.

### ЗАДАЧКА

Ариадна Николаевна, учительница математики, сообщила Лёве, как классному гению, что в специальной математической школе будет день открытых дверей и что она советовала бы ему пойти. А пошли втроем: Лёва, Юра и Машка.

Действительно прекрасная школа! Классы там - не классы, а кабинеты, и в одном счётно решающая машина стоит. Уроки называются не уроки, а лекции, и вместо учителей преподают доценты из университета, а один даже доктор наук. Уже в девятом классе проходят программу первого курса физмата и даже отчасти второго. Поэтому, кто не круглый отличник, у кого четвёрки, смешно даже думать туда попасть. У Юры четвёрок было две, у Лёвы - ни одной. А у Машки, конечно, чевёрок было немало.

Но когда день открытых дверей уже кончался, выступил директор этой математической школы. Он в своей речи сказал, что если кто не отличник, то пусть он всё-таки не отчаивается, главное - итоги математической олимпиады. Победители олимпиады получают право поступить в математическую школу без экзаменов.

Тогда-то ребята и решили идти втроём в воскресенье на олимпиаду, попытать счастье. Машка не считала тиким уж большим счастьем попасть в эту математическую школу. У неё были совсем другие планы. Однако было бы нечестно бросить мальчишек в такую ответственную минуту.

И вот олимпиада началась. Каждому полагалась своя задача. У Юры, например, такая: к одному королю съехались рыцари: известно, что каждый из них враждует с половиной гостей. Каким образом помощник короля мог бы рассадить их так, чтобы никто не сидел с врагом?

- А у тебя что? - спросил Юра, которому, конечно, захотелось сначала узнать, что досталось другу.

Лёве досталось про шахматистов. Мальчики с увлечением стали решать задачи.

## Experiment 2

атлас ['*a*tɬəs]
атлас [ʌ'tl*a*s]
без устали [bʲɪ'zustəlʲɪ]
весела ['vʲes$^{ji}$əɬʌ]
веселить [vʲ$^{ji}$əsʲɪ'lʲɪtʲ]
весело ['vʲes$^{ji}$əɬʌ]
веселье [vʲɪ'selʲjɪ]
высватала ['vɪsvətəɬʌ]
гада ['g*a*dʌ]
года [gʌ'd*a*]
годовой [gədʌ'voj]
город ['gorət]
города [gərʌ'd*a*]
господа [gəspʌ'd*a*]
господь [gʌ'spotʲ]
госпожа [gəspʌ'ʒ*a*]
грозы ['grozɪ]
грозы [grʌ'zɪ]
дала [dʌ'ɬ*a*]
дало ['d*a*ɬʌ]
дорого ['dorəgʌ]
дорогой [dərʌ'goj]
дорогой [dʌ'rogəj]
замок ['z*a*mək]
замок [zʌ'mok]
замужем ['z*a*muʒəm]
за мужем [zʌ'muʒəm]
звала ['zv*a*ɬʌ]
звала [zvʌ'ɬ*a*]
мала [mʌ'ɬ*a*]
мало ['m*a*ɬʌ]
молод ['mołət]
молода [məɬʌ'd*a*]
молодеть [məɬʌ'dʲetʲ]
молодо ['moɬədʌ]
молодой [məɬʌ'doj
моложе [mʌ'łoʒɪ]
падала ['p*a*dəɬʌ]
падать ['p*a*dətʲ]
плачу ['płatʃʲʉ]
плачу [plʌ'tʃʉ]
погода [pʌ'godʌ]
погоди [pəgʌdʲi]
подала [pədʌ'ɬ*a*]
подать [pʌ'd*a*tʲ]
права [prʌ'v*a*]
право ['pr*a*vʌ]
прохожий [prʌ'xoʒɨj]
прохожу [prəxʌʒu]
сватала ['sv*a*təɬʌ]
стало ['st*a*ɬʌ]
стара [stʌ'r*a*]
старый ['st*a*rɨj]
стола [stʌ'ɬ*a*]
сторожа ['storəʒʌ]
сторожа [stərʌ'ʒ*a*]
уставать [ustʌ'v*a*tʲ]
устала [u'st*a*ɬʌ]
холода [xəɬʌd*a*]
холодно ['xołədnʌ]
холодный [xʌ'łodnɨj]

## Experiment 3

Aavasaksa
asukkaana
haaskata
kaakattava
kalastaa
kalastava
kana
karkaava
lakatkaa
maalaamassa
maattava
makaamassa
naarakasa
paalata
palaamassa
palaavana
palavassa
parantava
parasta
raahaamana
raakana
raatavana
rakastaa
rakastama
raskaana
saamatta
saatavana
salaama
salakalla
salama
sama
samaa
samana
tappavaa
tasattava
tavaavana
tuli
tuuli
Vaajala
vakavana
varmaankaan
vastaavassa

