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SUN BO

THEORETICAL AND APPLIED ASPECTS OF MODIFICATIONS OF RUSSIAN VOWELS AND CONSONANTS IN CONNECTED SPEECH OF CHINESE SPEAKERS

(EXPERIMENTAL-PHONETIC RESEARCH)

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INTRODUCTION

The present study is devoted to the study of modifications of Russian vowels and consonants realized by native Chinese speakers in the conditions of unprepared reading of a phonetically representative text.

The relevance of the study is caused by the unflagging interest of the Chinese in studying and teaching Russian, starting from the first Russian school "Russian Language Palace" of the Qing dynasty emperor Kangxi (1708) to 158 universities1, as well as numerous schools teaching Russian in modern China. In turn, in Russia, as early as 2007, 13,639 Chinese students studied Russian at universities; in 2017 – 26,775, and in 2018-2019 – 35,000 undergraduate and postgraduate students2 . Russian as a foreign language is studied by 45,000 Chinese students in 250 schools across China (*Sun Bo 2020:142-145*).

The growing interest in the Russian language is connected with the strengthening of relations between Beijing and Moscow, with fruitful co-operation between the two countries in the humanitarian field. China and Russia support co-operation between universities. At present, there are 91 joint education projects, and 13 Chinese -Russian university associations have been established.

The expansion of economic, cultural and political ties between the People's Republic of China and the Russian Federation favours active language interaction in science and education.

The training of Chinese specialists with knowledge of Russian for adequate communication, understanding, exchange and reproduction of information includes training in Russian normative pronunciation, since, as is well known, "communication between people, the means of which language is the medium is alised precisely through and thanks to the sound side of language" (*Zinder 1979: 4).*

1 Data from the All-China Statistical Bulletin of Education Development. 2018г.
2 Data from the Ministry of Science and Education of the Russian Federation. 2022г

The paper considers Chinese and Russian –– far from each other in genealogical classification and in the typological characteristics of phonetic systems.

Chinese belongs to the Sino-Tibetan group, whereas Russian represents the Indo-European family of languages. Therefore, natural circumstances are difficulties in mastering foreign language pronunciation, in our case, Russian pronunciation by native speakers of Chinese.

Mastering of pronunciation skills of Russian by Chinese causes the greatest difficulties due to cardinal differences in the sound content organization of the languages in question, both at the segmental and supersegmental levels.

The main discrepancies include differences in the syllable structure in both languages, the absence in Chinese of correlation of consonants according to the differential features "voiced-voiceless", "hard-soft", stress and noticable vowel reduction (*Verbitskaya, Ignatkina 1993; Bondarko 1998)*, and, on the contrary, when the Chinese language has a system of tones and consonant opposition according to the feature "aspirated-unaspirated", etc. *(Kasevich 1983, Polivanov 1991, Speshnev 2015).*

In addition, the influence of native Chinese and its dialects on the acquisition of Russian pronunciation is considered to be one of the significant difficulties in establishing foreign-language articulation, as is the lack of sufficient knowledge of native Chinese phonetics as a basis for comparison with Russian and vice versa.

It is believed that Chinese dialects manifest themselves differently in Russian accent speech of native Chinese speakers. Examples of modern studies of the contact between Russian and Chinese dialects include the works: (*Chang Ching-Gwo 1999)* – Taiwanese dialect;

(Deng Jie 2011) – Cantonese dialect; *(Zhu Yu Fu, Wang Jing- Jing 2016)* – Shandong dialect; *(Zhang Xiaojuan 2018)* – Shanghai dialect.

Despite the fact that Russian interfered Chinese speech has been the subject of study in a number of studies (*Li Huei-Ying 1999; Chang Ching-Gwo 1999; Logasheva 2006; Zhao Xing 2016; Zhao Zhe; Tananayko 2018;*), it (speech) still remains understudied in terms of studying the realizations of Russian complex consonantal combinations absent in Chinese, which is the focus of the experiments in this paper (*Sun Bo 2019: 196-197; Sun Bo 2022: 114-119)*.

The present study is devoted to the experimental analysis of phonetic features of Russian vowel and consonant realizations in the context of a coherent phonetically representative text by native speakers of Chinese.

Theoretical description and experimental instrumental analysis of realizations of Russian vowels and consonants in the performance of native speakers of Chinese is an actual task, which the present work is aimed at solving.

The ***aim*** of the present study is to investigate modifications of phonetic processes on the example of realizations of vowels and consonants, including complex consonantal combinations of Russian in an experimental text performed by native speakers of Chinese and Russian.

Achievement of the set goal implies setting and solving the following **tasks**:

1. To analyze theoretical and experimental-phonetic theoretical and experimental phonetic studies, which cover the issues of language contacts, phonetic interference, modifications of vowels and consonants of the contacting languages;
2. To consider the sound systems of the Russian and Chinese languages in a comparative phonological aspect;

3. To study the phonetic processes of modification of Russian sounds in the realization of native speakers of Chinese;

4. To study modifications of sound units on the basis of recordings of phonetically representative text in phonetic aspect;

5. To study the realisations of consonant combinations of Russian in the realisation of native speakers of Chinese.

The theoretical and methodological basis of the study was the classical and modern works on the study of the phonetic aspect of linguistics, phonetics of the Russian language, interference, such scientists, such scholars as N. S. Trubetskoy [1960], Baudouin de Courtenay [1963], G. Fant [1964], U. Weinreich [1972], A. A. Reformatsky [1977], M. V. Gordina [1973], L. V. Shcherba [1974, 1983], V. B. Kasevich [1977, 1983, 1986], E. A. Bryzgunova [1977], L. R. Zinder [1979, 1989, 2006], N. A. Speshnev [1980], L. V. Bondarko [1981, 1998], R. I. Avanesov [1984], V. N. Sorokin [1985], S. B. Stepanova [1988], E. D. Polivanov [1991], I. M. Loginova [1992], L. A. Verbitskaya [1977, 1993], V. I. Kuznetsov [1997], Yu. S. Maslov [1997], P. A. Skrelin [1999], N. V. Bogdanova-Beglaryan [2001], S. V. Kodzasov, O. F. Krivnova [2001], L. D. Radnaeva [2003, 2019], L. N. Belyaeva [2004], A. S. Gerd [2005], N. A. Lyubimova, [2007, 2011], M. B. Popov [2014].

The thesis uses as an example modern methodological works of Chinese researchers related to the learning of Russian by native speakers of Chinese under interference conditions: Wang Xianzhong [1982], Zhao Zouying [1987], Chang Ching-Gwo [1999], Li Hui-Ying [1999], Chen Zhao-Lin [2000], Deng Jie [2010, 2011, 2015], Li Min [2010], Xu Laidi [2011], Zhao Xing. [2016], Zhao Zhe [2016, 2017], Du Yunsha [2017], Xu Longchuan [2017], Tan Yanjie [2017], Zhang Xiaozuan [2018, 2019], Zhang Xiaohui [2019].

When working on the thesis, we studied collective works and monographs devoted to the study of the phonetic aspect: Interference of

sound systems [1987]; Phonetics of spontaneous speech [1988]; Applied linguistics [1996]; Phonology of speech activity [2000]; Complex vowels [2001], Problems and methods of experimental-phonetic analysis of speech [2002]; Applied and computational linguistics [2017].

Analysis of sound units under conditions of phonetic interference include the following approaches: phonological (functional) and phonetic (articulatory, acoustic and perceptual aspects) (*Bondarko et al. 2004: 5).*

From the phonological (functional) point of view, interference is the result of interaction between the phonetic systems of the contacting languages both at the segmental level and at the suprasegmental level. At the segmental level, phonetic interference is caused by differences in the composition of segmental sound units, as well as their distribution; differences in the functional nature of the syllable and differential features. At the suprasegmental level, phonetic interference manifests itself in the realization of verbal accent and peculiarities of melodic design of speech of the contacting languages.

From the phonetic point of view, interference is the result of the peculiarities of the sound design of speech in a non-native language, indicating that "interference occurs in speech at the level of realisation of the phonological component of the language" (*Lyubimova 1988: 10)*. The phonetic approach considers three aspects: articulatory, acoustic and perceptual.

The analysis of interfered speech from the point of view of the *phonetic (articulatory*) approach is associated with the notion of articulatory base, which is understood as "a set of movements and positions of the pronunciatory organs habitual for a given language" (*Zinder 1979: 80*). According to A. I. Thompson's definition, "The totality of these physiological conditions of a given language,

adverb, etc. is called its articulatory base and is recognised from comparison with other languages, adverbs, etc.". *(Tompson 1904: 214)*.

Articulation of sounds in a non-native language "is carried out on the basis of skills formed by the primary system or skills incorrectly formed in the course of mastering the secondary system" *(Lyubimova 1988: 14)*.

The primary sound system is understood as the system of the bilingual's native language, while the secondary sound system is understood as the system of a non-native, second or learnt language.

The study of the articulatory aspect of phonetic interference is reflected in a number of modern works *(Zhao Zouying 1987; Li Hui Ying 1999; Vasilyeva, Tananaiko 2004; Zhao Zhe 2017; Tananaiko 2018)*.

Based on the phonetic acoustic approach, erroneous realizations of sound units of the secondary system are recorded during auditory analysis and analyzed using acoustic - oscillographic and spectral analyses. The following works served as examples of acoustic analysis of speech for the author: (*Fant 1964; Kuznetsov 1997; Skrelin 1999; Chang Ching-Gwo 1999; Logasheva 2006; Evdokimova 2014; Tananaiko 2018)*. The acoustic aspect of Russian-Chinese phonetic interference is reflected in the author's work: *(Sun Bo 2018: 207-210)*.

The analysis of interfered speech from the point of view of speech perception (*perceptual aspect*) demonstrates the steady influence of the primary sound system on the perception of the non-native language at the auditory level, which negatively affects the articulation of the learnt language. N. S. Trubetskoy believes that when perceiving foreign language speech, "the sounds of a foreign language receive a wrong interpretation in our minds, since they are passed through the 'phonological sieve' of our native language" (*Trubetskoy 1960: 59)*. The universal and specific mechanisms of manifestation of the 'phonological sieve' are confirmed in phonetic analyses of interfered speech on the material of different contacting languages (*Lyubimova 1985; Interference of sound systems 1987*). A number of experimental phonetic works have been devoted to the study of the perceptual aspect of phonetic

interference (*Bondarko 1981; Lyubimova 1988; Kasymova 1991; Stern 1992; Chang Ching-Gwo 1999; Shatokhina 2007; Zhu Zhihao 2020).*

The object of the present study is contemporary Russian speech of native Chinese speakers and recordings of untrained reading of phonetically representative text by Russian and Chinese speakers (See Application 1; P. 154).

The subject of the study is Russian vowels and consonants, as well as consonant combinations realised in the process of reading a text in Russian by native speakers of Chinese.

The scientific novelty of the work consists in studying the specifics of functioning of modification phonetic processes of vowels and consonants on the example of modern Russian language, realised in the process of unprepared reading of phonetically representative text performed by native speakers of Chinese with different degrees of language training and instrumental analysis of acoustic data.

The theoretical significance of the work lies in the linguistic interpretation of the obtained data on the realisation of vowels and consonants in the context of a coherent text. The representation of phonetic realisation of vowels and consonants in Chinese speech is given on the basis of theoretical analysis of scientific publications of foreign and domestic authors.

The practical significance of the study is expressed in the fact that its results will be used in describing the specifics of phonetic processes in the realisation of vowels and consonants, as well as complex combinations of consonants in theoretical courses on general phonetics and applied linguistics and in practical classes on the production of normative pronunciation of modern Russian in foreign-language audiences, including Chinese students.

The following scientific methods were used in the work:

1) descriptive;

2) experimental-phonetic;

3) auditory;

4) comparative;

5) instrumental (spectral);

6) mathematical and statistical

Recently, computer speech technologies have made it possible to study the acoustic parameters of vowel and consonant modifications in continuous speech of long duration (phonetically representative text in this paper), to perform recognition and segmentation of sound units, and to perform acoustic quantitative and qualitative analysis using Praat, Audisity, Sound Forge and other specialized speech signal processing software.

Technically, the study was conducted using the latest version of Praat, an experimental phonetic computer programme developed by Paul Boersma and David Weenik (2006) at the Institute of Phonetics, University of Amsterdam (The Netherlands; www.fon.hum.uva.nl/praat). The Praat program is designed to analyze, measure, modify and process speech signals; it makes it possible to measure spectral (formant) characteristics of sound signals, to record duration and intensity of pitch of signals of different lengths, to analyze sounds and intonation of any natural language.

Approbation of results.

The main conclusions and results of the thesis research were reported and received positive feedback at international and Russian conferences:

- International Scientific Philological Conference of SPbSU (St. Petersburg, 2019);

- Scientific and practical conference of teachers (Chita, 2020);
- International scientific-practical conference "Synergy languages and cultures: interdisciplinary research" (St. Petersburg, 2021);
- International Conference: "E-LEARNING, METHODOLOGY, TECHNOLOGY, EVALUATION AND FUTURE TRENDS" (Ulan Bator, 2021);
- Annual Scientific and Practical Conference of the Dorzhi Banzarov Buryat State University (Ulan-Ude, 2019-2024).

Provisions for defence:

1. Theoretical and applied bases of modifications of Russian vowels, consonants and consonant combinations in the performance of native speakers of Chinese language allow to methodically justify the difficulties of mastering articulatory, acoustic and perceptual features of the sound system of the Russian language.

2. Peculiarities of the Russian verbal accent, connected with its mobile and different place character, the presence of stressed and unstressed vowels have a negative interfering influence on the non-normative modification of vowels in the performance of native speakers of Chinese, manifested in the absence of quantitative vowel reduction, replacement of Russian vowels with their Chinese analogues, diphthongs and diphthonggoids and sound-types of the full type of pronunciation of all vowels in the composition of words from two-syllable to multi-syllable words.

3. Systematic interfering influence of the peculiarities of the Chinese language sound system on the realisation of the sound units of the Russian language, manifested in the pronounced aspirated character of Russian /p/, /pʲ/, /t/, /tʲ/, /k/, /kʲ/; falling out of sounds, vowel insertions in consonantal combinations and absolute word endings after consonants.

4. The action of phonetic interference in the pronunciation of Russian consonants by the Chinese arises in the manifestation of those features that are not represented in the Chinese language, namely the features: "hard-soft", "voiceless-voiceled".

Main results.

The results of the dissertation research are reflected in the scientific articles published in the editions recommended by the Higher Attestation Commission under the Ministry of Education and Science of the Russian Federation.

- Theoretically and empirically substantiated and proved phonological

and phonetic significance and interdependence of peculiarities of sound systems of the contacting languages in conditions of interference, demonstrated on the example of acoustic analysis of sound units obtained in the process of reading Russian experimental phonetically representative text performed by native speakers of Chinese. The results of the analysis are reflected in the article: "Theoretical and applied problems of phonetic design of speech in a foreign language"[3]. In the article in section 3.1. on pp. 133-134 reflects personal the author's contribution, in particular, presents the results of experimental-phonetic analysis of the duration of Russian two-member consonantal combinations pr, tr, st, kr, gr, sp, sn, str as part of lexical units in the realisation of native speakers of Chinese.

- Historical data on the modern Chinese language and its dialects, its functioning in the countries of South-East Asia and Russia have been analysed and systematised. The acoustic data on the duration and frequency characteristics

[3] Budazhapova S.V., Prokopyeva D.D., Radnaeva L.D., **Sun Bo**, Khubrakova I.V. Theoretical and applied problems of phonetic design of speech in a foreign language // Kazan Science. – 2022, № 5. – C. 134-135.

of Chinese initials and finals and their combinations were obtained experimentally with the help of the speech signal processing programme Praat. The results of the analysis are reflected in the author's article: "Peculiarities of the sound system of the modern Chinese language. Acoustic aspect"[4] .

- According to the results of the comparative study of sound systems of the Chinese and Russian languages and acoustic analysis of modifications of Russian vowels, consonants and consonant combinations of the "consonant+consonant" type in the speech of Chinese speakers, data on the duration of the analysed sound units were obtained. The results of the obtained analyses are reflected in the author's article "Pronunciation modifications of Russian consonant+consonant combinations in Chinese reading"[5].

The results of the thesis research are also presented in the materials published in the RINC database:

1) “Problems of the current state of Russian language teaching in the border regions of China”[6]; 2) “Quantitative characteristics of consonant combinations of the Russian language in the speech of native speakers of Chinese”[7]; 3) “Realisation of Russian complex consonant combinations in the speech of native Chinese speakers”[8]

[4] Sun Bo “Features of the sound system of the modern Chinese language” // Kazan Science. – 2018, №12. – 207-210.

[5] Sun Bo “Modification of the pronunciation of the Russian combination of consonant + consonant type in Chinese reading” // Kazan Science. – 2019, № 12. – C. 196-197.

[6] Sun Bo “Problems of the current state of Russian language teaching in the border areas of China” // Materials of the international scientific-practical conference: collection of articles. – Ulan-Ude: Izdvo Buryat. gos. un-ta – 2020.– P. 142-145.

[7] Sun Bo **“**Quantitative characteristics of consonant combinations of the Russian language in the speech of native speakers of Chinese” // Research and teaching of languages: analysis, experience, technology / Ed. by L.D. Radnaeva – Ulan-Ude: Izd-vo Buryat. gos. un-ta – 2022. – C. 114-119

[8] Sun Bo “Realisation of Russian complex consonant combinations in the speech of native Chinese speakers” // Speech analysis: theoretical and applied aspects / Ed. by L.D. Radnaeva – Ulan-Ude: Izd-voor Buryat. gos. un-ta – 2023. – C. 146-151.

The author published theses in English “Consonant Clusters study in acoustic and statistical data analysis to create effective e-learning and teaching environment”[9] .

Personal contribution of the author.

The aim, tasks, analysis of the obtained results, as well as the defended provisions and conclusions were formed and conducted jointly with Dr. Phil. Sci. L.D. Radnaeva. Speaker selection, preparation of recordings, segmentation, auditory, instrumental and statistical analyses of modification processes of vowels, consonants and consonant combinations were carried out by the author personally. The analysis of data on duration, frequency components of the analysed sound units was carried out by the author personally. The results of the research were regularly reported at the scientific postgraduate seminar "Phonetics and speech technologies" by the author personally.

Structure and scope of the work.

The dissertation consists of an introduction, three chapters, a conclusion, a list of used literature (including in other languages), dictionaries and other resources, and appendices. The volume of the work is 172 pages, 77 figures and 38 tables. The list of references amounts to 148 titles.

[9] Sun Bo "Consonant Clusters study in acoustic and statistic data analysis to create effective e-learning and teaching environment Proceedings of International Conference "E-LEARNING, METHODOLOGY, TECHNOLOGY, EVALUATION AND FUTURE TRENDS", September, 2021, Ulan-Baator, Mongolia.

CHAPTER 1. THEORETICAL ASPECTS OF THE STUDY. SOUND SYSTEMS OF RUSSIAN AND CHINESE LANGUAGES

The present study is carried out within the framework of general theoretical ideas about language interaction. This paper deals with issues related to phonetic processes arising from the interaction (contact) of differently structured languages, in particular Russian and Chinese. Chapter 1 is devoted to the main problems and terms necessary for the full disclosure of the research topic, and it presents the sound systems of the contacting languages.

1.1. The theory of language contact

Questions of the theory of language contact are presented in the works of G. Schuchardt (1950); L. V. Shcherba (1958, 1974); I. A. Baudouin de Courtenay (1963), A. E. Karlinsky (1967); U. Weinreich (1972); E. Haugen (1972); V. J. Rosenzweig (1972) and other linguists. The concept of language contact is broadly understood as the interaction and mutual influence of languages resulting from the contact of collectives speaking these languages. Language contact is due to geographical proximity and historical, ethnic and social ties.

У. Weinreich was the first to introduce the term language contact into wide scientific circulation. "Two or more languages are in contact if they are used alternately by the same person" (*Weinreich 1979: 22*). Linguists put into the concept of language contact such interpretations as: “contact of languages arising as a consequence of <...> linguistic communication between human collectives speaking different languages” (*Akhmanova 2004: 535*); “speech communication between two collectives” (*Rosenzweig 1972: 3*); “mixing of languages” *(Schuchartd 1950*); “mutual influence of languages” (*Shcherba 1974: 60*).

L. V. Shcherba lists three categories of facts leading to language contact: 1) borrowings <...> made by a given language from a foreign language; 2) changes in a language that it (the language) owes to the influence of a foreign language; 3) facts resulting from insufficient acquisition of the language (*Shcherba 1974: 60-74)*.

T. A. Bertagaev distinguishes two forms of language contacts: 1) distal - carried out in conditions of monolingualism in the absence of close contact between languages and realised only in borrowings; 2) proximal - carried out in conditions of bilingualism and direct language contact, which may result in modification of one of the languages (*Bertagaev 1972: 83*).

Y. A. Zhluktenko distinguishes two forms of language contact: natural, which occurs during direct communication between speakers of different languages; artificial, which occurs in a specially created environment for teaching a second language (*Zhluktenko 1974)*.

The study of language contact and language interaction is developing in modern theoretical and applied science in the field of sociology, psychology, sociolinguistics. A special section of science has developed in linguistics - linguistic contactology (kroeolistics), which studies the mechanisms of language contact. At the linguistic level, the problems of language interaction affect all levels of language from phonetics to stylistics.

The present work is related to the solution of the problem of changes (modifications) of sound units as a result of contact and language interaction at the phonetic level in the conditions of Russian-Chinese interference.

1.2. The concept of language interference

The term interference from Latin interferens, from inter – between + ferens – carrying, transferring - denotes in linguistics the consequence of the influence of one language on another, i.e. the application of the norms of one language in another in

written and/or spoken speech. "*Interference* – interaction of language systems in conditions of bilingualism, formed either by language contact or individual acquisition of a non-native language; it is expressed in deviations from the norms and systems of the second language under the influence of the native language" (*Large Encyclopaedic Dictionary 1998: 197).*

The term interference was introduced into the linguistic literature by scientists of the Prague Linguistic Circle (*Trubetskoy 1987: 46*). The term became widely recognized after the publication of the monograph Language Contacts (*Weinreich 1979*).

According to Weinreich, "interference is the interaction of language systems in conditions of bilingualism or multilingualism, caused by their structural differences and manifested in deviation from the codified norms of the contacting languages" (*Weinreich 1997: 156).*

B. Y. Rosenzweig defines interference as a violation by a bilingual (a person who speaks two languages) of the rules of correlation of the contacting languages, which manifests itself in his speech in deviation from the norm (*Rosenzweig 1972: 28).*

L. V. Shcherba writes indirectly about interference (without using this term) in the article "To the Question of Bilingualism" as a phenomenon that distorts a foreign language under the influence of the speaker's native language *(Shcherba 1974).*

When languages are in contact, interference is manifested at all levels of language: syntactic, lexical, grammatical, phonetic. Linguistics distinguishes different types of interference: phonetic; grammatical; lexical and others.

This paper deals with phonetic interference.

1.3. Phonetic interference

Phonetic interference results from the interaction of sound systems. Phonetic disorders in speech in a non-native language are a consequence of phonetic interference (*Lyubimova 1985: 7; Sun Bo 2022: 133-135).*

Phonetic interference has two varieties:

1) intralingual;

2) interlingual.

An example of intralingual interference is the Russian language. In this case, intralingual interference involves the interaction of different types of Russian national language: codified literary language, colloquial speech, territorial dialects, professional speech and common speech (*Bogdanova-Beglaryan 2001: 39*). Phonetic peculiarities of regional variants of the Russian language have been studied and reflected in special works (*Ignatkina 1982; Polyakova, Stern, Erofeeva 1998; Bogdanova-Beglarian 2001).*

Interlingual interference involves the phenomena of generation and perception of speech in a non-native language "in the process of influence of two or more contacting languages, manifested in deviations from the norm at all levels of linguistic structure from phonetics to syntax" (*Bogdanova-Beglarian 2001: 46).* An example of interlingual interference is Russian-Chinese interference – the subject of the present study.

It is known that phonetic interference has both positive and negative effects on the contacting languages (*Lyubimova 1988*). Positive influence is exerted in case of maximum articulatory-acoustic similarity of sound realizations of the contacting languages, similar intonation structures, accentuation, etc. The negative influence leads to the emergence of the sound realizations of the contacting languages.

Negative influence leads to the emergence of accent, which means pronunciation that reflects the sound features of a foreign language or adverb. The concept of accent is directly related to phonetic interference. This term is commonly used to refer to "a peculiar pronunciation that distinguishes a foreigner and consists in the involuntary replacement of sounds of a foreign language with sounds of the native language" (*Akhmanova 2004: 39).*

1.4. Phonological and phonetic approaches to the study of interference

The analysis of sound units under conditions of phonetic interference includes the following approaches: phonological (functional) and phonetic (articulatory, acoustic and perceptual aspects) *(Bondarko et al. 2004: 5).*

From the phonological (functional) point of view, interference is the result of interaction between the phonetic systems of the contacting languages at both segmental and suprasegmental levels. At the segmental level, interference is caused by differences in the composition of segmental sound units, as well as in their distribution; differences in the functional nature of the syllable and differential features. At the suprasegmental level, phonetic interference manifests itself in the realisation of verbal stress and peculiarities of melodic design of speech of the contacting languages.

From the phonetic point of view, interference is the result of the peculiarities of the sound design of speech in the non-native language, which indicates that "interference occurs in speech at the level of realisation of the phonological component of the language" *(Lyubimova 1988: 10)*. The phonetic approach considers three aspects: articulatory, acoustic and perceptual.

The articulatory approach to speech analysis is defined by the notion of articulatory base, which is understood as "a set of movements and positions of the pronunciation organs habitual for a given language" (*Zinder 1979: 80*). According to A. I. Thompson's definition, "the totality of these physiological conditions of a given language, adverb, etc. is called its articulatory base and is recognized from comparison with other languages, adverbs, etc." (*Thompson 1904: 211: 211*).

(Thompson 1904: 214). Articulation of sounds in a non-native language "is carried out on the basis of skills formed by the primary system or skills incorrectly formed in the process of mastering the secondary system" (*Lyubimova 1988: 14*).

The primary sound system is understood as the system of the bilingual's native language, while the secondary system is understood as the system of a non-native, second or learnt language.

The study of the articulatory aspect of Russian-Chinese phonetic interference is reflected in a number of modern works (*Zhao Zouying 1987; Li Hui Ying 1999; Vasilyeva, Tananayko 2004; Zhao Zhe 2017; Tananayko 2018).*

The *acoustic* approach contributes to the study of erroneous realisations of secondary system sound units registered during auditory analysis in the course of acoustic - oscillographic and spectral analyses. Examples of acoustic analysis of speech for the author were the following works: *Fant 1964; Kuznetsov 1997; Skrelin 1999; Chang Ching-Gwo 1999; Logasheva 2006; Evdokimova 2014; Tananaiko 2018*. The acoustic aspect of Russian-Chinese phonetic interference is reflected in the author's works: *(Sun Bo 2018: 207-210, Sun Bo 2019: 196-197, Sun Bo 2022: 133-135.)*.

The analysis of interfered speech from the point of view of speech perception (*perceptual aspect*) demonstrates the steady influence of the primary sound system on the perception of the non-native language at the auditory level, which negatively affects the articulation of the learnt language. N. S. Trubetskoy believes that when perceiving foreign language speech, "the sounds of a foreign language receive a wrong interpretation in our minds, since they are passed through the 'phonological sieve' of our native language" (*Trubetskoy 1960: 59*). The universal and specific mechanisms of manifestation of the 'phonological sieve' are confirmed in phonetic analyses of interfered speech on the material of different contacting languages (*Lyubimova 1985; Interference of sound systems 1987)*. A number of experimental phonetic works have been devoted to the study of the perceptual aspect of phonetic interference *(Bondarko 1981; Lyubimova 1988; Kasymova 1991; Stern 1992; Chang Ching-Gwo 1999; Shatokhina 2007; Zhu Zhihao 2020).*

The present study presents a comprehensive approach (functional and phonetic) to the analysis of modifications of Russian vowels and consonants in the realisation of native speakers of Chinese.

1.5. Modification of phonemes in speech flow – the object of research

In phonetics we know the notion that there is a big difference between a sound or word uttered separately and in the stream of speech (*Bondarko 1998*). Single-word utterances and words consisting of a single phoneme are negligible or they occur in rare situations (*Zinder 1979)*. As a rule, continuous sound sequences realised in the flow of connected speech are encountered in reality. Their perception and pronunciation seems to be a *difficult task for foreigners mastering the pronunciation of any language, including Russian*.

The continuous flow of connected speech is a complex articulatory, acoustic and functional picture, which can be characterised by the phenomenon 'modification' from Latin modificatio 'modification' *(Ushakov 2008)*. According to different sources, the synonyms of this term include the words: change, transformation, variety, variation, variant and others.

Here it is appropriate to note the difference between two concepts related to changes of sounds in the flow of speech: modification and alternation.

Phoneme modification is the variation of phoneme allophones depending, first of all, on the phonetic conditions in which phonemes appear in the flow of speech.

Alternation is connected with changes of sounds within the same morpheme. Phoneme alternation is a variation of the morpheme expression plan, which may be associated with the transmission of certain meanings. Being a grammatical means, alternations cover the whole system of declension, conjugation and word formation.

Individual sounds can be alternated in a morpheme [d]-t] *пру**д**ы – пру**д***; *трудыы – труд; судыы -суд*;; combinations of sounds: [p]-[pl] *ко**п**ить – ко**пл**ю; хра**п**ишь – хра**пл**ю*; sound with zero [o]-[ø] *с**о**н – сна*; *рот – рта; лоб – лба; лёд –льда*. When the grammatical property of a word or word-form changes, the place of verbal stress changes: *люблю́ – лю́бишь*; *сосна́ – сосне́* – со́снам. The alternation [o]-[ɑ] can participate in expressing the opposition of singular and plural: *дом–до́ма– до́му*; *дома́ – домо́в – дома́м*.

L. R. Zinder defines the listed modifications as allophonic variation conditioned by combinatorial and positional conditions in which a phoneme may appear in a given language *(Zinder 1979: 218).*

Combinatorial allophones arise in the flow of speech due to the interaction, mutual influence of neighbouring phonemes. The phenomenon of superimposition of articulation characteristic of one sound on the articulation of neighbouring sounds is called co-articulation (from Latin co - 'c, together' + co-articulation), first presented in the work of Menzerath and Lacerda (*Menzerath, Lacerda 1933*).

Two varieties of coarticulation are distinguished: 1) accommodation (from Latin 'accommodatio' - accommodation - 'adaptation') - adaptation of neighbouring consonant and vowel phonemes to each other; 2) assimilation (from Latin 'assimilatio' - 'assimilation') - assimilation of neighbouring sounds (two vowels or two consonants).

An example of accommodation in Russian is labialisation (from Latin labialis - lip, ogublenie) - a phenomenon of modification in which the lips bulge forward and take the form of a round hole, which leads to an increase in the front part of the resonator. Labialisation of consonants is observed in the position in front of the voiced vowels: *тут, луна, рука, бусы, ночь, лоск, форма, конь.* Labialisation acoustically attenuates the intensity, reduces the noise components of consonants, and lowers the F1 and F2 frequencies of vowels (*Fant 1964*).

Another example of accommodation is nasalisation (from Latin *nasus* - *nose*, from French *nasal* - *nasal*) – a phenomenon of modification, in which the sound acquires a nasal timbre, caused by the lowering of the palatine curtain and the escape of air simultaneously through the mouth and nose Vowels and consonants in the vicinity of nasal sounds are subject to nasalisation *фантик*, *бант*, *обман*, *ванна*, *наша*, *зонт*.

As a result of accommodation in the position after soft consonants, vowels acquire diphthongoid character: [ⁱɑ, ⁱu, ⁱo, ⁱe]: *мята*, *мячик*, *тюль*, *дюна*, *лён*, *пёс*, *лес*, *тень*.

An example of consonant assimilation in Russian is the pronunciation of the combinations: [tl], [dl]: *отлет, тление, атлас, седло, длань, длина, предложение, предлог, удлинение*. Conjunctive explosive consonants are realised without a characteristic explosion and acquire an alveolar character under the influence of the subsequent slit [l].

Another example of assimilation is the pronunciation of combinations [bm], [dn], [tn]: *обман*, *обмер*, *дно*, *одна*, *водный*, *поднос*, *лётный*, *чётный*, *заветный* in the realisation of which the lip and forelingual explosion of the forelingual consonant is replaced by a faucal explosion (from Latin *faux* 'throat') arising from the lowering of the palatine curtain.

As a result of assimilation, unpaired deaf consonants in the position before the following voiced consonants become voiced. This phenomenon is observed at the junction of words pronounced without pauses: *коне**ц** будет, лу**ч** будет, це**х** будет.*

The phenomenon of accommodation and assimilation can be *progressive*, if the preceding sound affects the subsequent sound following it, and *regressive,* in the case when the next sound affects the preceding one.

Positional allophones are realized under the condition that allophonic variation depends:

1) on the position of the phoneme in relation to the accent.

For the Russian language, an important factor influencing the modification of sounds is verbal stress. The main function of verbal stress is "to unite the sounds that form the appearance of a word" (*Zinder 1979:248*). Word stress emphasises a syllable in a word form ((*рука́, тропи́нка, завод́*) or combines several words into one phonetic whole (*на бе́рег, за́ городом, по́д гору*) (*Bondarko 1998:217*). Word stress can be free (stress on any syllable) and bound (stress on a specific syllable). Bound stress can be fixed, having a single permanent place (*ве́тер, ве́трено, ве́треный*).

The change in the place of word stress is due to the alternation of phonemes within a morpheme. One and the same morpheme in different word forms of the same lexeme can be stressed and unstressed, and can have stress on different syllables. From the point of view of morphological structure of a word we distinguish between mobile and fixed stress[100]. Mobility means that within the morphological paradigm the stress in different word forms can be either on the base or on the ending, which serves as a means of distinguishing grammatical forms (*о́кна -окна́; рука́-ру́ку; ру́ки-рука́ми; го́род, города́, городово́й).*

Multi-syllable words have a major and a minor stress (*две,надцатиметро́вый*). A distinction is made between stressed and unstressed syllables. Any syllable in a word can be stressed. All unstressed syllables are subject to qualitative and quantitative reduction. Depending on the stress, the quality and duration of the vowel are modified.

The properties of unstressed vowels depend on their position in relation to the stressed vowel – pre-stressed and over-stressed (*Bondarko 1998: 220*). The properties of verbal accent can vary when the accent-rhythmic structure of a word in an utterance or in the whole text is formalised.

[100] http://old.bigenc.ru/linguistics/text/4215511

A distinction is made between the first and second pre-stressed syllables, the first and second over-stressed syllables. Non-accented allophones of vowel phonemes undergo qualitative and quantitative reduction in the flow of speech. In the word *карандаш* [kъrʌndɑʃ] in the first prefinal syllable there is a positional allophone [ʌ] of the first degree of reduction; in the second prefinal syllable there is an allophone [ъ] of the second degree of reduction. The degree of reduction depends on the quality of the vowel and its position in relation to the stress (*Verbitskaya, Ignatkina 1993: 10*). The further away from the stressed syllable the vowel is located, the stronger is its reduction. Phonemes undergo various modifications (variation) in the flow of speech, being realised in different allophones. All unaccented allophones of vowel phonemes undergo qualitative and quantitative reduction in the flow of speech.

2) from the position of the phoneme in the word-form: the absolute beginning of the word, the absolute end of the word before the pause. The second prefinal vowel in the absolute beginning does not differ in its properties from the second prefinal vowel in the position after a consonant (*Bondarko 1998*) - cf. the phoneme /o/ in the words worked - worked. The backward vowel in the absolute end differs from the backward vowel before the consonant – cf. *роз**а** – роз**а**м*.

Combinatorial and positional variation of phonemes in the speech stream demonstrates the variety of modified sounds, when analysing which it is necessary to take into account *full and incomplete styles of pronunciation* (*Bondarko et al. 1974, Shcherba 1974, Zinder 1979*).

L. V. Shcherba first wrote about phonetic style in Russian in 1915 in his article ‘About different styles of pronunciation and about the ideal phonetic composition of words’. In his works L. V. Shcherba emphasised the importance of ‘keeping in mind the differences in the degree of clarity and distinctness of our speech’ (*Shcherba 1974).*

There are different types of speech: monologic – dialogic, prepared – spontaneous, thorough – casual. The type of utterance can be complete and incomplete. In ordinary speech, the complete type of utterance is never found

(*Shcherba 1974*). ‘The type of speech is very important for creating the phonetic appearance of an utterance’ (*Bondarko 1998: 258*). Depending on the conditions of communication, a pronunciation style is formed: official, neutral, conversational. The present paper considers the neutral style of speech of incomplete type of pronunciation realised in the process of unprepared reading of the text.

The literature names probable reasons contributing to the appearance of phonetic modifications in the flow of connected speech, including those depending on the style and type of speech (*Zinder 1979; Phonetics of spontaneous speech 1988; Bondarko 1998*):

1. accentuation;
2. general weakening of articulation;
3. pace of speech;
4. style and type of speech;
5. frequency of word usage;
6. individual vocal and age characteristics of the speakers;
7. emotional state and other.

At the acoustic level, modifications of vowels and consonants are reflected in changes in: 1) formant structure; 2) duration; 3) intensity; 4) noise and tone components (*Fant 1964; Derkach et al. 1983; Kuznetsov 1997; Skrelin 1999; Evdokimova 2014*).

The modifications that vowels and consonants undergo in modern Russian literary language, as well as alternations have detailed scientific descriptions (*Russian colloquial speech 1973; Matusevich 1976; Zinder 1979; Bondarko 1979; Zemskaya 1979; Avanesov 1984; Phonetics of spontaneous speech 1988; Kuznetsov 1997; Reformatsky 1997; Bogdanova-Beglarian 2001; Popov 2014*).

The paper then considers the main points characterising the sound systems and modification processes of the contacting languages: Russian and Chinese.

1.6. The sound system of the Russian language

The sound system of the Russian literary language has 42 phonemes, including the vowel system (six vowel phonemes: /i, ɨ, u, e, ɑ, o/) and the consonant system (thirty-six consonant phonemes: /p, pʲ, b, bʲ, m, mʲ, f, fʲ, v, vʲ, t, tʲ, d, dʲ, n, nʲ, c, ʲ, s, sʲ, z, zʲ, šʲː, l, lʲ, j, r, rʲ, k, kʲ, g, gʲ, x, xʲ/) (*Shcherba 1983: 37; Bondarko 1998: 22-46; Popov 2014: 45-46)*[11] .

1.6.1. The system of Russian vowels and their modification in speech

Phonologically essential (differential) features of vowel phonemes are: 1) vowel rise, 2) vowel row, 3) labialized – not labialized (labialization).

Table 1 demonstrates the vowel phonemes of the Russian language.

Table 1 – Russian vowel system [12]

Rise	Row		
	front	central	back
high	i	ɨ	u
medium	e		o
low			ɑ

Vowel rise determines the degree of open-closed articulation of the vowel and the degree of vertical elevation of the tongue body. There are three degrees of elevation: high, medium and low.

The vowel row determines the degree of advancement of the tongue body horizontally. Vowels are distinguished according to their belonging to a row: front, central, back rows *(Verbitskaya, Ignatkina 1993: 5)*; or front /i/, /e/ and non-front /ɨ/, /ɑ/, /o/, /u/ rows *(Popov 2014: 69)*.

[11] In the theoretical part of the work the transcription adopted by the International Phonetic Association is used. Further in the practical part of the work, the Russian alphabet is used for the convenience of presentation

[12] The system of Russian vowels presented by authors L. A. Verbitskaya, L. V. Ignatkina in Practical Phonetics of the Russian Language. SPb., 1993. - P.5. Vowel phonemes are labelled with the signs of the International Phonetic Alphabet.

According to the participation of the lips in the articulation of the vowel, the labial and not labial vowel phonemes are distinguished. L. V. Bondarko gives the following characteristic of vowel phonemes: /i, ɨ, u, e, ɑ, o/ *(Bondarko 1998: 25).*

/ɑ/ — low, back, not labial

/o/ — medium rise, back, labial;

/u/ — high, back, labial;

/e/ — mid-rise, front, not labial;

/i/ — high, front, not labial;

/ɨ/ — high, heterogeneous in the row (at the beginning of articulation – non-front, at the end – front), not labial.

The vowel phonemes presented above according to the differential features essential for distinguishing phonemes (rise, row, labialization) are subject to modifications in speech – allophonic variation. The phoneme /ɑ/ is realized in allophones [ʌ], [ъ] – reduced vowels of higher rise in the first and second prepositional syllables. The phonemes /i/, /ɨ/, /u/ are realized in allophones of lower rise in unaccented position, as compared to accented allophones.

Allophones of vowel phonemes are also modified by features that are not differentiated *(Popov 2014: 97):*

1) by duration (unaccented vowels are always realized more briefly than the accented ones);
2) by the degree of heterogeneity (monophthongs and diphthongoids);
3) by the work of the palatine curtain (non-nasalized - nasalized);
4) by intensity (the allophone at the beginning of the word-form is pronounced stronger than at the end of the word-form);
5) according to the degree of muscle tension (unaccented vowels are pronounced with less muscle tension than stressed vowels).

L. V. Bondarko singles out features characterizing the modification of phonemes in the conditions of reading a coherent Russian text:

1) the rhythmic structure of the word is rearranged due to changes in the properties of the unstressed vowels;

2) the degree of reduction of the unstressed vowel in the text is always greater than in the pronunciation of an individual word in the pronunciation of a single word;

3) stressed vowels become more closed, which leads to a change in the vowel itself;

4) the unstressed allophone of the not labial phoneme in the position before an unstressed labial allophone is realized in the labial variant;

5) in connected speech there is a restructuring of pronunciation programmes, which is reflected in the acoustic characteristics of sounds *(Bondarko 1998:261-267).*

The vowel /ɑ/ and its modifications in speech

When articulating /ɑ/, the tip of the tongue touches the lower teeth, the back of the tongue is slightly raised. The front part of the back of the tongue is lowered and a small depression is formed in it. The lips are passive.

In the position after soft consonants and /j/, the vowel /ɑ/ is realized in allophones with an i-shaped sound at the beginning of the sound and is pronounced from closed to more open vowel [^{i}ɑ]: *ряд, мята, тянуть*.

In the position between the soft consonants at the beginning and at the end of the vowel there is an i-shaped sound. The vowel is realized in a heterogeneous allophone [^{i}ɑ^{i}] in the words: *бязь, вязь, сядь, дядя, пять*.

In the position before soft consonants the vowel /ɑ/ is realized in allophones with i-shaped sound at the end of sound [ɑ ^{i}] in words: *дай, лай, май, трогай*.

The vowel /o/ and its modifications in speech

When articulating /o/, the lips are rounded and stretched forward, the tongue is slightly pushed back.

In the position after soft consonants and /j/ the vowel /o/ has an i-shaped sound at the beginning of the sound and is realized in the heterogeneous allophone [^{i}o] in the words: *нёс, нёс, Фёдор, лён.*

In the position between soft consonants at the beginning and at the end of the vowel there is an i-shaped sound at the beginning and at the end of the vowel sound and is realized in the heterogeneous allophone [^{i}o^{i}] in the words: *тётя, лёд, Лёня, Лёля.*

In position before soft consonants and /j/ the vowel /o/ is realised in allophones with i-shaped sound at the end of the sound [o^{i}] in words: *боль, роль, ноль, корь, огонь*.

The vowel /u/ and its modification in speech

When articulating the pronunciation of /u/ the tongue is pulled back, the back part of the back of the tongue is raised to the soft palate, the lips are rounded and stretched forward, the tip of the tongue is at the lower teeth.

In the position after soft consonants and /j/ the vowel /u/ is realized in allophones with i-shaped sound at the beginning of sound and is pronounced as [^{i}u] in words: *дюна, сюда, Люда, Юра, южный.*

In the position between soft consonants at the beginning and at the end of the vowel there is an i-shaped sound at the beginning and at the end of the vowel sound and is realized in the nonnative allophone [^{i}u^{i}] in the words: *люди, тюль, Нюра, чуть.*

In the position before soft consonants and /j/ the vowel /u/ is realized in allophones with i-shaped sound at the end of the sound [u^{i}] in the words: *Русь, пусть, жуть, путь.*

The vowel /e/ and its modification in speech

When pronouncing /e/ the tongue is pushed forward, the middle back of the tongue is raised to the hard palate. The tip of the tongue is near the lower teeth.

In the position after soft consonants and /j/ the vowel /e/ is realized in allophones with an i-shaped sound at the beginning of the sound and is pronounced as [^{i}e] in words: *нет, ел, сел, мел, привет, карета, дело, нерпа, песня.*

In the position between soft consonants at the beginning and at the end of the vowel /e/ there is an i-shaped sound at the beginning and at the end of the vowel sound and is realized in the non-uniform allophone [^{i}e^{i}] in the words: *дети, сени, реки, веки, тени, медь, отмель, тень, лень.* In position before soft consonants and /j/ the vowel /e/ is realized in allophones with i-shaped sound at the end of the sound [e ^{i}] in words: *отель, шерсть, модель*.

The vowel /i/ and its modification in speech

At pronunciation of /i/ the tongue is noticeably advanced, the edges of the tongue are pressed to the lateral teeth. The tip of the tongue rests on the lower teeth. The lips are stretched.

The main allophone of the vowel is the vowel realized in isolated pronunciation and in position after soft consonants in words: *и, тихий, Лиза, Дима, вишня, милый, кино*. In position before hard consonants the vowel /i/ is realized in a slightly pushed back allophone in the words: *ива, ирис, итог, икра, итог*. The middle back of the tongue is pushed backwards. Acoustically, there is a lowering of the second formant on the vowel-consonant boundary *(Bondarko 1998:113).*

In the position after soft consonants and before soft consonants, the quality of the vowel does not change and corresponds to the basic allophone of the vowel, with the consonants adapting to the articulation of the vowel, for example, in the words: *лилия, Лидия, сильный, гиря.*

In position after hard consonants before a pause, the vowel /i/ is accompanied by a glottal bow [ʔ], e.g.: *Вот и он* [vot ʔ i on].

The vowel /ɨ/ and its modifications in speech

When pronouncing /ɨ/, the tongue is slightly pushed backwards. The front part of the back of the tongue is raised to the hard palate, and the middle and back part to the soft palate. The tip of the tongue is pulled

back. The lips are slightly open. Pronunciation of the main vowel allophone /ɨ/ is characterized by a pronounced diphthongoid13 character [ɨ^{i}] in the position of the open syllable under stress in the words: *мы, ты, миры, дары, пары, горы, лозы*. The articulation of /ɨ/ begins with a non-front vowel and ends with a front vowel. Non-front articulation is characteristic only for the beginning of the vowel.

In position before soft consonants the vowel /ɨ/ also has an i-shaped element in words: *пыль, рыть, рысь, быль, ныть, выть, дынь, мыть*.

The vowel /ɨ/ is modified and acquires a more anterior character of articulation in position after forelingual consonants and an labial character after lip consonants.

The vowel /ɨ/ loses diphthongoidity and shortens in duration in the non-accented position in words: *пары, лапы, лупы, руны, раны, фары, чары*.

1.6.2. The system of Russian consonants and their modification in speech

All consonants are divided according to phonologically essential (differential) features:

1. place of obstruction (active speech organ) – according to this feature consonants are divided into labial /p, pʲ, b, bʲ, m, mʲ, f, fʲ, v, vʲ/, forelingual /t, tʲ, d, dʲ, n, nʲ, c, čʲ, s, sʲ, z, zʲ, šʲ:, l, lʲ, r, rʲ/, mediolingual /j/, backlingual /k, kʲ, g, gʲ, x, xʲ/;

2. type of obstruction – according to this feature consonants are divided into: occlusive /p, pʲ, b, bʲ, m, mʲ,/t, tʲ, d, dʲ, n, nʲ, c, čʲ, k, kʲ, g, gʲ/, slit /f, fʲ, v, vʲ, x, xʲ/; constrictive /r, rʲ/, affricates /c, čʲ/; In consonant formation one or two focuses may

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[13] Diphthongoid from the word diphthongoid. Diphthongoid - from Greek twice, twice + voice, sound - are vowels that sound heterogeneous. Diphthongoids begin and end with a short prism of another vowel, usually close in articulation; they are characterized by sliding articulation, but the degree of sliding in them is much weaker compared to diphthongs. Diphthongoids belong to the group of monophthongs.

occur. This feature divides two pairs of consonants: /s/ – /š/ and /z/ – /ž/ into single-focus and double-focus consonants;

3. behaviour of vocal cords – according to this feature consonants are characterized as voiced /b, bʲ,v, vʲ d, dʲ, z, zʲ, g, gʲ,/ and voiceless /p, pʲ, f, fʲ, t, tʲ, s, sʲ, k, kʲ/;

4. position of the middle back of the tongue in relation to the hard palate – according to this feature consonants are divided into hard /p, b, m, f, v, t, d, n, s, z, l, r, k, g, x/ and soft /pʲ, bʲ, mʲ, fʲ, vʲ, tʲ, dʲ, nʲ, sʲ, zʲ, lʲ, rʲ, kʲ, gʲ, xʲ/;

5. position of the soft palate when articulating a consonant – when the soft palate is lowered, nasal consonants are formed /m, mʲ, n, nʲ/, when raised – non-nasal (mouth) consonants /p, pʲ, b, bʲ, f, fʲ, v, vʲ, t, tʲ, d, dʲ, c, čʲ, s, sʲ, z, zʲ, šʲː, l, lʲ, r, rʲ, k, kʲ, g, gʲ, x, xʲ/;

The acoustic feature that separates consonants is the role of noise components in the sound spectrum. According to this feature, consonants are divided into noisy consonants and sonants. Table 2 shows a schematic representation of the system of consonant phonemes in the Russian language.

Table 2 – Consonant system of the Russian literary language[14]

Place of obstruction / Type of obstruction		Labial	Forelingual		Medio lingual	Backlingual
			Single-focus	Dual-focus		
Noise	Plosive	p pʲ b bʲ	t tʲ d dʲ			k kʲ g gʲ
	Affricates		c	čʲ		
	Constrictive	f fʲ v vʲ	s sʲ z zʲ	š šʲː ž (žʲ)		x xʲ
Sonants	Plosive	m mʲ	n nʲ			
	Approximant		l lʲ		j	
	Trill		r rʲ			

Commentary on the table: The table shows the disappearing phoneme in parentheses /žʲ/.

[14] The system of consonant phonemes presented in M. B. Popov's work Phonetics of the Modern Russian Language. SPb., 2014. – C. 76. Consonant phonemes are labelled with the symbols of the International Phonetic Alphabet.

General phonetics gives a classical idea of the three-phase articulation of any sound. Articulation consists of *excursion* (plosion) – the transition of the pronunciation organs from a resting state to a position characteristic of the articulation of a particular sound, of *exposition*, which corresponds to this position, and of *recursion* (plosion) – the return to a resting state *(Zinder 1979: 219)*. Exposition fixes the place of obstruction of the consonant. Depending on whether the third phase of articulation, recursion, is realized, three types of consonants are distinguished: *plosive* consonants, accompanied by a sharp opening of the bow; *affricates*, when articulating which the bow smoothly passes into a slit; *implosive* consonants, when realizing which there is no third phase of articulation, *recursion*.

Combinatory modification of consonants is manifested in their neighbourhood with vowels. The greatest influence on consonants is exerted by vowels following consonants in syllables like CV, CCV (*Bondarko 1998:117*). Under the influence of labial vowels, consonants are articulated with rounded and extended lips in words: *суд, тут, лук, гул; стул, звук, ткнуть*.

Combinations of two or more consonants are divided into homorganic and heterogeneous combinations. Homorganic combinations are formed by the work of the same active speech organ – lips or tongue *bm, b^jm^j, tn, dn, tn^j, d^jn^j*. As a result of coarticulation, a nasal explosion is realized instead of a mouth explosion in the words: *обмен, обман, обмять, пятница, дно, однажды, поднять, дневник, отнять*..

In homorganic combinations (explosive+lateral slit) *tl, dl* the bow of the explosive consonant opens into a lateral slit in the words: *атлет, отладить, отлёт, длина, предлог, предложение*.

Heterogeneous combinations of consonants are formed by the work of different active organs of speech: lips and the front part of the tongue *bn, tn, kn* in words: *обнова, Обнинск, относить, этнос, окно, сукно*.

Positional modifications of consonants are manifested in strong aspiration in the position of the absolute end of the word in deaf explosive consonants in the

words: *кот, рот, сток, шок, лоб, столп*. Sonants in the position of the absolute end of the word after deaf consonants are deafened in the words: *метр, фетр, бинокль, вопль, спектакль.*

Positional modifications of voiceless consonants are manifested in the position after all vowels, in the process of which a partial voicing of consonants is observed, manifesting itself in a voiced bow in voiceless consonants and in a voiced slit phase in constrictive consonants *(Bondarko 1998:121)*.

1.6.3. Russian syllable structure

In Russian, a syllable is understood as a minimal pronunciation unit of the language containing a vowel, one or more consonants that precede or follow it. A vowel, which is the top of a syllable, can separately represent a syllable.

L. V. Bondarko writes about four types of syllables *(Bondarko 1998:189).* The following syllables are distinguished: open (ending with a vowel) in words: *мы, все, три, два, жду*; closed (ending with one or more consonants) in words: *их, риск, ромб*; covered (beginning with one or more consonants) in words: *ты, стремя, встреча*; uncovered (beginning with vowels) in words: *он, астр, игл*.