## Experiment 4

aalto
aamu
aasi
aate
aatto
ala
alaan
alan
alas
alkaa
allas
haastaa
jalat
kaada
kaadat
kaappaa
kaappi
kaataa
kala
kalaa
kalla
kappa
kasa
kasaa
kasaat
kassa
kassat
laadi
laadit
laahaa
laakso
laattaa
laatu
lakkaa
maalaa
maalaat
maali
maata
malli
mallit
naarmu
paahtaa
paasaan
paasaat
paasto
paatti
paha
pahat
paja
pakan
pakka
pala
palaa
palaan
palaat
palan
parjaat
passaat
pata
pataa
patsaat
saada
saadaan
saalis
saari
saaste
saatan
saattaa
sadan
sata
sataa
sataan
tapaa
tappaa
tasaan
tasan
tatti
tuuppaan
vaara
vaaraa
Vaasaan
Vaasan
varaat
vartaat

атлас ['*a*tłəs]
атлас [ʌ'tl*a*s]
бабам ['b*a*bəm]
баржа ['b*a*rʒʌ]
баржа [bʌ'rʒ*a*]
баржам ['b*a*rəm]
баржам [bʌ'rʒ*a*m]
бобам [bʌ'b*a*m]
вазам ['v*a*zəm]
вала ['v*a*'łʌ]
валом ['v*a*łəm]
возам [vʌ'z*a*m]
вола [vʌ'ł*a*]
волам [vʌ'ł*a*m]
гада ['g*a*dʌ]
г*а*дам ['g*a*dəm]
главам [glʌ'v*a*m]
главам ['gl*a*'vəm]
глаза ['gl*a*zʌ]
глаза [glʌ'z*a*]
глазам [glʌ'z*a*m]
глазом ['gl*a*zəm]
года [gʌ'd*a*]
годам [gʌ'd*a*m]
дала [dʌ'ł*a*]
дало ['dałʌ]
дамам ['d*a*məm]
домам [dʌ'm*a*m]
замкам [zʌ'mk*a*m]
замкам ['z*a*mkəm]
запах ['z*a*pəx]
запах [zʌ'p*a*x]
звала ['zv*a*łʌ]
звала [zvʌ'ł*a*]
кара ['k*a*rʌ]
касса ['k*a*s:ʌ]
кора [kʌ'r*a*]
коса [kʌ's*a*]
латка ['ł*a*tkʌ]
лотка [łʌ'tk*a*]
мазка [mʌ'sk*a*]
мазкам [mʌ'sk*a*m]
мала [mʌ'ł*a*]
мало ['m*a*łʌ]
маска ['m*a*skʌ]
маскам ['m*a*skəm]
масла ['m*a*słʌ]
масла [mʌ'sl*a*]

маслам [mʌ'slam]
маслом ['masɬəm]
напал [nʌ'pał]
на пол ['napəɬ]
падал ['padəɬ]
палка ['pałkʌ]
палкам ['pałkəm]
папа ['papʌ]
пара ['parʌ]
партам ['partəm]
паста ['pastʌ]
подал [pʌ'dał]
полка [pʌ'łka]
полкам [pʌ'łkam]
попа [pʌ'pa]
пора [pʌ'ra]
портам [pʌ'rtam]
поста [pʌ'sta]
права [prʌ'va]
правам [prʌ'vam]
право ['pravʌ]
правом ['pravəm]
раса ['rasʌ]
рвала ['rvałʌ]
рвала [rvʌ'ła]
роса [rʌ'sa]
Савва ['sav:ʌ]
слава ['slavʌ]
слова [slʌ'va]
сова [sʌ'va]
спала ['spalʌ]
спала [spʌ'ła]
стала ['stałʌ]
стола [stʌ'ła]
шагам [ʃʌ'gam]
шагом ['ʃagəm]
шарам [ʃʌ'ram]
шаром ['ʃarəm]