According to L.V. Bondarko's syllable theory, confirmed by experimental data, ‘the Russian language is characterised by a tendency to form an open syllable; the sounds forming one syllable are characterised by greater connectedness, interdependence than the sounds included in different syllables’ (Bondarko 1977: 129). The frequency characteristics of syllables in Russian speech show that the most frequent syllables are CV and CVC – 54, 34 % and 14.06 %; the least frequent syllables are V – 8.5 % and VC – 1.56 %, respectively. The remaining syllables containing complex sequences of consonant phonemes CVCC, CCV, CCVC, CCCV, CCCV, CCVCC are few in number, totalling about 20%. CCCV, CCCCV, VCCC are the most complex. CCCV – 84 cases in words: *вблизи, штрих*,

вспомнить, страница; CCVCCV – 21 cases in words: *взгляд, вздремнуть*; VCCC – 30 cases in words: *Орск, Витебск, Невельск, спектр, текст*; VCCC – 9 cases in words: *государств, ведомств, пространств (Bondarko 1998: 249)*.

Syllables with complex sequences of consonants from two to four represent the greatest difficulty for native Chinese speakers learning the pronunciation of Russian, as the Chinese language is not characterised by a cluster of consonants. The peculiarities of the Chinese language system are noted in the author's work[15]. The study of modifications of Russian consonants in complex syllables and their realisation by Chinese speakers is one of the tasks of the present study Phonetic modifications of Russian vowels and consonants correlate with the idea of normative pronunciation, exemplary pronunciation with observance of all pronunciation norms and (modifications of sounds - author's addition) (Bondarko 1998: 249). In a general sense, pronunciation norm, as well as language norm in general, "is a set of phenomena authorised by the language system, reflected and fixed in the speech of native speakers and being obligatory for all speakers of the literary language in a certain period of time" (Verbitskaya 2001:15).

Perfect command of language is connected with the concept of orthoepic norm. The term 'orthoepia' (from Greek *orthos* – straight, correct and *epos* – speech) is a set of rules of oral speech, ensuring the unity of its sound design in accordance with the norms of the national language *(Avanesov 1984:13)*. Mastering the orthoepic norm of the language is the goal of students learning Russian as a foreign language. Violation of orthoepic norms leads to pronunciation errors, the consideration of which involves issues of interference, phonetic interference in particular.

[15] Sun Bo Peculiarities of the sound system of the modern Chinese language. Acoustic aspect // Kazan: Izd-vo Kazanskaya nauka. – №12. – C. 207-210.

1.7 Chinese literary language and Chinese dialects

This section is based on the author's work[16]. The Chinese language belongs to the Sino-Tibetan (Sino-Tibetan) language family. The Chinese language belongs to the Sino-Tibetan (Sino-Tibetan) language family. Chinese is spoken by 90 per cent of the Chinese population. The population of China is 1,394,102,197 people (2018)[17]. The Chinese language is also spoken in Cambodia, Indonesia, Laos, Vietnam, Myanmar, Malaysia, Thailand, Singapore, as well as Taiwan, Macau and Hong Kong.

The term "Han yu" is defined in the Big Dictionary of the Chinese Language as "the language of the Han nationality", the main language in China. The literary language of modern Chinese is Putonghua (Chinese 现代汉语的标准是普通话". Mandarin is the norm of Chinese literary language. Putonghua's phonetics and vocabulary are based on the pronunciation norm of the Beijing dialect. Putonghua grammar corresponds to the norms enshrined in the literary works of modern Chinese – baihua.

Thus, the expression "Chinese language" in Russian denotes the word Putonghua. Mandarin has been standardized and brought to a single norm to facilitate communication in various regions of China and its use is recommended in official documents and educational institutions. In different regions of China, along with Mandarin, different dialects of Chinese are used, which functionally and linguistically meet the criteria of a full-fledged language, such as Dalian, Cantonese, Cantonese, Kunming, Xi'an, Shanghai and other dialects.

[16] Sun Bo Peculiarities of the sound system of the modern Chinese language. Acoustic aspect // Kazan: Izdvo Kazanskaya nauka. - 2018.- №12. - C. 207-210

[17] https://zhidao.baidu.com/question/1964412659330037420/answer/3140816246.html

In China, seven dialect groups are traditionally distinguished: the *Bei, Gan, Xiang, Wu, Yue, Min, and Hakka groups*. Figure 1 shows the distribution of Chinese dialects on a map.

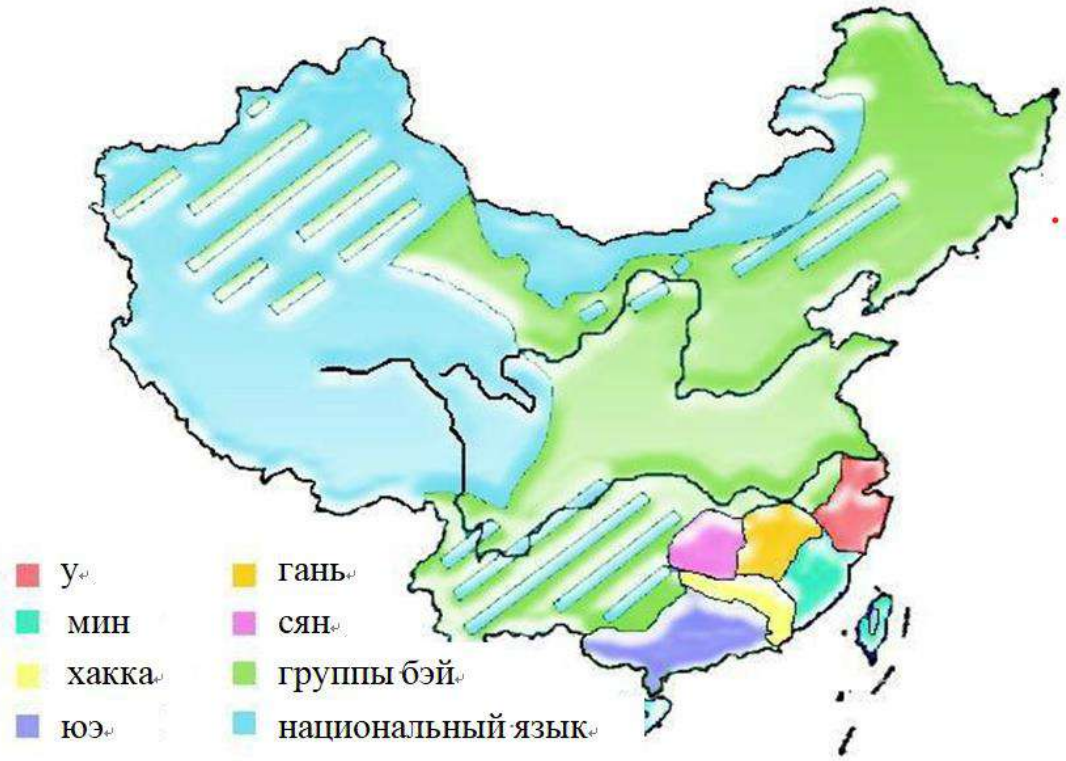

Figure 1. – Map of Chinese language dialects

The groups differ in phonetics, vocabulary and grammar. In fact, the diversity of dialects creates significant language barriers to communication between people from different regions in the country.

At the same time, the different dialects cause a variety of pronunciation errors in Chinese non-native speakers, which increases the degree of difficulty in teaching. For example, Russian pronunciation, as it is obvious that both Russian and Chinese teachers do not know all dialects and do not know all phonetic features of each dialect.

1.7.1. The sound system of the Chinese language

This section is based on the works of well-known researchers in Chinese linguistics (Zhao Yuanzhen 1968; Wang Tianchang 1974; Speshnev 1980; 2015;

Zhou Tongchun 2003; Chaofen Sun 2006; Ding Chongming 2012; Jiang Liping 2013; Shao Jingming 2016 and the author's work [18].

Chinese belongs to tonal syllabic languages, which have a wide distribution in different parts of the world in China, Southeast Asia, West Africa and Latin America *(Krylov 2009)*. The Chinese sound system differs significantly from Russian, both in sound composition and in the organization of the syllabic structure of the language. In syllabic tonal languages Chinese, Vietnamese, Thai, Burmese and others there is no word stress. Each syllable of a word is equal to a morpheme. Syllables of the same sound composition but with different tones are different words: 妈mā *mother*，麻má *bast fibre*，马mǎ *horse*，骂mà *scold*. The Chinese language uses hieroglyphic writing, but in addition there is a system of recording sounds using Latin letters, pinyin, which was adopted in the mid-twentieth century. Figure 2 demonstrates the Pinytin system of recording the sounds of Chinese.

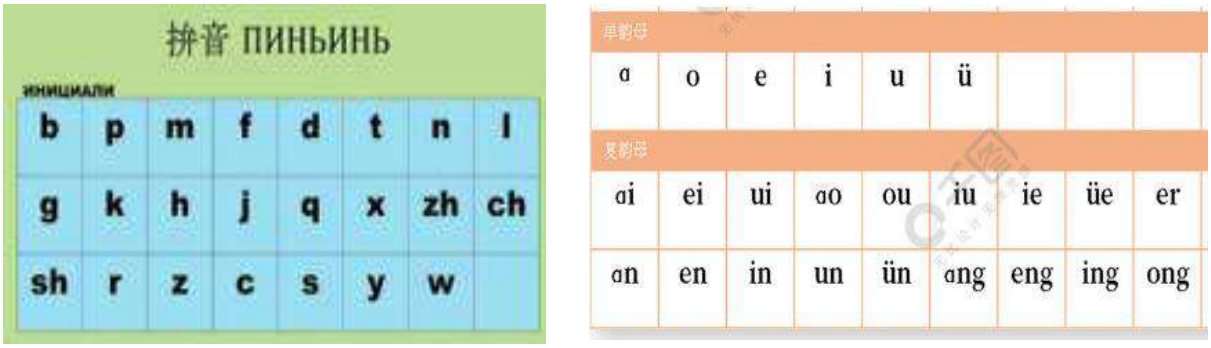

Figure 2 – Pinyin is a system of recordings of Chinese language sounds

In this paper, the description of the sound system is based on Mandarin Chinese.

The Chinese sound system consists of 23 initials: b, p, m, f, d, t, t , n, l, g, k, h, j, q, x, zh, ch, sh, r, z, c, s, y, w;

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24 finals: a, o, e, i, u, u, ü, ai, ei, ui, ao, ou, iu, ie, üe, er, an, en, in, un, unün, ang, eng, ing, ong and 4 tones[19]

All finals are divided into 4 groups:

1. simple （单韵母）: a， o， e， i， u， ü

2. compound （复韵母）: ai，ei，ui，ao，ou，iu，ie，üe

3. special (特殊)：er

4. nose finials （鼻韵母）

1) finals with a front nasal （前鼻韵母）: an，en，in，un，ün

2) finals with a back nasal（后鼻韵母）: ang，eng，ing，ong

Finals are categorised:

- by row (front - back - mixed row);
- by degree of lift (lower - middle - upper lift);
- by the presence or absence of labialisation (unlabialised vs. labialised);

Simple finals include monophthongs, complex and nasal finals include diphthongs and triphthongs.

Initials (consonants) are classified according to differential features: place of formation, method of formation. According to the acoustic sign of the ratio of noise and tone, initialisms are divided into noisy and sonants.

According to the manner of the place of formation consonants are divided into lip (p, p^h, f, m), anterolingual (t, t^h, ts, ts^h, s, n, l, $\widehat{ʈʂ}$, $\widehat{ʈʂ}^h$, ʂ (ʐ), ɻ, (tɕ), (tɕ ^{h}), (ɕ), midlingual (j) and posterior lingual (k, k^h, x, ŋ). According to the manner of

[19] According to the Hanyu pinyin website. http:/yunmu.hanyupinyin.cn

production consonants are divided into noisy (p, p^h, f, t, t^h, ts, ts^h, s, l, ʈʂ, ʈʂʰ, ʂ (ʐ), ɻ, (tɕ), (tɕʰ), (ɕ), (k, k^h, x) and sonants (m, n, l, ɻ, j, ŋ).

Noisy are classified as bowed (p, p^h, t, t^h, ts, ts^h, ʈʂ, ʈʂʰ, tɕ), (tɕʰ), k, k^h) and slotted (f, s, ʂ (ʐ), (ɕ), x). Consonants are divided into plosive (p, p^h, t, t^h, k, k^h) and affricates (ts, ts^h, ʈʂ, ʈʂʰ, (tɕ), (tɕʰ).

Table 3 shows the consonant system of Chinese.

Table 3 – Consonant system of Chinese literary language[20]

Place of obstruction / Type of obstruction			Labial	Forelingual			Medium lingual	Backlingual
				Alveo-palatal	Retro-flexed	Alveo-alveolar-palatal		
Noisy	Conjunctive	Plosive (without aspiration)	p	t				k
		Plosive (with aspiration)	p^h	t^h				k^h
		Affricates (without aspiration)		ts	ʈʂ	(tɕ)		
		Affricates (with aspiration)		ts^h	ʈʂʰ	(tɕʰ)		
	Constrictive		f	s	ʂ (ʐ)	(ɕ)		x
Sonants	Plosive		m	n				ŋ
	Constrictive			l	ɻ		j	

Commentary to the table: Consonants are labelled with the characters of the International Phonetic Alphabet

A distinctive feature of Chinese is the opposition of aspirated and unaspirated plosive consonants and affricates. Thus, among plosive consonants there are plosive, unaspirated (p, t, k) and plosive, aspirated (p^h, t^h, k^h). Affricates include affricates, unaspirated (ts, ʈʂ, (tɕ) and affricates, aspirated (ts^h, ʈʂʰ, (tɕʰ).

Sonants are divided into plosive (m, n, ŋ) and constrictive (l, ɻ, j).

[20] The table “System of consonants of the Chinese literary language” is compiled by the author on the basis of linguistic principles of the St. Petersburg phonological school.

1.7.2. Chinese syllable structure

The nature and structure of the Chinese syllable have their own peculiarities, which are not unequivocally considered by linguists. Some researchers single out the sillabeme (syllabic phoneme) as the basic indivisible unit of the Chinese language (*Dragunov and Dragunova 1955; Kasevich 1983; Shcherba 1983; Polivanov 1991*;). On the contrary, other scholars define a phoneme as a minimal phonetic unit of the Chinese language (*Rumyantsev 1978; Zhao Yuanzhen 1985; Huang Bozhong 2002; Aleksakhin 2010*). Let us present arguments in favour of the first point of view.

In syllabic languages, there is no analogue of a phonological unit similar to the phoneme characteristic of Indo-European, Turkic, Finno-Ugric, Semitic and other languages. A phoneme, being a minimal unit of a language performing a constitutive function, is capable of being an exponent of a morpheme independently in the above languages (*Shcherba 1983; Zinder 1979*). In this case, "if some element of the expression plan is not capable of forming a morpheme by combining with element(s) of the content plan, it cannot correspond to a phoneme" (*Kasevich 1983:120*).

The analogue of the phoneme in syllabic languages in terms of constitutive function is the syllable, as a necessary minimum for the exponent of a morpheme. At the same time, individual consonants or combinations of consonants in syllabic languages cannot act like 'non-syllabic' morphemes морфемам *л, к, в, щ* in Russian. Single vowels representing morphemes are also syllables, acting as the exponent of the morpheme.

One syllable is denoted by one hieroglyph. A character read with different tones stands for different words: 温wēn *warm*, 闻wén *sniff*, 吻wěn *kiss*, 问wèn *ask*. In the flow of speech, a syllable retains its sound composition, remaining a stable sound formation (*Maslov 1987: 68*).

Structurally, the Chinese syllable is strictly organized. There are two main elements in a syllable: *initial* - the initial part consisting of a consonant and *final* – the final part consisting of a vowel. The final, in turn, is divided into – *medial* and *subfinal*. The subfinal is divided into the *centrum* and the *terminal*. The initial always stands at the beginning of the syllable. The rest of the syllable is the final, which consists of a vowel or a combination of a vowel and a consonant. The final is an obligatory part of the syllable. A syllable can only consist of a final. For example: 是 shì *be*，中 zhōng *centre*，魂hún *perfume.* Characteristics of Chinese initials and finals are presented in the author's work[21].

H. A. Speshnev in his book Phonetics of the Chinese Language presents the structure of the Chinese syllable (*Speshnev 1980*). Figure 3 shows the syllable structure of the Chinese language.

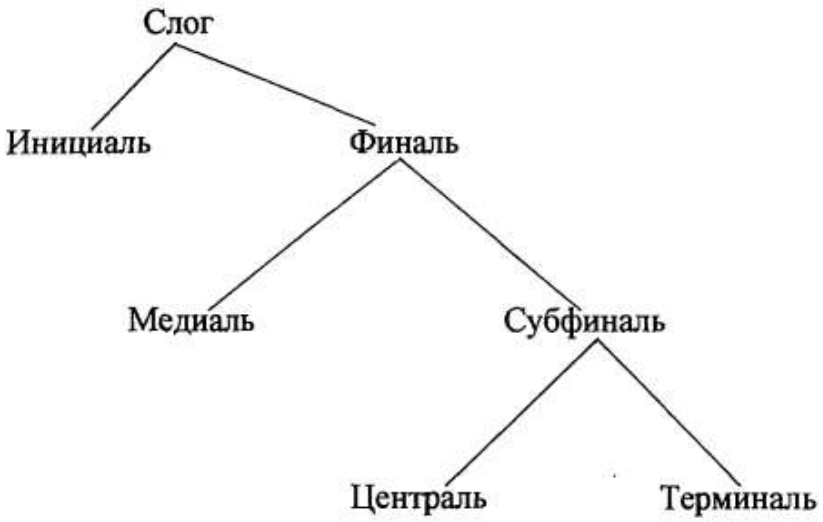

Figure 3 – Syllable structure in the Chinese language

There are four tones in the Chinese language. 1) high flat; 2) rising from middle level to high level; 3) low falling and then rising to middle level; 4) falling from high level to low level. Each tone has its own symbol, which is labelled above the vowel sound in the word final.

[21] Sun Bo Peculiarities of the sound system of the modern Chinese language. Acoustic aspect // Kazan: Izdvo Kazanskaya nauka. - 2018.- №12. - С. 207-210.

Figure 4 shows a schematic representation of the four Chinese tones.

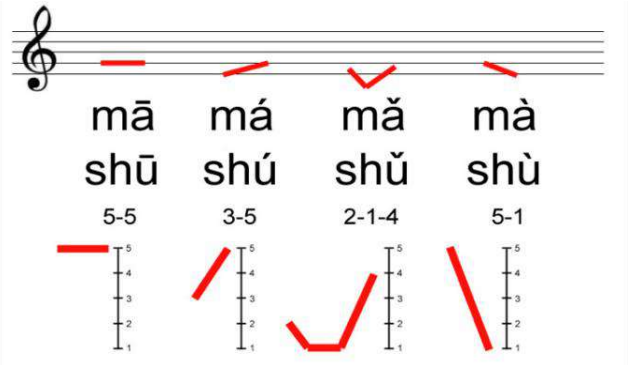

Figure 4 – Schematic of Chinese tones

1.8. Vocalism of contacting languages and prediction of probable errors

There are six vowel phonemes in the sound composition of the modern Russian language: /ɑ/, /e/, /i/, /o/, /u/, /ɨ/. Modern Chinese has six vowel monophthongs <a>, <o>, <u>, <e>, <i>, <ɘ>. Russian and Chinese vowels are distinguished by the following similar differential features: <vowel rise>, <vowel row>, <presence or absence of labialization>. The Chinese language differs from Russian in the presence of the differential feature <stability of articulation>, according to which, besides 6 monophthongs, there are 29 diphthongs and triphthongs in the language.

Russian /i/ and Chinese <i> coincide on the features of <vowel rise> and <vowel row>, being vowels of upper rise, front row. The phoneme /i/ is realised in stressed and unstressed positions at the absolute beginning of words and after soft consonants: *ил, ирис, иней, игра, икра, мир, Мила, Рита, рис, тигр, река, леса, часы, эпитет, пятак, вековой, бега, дела, лимон*.

The Chinese monophthong <i> is realized after hard consonants: *li, ni, mi, pin, ding, ting.* The Chinese monophthong coincides with the Russian phoneme /i/ in the stressed position.

Prediction of probable errors: 1. The absence of soft consonants in Chinese causes difficulties in their articulation by native Chinese speakers in the position

before /i/. 2. Lack of quantitative reduction of the vowel /i/ in the unstressed syllable.

Russian /e/ and Chinese <e> coincide in terms of <vowel row>, being front vowels. Russian /e/ is characterized as a mid-range vowel and is realized in a more closed variant than Chinese <e>, which is a mid-lower vowel. The phoneme /e/ is realized in stressed and unstressed syllables at the absolute beginning of a word: *эхо, эра, этот* and in position after soft consonants: *семь, дело, век, ревень, ребус, честь, тесть, лента.*

The Chinese monophthong <e> is realized in position only after consonants: *pen, deng, ben, ceng, leng, fen.*

Prediction of probable errors: 1. Realization of Russian <e> by native speakers of Chinese in a more open variant of the vowel /e/; 2. Absence of i-shaped transition in the position after and before soft consonants: *семь* [^{i}e^{i}].

Russian /a/ and Chinese <a> coincide on the features of <vowel rise> and <vowel row>, being vowels of lower rise, back row. The phoneme /*a*/ is realized in accented and unaccented position in the absolute beginning of the word and in the position after hard and soft consonants: *ах, акт, карась, карандаш, скука, собака, вода, молодец, мячик, Кяхта.*

The Chinese monophthong <a> is realized at the absolute beginning of a word and in position after consonants: *an, ban, da, fa, na, kan.*

Russian /ɑ/ and Chinese <a> vowels are realized in combinatory allophones in position after labial and forelingual consonants: in allophones in the position before or after back lingual consonants:

Russian /ɑ/ and Chinese <a> vowels are realized in combinatory allophones in the position after labial and forelingual consonants: in allophones in the position before or after back lingual consonants:

Prediction of probable errors: 1. Absence of quantitative reduction of the vowel /ɑ/ in the unaccented position; 2. Absence of i-transition in the position after and before soft consonants: *няня* [^{i}ɑ^{i}], *Надя* [^{i}ɑ].

Russian /u/ and Chinese <u> coincide on the features of <vowel rise>, <vowel row>, <labial-not labial>, being high-lift, back-row labial vowels. Russian /u/ is realized in accented and unaccented position in the absolute beginning of the word and in the position after hard and soft consonants: *ум, ужин, суть, рубль, ухо, турист, студент, букварь, утюг, бумага*

Chinese monophthong <u> is realized in position after hard consonants: *bu, du, fu, ku, mu, nu, xun.*

Prediction of probable errors: 1. No quantitative reduction of the vowel /u/ in the unaccented position.

Russian /o/ and Chinese <o> coincide on the features of <vowel row>, <vowel nondegeneracy>, being back-row vowels. Chinese <o> is an upper-middle vowel, while Russian /o/ is a middle vowel.

Russian /o/ is realized in stressed and unstressed syllables at the absolute beginning of words and in the position after hard and soft consonants: *он, сон, дом, кот, мост, лён, клён, тётя, город, города, доктор, холод, холодновато*. In the unaccented position, the vowel /o/ undergoes quantitative and qualitative reduction. In the position before and after soft consonants, the vowel /o/ is realised in combinatory allophones [^{i}o], [^{i}o^{i}].

Chinese <o> is realized in position after consonants: *bo, fo, mo, gong, long, hong.*

Prediction of likely errors: 1. absence of quantitative and qualitative reduction of the vowel /o/ in the stress-free position; 2. absence of the i-shaped transition in the position after and before soft consonants: *лён* [^{i}o], *Лёня* [^{i}o^{i}].

The Russian unstressed vowel /ɨ/ of the upper rising, middle row does not match any vowel of Chinese. The vowel /ɨ/ is realized in accented and unaccented positions: *был, пышка, шить, розы, жена, цена, он идет, брат и сестра, сад и*

огород. The vowel /ɨ/ has a diphthongoid character and is realized with an i-shaped sound at the end of the sound.

Prediction of likely errors: 1. replacement of /ɨ/ by /i/; 2. absence of the diphthongoid i-sound. 3. replacement of /ɨ/ by the Chinese vowel of middle rising, middle row <ɘ>, as in the words: *piən, xɘ*. 4. replacing /ɨ/ with a Chinese upper-lift, front-row <y> vowel, as in the words *yan, yen, yeng.* Table 4 contains possible pronunciation variants of Russian vowels by speakers of different dialect groups of Chinese according to Zhao Zhe (*Zhao Zhe 2016: 179*).

Table 4 – Possible variants of pronunciation of Russian sounds in the speech of speakers of different dialectal areas

	Putonghua	У	Xian		Gan	Hakka	Ming		Yue
			New	Old			South	North	
[и]	<i>	<i>	<i>	<i>	<i>	<i>	<i>	<i>	<i>
[ы]	<əi>	<əi>	<əi>	<əi>	<əi> <ə>	<əi>	<əi>	<əi>	<əi>
[у]	<u>	<u>	<u>	<u> <ʊ>	<u>	<u>	<u>	<u>	<u> <ou>
[е]	<ie>	<ie>	<ie>	<ie> <e>	<ie>	<ie>	<ie> <e>	<ie>	<ie>
[э]	<ai>	<ɛ> <æ> <ai>	<ai>	<ai>	<ɛ> <ə>, <ai>	<ɛ> <ai>	<ai>	<ɛ>,<ai>	<ɛ> <ai>
[о]	<o> <au> <əu>	<o> <əu>	<o> <au> <əu>	<o> <ʊ> <əu>	<o> <ɔ>	<o> <ɔ> <au>	<o> <ɔ> <au>	<o> <ɔ> <au>	<o> <ɔ> <au>
[а]	<a>	<æ>	<a>	<a>	<a>	<a>	<a>	<a>	<a>

1.9. Consonantism of contacting languages and prediction of probable errors

The consonantal systems of Russian and Chinese have significant differences in the number of consonants in the language system: by the features <place of

formation>, <method of formation>, <deafness-voicelessness>, <softness-hardness>, <aspiration-unaspiration>. There are 36 consonants in the sound composition of the Russian language, and 23 consonants in the Chinese language.

1.9.1. Comparative analysis of consonants on the basis of <place of formation>

On the basis of the <place of formation>, there are 10 lip consonants in Russian, of which 6 are lip-labial and 4 lip-dental consonants. In Chinese, there are 3 lip consonants, 1 lip-dental. Russian /m/, /f/ and Chinese <m>, <f> consonants are similar in terms of <place of formation>. Close on articulation are Russian /p/ and Chinese /p^h /; Russian /b/ and Chinese <p>. The soft consonants /p^j/, /b^j/, /m^j/, /f^j/, /v^j/ and the hard lip-dental consonant /v/ are not represented in Chinese and may cause difficulties in the production of Russian pronunciation by Chinese learners. Table 5 shows the classification of Russian and Chinese consonants by <place of obstruction >.

Table 5 – Comparative classification of consonants based on the feature of <place of obstruction>

Place of obstruction	Russian	Chinese
LABIAL:		
lip-toothed	p, p^j, b, b^j, m, m^j	p, p^h, m
lingual	f, f^j, v, v^j	f
FORELINGUAL:		
dorsal	t, t^j, d, d^j, c, $č^j$, s, s^j, z, z^j, $š^j$:, n, n^j	–
apical	l, l^j	t, t^h, ts, ts^h, s, n, l, ɻ
cacuminal	š, ž, r, r^j	$\widehat{ʈʂ}$, $\widehat{ʈʂ}^h$, ʂ, ($z_{\circlearrowleft}$)
MEDIUMLINGUAL	j	tɕ, $tɕ^h$, ɕ
BACKLINGUAL	k, k^j, g, g^j, x, x^j	k, k^h, x, ŋ

Russian language is represented by 19 forelingual consonants - 19. Of these, there are 13 dorsal consonants, 2 apical consonants, and 4 cacuminal consonants. In Chinese, the forelingual consonants are represented by 12 consonants. Of these, there are no dorsal consonants, 8 apical consonants, and 4 cacuminal consonants. As

the comparison of the forelingual consonants of the contacting languages shows, Russian forelingual consonants have a dorsal character, while Chinese consonants are characterized by an apical articulatory pattern. At the same time, the following Russian and Chinese consonants can be classified as close in articulation:

Russian		Chinese
/ t /	–	<tʰ >
/ d /	–	<t>
/ c /	–	<tsʰ>
/ s /	–	<s>
/ n /	–	<n>
/ l /	–	<l>
/ čʲ /	–	<t͡ʂ ʰ >
/ š /	–	<ʂ>
/ ž /	–	<ʐ>

Russian forelingual soft consonants /tʲ/, /dʲ/, /čʲ/, /sʲ/, /zʲ/, /šʲː/, /nʲ/, /lʲ/, /rʲ / have no analogues in Chinese and may cause difficulties for Chinese learners.

Mediolingual consonants in Russian are represented by one consonant /j/; in Chinese - by three consonants (tɕ, tɕʰ, ɕ).

Backlingual consonants in Russian are represented by 6 consonants, in Chinese – by 4 consonants. Among them the consonants Russian /k/ and Chinese <kʰ>; /g/ and <k>; /x/ and <x> respectively have similar articulation. The Russian soft back-lingual consonants /kʲ/, /gʲ/, /xʲ/, which are absent in Chinese, may cause difficulties for Chinese learners.

1.9.2. Comparative and correalative analyses of consonants on the basis of <type of obstruction>

In Russian, there are 18 plosive consonants, including 12 explosive consonants, 2 affricates and 4 nasal consonants. In Chinese there are 14 plosive consonants, including 6 explosive, 6 affricates and 2 nasal consonants.

Table 6 shows the classification of Russian and Chinese consonants in comparative terms on the basis of <type of obstruction>.

Table 6 – Comparative classification of consonants based on the feature <Place of obstruction >

Place of obstruction	Russian	Chinese
PLOSIVE:		
explosive	p, pʲ, b, bʲ, t, tʲ, d, dʲ, k, kʲ, g, gʲ	p, pʰ, t, tʰ, k, kʰ
affricates	c, čʲ	ts, tsʰ, t͡ʂ, t͡ʂʰ, tɕ, tɕʰ
nasal	m, mʲ, n, nʲ	m, n
CONSTRICTIVE:	f, fʲ, v, vʲ, s, sʲ, z, zʲ, šʲː, x, xʲ, j, l, lʲ, š, ž	f, s, ʂ, (zˌ), ɕ, x, l
THRILL:	r, rʲ	–

Constrictive consonants in Russian are represented by a wide set of 16 consonants, in Chinese by 7 constrictive consonants. Some of the Russian and Chinese semantic and slit consonants have similarities in terms of <type of obstruction>. Table 7 shows Russian and Chinese plosive and constrictive consonants in comparative terms.

Table 7 – Plosive and constrictive consonants in Russian and Chinese

Plosive		Constrictive	
Russian	Chinese	Russian	Chinese
/p/, /b/	<p>, <pʰ>	/f/, /v/	<f>,
/t/, /d/	<t>, <tʰ>	/s/, /z/	<s>, <ʂ>
/k/, /g/	<k>, <kʰ>	/x/	<x>
/m/, /n/	<m>, <n>	/l/	<l>
/c/	<ts>, <tsʰ>		

A distinctive feature of Russian consonants on the basis of <type of obstruction> is the presence of thrill consonants /r/, /rʲ/, which cause the greatest difficulties for Chinese learners.

1.9.3. Comparative and correlative analyses of consonants on the basis of <voiceless- voiced>

There are 16 voiceless consonants and 10 voiced consonants in Russian. In Chinese, there are 11 voiceless consonants and no voiced consonants. Among Chinese voiceless consonants, semivocalic and aspirated consonants are distinguished (*Speshnev 1980:30*). Some of the voiceless consonants in both languages have partial similarities. Table 8 demonstrates the classification of Russian and Chinese consonants on the basis of the feature <voiceless-voiced>.

Table 8 – Comparative -correlative classification of consonants on the basis of of the feature "voiceless-voiced"

	Russian	Chinese
VOICELESS	p, pʲ, f, fʲ, t, tʲ, s, sʲ, š, k, kʰ, x, xʲ, c, čʲ, šʲː	pʰ, tʰ, kʰ, tsʰ, t͡ʂʰ, tɕʰ; f, s, ɕ, x, ʂ
VOICED	b, bʲ, v, vʲ, d, dʲ, z, zʲ, g, gʲ	ʐ
SEMIVOCALIC	–	p, t, k, ts , t͡ʂ, tɕ

Chinese learners have the most difficulty pronouncing Russian voiced consonants, which are absent in the Chinese language system. The voicing of Russian voiced consonants is ensured by the vocal cords, which are contracted, tense and oscillate throughout the sound of the voiced consonants.

In Chinese, when pronouncing semi-voiced consonants, the vocal cords vibrate in the second half of the sound of the consonant and therefore are perceived as voiceless consonants.

Russian paired words contrasted on the basis of " voiceless -voiced" are not distinguished by Chinese learners: *путь–будь, палка–балка, порт–борт, просит–бросит, дам-там, быть–пить*.

A distinctive feature of Chinese is oppositions on the basis of <aspirated - unaspirated>.

Table 9 shows Chinese aspirated and unaspirated consonants.

Table 9 – Classification of Chinese consonants by characteristic

<aspirated – unaspirated>

Aspirated	Unaspirated
p^h, t^h, k^h, ts^h, $\widehat{ʈʂ}^h$, $tɕ^h$	p, t, k, ts , $\widehat{ʈʂ}$, tɕ, f, s, ɕ, x, ʂ, m, n, l

When pronouncing Russian deaf consonants, native speakers of Chinese realize them with partial aspiration.

Chapter 1 conclusions

1. The theoretical aspects of the research on the theory of language contacts and language (phonetic) interference are defined.
2. The object of research “phonetic modification” is defined.
3. The description of positional-combinatorial modification phonetic processes is given.
4. The description of the sound system of the modern Russian language: vowels, consonants and consonant combinations is presented.
5. A description of the peculiarities of the Russian syllable is presented.
6. The description of the sound system of the modern Chinese language is presented: initials and finals.
7. The specificity of the Chinese syllable is described.
8. A comparative analysis of vowels of Russian and finals of Chinese is presented.
9. A comparative-correlative analysis of consonants of Russian and initials of Chinese is presented.
10. A prediction of probabilistic pronunciation errors in the Russian speech of native speakers of Chinese in the realization of vowels and consonants is presented.

CHAPTER 2. MATERIAL AND METHODOLOGY OF THE EXPERIMENTAL RESEARCH

The Chapter 2 contains a description of the sound material, justification of the choice of the experimental phonetic text for studying the realizations of vowels and consonants and complex consonant combinations in a coherent text. The chapter gives an introduction to the speakers – participants of the experiment, conditions and technology of processing the recordings, their structuring and storage in the sound database. The chapter describes the methods of auditory, instrumental and statistical analyses, methods of transcribing using the international phonetic alphabet and diacritical marks.

The solution of the tasks set in the work was carried out using a set of modern techniques for the analysis and processing of speech signals, with the use of elements of mathematical statistics. Problem solving was carried out according to algorithms in a given sequence.

Figure 6 demonstrates the structural scheme of the research, according to the network schedule of which the author conducted his research.

2.1. Research material

The object of the study was vowels and consonants, as well as consonant combinations of the modern Russian literary language. The paper analyzed the phenomena of modifications of Russian language sound units in the composition of words under the conditions of unprepared reading of an experimental phonetic text performed by native speakers of Chinese and Russian.

The phonetic representative text (PRT) is an exemplary example of a phonetically balanced model of the sound system of the Russian language. Appendix 1 contains the full text of the experimental phonetic text. The text was developed at the Department of Phonetics and Foreign Language Teaching Methodology of St. Petersburg State University by S. B. Stepanova under of Professor L. V. Bondarko (*Stepanova 1988; Bondarko 1992:132-134).*

The phonetic representative text contains 54 sentences and 488 words. The text presents 200 most frequent syllables of Russian speech, covering 75-80% of any text. When developing the text, S. B. Stepanova based on calculations and statistical data obtained by researchers (*Elkina, Yudina 1964; LEF Report 1969; Moiseev 1975; Bondarko 1977; Morkovkin 1984; Bogdanova 1985; Levels.. 1986).* Calculations included the following parameters:

- syllable representativeness;
- distribution of rhythmic structures;
- average word length;
- consonant coefficient;
- distribution of stressed and unstressed allophones;
- typical representativeness of morphemic structures;
- typical lexical units.

Thus, 95% of lexical units of the text are among the 2500 most used words in the Russian language according to the dictionary of V. B. Morkovkin (*Morkovkin et al. 1984*). According to L. V. Bondarko, the consonant coefficient of the text is 1.33; the average length of a word consists of 5.9 phonemes or 2.6 syllables (*Bondarko 1977*); Information on the statistics of open syllables was obtained at the Institute of Mathematics of the Siberian Branch of the USSR Academy of Sciences (*Elkina, Yudina 1964*). A list of the 202 most frequent syllables is presented in the work of L. V. Bondarko (*Bondarko 1982: 3-9).*

2.2. Information on speakers

The speakers were twenty-eight respondents who were native speakers of Modern Standard Chinese (12 males and 16 females) between the ages of 19 and 30. All speakers are residents of the Inner Mongolia Autonomous Region of China. The speakers are students, undergraduates, and postgraduates of universities in China and Russia. 43% represent male voices and 57% represent female voices. Table 10 presents information about the speakers, their age, level of Russian language proficiency and status at the time of audio recording.

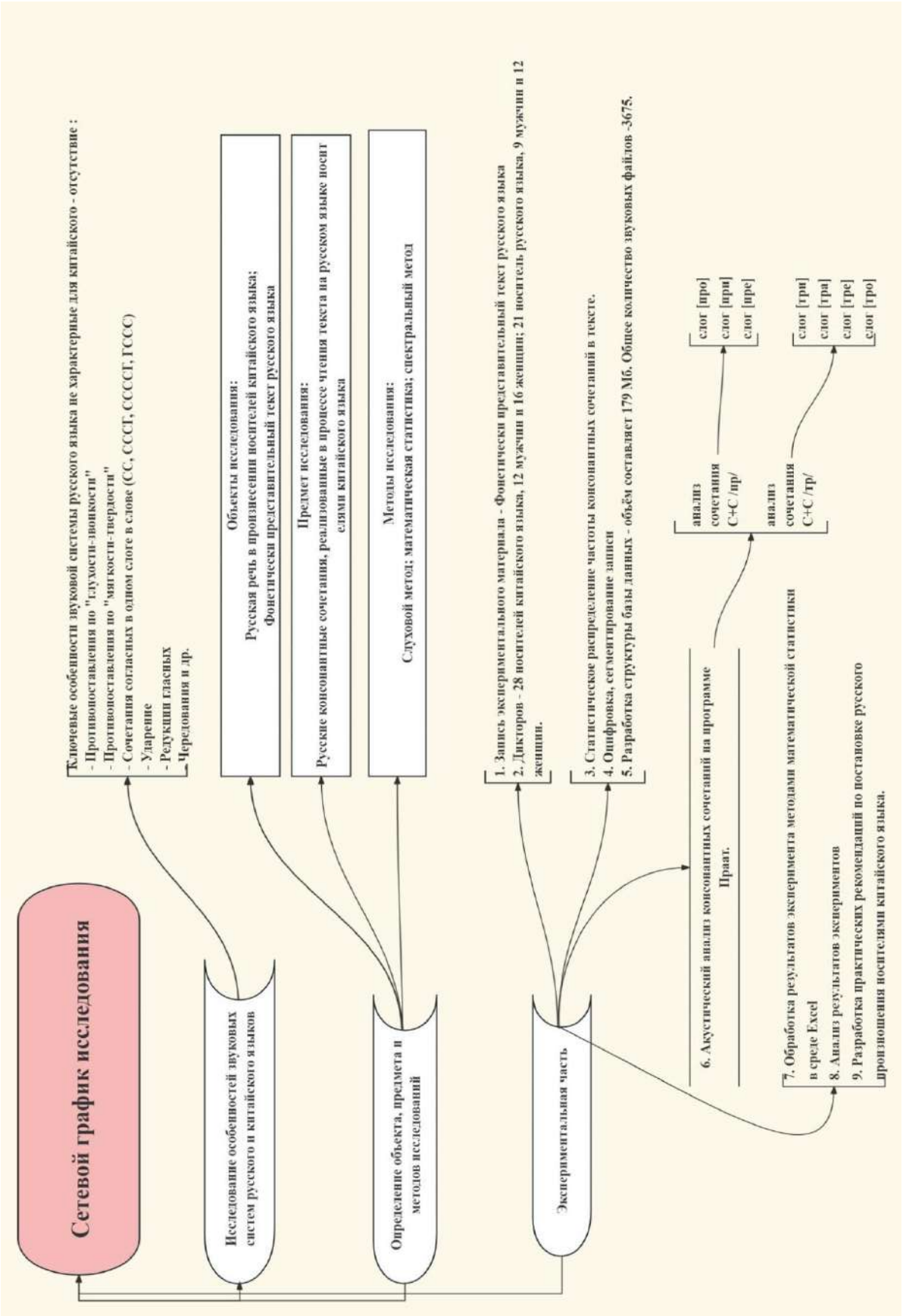

Figure 5 – Structural design of the study

Table 10 – Information about speakers

Speakers	Name	Age	Status
РМ1	Vladislav	20	3rd year student of Dorzhi Banzarov Buryat State University
РМ2	Maxim	37	teacher
РМ3	Andrey	37	teacher
РМ4	Misha	35	teacher
РМ5	Kolya	18	4th year student of Dorzhi Banzarov Buryat State University
РМ6	Ilya	19	4th year student of Dorzhi Banzarov Buryat State University
РМ7	Egor	20	4th year student of Dorzhi Banzarov Buryat State University
РМ8	Arsalan	19	4th year student of Dorzhi Banzarov Buryat State University
РМ9	Nikita	21	4th year student of Dorzhi Banzarov Buryat State University
РЖ1	Yulia Avdeeva	21	4th year student of Dorzhi Banzarov Buryat State University
РЖ2	Olya	19	3rd year student of Transbaikal State University
РЖ3	Oyuna	39	lecturer
РЖ4	Adissa	31	teacher
РЖ5	Natasha	35	teacher
РЖ6	Vera	35	teacher
РЖ7	Xenia	37	lecturer
РЖ8	Arjuna	18	4th year student of Dorzhi Banzarov Buryat State University
РЖ9	Anita	20	4th year student of Dorzhi Banzarov Buryat State University
РЖ10	Zlata	18	4th year student of Dorzhi Banzarov Buryat State University
РЖ11	Soelma	20	4th year student of Dorzhi Banzarov Buryat State University
РЖ12	Varya	19	4th year student of Dorzhi Banzarov Buryat State University
КМ1В	Hu Buqin	30	1st year postgraduate student of Dorzhi Banzarov Buryat State University
КМ2С	Wang Xianzhe	23	4th year student of Erlian International Institute of Inner Mongolia Pedagogical University of Inner Mongolia China
КМ3Н	Chen Xiaonan	21	2th year student of Erlian International Institute of Inner Mongolia Pedagogical University of Inner Mongolia China
КМ4Н	Zhang Yuan	20	2th year student of Erlian International Institute of Inner Mongolia Pedagogical University of Inner Mongolia China
КМ5В	Wang Dongxu	29	2nd year Master's student at Dorzhi Banzarov Buryat State University
КМ6В	Yang Rui	27	2nd year Master's student at Dorzhi Banzarov Buryat State University
КМ7В	Hua Zinzin	23	2nd year Master's student of Inner Mongolia Normal University, Inner Mongolia, China
КМ8С	Yan Tian	21	3th year student of Erlian International Institute of Inner Mongolia Pedagogical University of Inner Mongolia China
КМ9С	Teng Xinyuan	21	3th year student of Erlian International Institute of Inner Mongolia Pedagogical University of Inner Mongolia China
КМ10С	Qianyu Liu	21	3th year student of Erlian International Institute of Inner Mongolia Pedagogical University of Inner Mongolia China

КМ11Н	Wang Chao	21	2th year student of Erlian International Institute of Inner Mongolia Pedagogical University of Inner Mongolia China
КМ12Н	Quan Yaoxing	24	2th year student of Erlian International Institute of Inner Mongolia Pedagogical University of Inner Mongolia China
КЖ1В	Zhang Xiaoguang	24	1st year Master's student at Ural Federal University
КЖ2В	Cai Jia	23	4th year student of Erlian International Institute of Inner Mongolia Pedagogical University of Inner Mongolia China
КЖ3С	Guo Na	21	4th year student of Inner Mongolia Pedagogical University of Inner Mongolia, China
КЖ4С	Bai Li	21	2nd year Master's student at Dorzhi Banzarov Buryat State University
КЖ5С	He Yi	20	4th year student of Inner Mongolia Pedagogical University of Inner Mongolia, China
КЖ6С	Li Qixing	20	4th year student of Inner Mongolia Pedagogical University of Inner Mongolia, China
КЖ7Н	Chen Mengyuan	20	2th year student of Erlian International Institute of Inner Mongolia Pedagogical University of Inner Mongolia China
КЖ8Н	Li Shiyu	20	2th year student of Erlian International Institute of Inner Mongolia Pedagogical University of Inner Mongolia China
КЖ9Н	Li Zhenzhui	19	2th year student of Erlian International Institute of Inner Mongolia Pedagogical University of Inner Mongolia China
КЖ10Н	Ren Chani	20	2th year student of Erlian International Institute of Inner Mongolia Pedagogical University of Inner Mongolia China
КЖ11Н	Sun Yunhua	20	2th year student of Erlian International Institute of Inner Mongolia Pedagogical University of Inner Mongolia China
КЖ12Н	Wang Zhixin	20	2th year student of Erlian International Institute of Inner Mongolia Pedagogical University of Inner Mongolia China
КЖ13Н	Xu Xiaofeng	20	2th year student of Erlian International Institute of Inner Mongolia Pedagogical University of Inner Mongolia China
КЖ14Н	Zheng Haotian	18	2th year student of Erlian International Institute of Inner Mongolia Pedagogical University of Inner Mongolia China
КЖ15Н	Zhou Yang	19	2th year student of Erlian International Institute of Inner Mongolia Pedagogical University of Inner Mongolia China
КЖ16Н	Sun Shuo	21	2nd year student of Dorzhi Banzarov Buryat State University

Commentary on the table: Р - Russian speaker; К – Chinese speaker; М - male; Ж - female; digits – speaker number; В – high level of Russian language proficiency; С – average level of Russian language proficiency; Н – low level of Russian language proficiency.

The speakers studied Russian and have different levels of linguistic communicative competence in Russian as a foreign language. All speakers were divided into three groups depending on the level of Russian language proficiency at the time of audio recording according to the approved requirements[22]. Thus, the number of speakers with a high level of Russian language proficiency (first level) was 21 %, with an average (basic) – 29 % and with a low level of proficiency (elementary) – 50 .

Figure 6 shows the ratio of the total number of native Chinese speakers by gender in %. 43 % are men and 57 % are women.

Figure 7 shows the indicator of the level of communicative competence of speakers of Russian as a foreign language: high, medium, low.

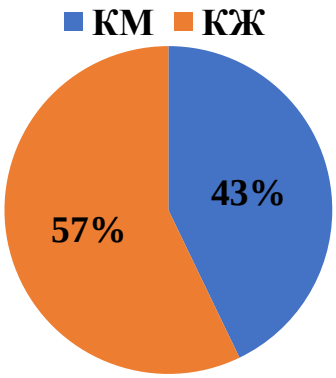

Figure 6 – Ratio of total number of native Chinese speakers by gender in %.

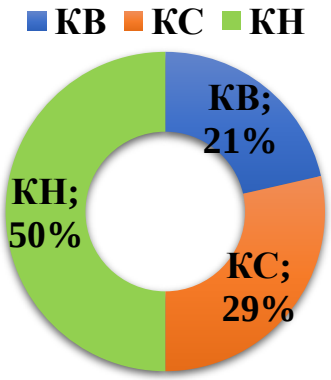

Figure 7 – Distribution of speakers depending on the level of communicative competence in Russian as a foreign language in %

Commentary on figures: Р – Russian speaker; К – Chinese speaker; М – male; Ж - female; digits – number of speakers; В – high level of Russian language proficiency; С – average level of Russian language proficiency; Н – low level of Russian language proficiency.

[22] Order of the Ministry of Education and Science of the Russian Federation (Ministry of Education and Science of the Russian Federation) of 1 April 2014 N 255, Moscow “On Approval of the Levels of Proficiency in Russian as a Foreign Language and Requirements for Them”.

2.3. Audio recording parameters

This section is based on sections 1-3 of the author's work[23]. Recording of the reading of phonetic representative text was made in the conditions of an isolated room on a Lenovo computer voice recorder. The way of realization of the sound material was reading the text. The speakers were not familiarized with the text beforehand and were not initiated into the tasks of the experiment. The speakers were tasked to read a complete phonetically representative text. Recording of the text reading was done at a natural reading pace. The recording was not paused. The text recording was done under the supervision of a technician and a researcher. The quality of the recording was assessed and tested by an expert phonetician.

The prepared recordings were digitized at a sampling rate of 20,000 Hz and entered into computer memory. The audio recordings were stored in sound files as a database in full, as well as in separate files of speaker recordings for acoustic analysis.

The total recording amounted to 179 MB. The total duration of the reading recordings of all speakers was 2.2 h (132.5 min) with pauses. The average reading duration with pauses of the whole set of material was 6.1 min (361 s) per speaker. Chinese speakers with high levels of language competence read the text expectedly faster than speakers with medium and low levels. For example, speaker Hu Buqin (KM1B) read the text in 346 ms and speaker Chen Xiaonan (KM3H) in 455 ms.

The average duration of text reading for Russian speakers was 201 ms. At the same time, the female speaker realizes the text slightly faster than the speaker with a male voice. The average duration of 28 Chinese speakers was 377 ms. Thus, Russian speakers read the text twice as fast as Chinese speakers.

[23] S.V. Budazhapova, D.D. Prokopyeva, L.D. Radnaeva, Bo Sun, I.V. Khubrakova Theoretical and applied problems of phonetic design of speech in a foreign language // Kazan: Izd-vo Kazan Science. – 2022. – №5. – C.133-135.

Figure 8 shows the duration of reading a phonetically representative text performed by all native speakers of Chinese and Russian.

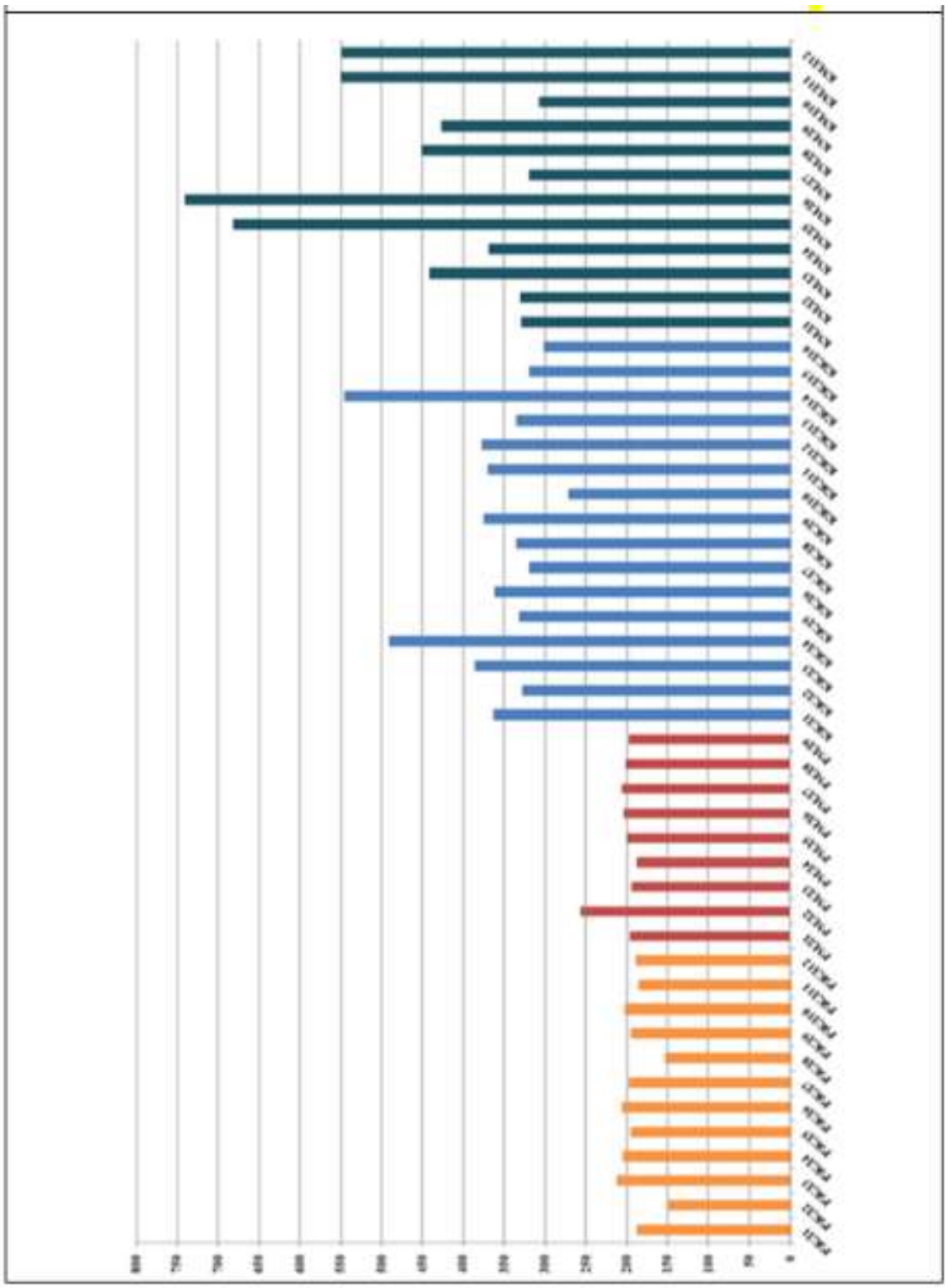

Figure 8 – Duration of reading the experimental text performed by Russian and Chinese speakers in ms. КМ, КЖ – Chinese speakers, men and women; РМ, РЖ – Russian speakers, men and women

Figure 9 shows the data on the duration of the text performed by Chinese speakers with high and low levels of Russian language proficiency at the time of audio recording.