## Experiment 5

база ['bázʌ]
беги [bʲɪ'gʲi]
беда [bʲɪ'da]
бежать [bʲɪ'ʒatʲ]
бокал [bʌ'káɬ]
болит [bʌ'lʲit]
быка [bɪ'ka]
быкам [bɪ'kam]
ваза ['vazʌ]
вазе ['vazʲɪ] (?)
Валя ['valʲə]
варят ['varʲət]
вези [vʲɪ'zʲi]
везут [vʲɪ'zút]
возя [vʌ'zʲa]
вяли [vʲal'ɪ]
гада ['gadʌ]
Гали ['galʲɪ]
гасить [gʌ'sʲitʲ]
гасят ['gasʲat]
года [gʌ'da]
гони [gʌ'nʲi]
горят [gʌ'rʲat]
горит [gʌ'rʲit]
губам [gu'bám]
гуди [gu'dʲi]
гудят [gu'dʲat]
гуще ['guʃʲɪ]
горам [gʌ'ram]
горят [gʌ'rʲat]
дали ['dalʲɪ]
дамы ['damɪ]
дата ['datʌ]
датам ['datəm]
даты [da'tɪ]
дела [dʲɪ'ła]
детя [dʲɪtʲa]
дыма ['dɨmʌ]
дядя ['dʲadʲɪ]
дядям [dʲadʲəm]
дуба ['dúbʌ]
жара [ʒʌ'ra]
жена [ʒɪ'na]
жили ['ʒɨlʲɪ]
занял ['zanʲəɬ]
за вас [zʌ'vas]
Зина ['zʲinʌ]
зови [zʌ'vʲi]
зовя [zʌ'vʲa]
изюм [ɪ'zʲʉm]
кидай [kʲɪ'daj]
коня [kʌ'nʲa]
копать [kʌ'patʲ]
копи [kʌ'pʲi]
коса [kʌ'sa]
косить [kʌ'sʲitʲ]
кося [kʌ'sʲa]
купи [ku'pi]
купят [ʾkupʲʲət]
лагерь [łagʲʲərʲ]
лежать [lʲɪ'ʒatʲ]
лепить [lʲɪ'pʲitʲ]
летать [lʲɪ'tatʲ]
летят [lʲɪ'tʲat]
Лида ['lʲidʌ]
Лиде ['lʲidʲɪ]
лиса [lʲɪ'sa]
луна [łu'na]
лыжи ['łɨʒɪ]
Люба ['l'ʉbʌ]
любя [lʲʉ'bʲa]
ляжем ['lʲaʒəm]
ляжет ['lʲaʒət]
мадам [mʌ'dam]
мала [mʌ'ła]
маме ['mamʲə]
Маша ['maʃʌ]
мила [mʲɪ'łá]
мило ['mʲiłʌ]
мочи [mʌ'tʃʲi]
мытых ['mɨtɨx]
мяли ['mʲalʲɪ]
на вас [nʌ'vas]
надо ['nádʌ]
Надя ['nadʲə]
нажал [nʌ'ʒał]
нами ['namʲɪ]
на час [nʌ'tʃʲas]
не дам [nʲɪ'dam]
неси [nʲɪ'sʲi]
не щи [nʲɪ'ʃʲi]
Нина ['nʲinʌ]
ноги [nʌ'gʲi]

ножа [nʌ'ʒa]
носи [nʌ'sʲi]
няня ['nʲanʲə]
папам ['papəm]
парад [pʌ'rat]
паром ['parəm]
пиво ['pʲivʌ]
пили ['pʲilʲɪ]
пиши [pʲɪ'ʃi]
погас [pʌ'gas]
подам [pʌ'dam]
подать [pʌ'datʲ]
пожар [pʌ'ʒar]
пожарь [pʌ'ʒarʲ]
пока [pʌ'ka]
поля [pʌ'lʲa]
понять [pʌ'nʲatʲ]

пяти [pʲɪ'tʲi]
пятый ['pʲatɨj]
рада ['radʌ]
ради ['radʲɪ]
рады ['radɨ]
рамок ['ramək]
раса ['rasʌ]
роса [rʌ'sa]
ряды ['rɨdɨ]
сада ['sadʌ]
сады [sʌ'dɨ]
сама [sʌ'ma]
Сибирь [sʲɪ'bʲirʲ]
сидят [sɪ'dʲat]
синий ['sʲinʲɪj]
сына ['sɨnʌ]
сядем ['sʲadʲəm]

Таня ['tanʲə]
тащишь ['taʃʲɪʃ]
тебя [tʲɪ'bʲa]
тихий ['tʲixʲɪj]
тихо ['tʲixʌ]
ты же ['tɨʒə]
тянем ['tʲanʲəm]
тяни [tʲɪ'ni]
хотят [xʌ'tʲat]
хотя [xʌ'tʲa]
шаги [ʃʌ'gʲi]
шагом ['ʃagəm]
шире ['ʃirʲɪ]
ширить ['ʃirʲɪtʲ]
щами ['ʃʲamʲɪ]