Figure 10 shows the data on the average reading duration of the experimental text performed by Russian and Chinese speakers in comparative terms.

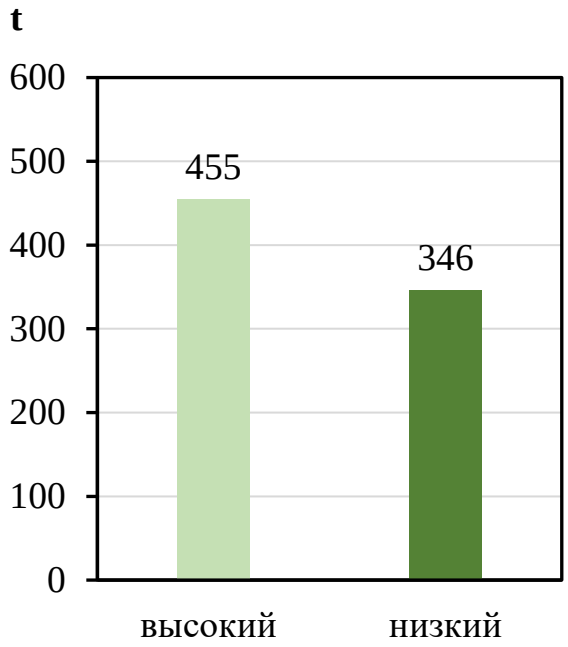

Figure 9 - Text duration in Chinese speakers with high and low levels of language competence in ms.

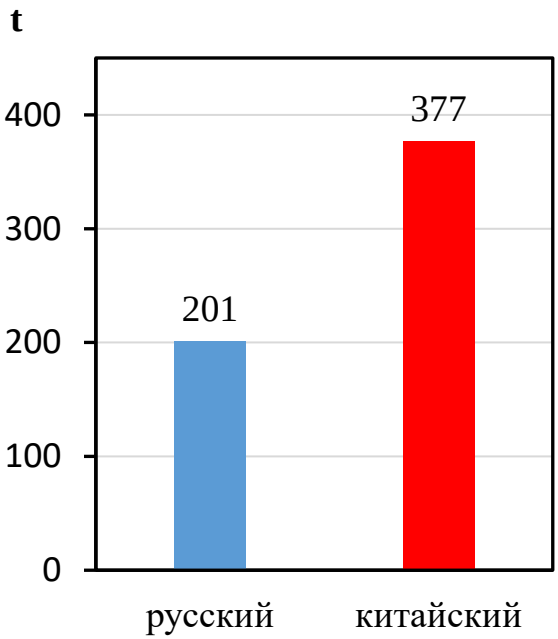

Figure 10 - Average duration of text reading performed by native speakers of Russian and Chinese in ms.

Comparison of data on the average duration of text reading by male and female Russian speakers showed no significant difference and totalled 208 ms. and 194 ms. respectively.

Comparison of data on average text reading duration between male and female Chinese voices showed that the average text reading duration of male Chinese speakers was 382 ms and the average duration of female Chinese speakers was 376 ms. The data correlate with the data for male and female native Russian speakers.

Figures 11 and 12 show the average duration of text reading in the realisations of Russian and Chinese male and female speakers.

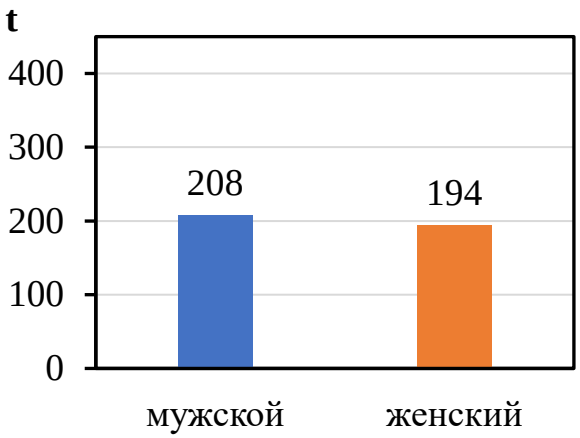

Figure 11 – Average duration of text reading performed by native Russian speakers (male and female voices) in ms.

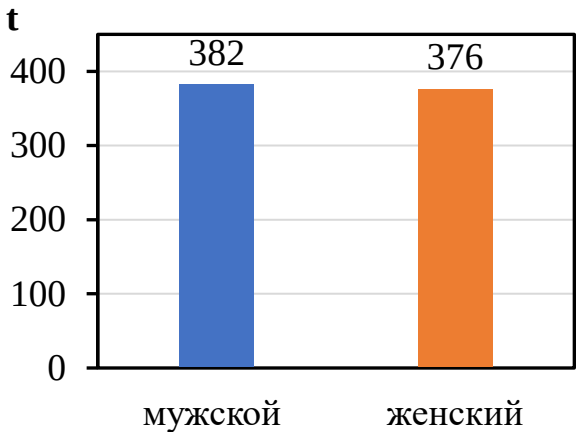

Figure 12 – Average duration of text reading performed by native Chinese speakers (male and female voices) in ms.

All Chinese male and female speakers read text twice as long as Russian male and female speakers. Figures 13 and 14 show the average duration of text reading in the realisation of Russian and Chinese speakers.

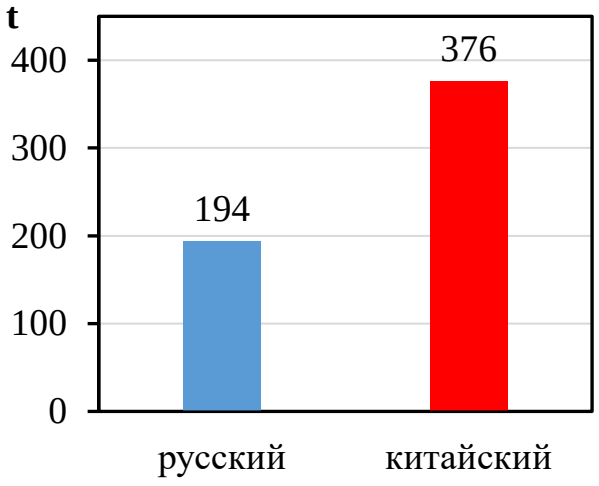

Figure 13 – Average duration of text reading by Russian and Chinese speakers (female voices) in ms.

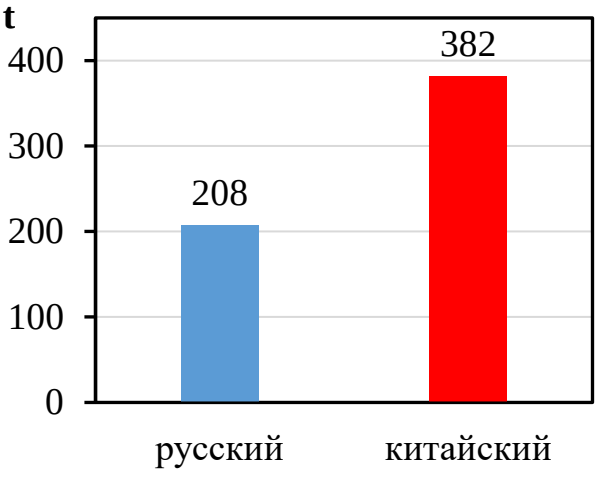

Figure 14 – Average duration of text reading by Russian and Chinese speakers (male voices) in ms.

2.4. Auditory analysis

Recordings of phonetically representative text were listened to and analyzed under the supervision of the research supervisor Dr. L. D. Radnaeva. During listening, errors in the pronunciation of vowels and consonants, as well as consonantal combinations of Russian in the performance of native speakers of Chinese were noted. The frequency of erroneous realizations was recorded during the analysis.

When listening to and analyzing the recordings, we used special basic and additional transcriptional signs from L. R. Zinder's work “General Phonetics” *(Zinder 1979:150)*, as well as symbols adopted from the International Phonetic Association (https://www.internationalphoneticassociation.org) IPA – International Phonetic Alphabet[24]. Figure 15 shows the classification of consonants and vowels of the International Phonetic Alphabet.

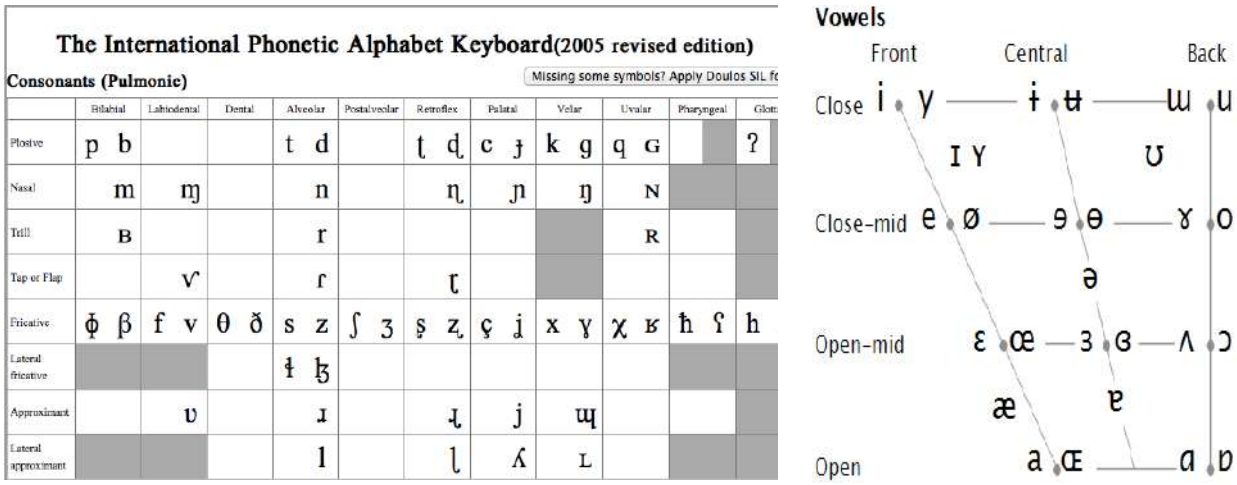

Figure 15 – International phonetic alphabet: consonants and vowels

[24] The International Phonetic Alphabet (IPA) is an ordered set of symbols for recording elements of sounding speech. Compiled by the International Phonetic Association on the basis of the Latin alphabet. The Association was formed in 1886 by a group of English and French language teachers and linguists. In 1888 its members developed an alphabet, which was supposed to record transcriptions of different languages. Since that year, this system has been reformed several times, and in 2005 it contained 107 letters, 52 diacritical marks, and 4 symbols for accent (tone, intonation). There is also an additional set of characters to represent rare speech features. The International Phonetic Alphabet is designed to represent the sounds of all the world's languages. The developers tried to avoid situations when one symbol means two or more sounds.

Table 11 contains the transcription marks used in the auditory analysis work, along with phonetic characteristics and examples of transcription marks.

Table 11 – Additional diacritic transcription marks

№	Characterisation	Example	Example
2	palatalisation	pʲ	pʲatʲ
3	labialisation	tʷ	tʷʊs
4	velarisation	tˠ	tˠak
5	nasalisation	ã	nãs
7	apicality	S̻	S̻un
8	dorsality	S̺	S̺on
9	cacuminality	S̢	S̢on
11	aspiration	pʰ	pʰin
12	voicing	l̬	l̬ uk
13	deafness	l̥	l̥ uk̥
14	implosiveness	t̩	t̩ uk
18	forwardness	u̟	tu̟k
19	backwardness	e̠	ne̠s
20	longitude	u:	ʁu:l
21	brevity	u.	ʁu.l
22	main stress	ˈmɑ	ˈmɑstɘ
23	secondary stress	-ˌnun-	proˌnunciˈation
24	pause within a sentence and a phonetic word		/
25	pause between sentences		//

2.5. Instrumental analysis

Instrumental analysis of modifications of vowel, consonant and consonant combinations of Russian in the realization of native speakers of Chinese was carried out according to the methodology adopted in the Laboratory of Experimental Phonetics of St. Petersburg State University (Stepanova 1988, Skrelin 1999, Bondarko, Verbitskaya, Gordina 2000; Kuznetsov 2007; Evdokimova 2014) using the latest version of the Praat computer program developed by P. Boersma and D. Weenik in 2006 at the Institute of Phonetics, University of Amsterdam, the Netherlands (Praat: www.fon.hum.uva.nl/praat**).** Figure 16 shows a fragment of the Praat start page.

Figure 16 – Start page of the Praat computer programme

The Praat software is designed to analyse, measure, modify and process speech signals and makes it possible to measure spectral (formant) characteristics of audio signals, record duration and intensity, pitch of signals of various lengths, analyse sounds and intonation of any natural language. The Praat programme allows you to process audio files in WAV, AIFF, FLAC and other formats. The interface is presented in English.

The Praat programme consists of two layers: the periphery and the core. The periphery consists mainly of an object window (Praat – object) and a drawing window (Praat – image), which are automatically opened each time the programme is launched. The project window is also the main window that remains open throughout the session and is required for most of its functions.

Figure 17 shows a fragment of the Praat periphery and core window.

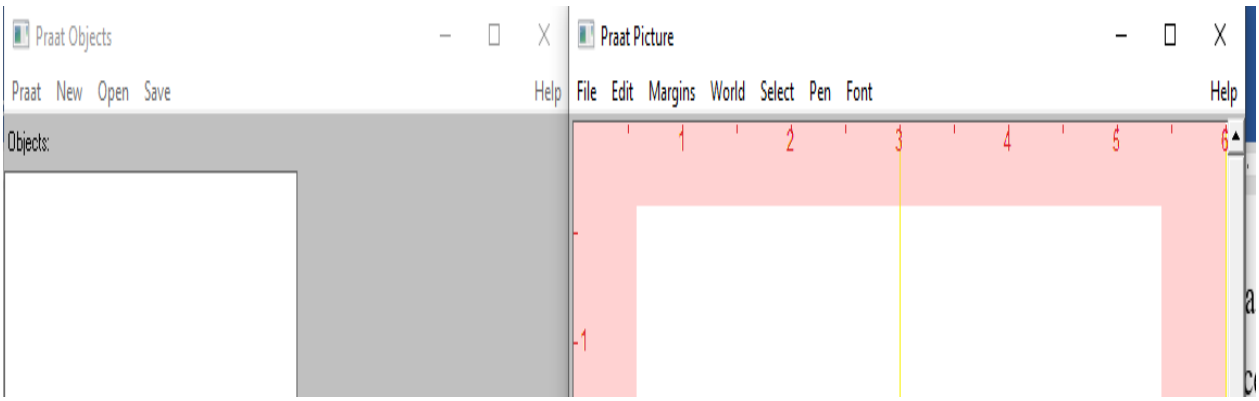

Figure 17 – Window of the two layers of the Praat periphery and core programme

The experimental phonetic text was transcribed using the main window of the Praat programme. Figure 18 shows a fragment of the transcription of sentences from the experimental text: “Был тихий серый вечер”. “Дул ветер, слабый и теплый " in the realization of Chinese speaker 1 (female voice). The sentences and words are presented in orthography and transcription. Level 1 – text; Level 2 – sentences; Level 3 – syntagms; Level 4 – words; Level 5 – syllables; Level 6 – vowels.

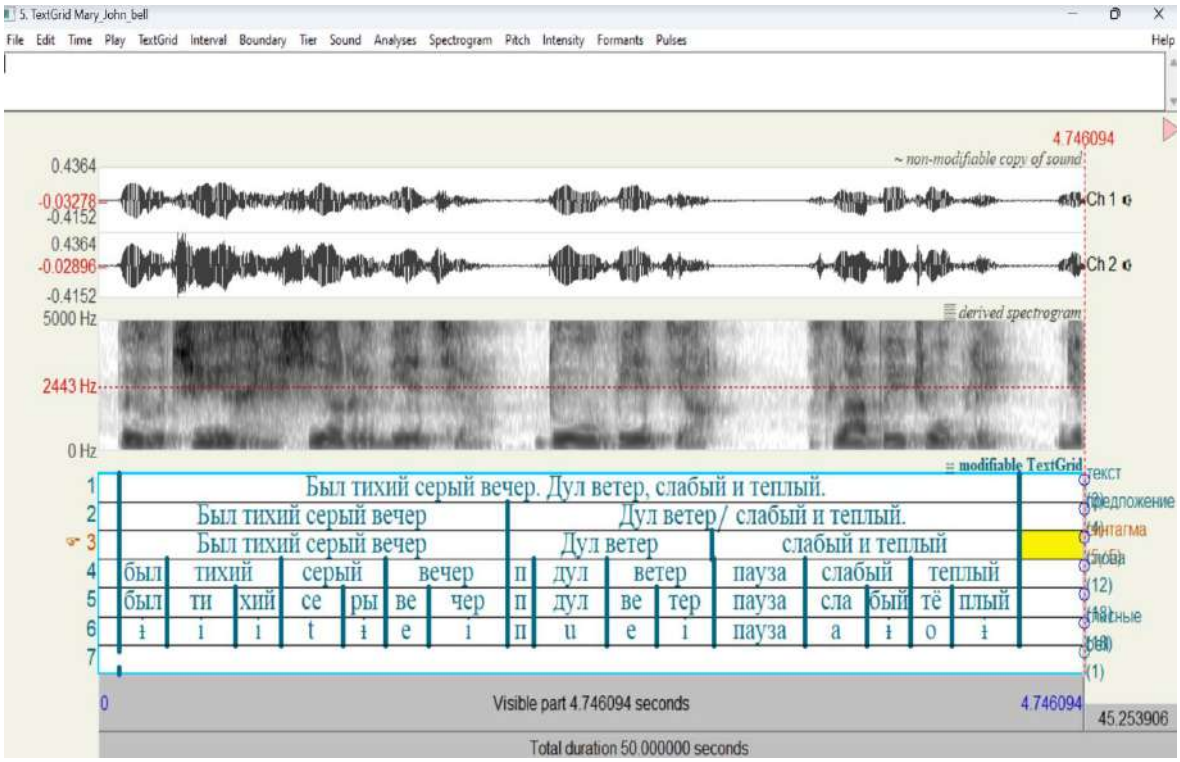

Figure 18 – Praat programme window with transcription of the experimental-phonetic text fragment

2.6. Statistical analysis

The results of experiments were processed using methods of mathematical statistics using the STATISTICA software package. The primary processing of the experimental results was carried out in accordance with GOST R ISO 5725-2-2002 Accuracy (correctness and precision) of methods and results of measurements.

The outliers were rejected by the Smirnov-Grubbs criterion, confidence probability 0.95.

The actual value of the parameter was calculated by the formula:

$X_д = \pm \Delta x$, где $\Delta x = t \times S_x / \sqrt{n}$

where Δx is the confidence interval;

S_x - standard deviation of the mean;

t_t - is the tabulated value of Student's criterion determined at a significance level of 0.05, number of degrees of freedom f = m -1 (m is the number of repetitions).

Data were processed using parametric method with Student's t-test for independent samples. A total of 1962 measurements were performed.

Chapter 2 conclusions

1. A research design was developed.
2. The object of study, a phonetically representative text, has been analyzed.
3. The characteristic of the speakers - participants of the experiment is presented.
4. A description of the procedure of recording the experimental material is prepared.
5. Statistical characterization of the experimental material is given.
6. The methodology of auditory analysis and transcribing is described.
7. A computer programme for processing acoustic data is presented.
8. Information on the methodology of statistical analysis of data is outlined.

CHAPTER 3. ANALYSIS OF RUSSIAN VOWELS AND CONSONANTS MODIFICATIONS IN THE SPEECH OF CHINESE

3.1. Vowel modification

3.1.1. Vowel /ɑ/

The vowel /ɑ/ is the most variable phoneme of the Russian language in terms of realization. The Russian vowel has its Chinese analogue <a>. The modification of a vowel depends on its position in a word or phrase and on its combination with surrounding consonants. The analysis of vowel realizations by native speakers of Chinese demonstrates the variety of variants of vowel /**ɑ**/ pronunciation.

/ɑ/ under stress

The vowel /ɑ/ was analyzed as part of words from the experimental text in the stress position after hard and soft consonants: *сл**а**бый, з**а**пад, стр**а**нах, сажа**а**ла, с**а**мый, м**а**ме, гл**а**вное, н**а**шего, стр**а**нно, м**а**льчик, отвор**а**чивался, тов**а**рищ, показ**а**ли, улыб**а**ться, назыв**а**л, пок**а**зывал, преподав**а**тель, р**а**дио, вырыв**а**лся, д**я**дя, с**я**дь, св**я**зях,* etc. in the realizations of 28 speakers (12 men and 16 women) - native speakers of modern Chinese. There is a total of 667 realizations. Table 12 presents information on the number of realizations of the vowel /ɑ/ by Chinese males and females.

Table 12 – Number of speakers and realizations of allophones of the stressed vowel /ɑ/

Speakers	men	women
	12	16
Realizations	276	391
Total	667	

Registration of frequency components during simultaneous auditory control was performed using the stationary part of the vowel spectrum. The data were recorded in Excel spreadsheets.

The following sections of Chapter 3 are based on the author's articles *Sun Bo (2018: 207-210); Sun Bo (2019: 196-197); Sun Bo (2022: 133-135).*

The results of the spectral analysis of the obtained data demonstrate a wide range of realizations of the percussive vowel /ɑ/ in F1-F2 space on the feature 'vowel row' in the pronunciation of native Chinese speakers. Table 13 shows the frequency characteristics of the stressed vowel /ɑ/ in Hz.

Table 13 – Frequency characteristics of the stressed vowel /ɑ/

Announcers	F1	F2	Announcers	F1	F2
КМ1В	554	1333	КЖ1В	801	1927
КМ2С	573	1144	КЖ2В	842	1642
КМ3Н	687	1125	КЖ3С	890	1532
КМ4Н	611	1276	КЖ4С	931	1789
КМ5В	592	1295	КЖ5С	841	1356
КМ6В	725	1163	КЖ6С	801	1390
КМ7В	536	1030	КЖ7Н	896	1675
КМ8С	561	1213	КЖ8Н	893	1543
КМ9С	557	1289	КЖ9Н	856	1776
КМ10С	571	1131	КЖ10Н	841	1567
КМ11Н	599	1411	КЖ11Н	880	1642
КМ12Н	621	1561	КЖ12Н	831	1754
-	-	-	КЖ13Н	794	1865
-	-	-	КЖ14Н	804	1754
-	-	-	КЖ15Н	831	1987
-	-	-	КЖ16Н	841	1786

Commentary on the table: Designations F1, F2 – frequency characteristics of vowels in Hz; КМ – Chinese male speaker; КЖ – female speaker; В – high, С – medium, Н – low levels of Russian language proficiency. Digit – ordinal number of the speaker.

The scatter of frequency values on the feature "vowel row" varies from 1030 Hz to 1561 Hz in men and from 1356 Hz to 1987 Hz in women. The scatter of vowel frequency characteristics /ɑ/ for the feature "vowel rise" is 531 Hz in males and 631 Hz in females, respectively. Figures 19 and 20 show the frequency characteristics of the stressed vowel /ɑ/ in the word weak in the pronunciation of 16 Chinese and one Russian speaker (male and female).

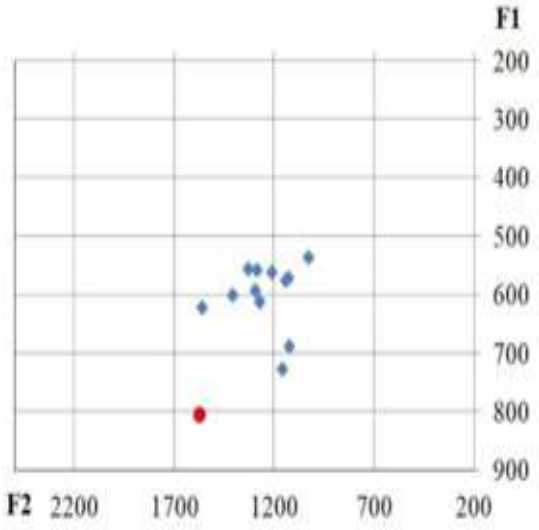

Figure 19 – Frequency characteristics of the stressed vowel /ɑ/ in the realization of RM (scarlet circle) CM (blue cubes) in F1-F2 space in Hz

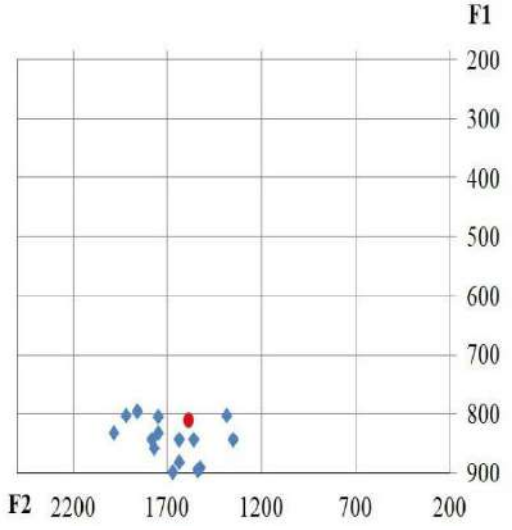

Figure 20 – Frequency characteristics of the percussive vowel /a/ in the realization of RW (scarlet circle) CW (blue cubes) in F1-F2 space in Hz

Commentary to the figures: RM - Russian speaker, male. CM – Chinese speaker, male. F1, F2 – frequency characteristics of vowels in Hz.

The following vowel allophone sound-types were recorded during the analyses /ɑ/:

a	ʌ	ъ	ia	a^{i}	$^{u}ɑ$	$ɑ^{u}$	ã	a̰	ɑ	$^{o}ɛ$	$^{o}ɛ$

In the position after forelingual and lip consonants according to the feature "vowel row", the stressed allophones of the vowel /ɑ/ in male speakers in comparison with females are realized in the sound types of vowels of the front and

middle rows in the words *м*[a]*ма, сп*[a]*ть, улыб*[a]*ться, т*[a]*гда, н*[ã]*до, з*[a]*пад, р*[a]*дио*. In the position after posterior consonants, allophones of the vowel /ɑ/ are also realised by more posterior articulation of the allophones /ɑ̟/ in the words *пок*[ɑ̟]*зывал, отыск*[ɑ̟]*л*. In female speakers the indicators of realizations of allophones of the vowel /ɑ/ are close to the normative realizations of the vowel by native speakers of Russian.

The analysis of realizations of allophones of the vowel /ɑ/ in male speakers differs markedly from the realizations in female speakers. Male speakers are characterized by a more closed type of vowel pronunciation, while female speakers realize the vowel in open allophones.

The variability of the realizations of the vowel /ɑ/ under stress in the position after soft consonants is represented to a lesser extent than after hard consonants, for example, in the words: *д**я**дя, с**я**дь, св**я**зях*. The absence of soft consonants in the Chinese language system prevents the normative realization of the vowel in this position. The vowel is realized in the following sound types:

ⁱa	i	a	ɛ	ⁱɛ	æ

According to the feature "vowel rise", the vowel /a/ in the performance of male speakers is realized in a narrow range from 323 Hz to 475 Hz. The total variation was 152 Hz. The vowel is realized in more closed vowel sound types.

The F1 data of the Russian speaker is 805 Hz. In Chinese male speakers the F1 data ranges from 536 to 725 Hz. This indicates that none of the native Chinese speakers among the participants of the experiment realizes the vowel on the basis of "vowel rise" in normative performance. Only one speaker with a high level of linguistic competence (KM6B) realizes the vowel close to the F1 data of the Russian speaker.

It is noteworthy that the high level of language competence does not affect the normative realization of the vowel according to the feature "vowel rise". Speakers with low and medium levels of Russian language competence realize the vowel /ɑ/ at the same level. Thus, male speakers of Chinese realize vowels in a more closed vowel sound-type /ɑ/ far from the normative pronunciation.

Chinese female speakers realize the analyzed vowel according to the characteristics peculiar to a native speaker of Russian. The F2 of the vowel /ɑ/ in the Russian realization is equal to 1573 Hz. In Chinese speakers, these F2s range from 1030 Hz to 1561 Hz. This indicates that none of the Chinese speakers among the participants of the experiment realizes the vowel according to the feature "vowel row" in the normative performance.

/a/ unstressed

The vowel /ɑ/ was analyzed in the composition of words from the experimental text after hard and soft consonants in the first prefinal position: *м**о**ряк*, *преп**о**даватель*, *п**о**казывал*, *п**о**том*, *т**о**гда*, *п**о**крыто*, *т**а**щил*, *х**о**дила*, *неп**о**нятно*, *скор**о***; in the second and third prefinal positions: *лаб**о**ратории*, *с**о**ставляющих*, *странн**о***, *след**о**вали*, *зол**о**то*, *рядом*, *г**а**зетах*, *п**о**верхностью*, *Шур**о**чка*, *п**о** центральному*, *д**а**леко*, *преп**о**даватель*, *достат**о**чно*, *м**а**лыша*, *килограмм**о**в*, *отворачив**а**лся*, *п**о** проверке*, *показыв**а**л*. A total of 784 realizations.

Table 14 presents information on the number of realizations of the vowel /a/ by male and female speakers.

Table 14 – Number of speakers and realizations of allophones of the unstressed vowel /ɑ/

Speakers	men	women
	12	16
Realizations	336	448
Total	784	

The analysis of realizations showed a wide variety of sound types of the vowel /a/ in the performance of native Chinese speakers. The non-accented position of the vowel /ɑ/ is the most vulnerable position for learning correct pronunciation. All the Chinese speakers made errors in accent, which resulted in distorted pronunciation of words. In place of the unstressed vowel, the stressed allophone of the vowel /ɑ/ was realized and vice versa. Multisyllabic words with the stressed vowel /ɑ/ caused the greatest difficulties in pronunciation. In the course of the analysis the following vowel sound types were recorded /a/:

a	ʌ	ъ	^{i}a	a^{i}	^{u}ɑ	ɑ^{u}	ã	a̰	ɑ	^{o}ɛ	^{o}ɛ

The analysis of the modifications of the unstressed vowel /ɑ/ confirmed the previously predicted errors in the speech of native Chinese speakers, namely the absence of quantitative vowel reduction. 85% of the total number of speakers made the mistake of stressing the vowel /ɑ/ in the unstressed position and pronounced the unstressed vowel /ɑ/ under stress. For example, a male speaker with a high level of language proficiency made accent errors in the words: *мАлыш*, *равЕнство*, *граммАми*, *тучАми товарИщ* and others. (See Application 2; P. 153).

The analysis of realizations of the stressless vowel /ɑ/ in multisyllabic words of the text: *препод*[ɑ]*ватель, следов*[ɑ]*ли, нер*[ɑ]*вномерным, отворачив*[ɑ]*лся прислушив*[ɑ]*лся, р*[ɑ]*ссказыв*[ɑ]*л, мех*[ɑ]*низации, прислушив*[ɑ]*лся, туч*[ɑ]*ми* etc. demonstrates the speakers' aspiration to read words syllabically, with all vowels realized as part of isolated pronounced syllables.

Unstressed vowels in words are not reduced in duration, including the vowel /ɑ/. The average duration of an unstressed syllable with the vowel /ɑ/ is 0.23 ms. in the word *прислушив*[ɑ]*лся* in Chinese speakers in five-syllable words compared to Russian speakers 0.09 ms. The average

duration of an unstressed syllable with the vowel /ɑ/ in the two-syllable word *туч*[ɑ]*ми* in the realization of Chinese speakers was 0.36 ms, in the Russian speaker – 0.04 ms.

The analysis of the vowel /ɑ/ in the word *р*[ɑ]*сск*[ɑ]*зыв*[ɑ]*л* showed the distribution of the duration of /ɑ/ in the pronunciation of Chinese speakers: 0.12 – 0.15 – 0.17 ms. In Russian speakers, the distribution of the duration of /ɑ/ in the analyzed word was 0.07 – 0.16 – 0.06 ms, respectively. at that, the duration of the stressed syllable exceeds the duration of the pre- and post-impact syllables more than twice.

Thus, the unstressed vowel /ɑ/ in the pronunciation of native speakers of Chinese is not subject to quantitative reduction and is realized by duration equally with the stressed vowel.

3.1.2. Vowel /o/

The vowel /o/ was analyzed in words from the experimental text in position after hard and soft consonants. The Russian vowel /o/ has its Chinese analogue <o>. The modification of the vowel depends on its position in the word and phrase and on the combination with the surrounding consonants. The analysis of vowel realizations by native speakers of Chinese demonstrates the variety of variants of vowel /o/ pronunciation in words: *г**о**род, уч**е**ных, разгов**о**ров, х**о**р, нев**о**льно, пойд**е**м, ш**е**л, усл**о**вных, кот**о**рую, п**е**сика, авт**о**бус, ос**о**бенно, т**е**плый, скв**о**зь, ф**о**рмула, чт**о***. The frequency characteristics of the vowel were recorded over the stationary area of the vowel realizations. A total of 448 realizations were analyzed. The obtained data were entered into an Excel spreadsheet.

Table 15 shows the number of realizations of the vowel / o / by male and female Chinese speakers.

Table 15 – Number of speakers and realizations of allophones vowel /o/

Speakers	men	women
	12	16
Realizations	192	256
Total	448	

The following vowel sound-types were recorded during the analyses /o /:

o	ɔ	ʊ	ɛ	ɵ	ɘ	ɞ	^{i}o	ø	ʊo

Table 16 contains the F1, F2 performance of the vowel /o/ as performed by native Chinese speakers.

Table 16 – Frequency characteristics of the vowel /o/ in Hz

Speakers	F1	F2	Speakers	F1	F2
КМ1В	421	929	КЖ1В	468	1178
КМ2С	534	1149	КЖ2В	540	909
КМ3Н	480	838	КЖ3С	479	956
КМ4	481	1167	КЖ4С	493	1079
КМ5В	532	1581	КЖ5С	499	856
КМ6В	705	1202	КЖ6С	430	1084
КМ7В	524	1250	КЖ7Н	511	1220
КМ8С	659	1131	КЖ8Н	503	849
КМ9С	324	957	КЖ9Н	549	1030
КМ10С	521	1261	КЖ10Н	603	1099
КМ11Н	531	1103	КЖ11Н	554	858
КМ12Н	498	1103	КЖ12Н	687	1371
-	-	-	КЖ13Н	384	877
-	-	-	КЖ14Н	498	1078
-	-	-	КЖ15Н	521	1321
-	-	-	КЖ16Н	478	967

Commentary on the table: Designations F1, F2 – frequency characteristics of vowels in Hz; КМ – Chinese speaker – male; КЖ – Chinese speaker – female; В - high, С – medium, Н – low levels of Russian language proficiency. The digit is the speaker's ordinal number. F1, F2 vowel indices were determined by the stationary part of the vowel spectral pattern.

The frequency characteristics of F1 and F2 of the vowel in the realizations of male Chinese speakers and female Chinese speakers show a wide range of realizations of the vowel /o/ in terms of "vowel row" and "vowel rise".

The variation of values for "vowel rise" varies from 321 Hz to 705 Hz in 12 male speakers; the average F1 of the vowel /o/ in Russian speakers is 463 Hz, which corresponds to a vowel of medium rise. The total variation of F1 in Chinese male speakers is 386 Hz, indicating a significant variation of vowel realization on the basis of "vowel rise". The analysis of F1 indicators in Chinese male speakers in terms of the level of Russian language proficiency has shown that male speakers КМ1В, КМ5В, КМ7В, КМ3Н, КМ12Н with high and low levels of Russian language proficiency have normative realizations of the vowel on the "vowel rise" feature.

Analysis of the realizations of the vowel /o/ by 16 female Chinese speakers varies from 384 Hz to 687 Hz. Female speakers realize the vowel in a more compact range of frequency space. The realizations of the vowel /o/ by the speakers КЖ1В, КЖ3С, КЖ4С, КЖ5С, КЖ6С, КЖ16Н correspond to the normative realization on the feature "vowel rise".

The analysis of the vowel allophone realizations for "vowel row" shows a range of 838 Hz to 1581 Hz for male Chinese speakers and 849 Hz to 1371 Hz for female speakers. The mean performances in Chinese speakers were 1138 Hz and

1045 Hz in male and female speakers, respectively. At the same time, the realizations of the Russian speaker are 1150 Hz. The vowel realizations of Chinese female speakers КЖ1В, КЖ6С, КЖ7Н, КЖ10, КЖ14Н with high, medium and low levels of Russian language proficiency correspond to the normative realization of the vowel on the "vowel series" feature and are within the acceptable normative pronunciation on the "vowel series" feature.

Figures 21 and 22 show the frequency characteristics of the vowel /o/ in F1-F2 space in Hz in the realizations of male and female speakers of Chinese and Russian.

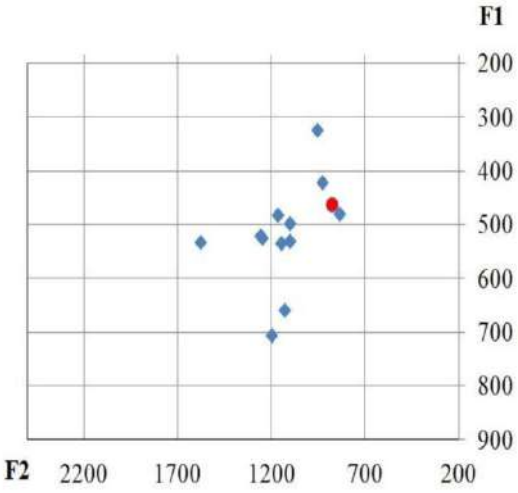

Figure 21 – Frequency characteristics of vowel /o/ in РМ and (scarlet circle) КМ (blue cubes) realizations in F1-F2 space in Hz

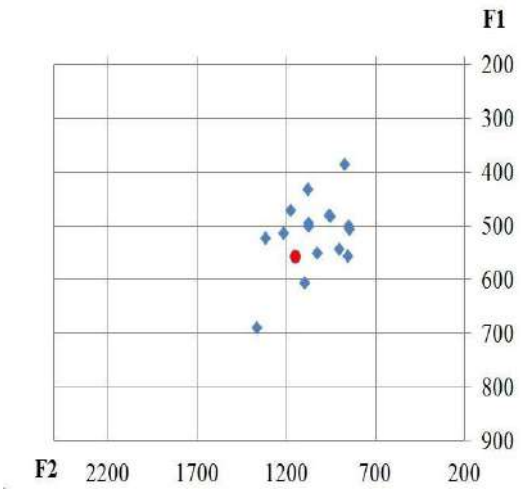

Figure 22 – Frequency characteristics of the vowel /o/ in РЖ and (scarlet circle) КЖ (blue cubes) realizations in F1-F2 space in Hz

Commentary to figures: Designations РМ - Russian male speaker. КМ – Chinese male speaker. РЖ – Russian female speaker, КЖ – Chinese female speaker. F1, F2 – frequency characteristics of vowels in Hz.

The analysis of modifications of the vowel /o/ confirmed the previously predicted errors in the speech of native speakers of Chinese, namely the absence of quantitative vowel reduction. 85% of the total number of speakers made an erroneous realization of the vowel /o/. For example, Chinese speakers erroneously realized the vowel /o/ in the words: *золотО, формУлы, розОвый, голУби, позволИть, сторонУ,* etc. (See Application 2; P. 156-158).

The announcers read multi-syllable words syllable by syllable, trying to put the stress on each syllable of the word. Thus, vowels in syllables are realized as in isolated pronounced syllables, for example, in the word *золото* all vowels /o/ are realized qualitatively and quantitatively the same.

The variability of realizations of the vowel /o/ in the position after soft consonants is represented to a lesser extent than after hard consonants, e.g. in the words: *теплый, пойдем, песика, ученых*; in the position before soft consonants, e.g. in the text words: *сквозь, невольно*. The absence of soft consonants in the Chinese language system prevents the normative realization of the vowel in these positions. The vowel is realized in the following sound types:

^{i}o	ɑu	ɘu	ʊ

3.1.3. Vowel /u/

The vowel /u/ was analyzed in words from the experimental text in the stress position after hard and soft consonants. The Russian vowel /u/ has its Chinese analogue <u>. The modification of the vowel depends on its position in the word and phrase and on the combination with the surrounding consonants. The analysis of vowel realizations by native speakers of Chinese demonstrates the variety of variants of vowel /u/ pronunciation in the words: blowing, best, other, young, rays, page, central, next, Frequency characteristics of the vowel were recorded by the stationary area of vowel realization.

Table 17 presents information on the number of realizations of the vowel /u/ by male and female Chinese speakers.

Table 17 – Number of speakers and realizations of allophones vowel /u/

Speakers	men	women
	12	16
Realizations	96	128
Total	224	

The following vowel sound-types were recorded during the analyses /u/:

o	ɔ	ʊ	ɛ	ɵ	ɘ	ɞ	u	ø	ᵘo

Traditionally, the Russian vowel /u/ is realized in accented and unaccented positions. Non-accented /u/ is characterized by a shorter duration, is pronounced with less intensity and is subject to reduction. The accented vowel /u/ is pronounced distinctly and is not reduced.

Table 18 shows the F1, F2 frequency characteristics of the stressed vowel /u/ in the realizations of native Chinese speakers.

Table 18 – Frequency characteristics of the stressed vowel /u/

Announcers	F1	F2	Announcers	F1	F2
КМ1В	327	972	КЖ1В	450	1528
КМ2С	346	934	КЖ2В	471	1032
КМ3Н	346	1049	КЖ3С	516	890
КМ4Н	422	858	КЖ4С	439	1311
КМ5В	308	1030	КЖ5С	422	1432
КМ6В	365	801	КЖ6С	422	934
КМ7В	422	1504	КЖ7Н	460	915
КМ8С	378	998	КЖ8Н	410	987
КМ9С	367	1024	КЖ9Н	453	1241

КМ10С	345	898	КЖ10Н	478	941
КМ11Н	321	976	КЖ11Н	478	1101
КМ12Н	432	981	КЖ12Н	589	1409
-	-	-	КЖ13Н	476	934
-	-	-	КЖ14Н	467	954
-	-	-	КЖ15Н	476	1321
-	-	-	КЖ16Н	567	1361

Commentary on the table: Designations F1, F2 – frequency characteristics of vowels in Hz; КМ – Chinese speaker – male; КЖ – Chinese speaker – female; В – high, С – medium, Н – low levels of Russian language proficiency. Digit – ordinal number of the speaker.

Analyses of the vowel realizations of /u/ for the feature "vowel rise" showed a range of values from 308 Hz to 432 Hz in male Chinese speakers and from 422 Hz to 589 Hz in female Chinese speakers. The mean values were 364 Hz and 473 Hz, respectively. It is noteworthy that the F1 values of Russian male and female speakers are 374 Hz and 366 Hz, respectively. Thus, female Chinese speakers realize the allophones of the vowel /u/ in a more open variant than male Chinese speakers and native speakers of Russian. The realization of /u/ allophones by Chinese male speakers on the basis of "vowel rise" is within the limits of normative pronunciation.

Figures 23 and 24 show the frequency characteristics of the vowel /u/ in the F1-F2 space in Hz in the realizations of male and female speakers of Chinese and Russian languages.

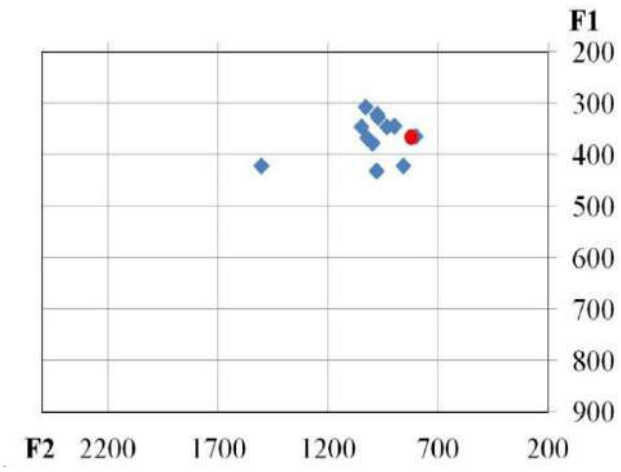

Figure 23 – Frequency characteristics of the stressed vowel /u/ in the RM and (scarlet circle) CM (blue cubes) realizations in F1-F2 space in Hz

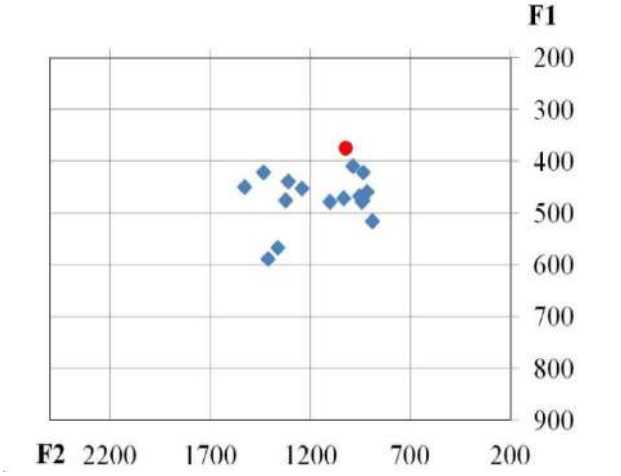

Figure 24 – Frequency characteristics of the stressed vowel /u/ in the RF and (scarlet circle) CF (blue cubes) realizations in F1-F2 space in Hz

Commentary on figures: Designations RM – Russian male speaker. CM – Chinese male speaker. RF – Russian female speaker. CF – Chinese speaker female. F1, F2 of vowel /u/ in Hz.

The analysis of the realizations of the vowel allophones /u/ by the feature "vowel row" showed a scatter of 801 Hz to 1504 Hz in male Chinese speakers and 890 Hz to 1528 Hz in female Chinese speakers. The mean scores were 1002 Hz and 1143 Hz, respectively. The performance of Russian male and female speakers is 822 Hz and 1022 Hz, respectively. Thus, native speakers of Chinese pronounce allophones of the vowel /u/ in a more advanced forward variant on the "vowel row" feature compared to the normative realization.

The analysis of modifications of the vowel /u/ confirmed the previously predicted lack of quantitative reduction of the unstressed vowel /u/. Vowels in syllables are realized as in isolated pronounced syllables. Announcers read multisyllabic words *центральномУ, экспериментУ* by syllables, trying to put

stress on each syllable of the word and, as a consequence, all vowels are realized with the same duration. Also, the erroneous stress led to the distortion of the vowel /u/ and the following words in general: *лУчи, формУлы, голУби, сторонУ, лампочкУ, дУша, шУметь, дрУгим, задумАвшись*, etc. (See Application 3; P. 156-158).

3.1.4. Vowel /i/

The vowel /i/ was analyzed in words from the experimental text in the stress position after soft consonants. Русский гласный /i/ имеет свой китайский аналог <i>. Модификация гласного зависит от его позиции в слове и фразе и от комбинации с окружающими его согласными. Анализ реализаций гласного носителями китайского языка демонстрирует разнообразие вариантов произнесения гласного /i/ в словах и сочетаниях слов: *след**и**ли, **и**сполнял, тащ**и**л, **и** судьбе, д**е**ржа, сопрот**и**влен**ии**, пр**е**подаватель, в с**е**кунду, механ**и**зац**ии**, **и**зуч**и**ть, куп**и**л, б**е**да, сч**и**тает, Тр**е**вог**и**н, люб**и**т, ответ**и**л*. The frequency characteristics of the vowel were recorded by stationary vowel realisation area.

Table 19 presents information on the number of realizations of the vowel /i/ by male and female Chinese speakers.

Table 19 – Number of speakers and realizations of vowel allophones /i/

Speakers	men	women
	12	16
Realizations	252	336
Total	578	

The following vowel sound-types were recorded during the analyses /**i/:**

i	ɪ	ɘ	i̞	ʏ	e

Table 20 contains the frequency indices F1, F2 of the stressed vowel /i/ in the realisations of native Chinese speakers.

Table 20 – Frequency characteristics of vowel allophones /i/

Speakers	F1	F2	Speakers	F1	F2
КМ1В	286	2184	КЖ1В	270	2530
КМ2С	399	2175	КЖ2В	384	2682
КМ3Н	344	1971	КЖ3С	498	2815
КМ4Н	306	2122	КЖ4С	498	2663
КМ5В	307	2051	КЖ5С	479	3156
КМ6В	383	2250	КЖ6С	477	2782
КМ7В	307	2032	КЖ7Н	345	2544
КМ8С	304	2101	КЖ8Н	498	2492
КМ9С	336	2291	КЖ9Н	346	2720
КМ10С	311	2471	КЖ10Н	517	2264
КМ11Н	308	2186	КЖ11Н	403	2625
КМ12Н	293	2291	КЖ12Н	327	1011
-	-	-	КЖ13Н	327	2682
-	-	-	КЖ14Н	308	2226
-	-	-	КЖ15Н	289	2188
-	-	-	КЖ16Н	346	2739

Commentary on the table: Designations F1, F2 - frequency characteristics of vowels in Hz; CM – Chinese speaker - male; CW – Chinese speaker - female; H – high, S – medium, L – low levels of Russian language proficiency. Digit – ordinal number of the speaker.

The analysis of vowel /i/ realizations for the vowel rise feature showed a range of F1 values from 308 Hz to 432 Hz in male Chinese speakers and from 422 Hz to 589 Hz in female Chinese speakers. The mean F1 scores were 364 Hz and 473 Hz, respectively. The F1 values of male and female Russian speakers are 324 Hz and 360 Hz, respectively.

Thus, native speakers of Chinese realize the vowel /i/ on the basis of "vowel rise" within the normative realization.

The analysis of realizations of allophones of the vowel /i/ by the feature "vowel row" showed a scatter in male speakers from 2032 Hz to 2471 Hz and from 1011 Hz to 2815 Hz in female speakers. The mean F2 values were 2177 Hz and 2507 Hz, respectively. The F2 values in Russian speakers correspond to 2199 Hz in male and 2161 Hz in female speakers. The realization of allophones /i/ in Chinese male speakers is within the normative pronunciation. Female Chinese speakers realize allophones of the vowel /i/ in vowel sound-types significantly advanced (by 400 Hz on average) on the "vowel row" feature.

Figures 25 and 26 show the frequency characteristics of the vowel /i/ in F1-F2 space in Hz in the realizations of male and female speakers of Chinese and Russian languages.

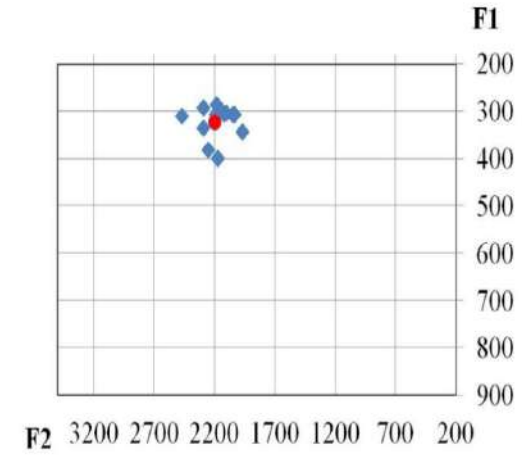

Figure 25 – Frequency characteristics of the stressed vowel /i/ in PM and (scarlet circle) КМ (blue cubes) realizations in F1-F2 space in Hz

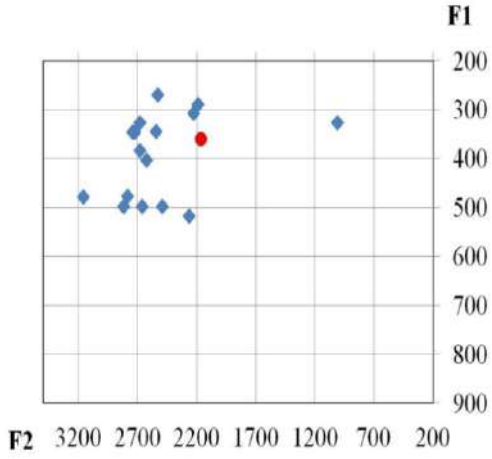

Figure 26 – Frequency characteristics of the stressed vowel /i/ in the realization of РЖ and (scarlet circle) КЖ (blue cubes) in F1-F2 space in Hz

Traditionally, the Russian vowel /i/ is realized in stressed and unstressed positions. The accented vowel /i/ is pronounced distinctly and is not reduced.