бабушек ['babuʃək]
баловать ['bałəvətʲ]
бегите [bʲɪ'gʲitʲɪ]
битая ['bʲitəjɪ]
битого ['bʲitəvʌ]
боками [bʌ'kamʲɪ]
бумага [bu'magʌ]
бывает [bɨ'vajɪət]
возите [vʌ'zʲitʲɪ]
в улицах ['vulʲitsəx]
выведи ['vɨvʲɪədʲɪ] вы-
выдумав ['vɨduməf]
выносить [vɨnʌ'sʲitʲ]
вычитав ['vɨtʃʲɪtəf]
говорим [gəvʌ'rʲim]
говорит [gəvʌ'rʲitʲ]
годиться [gʌ'dʲitsʌ]
давала [dʌ'vałʌ]
дачами ['datʃʲəmʲɪ]
девица [dʲɪ'vʲitsʌ]
догоня [dəgʌ'nʲa]
до пяти [dəpʲɪ'tʲi]
дотянуть [dətʲɪ'nutʲ]
дамами ['daməmʲɪ]
жарилась ['ʒarɨłəsʲ]
заболит [zəbʌ'lʲit]
за Валей [zʌ'valʲəj]
завяли [zʌ'vʲalʲɪ]
завянет [zʌ'vʲanʲət]
занова ['zanəvʌ]

занято ['zanʲətʌ]
казалось [kʌ'załəsʲ]
купили [ku'pʲilʲɪ]
корица [kʌ'rʲitsʌ]
лениво [lʲɪ'nivʌ]
летите [lʲɪ'tʲitʲɪ]
ловите [lʌ'vʲitʲɪ]
лютики ['lʲutʲɪkəm]
мамины ['mamʲɪnɨ]
матери ['matʲərʲɪ]
машины [mʌ'ʃɨnɨ]
мытая ['mɨtəjɪ]
надевал [nədʲɪ'vał]
налито [nʌ'lʲitʌ]
на полях [nəpʌlʲax]
на тебя [nətʲɪ'bʲa]
научат [nʌutʃʲət]
начало [nʌ'tʃʲałʌ]
начинал [nətʃʲɪ'nał]
не копил [nʲəkʌ'pʲiɬ]
не ломай [nʲəłʌ'maj]
не лазим [nʲɪ'łazʲɪm]
не надо [nʲɪ'nadʌ]
не пили [nʲɪ'pʲilʲɪ]
не пишешь [nʲɪ'pʲiʃəʃ]
не понять [nʲəpʌnʲatʲ]
не шуми [nʲəʃu'mʲi]
падала ['padəłʌ]
о маме [ʌ'mamʲɪ]
памяти ['pamʲətʲɪ]

папаша [pʌ'paʃʌ]
передач [pʲəɾʲɪ'datʃʲ]
пирогам [pʲɪrʌ'gam]
победить [pəbʲɪdʲɪtʲ]
повези [pəvʲɪ'zi]
погадать [pəgʌ'datʲ]
показав [pəkʌzaf]
показать [pəkʌzatʲ]
покупать [pəku'patʲ]
полетят [pəlʲɪ'tʲat]
полями [pʌ'lʲamʲɪ]
помяли [pʌ'mʲalʲɪ]
понимать [pənʲɪ'matʲ]
порядок [pʌ'rʲadək]
посиди [pəsʲɪ'dʲi]
пятого ['pʲatəvʌ]
пятая ['pʲatəjɪ]
радовать ['radəvətʲ]
рыжая ['rɨʒəjɪ]
рыжего ['rɨʒəvʌ]
самого ['saməvʌ]
сахара ['saxərʌ]
с ужаса ['suʒəsʌ]
считаю [ʃʲɪ'tajʉ]
сядете ['sʲadʲətʲɪ]
тамада [təmʌ'da]
тащите [tʌ'ʃʲitʲɪ]
тишина [tʲɪʃɨ'na]
товарищ [tʌ'varʲɪʃʲ]
удивить [udʲɪ'vʲitʲ]

хотите [xʌ'tʲitʲɪ]
читатель [tʃʲɪ'tatʲiəlʲ]
чужая [tʃʲʉ'ʒajɪ]
шарикам ['ʃarʲɪkəm]
шарами ['ʃarəmʲɪ]
языки [jɪzɨ'kʲi]

kiri
kiva
liitin
pasaati
saatava
sakarat
salaman
makaat
takana
tavat

## Experiment 6

asukkaana
masentavaa
palaavana
parantava
roskaamana
saatavana
salaamana
salamana
samovaari

атаманша [ʌtʌ'manʃʌ]
баловала ['bałəvəłʌ]
баловалась ['bałəvəłəsʲ]
догадаться [dəgʌ'datsʌ]
жаловала ['ʒałəvəłʌ]
жаловалась ['ʒałəvəłəsʲ]
заказана [zʌ'kazənʌ]
закатала [zəkʌ'tałʌ]
заколдовал [zəkəłdʌ'vał]
запаковать [zəpəkʌ'vatʲ]
колокола [kəłəkʌ'ła]
колоколам [kəłəkʌ'łam]
пароварка [pərʌ'varkʌ]
пароваркам [pərʌ'varkəm]
пожаловал [pʌ'ʒałəvəł]
размазана [rʌ'zmazənʌ]
самовара [səmʌ'varʌ]
самоварам [səmʌ'varəm]