The non-accented /i/ is characterized by a shorter duration, is pronounced with less intensity and is subject to reduction. The vowel /i/ in the pre-pronoun and post-pronoun positions in the words [i]*сполнял, сч*[i]*тает, Тревог*[i]*н, люб*[i]*т* undergoes quantitative reduction. The average duration of /i/ in the unstressed position is up to 0.02 ms in the pronunciation of a native speaker of Russian. Analysis of the realizations of the unstressed vowel /i/ in the pronunciation of native speakers of Chinese demonstrates the results indicating the absence or minimal reduction of the vowel. The average duration of the unstressed vowel is 0.12 ms in Russian speakers, which is 0. 10 more than in Chinese speakers. Such indicators are characteristic of Chinese speakers with medium and low levels of Russian language proficiency. No differences were observed between female and male speakers.

3.1.5. Vowel /ɨ/

The vowel /ɨ/ is analyzed in words from the experimental text in the stressed position after hard consonants. The Russian vowel /ɨ/ has no Chinese analogue. Often in place of Russian /ɨ/ the Chinese diphthong /ɘi / is realized, which exists in Mandarin and its dialects. The modification of a vowel depends on its position in the word and phrase and on its combination with the surrounding consonants. As discussed earlier (Chapter 1) Russian /ɨ/ is often characterized as a heterogeneous vowel [ɨ^{i}]. The articulation of /ɨ/ begins with a non-front vowel and ends with a front vowel. The non-front articulation is characteristic only for the beginning of the vowel.

The analysis of vowel realizations by native speakers of Chinese confirmed the prediction of pronunciation errors and demonstrated the variety of pronunciation variants of the vowel /ɨ/, including heterogeneous realisations of the vowel in the stressed position: *б**ы**л, с**ы**на, м**ы**, прив**ы**кли, т**ы***; in the non-impacted position: *музы**к**у, разглядывал, выр**ы**вался, прислушивался, непонятным, бывавший,*

*неравномерн**ы**м, обыкновенн**ы**х*. Table 21 presents information on the number of realizations of the vowel /ɨ/ by male and female Chinese speakers.

Table 21 – Number of speakers and realisations of vowel allophones /ɨ/

Speakers	men	women
	12	16
Realizations	156	208
Total	364	

The following vowel sound-types were recorded during the analyses /ɨ/**:**

ɨ	ɪ	ɘ	i	ʏ	e	ɘi	ɨ^{i}

Registration of frequency components was carried out for the stationary segment of the vowel. The obtained data were recorded in the table.

It should be noted that the duration of the vowel /ɨ/ in the unaccented position is similar to its realization in the accented position. As with other vowels, there is a lack of quantitative reduction of the vowel, caused by the speakers' desire to pronounce each syllable as a stressed syllable of the word.

The analysis of the realizations of the vowel /ɨ/ on the feature "vowel rise" showed a scatter of 323 Hz to 475 Hz in Chinese male speakers. The scatter of F1 scores in female Chinese speakers ranked from 381 Hz to 517 Hz. The mean values were 377 Hz and 451 Hz, respectively. The F1 scores of male and female Russian speakers are 393 Hz and 429 Hz respectively. Thus, native speakers of Chinese realise the vowel /ɨ/ by the feature "vowel rise" within the normative realization.

The analysis of the realizations of the vowel /ɨ/ on the feature "vowel row" showed a scatter of values from 1027 Hz to 2291 Hz in male Chinese speakers and from 1441 Hz to 2871 Hz in female Chinese speakers. The mean values were 1407

Hz and 2060 Hz, respectively. The F2 values of male and female Russian speakers were 1396 Hz and 1515 Hz, respectively. Thus, native speakers of Chinese realize the vowel /ɨ/ by the feature "vowel row" in a wide range beyond the normative realization. This is especially characteristic of female Chinese speakers.

Table 22 contains the frequency indicators of F1, F2 characteristics of the stressed vowel /ɨ/ in the realizations of native speakers of Chinese.

Table 22 – Frequency characteristics of vowel allophones /ɨ/

Speakers	F1	F2	Speakers	F1	F2
КМ1В	323	1058	КЖ1В	384	2125
КМ2С	401	1027	КЖ2В	421	2250
КМ3Н	475	1136	КЖ3С	498	2871
КМ4Н	363	1763	КЖ4С	498	2397
КМ5В	325	1706	КЖ5С	460	2815
КМ6В	420	1786	КЖ6С	381	1441
КМ7В	364	1274	КЖ7Н	496	1823
КМ8С	367	1233	КЖ8Н	422	1542
КМ9С	353	1024	КЖ9Н	460	2112
КМ10С	399	1326	КЖ10Н	517	2150
КМ11Н	372	1266	КЖ11Н	479	2131
КМ12Н	371	2291	КЖ12Н	479	1846
-	-	-	КЖ13Н	422	2131
-	-	-	КЖ14Н	422	2131
-	-	-	КЖ15Н	384	1751
-	-	-	КЖ16Н	498	1447

Commentary on the table: Designations F1, F2 – frequency characteristics of vowels in Hz; КМ – Chinese speaker - male; КЖ- Chinese speaker – female; В – high, С – medium, Н – low levels of Russian language proficiency. Digit – ordinal number of the speaker.

Figures 27 and 28 show the frequency characteristics of the vowel /ɨ/ in F1-F2 space in Hz in the realizations of male and female speakers of Chinese and Russian languages.

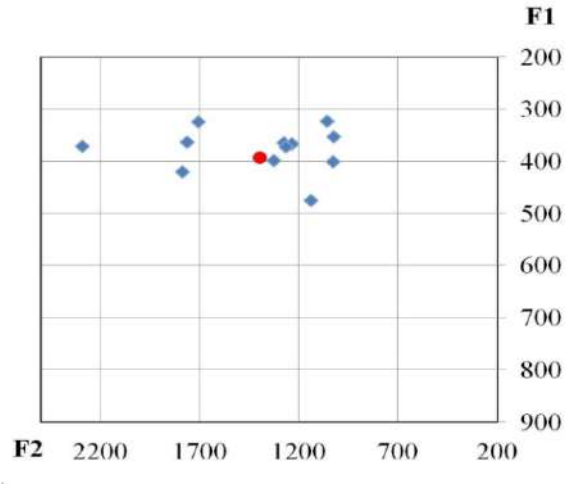

Figure 27 – Frequency characteristics of the stressed vowel /ɨ/ in PM and (scarlet coloured circle) KM (blue cubes) realizations in F1-F2 space in Hz

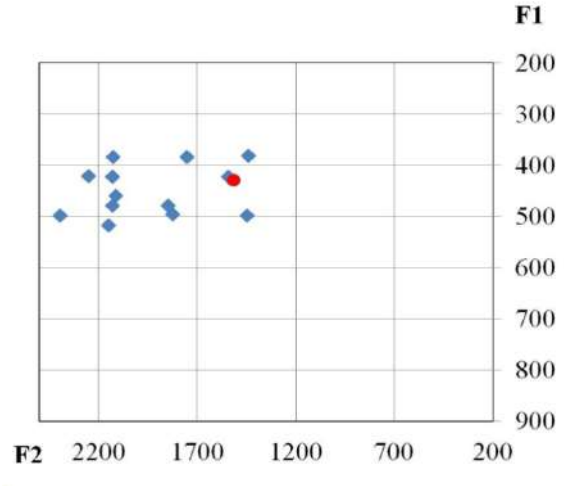

Figure 28 – Frequency characteristics of the stressed vowel /ɨ/ in the РЖ and (scarlet circle) КЖ (blue cubes) realizations in F1-F2 space in Hz

Commentary on figures: PM – Russian male speaker. KM – Chinese male speaker. F1, F2 – frequency characteristics of vowels in Hz.

3.1.6. Vowel /e/

The vowel /e/ was analyzed in words from the experimental text in stress position after hard and soft consonants. The Russian vowel /e/ has its Chinese analogue <e>. The modification of the vowel depends on its position in the word and phrase and on the combination with the surrounding consonants. The analysis of vowel realizations by native speakers of Chinese demonstrates the variety of variants of vowel /e/ pronunciation in words: ***э**то*, *соотнош**е**ние*, *с**е**л*, *о п**е**рвых*, *неравном**е**рном*, *знач**е**ние*, *сид**е**нье*, *пов**е**рхностью*, *шум**е**ть*, *теп**е**рь*, *себ**е***, *п**е**рвой*. Table 23 presents information on the number of realizations of the vowel /e/ by male and female Chinese speakers.

Table 23 – Number of speakers and realizations of vowel allophones / **e** /

Speakers	men	women
	12	16
Realizations	144	192
Total	336	

The following vowel sound-types were recorded during the analyses / **e** /**:**

e	ɪ	ɘ	i	ɛ	ɨ	ø

Table 24 contains indicators of frequency characteristics F1, F2 of the stressed vowel /e/ in the realizations of native Chinese speakers.

Table 24 – Frequency characteristics of vowel allophones /e/

Speakers	F1	F2	Speakers	F1	F2
КМ1В	347	1963	КЖ1В	583	2278
КМ2С	533	1498	КЖ2В	579	1973
КМ3Н	578	1443	КЖ3С	756	2424
КМ4Н	500	1577	КЖ4С	786	1827
КМ5В	472	1632	КЖ5С	697	1869
КМ6В	682	1619	КЖ6С	673	2118
КМ7В	361	1962	КЖ7Н	544	2193
КМ8С	686	1348	КЖ8Н	648	1806
КМ9С	488	1678	КЖ9Н	670	1851
КМ10С	531	1890	КЖ10Н	687	2033
КМ11Н	531	1954	КЖ11Н	706	2264
КМ12Н	537	2011	КЖ12Н	896	1979
-	-	-	КЖ13Н	801	1903
-	-	-	КЖ14Н	674	2522
-	-	-	КЖ15Н	578	2324
-	-	-	КЖ16Н	743	2422

Commentary on the table: Designations F1, F2 - frequency characteristics of vowels in Hz; КМ – Chinese speaker – male; КЖ – Chinese speaker – female; В – high, С – medium, Н – low levels of Russian language proficiency. Digit – ordinal number of the speake*r*.

The frequency characteristics of the vowel were recorded for the stationary segment of the vowel realization.

Analysis of vowel /e/ realizations for vowel rise showed a range from 347 Hz to 686 Hz in male Chinese speakers and from 544 Hz to 802 Hz in female Chinese speakers. The mean values were 520 Hz and 688 Hz, respectively. The F1 values in male and female Russian speakers were 418 Hz and 672 Hz, respectively. Thus, both male and female speakers of Chinese realize the vowel /e/ on the basis of "vowel rise" in a wide range outside the normative realization. The figures demonstrate the recorded indicators.

Figures 29 and 30 show the frequency characteristics of the vowel /ɨ/ in F1-F2 space in Hz in the realizations of male and female speakers of Chinese and Russian languages.

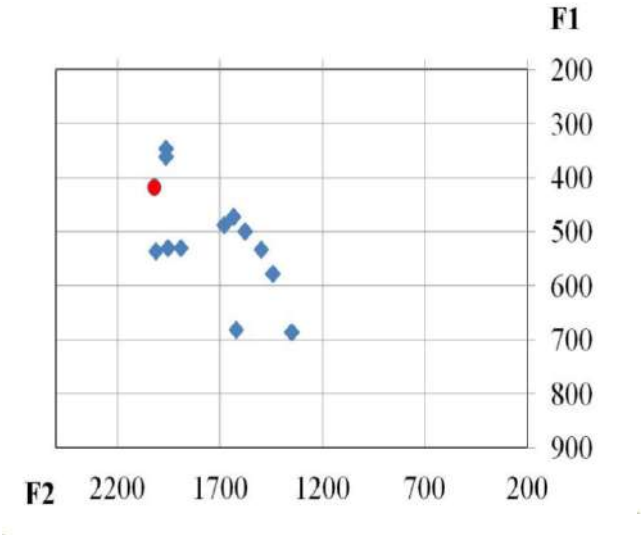

Figure 29 – Frequency characteristics of the stressed vowel /e/ in PM and (scarlet circle) KM (blue cubes) realizations in F1-F2 space in Hz

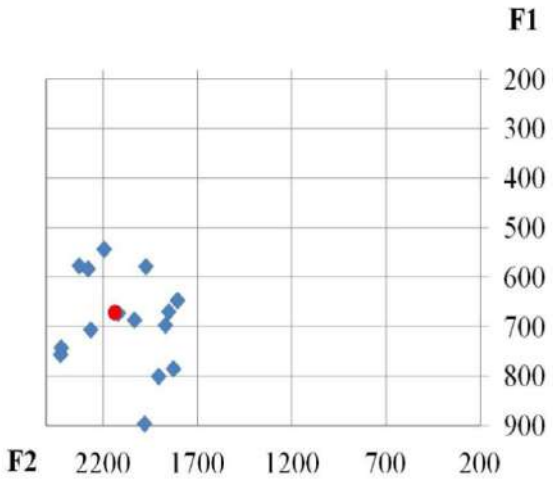

Figure 30 – Frequency characteristics of the stressed vowel /e/ in the РЖ and (scarlet circle) КЖ (blue cubes) realizations in F1-F2 space in Hz

Commentary to figures: Designations PM – Russian male speaker. KM – Chinese male speaker. F1, F2 – frequency characteristics of vowels in Hz.

The analysis of the realizations of the vowel /e/ on the "vowel row" feature showed a range of values from 1348 Hz to 2011 Hz in male Chinese speakers and from 1806 Hz to 2533 Hz in female Chinese speakers. The mean values were 1714 Hz and 2111 Hz, respectively. The F2 values in Russian male and female speakers were 2021 Hz and 2135 Hz, respectively. Thus, both male and female speakers of Chinese realize the vowel /e/ on the basis of "vowel row" in a wide range outside the normative realization.

The frequency characteristics of Russian vowel realizations /ɑ/, /e/, /i/, /ɨ/, /u/, /o/ are demonstrated in a single F1-F2 space. Figure 31 shows the summarized vowel performance of male and female native Chinese speakers.

3.1.7. Vowel modification in F1-F2 space

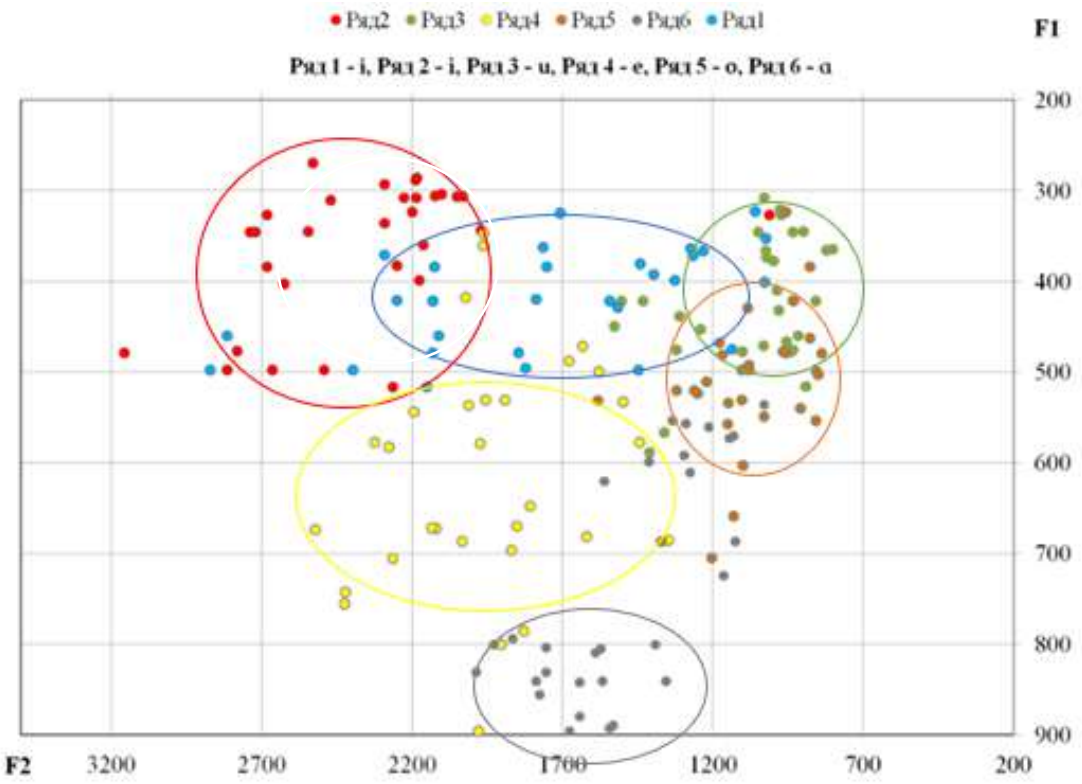

Figure 31 – Allophones of Russian vowels /ɑ/, /e/, /i/, /ɨ/, /u/, /o/ in F1-F2 space. On the abscissa axis – F2. On the ordinate axis – F1.

Table 25 presents the frequency characteristics of vowel allophones /**ɑ**/, /**e**/, /i/, /**ɨ**/, /**u**/, /**o**/.

Table 25 - F1, F2 indicators of Russian vowels in Chinese realisations

	ɨ		**i**		**e**		**o**		**ɑ**		**u**	
	F1	**F2**	**F1**	**F2**	**F1**	**F2**	**F1**	**F2**	**F1**	**F2**	**F1**	**F2**
КМ1В	323	1058	366	2184	347	1963	421	929	554	1333	327	972
КМ2С	401	1027	399	2175	533	1498	534	1149	573	1144	346	934
КМ3Н	475	1136	344	1971	578	1443	480	838	687	1125	346	1049
КМ4Н	363	1763	306	2122	500	1577	481	1167	611	1276	422	858
КМ5В	325	1706	307	2051	472	1632	532	1581	592	1295	308	1030
КМ6В	420	1786	383	2250	682	1619	705	1202	725	1163	365	801
КМ7В	364	1274	307	2032	361	1962	524	1250	536	1030	422	1504
КМ8С	367	1233	304	2101	686	1348	659	1131	561	1213	378	998
КМ9С	353	1024	336	2291	488	1678	324	957	557	1289	367	1024
КМ10С	399	1326	311	2471	531	1890	521	1261	571	1131	345	898
КМ11Н	372	1266	308	2186	531	1954	531	1103	599	1411	321	976
КМ12Н	371	2291	293	2291	537	2011	498	1103	621	1561	432	981
КЖ1В	384	2125	270	2530	583	2278	468	1178	801	1927	450	1528
КЖ2В	421	2250	384	2682	579	1973	540	909	842	1642	471	1032
КЖ3С	498	2871	498	2815	756	2424	479	956	890	1532	516	890
КЖ4С	498	2397	498	2663	786	1827	493	1079	931	1789	439	1311
КЖ5С	460	2815	479	3156	697	1869	499	856	841	1356	422	1432
КЖ6С	381	1441	477	2782	673	2118	430	1084	801	1390	422	934
КЖ7Н	496	1823	345	2544	544	2193	511	1220	896	1675	460	915
КЖ8Н	422	1542	498	2492	648	1806	503	849	893	1543	410	987
КЖ9Н	460	2112	346	2720	670	1851	549	1030	856	1776	453	1241
КЖ10Н	517	2150	517	2264	687	2033	603	1099	841	1567	478	941
КЖ11Н	479	2131	403	2625	706	2264	554	858	880	1642	478	1101
КЖ12Н	479	1846	327	1011	896	1979	687	1371	831	1754	589	1409
КЖ13Н	422	2131	327	2682	801	1903	384	877	794	1865	476	934
КЖ14Н	422	2131	308	2226	674	2522	498	1078	804	1754	467	954
КЖ15Н	384	1751	289	2188	578	2324	521	1321	831	1987	476	1321
КЖ16Н	498	1447	346	2739	743	2422	478	967	841	1786	567	1361

Commentary on the table: КМ – Chinese speaker, male, КЖ – Chinese speaker, female. B - high, C - average, H – low level of Russian language proficiency. Digit – number of the speaker.

Frequency characteristics of F1-F2 vowels are presented in Figure 32 - males; in Figure 33 - females.

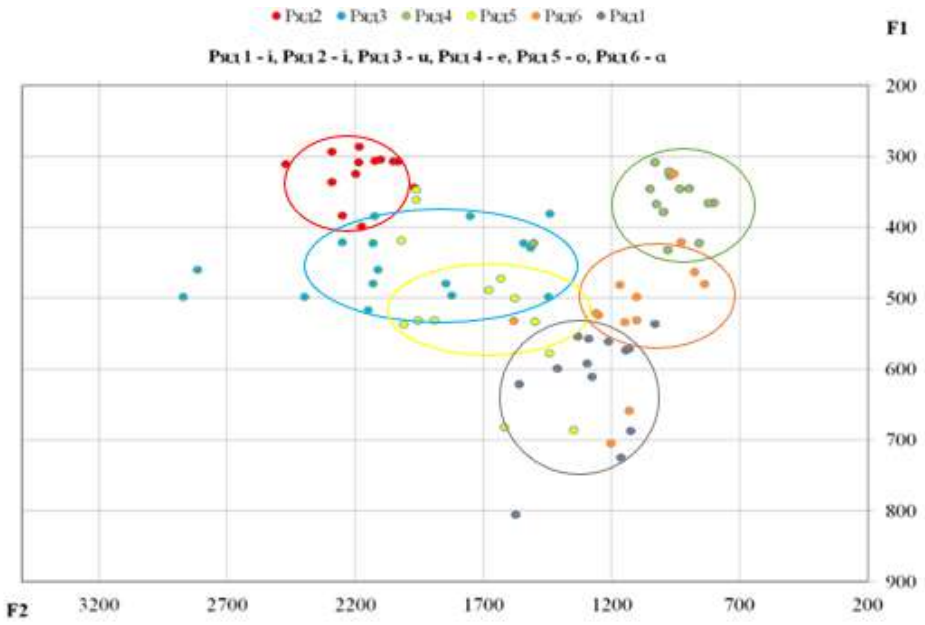

Figure 32 – Frequency characteristics of Russian vowels in the realization of 12 male speakers. On the ordinate axis – F1; on the abscissa axis – F2 in Hz.

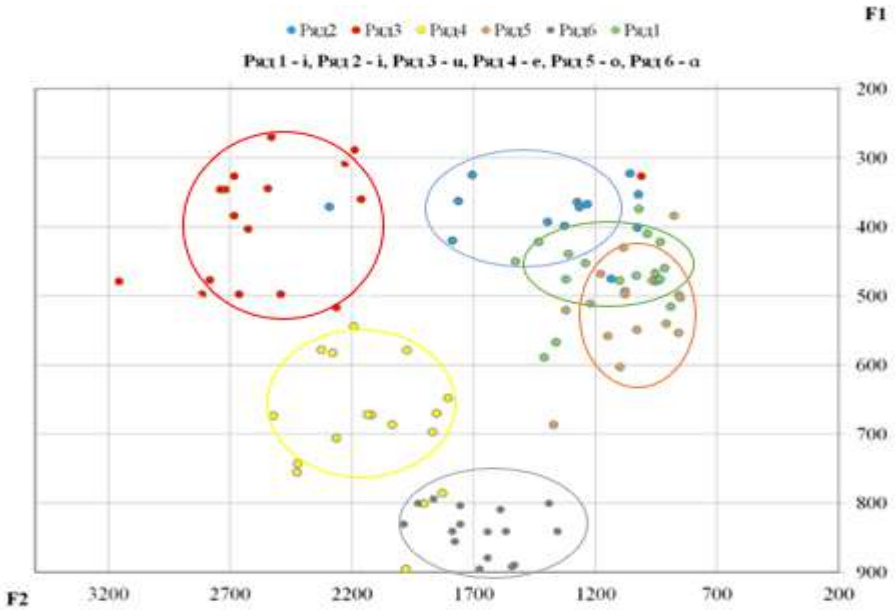

Figure 33 – Frequency characteristics of Russian vowels in the realization of 16 female speakers. On the ordinate axis – F1; on the abscissa axis – F2 in Hz.

Analysis of the distribution of Russian vowels /ɑ/, /e/, /i/, /ɨ/, /u/, /o/ in the performance of Chinese male speakers shows a more compact arrangement of sound units within the classical triangle in the F1-F2 space. This picture indicates a more closed character of vowel realizations according to the feature "vowel lift" and more posterior articulation according to the feature "vowel row" .

Analysis of the distribution of Russian vowels /ɑ/, /e/, /i/, /ɨ/, /u/, /o/ as performed by Chinese female speakers demonstrates a wide range of distribution of vowel allophones within the classical triangle in F1-F2 space. The pronunciation of vowels tends to be more open in terms of vowel lift. Vowel articulation tends towards a more anterior character of vowel pronunciation on the feature “vowel row”.

In the course of the study, a comparative-comparative analysis of F1-F2 vowel frequencies in the realisations of native speakers of Russian and Chinese was carried out. Table 26 shows the average F1-F2 rates in the realisation of speakers of the two languages.

Table 26 – Averaged data on frequency characteristics of vowel allophones performed by Chinese and Russian speakers

Vowels	Chinese speakers		Russian speakers	
	F1	F2	F1	F2
[ɨ]	419	1780	411	1456
[i]	364	2365	342	2181
[e]	616	1941	545	2078
[o]	514	1085	511	1013
[a]	741	1498	808	1582
[u]	426	1082	370	922

Analysis of the realizations of six Russian vowels /ɑ/, /e/, /i/, /ɨ/, /u/, /o/ performed by native speakers of Chinese and Russian within the articulatory triangle

shows the classical distribution of vowel allophones in the F1-F2 space. The character of modifications of Russian vowels in Chinese speakers is characterized by a tendency to pronounce vowels with the tongue body moving forward on the basis of "vowel row". This is especially characteristic of the vowel of the front row, high rise /i/. The vowel /i/ is realized in a pronounced advancement of the vowel articulation forward on the "vowel row" feature. The vowels of the back row /u/, /o/ demonstrate advancement of the tongue body to the centre of the articulatory triangle when articulating vowels. The vowel /ɑ/ is realized as a vowel of higher elevation, pushed back row. The front vowel /e/ is realized by Chinese speakers similarly to Russian speakers. The mid-row vowel /ɨ/ is realized by Chinese speakers in the advanced forward variant on the basis of the “vowel row” feature.

Figure 34 demonstrates the obtained acoustic triangles of Russian vowel realizations /ɑ/, /e/, /i/, /ɨ/, /u/, /o/ by native speakers of Chinese and Russian in comparative terms.

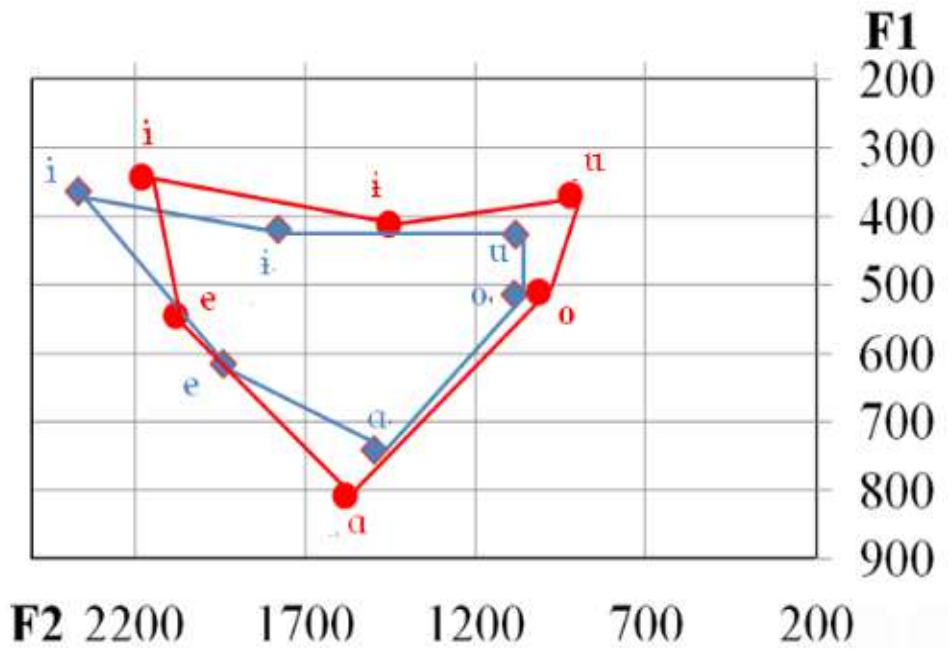

Figure 34 – Average frequency characteristics of vowel allophones performed by 28 native Chinese speakers (blue cubes) and Russian speakers (scarlet circles). On the ordinate axis – F1; on the abscissa axis – F2 in Hz.

The modification of vowels in the performance of Chinese speakers, represented by a variety of combinatorial-position variants of vowels, as the analysis showed, is caused by several reasons:

- erroneous accent;
- lack of accent (pronunciation of words by syllables);
- lack of quantitative vowel reduction;
- lack of qualitative vowel reduction;
- replacement of Russian vowels with Chinese analogues;
- replacement of Russian vowel monophthongs by Chinese diphthongs.

The modification of Russian vowels in the pronunciation of native speakers of Chinese is dependent on their native language sound system, manifested in the acoustic character of the obtained data, registered vowel sound-types, including diphthongoid character.

Modification of Russian vowels by native speakers of Chinese with different levels of language training (high, medium, low) shows pronunciation of Russian vowels by speakers with a high level of language training close to the normative realization. Speakers with medium and low levels of language training demonstrated a wide variety of recorded variants of vowel sound-types reflected in the space of the acoustic triangle.

Modification of Russian vowels in the performance of native speakers of male Chinese demonstrates a tendency to vowel realization within the framework of normative pronunciation.

Modification of Russian vowels in the performance of native speakers of Chinese by women is characterized by a wide range of distribution of variants within the acoustic triangle, which is expressed in the variety of vowel sound-types demonstrated.

Vowel modification in the performance of female speakers goes beyond the limits of normative realization.

3.2. Consonant modification

The literature has accumulated experience of research, including experimental-phonetic analysis, of the realisations of Russian consonants by native speakers of Chinese and its dialects, as well as by Taiwanese speakers (*Li Huei-Ying 1999; Chang Ching-Gwo 1999, Chen Jao Lin 2000; Zhao Zhe 2017, Du Yunsha 2017*) *Sun Bo 2022: 114-119; Sun Bo 2023: 146-151*).

The research experience shows that the main difficulties in the realization of Russian consonants by native speakers of Chinese are related to violations of:

1. the “hard-soft” correlation;
2. the correlation "voiceless-voiced";
3. the way consonants are formed;
4. phoneme identity.

In the sound system of the Russian language, 15 pairs of consonants are contrasted on the basis of “hard-soft” correlation. Table 27 shows paired examples of consonants that may cause difficulties in mastering correct Russian pronunciation.

Table 27 – Hardness-softness correlation of consonants

/p-pʲ/	папка	–	пятка	/z-zʲ/	зал	–	взял
/b-bʲ/	был	–	бил	/k-kʲ/	кот	–	ткёт
/f-fʲ/	готов	–	готовь	/g- gʲ/	год	–	Гёте
/v-vʲ/	живот	–	живёт	/x-xʲ/	стих	–	стихи
/t-tʲ/	турки	–	тюрки	/m-mʲ/	мал	–	мял
/d-dʲ/	дата	–	дядя	/n-nʲ/	нос	–	нёс
/s-sʲ/	сад	–	сядь	/l-lʲ/	луг	–	люк
				/r-rʲ/	рад	–	ряд

The remaining consonants are unpaired /š/, /ž/, /c/ always hard and /čʲ/, /šʲː/ are always soft. The palatal consonant /j/ is always soft. According to the work of the tongue tip, forelingual consonants are divided into dorsal /t, tʲ, d, dʲ, c, čʲ, n, nʲ,

s, sʲ, z, zʲ, šʲ/; apical /l, lʲ/ and cacuminal /š, ž, r, rʲ/. The given unpaired consonants are articulatory different from Chinese sounds.

In Russian, 22 consonants form 11 pairs opposed on the basis of “voiced-voiceless”: /p-b/, /f-v/, /t-d/, /s-z/, /k-g/, /š-ž/, /pʲ-bʲ/, /fʲ-vʲ/, /tʲ-dʲ/, /sʲ-zʲ/, /kʲ-gʲ/. Table 28 shows paired examples of consonants that can cause difficulties in mastering correct Russian pronunciation.

Table 28 – Correlation of consonants in terms of “voiced-voiceless”

/p-b/	пар	–	бар	/š-ž/	шар	–	жар
/f-v/	фаза	–	ваза	/pʲ-bʲ/	пить	–	бить
/t-d/	точка	–	дочка	/fʲ-vʲ/	сфера	–	Вера
/s-z/	суп	–	зуб	/tʲ-dʲ/	тина	–	Дина
/k-g/	кот	–	год	/sʲ-zʲ/	сядь	–	зять
				/kʲ-gʲ/	кит	–	гид

The noisy consonants /šʲ:/, /čʲ/, /c/, /x/, /xʲ/ have no voiced pairs.

The realization of Russian consonants in Chinese speech is considered on the extended material of recordings of the experimental text performed by 28 native speakers of Chinese - participants of the experiment with different levels of language proficiency from low to high levels. The obtained data were compared and contrasted with the realizations of the analyzed consonants in the performance of 21 native speakers of Russian. The results allowed us to obtain a reliable picture of the realizations of Russian consonants in the performance of native speakers of Chinese and to identify the pronunciation difficulties encountered by learners mastering the phonetic features of the Russian language.

The contemporary Russian received language consists of 36 consonant phonemes (*Verbitskaya, Ignatkina 1993:21; Popov 2014:45*). The number of consonants exceeds the number of initials in Chinese (23 units) almost twice as much. This circumstance causes difficulties in mastering Russian consonants by Chinese learners. In this paper, the phonetic analysis is carried out in the order of consonants distribution according to the principle of place of formation: lip, fore-lingual, middle-lingual, posterior-lingual.

3.2.1. Labial consonants

There are 10 labial consonants in Russian (of which 6 are labio-labial; 4 are labio-dental), and 4 initials in Chinese (of which 3 are labio-labial; 1 is labio -dental). Table 29 shows Russian and Chinese labial consonants.

Table 29 – Russian and Chinese lip consonants

Place of obstruction	Russian	Chinese
labio-labial	p, p^j, b, b^j, m, m^j	p, p^h, m
labio-dental	f, f^j, v, v^j	f

The share of labial consonants in Russian is 23% of the total number of consonants in the language; in Chinese – 17% of the total number of initials in the language. The greatest difficulties for the Chinese in this group are the correlation of Russian consonants by hard-soft correlation; by voiceless-voices correlation.

/p/, /p^j/

Labio-labial, plosive, voiceless consonants /**p/, /p^j**/ were analyzed in the composition of words and word groups from the experimental text in the position of absolute beginning and middle of the word: *по центральному, по проверке, позволить, при высоком, прислушивался, теплый, предстоящей, плотности, первый, показывал, купил, спросил, спать, потом, вспомнил, сопротивлялся, сопротивления, покрыто, прорывались, всеобщее, поздно*, etc.

The following non-normative realizations of /**p/, /p^j**/ were noted during the auditory analysis:

1) Pronunciation of Chinese aspirated [p^h] in place of [p]: *потом* – [p^h]*отом, первый* – [p^h]*ервый, всеобщее – всео*[p^h]щее.

2) Pronunciation of the voiced [p] in place of the deaf [p] in the word *вспомнил – вс*[p]*омнил, теплый – те*[p]*лый*.

3) Pronunciation of the voiced [b] in place of the deaf [p]: *вспомнил – вс*[b]*омнил, поздно* – [b]*оздно, хлеб – хле*[b], *плотности* – [b]*лотности*..

4) Pronunciation of soft aspirated [pʲʰ] in place of soft [pʲ]: *купил – ку*[pʲʰ]*ил, первый –* [pʲʰ]*ервый*.

5) Vowel insertion of [ъ] in consonantal combinations with [p]: *прорывались – п*[ъ]*рорывались, сопротивлялся – соп*[ъ]*ротивлялся*.

6) Pronunciation of hard [p] in place of soft [pʲ]: *песенку* – [p]*есенку, пёсика* – [p]*ёсика*.

/b/, /bʲ/

Labio-labial, plosive, voiced consonants /**b/, /bʲ**/ were analyzed as a part of words and word groups from the experimental text in the position of the absolute beginning and middle of the word before the vowel and consonant: *б*ыл, *б*ыло, *б*ывавший, *об*ъединениях, *об*ъема, улы*б*аться, авто*б*усе, се*б*е, *об*ратил, осо*б*енно, сла*б*ый, *б*еда, *об* уче*б*е, *б*лизко и др.

The following non-normative realizations were registered during the analysis:

1) Devoicing of the hard [b] in the position before vowels: *улыбаться –* *улы*[b]*аться, автобусе – авто*[b]*усе, бывавший –* [b]*ывавший, был –* [b]*ыл*.

2) Devoicing of soft [bʲ] in position before vowels: s*себе – се*[bʲ]*е, особенно – осо*[bʲ]*енно*.

3) Pronunciation of soft [pʲ] in place of soft voiced [bʲ]: *об*ъединениях – *о*[pʲ]*ъединениях.*

/m/, /mʲ/

Labio-labial, plosive, nasal sonants /**m/, /mʲ**/ were analyzed as part of words and word groups from the experimental text in the position of the absolute beginning and middle of the word: *м*узыку, *м*узеях, *м*еханизации, раз*м*ещением, *м*еня, *м*альчик, *м*а*м*а, *м*огла, са*м*ый, су*м*ке, *м*алыш, килогра*мм*ов, *м*ы, *м*оя, *ма*му, *м*оем, *м*не, *м*ало, задумавшись, грамма*м*и.

The following non-normative realizations were registered during the analysis:

1) Pronunciation of hard [m] in place of soft [mʲ]: *размещением* – *раз*[m]*ещением, меня* – [m]*еня, механизации* – [m]*еханизации, семь* – *се*[m].
2) Devoicing of the hard sonant /m/: *заду<u>м</u>авшись – заду*/m/*авшись*.
3) Devoicing of soft sonant /mʲ/ in position before vowels: *<u>м</u>еханизации* – /mʲ/*еханизации*.
4) Insertion of a vowel (epithesis[25]) in the position of the end of the word: *потом – пото*[mu].
5) Elision[26] of [m] in the absolute end of the word: *другим – други*[#], *неравномерным – неравномерны*[#], *непонятным – непонятны*[#].

/f/, /fʲ/

Labio-dental, constrictive voiceless consonants /**f/, /fʲ**/ were analyzed as part of words and word groups from the experimental text in the position of the absolute beginning and middle of the word: *а<u>в</u>тобус, <u>ф</u>ормулы, ци<u>ф</u>ру, со<u>в</u>сем, <u>в</u> секунду*.

The following non-normative realizations were noted during the auditory analysis /f/, /fʲ/.

1) Pronounciation of [v] in place of [f]: *впереди* – [v]*ереди*
2) Insertion (epenthesis[27]) of a vowel after [f]: *все* – [fu]*се.*
3) Elision of [**f**]: *впереди* – [#]*переди.*

[25] Epithesis (Greek for "apposition, superimposition") is a phonetic term denoting the occurrence of a non-etymological reference or transitional sound at the end of a word for ease of pronunciation.

[26] Elision (from Latin "squeezing", "pushing out" - the falling off of a sound (vowel or consonant or syllable in a word or phrase to facilitate pronunciation for the speaker

[27] Epenthesis (Greek for "insertion") is a phonetic phenomenon, the addition of one or more sounds (consonant or vowel) to a word.

/v/, /vʲ/

Labio-dental, constrictive voiced, hard and soft consonants /**v/, /v**ʲ/ were analyzed as part of words and word groups from the experimental text in the position of absolute onset and mid-word before the vowel and consonant: *ветер, вечер, великий, видны, невольно, разговорам, равенство, заводов, связях, проверке, неизвестно, товарищ, очевидно, вызывается, внимание, отворачивался, видно, своего, позволить, двадцать, сопротивлялся, вид, воспоминания, первых.*

The following non-normative realizations were noted during the auditory analysis /v/, /vʲ/:

1) Pronunciation of voiceless [f] in place of hard [v]: *в руке* – [f] *руке.*

2) Pronunciation of the combination of voiceless constrictive + vowel [fu] in the place of the voiced [v]: *в лекции* – [fu] *лекции, в руке* – [fu] *руке*.

3) Pronunciation of the combination of voiceless constrictive + vowel [fɘ] in the place of the [v]: *в объединениях* – [fɘ] *объединениях, в дорожной* – [fɘ]*дорожной, в сторону* – [fɘ] *сторону*.

4) Pronunciation of the combination of voiced [v] + vowel in place of [f]: *в сторону* – [fɘ] *сторону*.

3.2.2. Forelingual consonants

There are 19 forelingual consonants in Russian and 12 initials in Chinese. Table 30 shows Russian and Chinese anterior consonants.

Table 30 – Russian and Chinese anterior lingual consonants

Place of		Russian	Chinese
dorsal		t, tʲ, d, dʲ, c, čʲ, s, sʲ, z,	–
apical		l, lʲ	t, tʰ, ts, tsʰ, s,
cacuminal		š, ž, r, rʲ	t͡ʂ, t͡ʂʰ, ʂ, (z̧)

The share of anterior consonants in Russian is 45.2 per cent of the total number of consonants in the language; in Chinese – 52 per cent of the total number of initials. The greatest difficulties for the Chinese in this group are the correlation of consonants by hardness-softness; by voicing-deafness, as well as by mode of formation.

/t/, /tʲ/

Forelingual, dorsal, plosive? voiceless, hard and soft consonants /**t/, /tʲ**/ were analyzed as part of words and word groups from the experimental text in the position of absolute onset and mid-word before the vowel and consonant: *тихий, ветер, покрыто, равенство, предстоящей, Тревогин, обратил, три, рассердится, считает, странице, кит, сантиметров, потом, чуть, тогда, там, так, город, пути, интересный, ребят*.

The following non-normative realizations of /t/, /tʲ/ were noted during the auditory analysis:

1) Pronunciation of Chinese aspirated [tʰ] in place of [t]: *запад – запа*[tʰ], *кит – ки*[tʰ], *ребят – ребя*[tʰ], *там –* [tʰ] *ам, так –* [tʰ] *ак, тучами –* [tʰ] *учами, Тривогин –* [tʰ] *ривогин, любит – люби*[tʰ].

2) Pronunciation of aspirated [tʲʰ] in place of [tʲ]: *теперь –* [tʲʰ]*еперь, тихий –* [tʲʰ]*ихий, заметил – заме*[tʲʰ]*ил, десяти – деся*[tʲʰ]*и, сопротивления – сопро*[tʲʰ]*ивления, ответил – отве*[tʲʰ]*ил*.

3) Pronunciation of [t] is not hard enough: *вид – ви*[t], *кит – ки*[t].

4) Pronunciation of [t] in intervocalic position: *которую – ко*[t] *орую*.

5) Pronunciation of [tʲ]: *тихий –* [tʲ]*ихий*.

6) Pronunciation of [dʲ] in place of [tʲ]: *сядь – ся*[dʲi], *шуметь – шуме*[dʲi], *тема –* [dʲ]*ема*.

7) Pronunciation of affricated [dzʲ]: *обратил – обра*[dzʲ]*ил*.

8) Pronunciation of affricated [tcʲ]: *тихий – ти*[tcʲ]*ий, ветер – ве*[tcʲ]*ер*.

9) Elision of the consonant [#]: *любит – люби*[#], *считает – считае*[#].

10) Insertion (epenthesis) or addition of a vowel at the absolute end of a word after [t]: *ребят – ребят* [tə], *двадцать – двадца*[tʲi], *ест – ес*[tʲi].

/d/, /dʲ/

Forelingual, dorsal, plosive, voiced, hard and soft consonants /d/, /dʲ/ were analyzed as part of words and word groups from the experimental text in the positions of absolute word onset and mid-word: before vowel and consonant: *дул, видны, впереди, судьбе, десяти, очевидно, думаю, длины, рассердится, детей, для, дочки, дядя, двадцать, душа, дыхание, дневного etc.*

The following non-normative realizations of /d/, /dʲ/ were noted during the auditory analysis:

1) Devoicing of forelingual, plosive, voiced [d] in position before vowels /ɑ/, /o/: *дорожной* – [d]*орожной, достаточно* – [d] *остаточно, дочки* – [d] *очки, дул* – [d] *ул.*

2) Pronunciation of the soft affricated sound [dᶻʲ] in place of /dʲ/ in the word: *дядя*– [dᶻʲ]*я*[dᶻʲ]*я, заходящего – захо*[dᶻʲ]*ящего, впереди – впере*[dᶻʲ]*и.*

3) Pronunciation of a voiceless plosive [t] in the place of the forerlingual voiced /d/ in position before vowels /ɑ/, /ʊ/, /ɨ/: *дыхание* – [t]*ыхание, думаю* – [t]*умаю, далеко* – [t]*алеко, дул* – [t]*ул, задумавшись*– *за*[t]*умавшись.*

4) Pronunciation of [t] in place of /d/ before the sonant /n/:*видны – ви*[t]*ны, дневного* – [t]*невного, очевидно – очеви*[t]*но.*

5) Realization of insufficiently voiced [dʲ] in words: *единиц – е*[dʲ]*иниц, судьбе – су*[dʲ]*бе, нужде – нуж*[dʲ]*е.*

6) Devoicing of soft /dʲ/: *нужде – нуж*[dʲ], *детей* – [dʲ]*етей*.

/c/

Forelingual, dorsal, voiced, hard affricate[28] /**c**/ analyzed in the composition of words and word groups from the experimental text in the position of absolute beginning and middle of the word: *солнца*, *центральному*, *границей*, *механизации*, *лекции*, *детстве*, *цель*, *цифру*.

The following non-normative realizations of /**c**/ were noted during the auditory analysis:

1) Elision of [**c**]: *детстве – де*[**t**]*ве*.

2) Pronunciation of [**s**] on the spot [**c**]: *наконец – наконе*[**s**], *центральному* – [**s**]*ентральному цифру* – [**s**]*ифру*.

/čʲ/

Forelingual, dorsal, voiceless, soft affricate /**čʲ**/ was analyzed within words and word groups from the experimental text in absolute onset and mid-word position: *ве̲чер*, *ту̲чами*, *электри̲ческие*, *до̲чке*, *̲чуть*, *выключ̲ил*, *у̲чебе*, *лу̲чше*, *у̲ченых*, *очень*

The following non-normative realizations of /**čʲ**/ were noted during the auditory analysis.

1) Pronunciation of Chinese forelingual, cacuminal, aspirated [t͡ʂʰ] in place of [**čʲ**]: *ученых – у*[t͡ʂʰ] *еных*.

2) Pronunciation of soft, constrictive [šʲ] in place of [**čʲ**]: *очевидно – о*[šʲ]*видно*.

3) Pronunciation of the Chinese apical, aspirated [tsʰ] in the place of [čʲ]: *очень – о*[tsʰ]*ень*.

4) Pronunciation of the hard [s] in place of [**čʲ**]: *лучше – лу*[s] *ше*.

[28] Affricate - a consonant sound with a slit recursion instead of a burst, usually resulting from the combination of a bowed sound with a subsequent homorganic and initially slit sound. - O. S. Akhmanova Dictionary of Linguistic Terms. Moscow: Unitorial Urss, 2004. – C. 61.

5) Pronunciation of [sʲ] in place of [**č**ʲ]: *дочки – до*[sʲ] *ки, ночь – но*[sʲ].

6) Pronunciation of [ʃ] in place of [**č**ʲ]: *чуть* – [ʃ]*уть*.

7) Pronunciation of the Chinese aspirated [tʰ] in the place of [**č**ʲ]: *выключил – выклю*[tʰ]*ил*.

/s/, /sʲ/

Forelingual, dorsal, constrictive, voiceless, hard and soft consonants /**s/, /s**ʲ/ were analyzed as part of words and word groups from the experimental text in the position of the absolute beginning and middle of the word before the vowel and consonant: *серый, слабый, солнца, старый, судьбе, странно, совсем, сажала, сохранять, считает, семь, сына, самый, себе, сюда, спать, есть, секунду, десяти etc.*.

The following non-normative realizations of /**s/, /s**ʲ/ were noted during the auditory analysis:

1) Pronunciation of [ʃ] in place *совсем – сов*[ʃ]*ем*.

2) Pronunciation of [**z**] in place of [**s**]: *связях* – [**z**]*вязях*.

3) Pronunciation of hard [**s**] in place of [**s**ʲ]: *семь* – [**s**]*емь, десяти – де*[**s**]*яти, сядь* – [**s**]*ядь, сюда* – [**s**]*юда, осени – о*[**s**]*ени*.

4) Pronunciation of the Chinese, cacuminal, aspirated [t͡ʂʰ] in place of [**s**ʲ]: *вызывается – вызывает*[t͡ʂʰ]*я*.

5) Insertion of a vowel (epithesis) after [**s**ʲ]: *прорывались – прорывали*[**s**ʲi].

6) Elision of [**s**ʲ] at the absolute end of the word *задумавшись – задумавши*[#].

7) Pronunciation of [**z**] in place of [**s**ʲ]: *сквозь – скво*[**z**].

8) Pronunciation of the combination of consonant [**z**ʲ] + vowel in place of [**s**ʲ]: *сквозь – скво* [**z**ʲ].

9) Inserting a vowel at the absolute end of a word after [**z**ʲ]: *сквозь – скво* [**z**ʲi].

10) Insertion a vowel in the combination of [**s**tr]: *странах* – [**s**tɑr]*анах*.

/z/, /zʲ/

Forelingual, dorsal, constrictive, voiced, hard and soft consonants **/z/, /zʲ/** were analyzed as part of words and word groups from the experimental text in the absolute onset and mid-word position before the vowel and consonant: *сквозь, заходящего, музыку, золото, рассказывал, связях, называл, изучить, показывал, позволить, нельзя, поздно, жизни, заметил, изучить* etc.

The following non-normative realizations of **/z/, /zʲ/** were noted during the auditory analysis:

1) Pronunciation of insufficiently phonated hard [z]: *называл – на*[z]*ывал, показывал – пока*[z]*ывал, золото –* [z]*олото.*

2) Pronunciation of the soft [zʲ]: *связях – свя*[zʲ]*ях, нельзя – нель*[zʲ]*я.*

3) Pronunciation of [ž] in its place [z]: изучить – и[ž]учить.

/šʲː/

Forelingual, dorsal, constrictive, bifocusedal, long, voiceless **/šʲː/** was analyzed as part of words from the experimental text in the position of absolute onset and mid-word before vowels and consonants: *заходящего, защищают, предстоящей, размещением, составляющих, женщину, следующую, тащил, спящего.*

The following non-normative realizations of **/šʲː/** were noted during the auditory analysis**:**

1) Pronunciation of [sʲ] in place of [**šʲː**]: *защищают – за*[sʲ]*и*[sʲ]*ают, товарищ – товари*[sʲ], *женщину – жен*[sʲ]*ину, тащил – та*[sʲ] *ил.*

2) Pronunciation of [š] in place of [**šʲː**]: *следующую – следую*[**š**]*ую.*

3) Pronunciation [s] in place of **/šʲː/:** *еще – е*[s] *е*

/n/, /nʲ/

Forelingual, dorsal, constrictive, hard and soft sonants /n/, /nʲ/ were analyzed as part of words and word groups from the experimental text in the position of absolute onset and mid-word before vowels and consonants: *небо*, *иногда*, *наш*, *видны*, *невольно*, *них*, *нас*, *наша*, *особенно*, *над*, *называл*, *надо*, *не*, *сына*, *нет*, *на*, *небу*, *нарисовал*, *ночь*, *дневного*, *понял*, *нужно*, *нашего*.

The following non-normative realisations of /n/, /nʲ/ were noted during the auditory analysis:

1) Elision of [n]: *конференции – ко*[#]*ференции, Тревогин – Тревоги*[#], *женщину – же*[#]*щину, ребенка – ребе*[#]*ка, женщину – же*[#]*щину*.

2) Replacing [n] with [t]: *знает – з*[t]*ает*.

/l/, /lʲ/

Forelingual, apical, constrictive, hard and soft sonants /l/, /lʲ/ were analyzed as part of words from the experimental text in the positions of absolute beginning and middle of the word before vowel and consonant, absolute ending: *был*, *лучи*, *великий*, *электрические*, *прислушивался*, *лаборатория*, *отдала*, *сопротивления*, *условных*, *лекции*, *длины*, *малыша*, *улыбаться*, *лучше*, *шалун купил*, *открыл*, *любит*, *милый*, *заглядывая. сколько*, *привлекли*, *хлеб*, *понял*, *главное*, *мало*, *близко*.

The following non-normative realizations of /l/, /lʲ/ were noted during the auditory analysis**:**

1) Pronunciation of the hard sonant [r] in place of [l]: *главное – г*[r]*авное, лаборатория* – [r]*аборатория, слабый – с*[r]*абый, было – бы*[r]*о*.

2) Pronunciation of the hard sonant [l] in place of the soft [lʲ]: *великий – ве*[l]*икий, были – бы*[l]*и*.

3) Pronunciation of the soft sonant [lʲ] in place of the hard [l]: *было – бы*[lʲ]*о*.

4) Inserting a vowel at the absolute end of a word after /lʲ/: *цель – це*[lʲi], *преподаватель – преподавате*[lʲi].

5) Pronunciation of the soft sonant [rʲ] in place of [lʲ]: *привлекли – прив*[rʲ] *екли*.

6) Elision[29] of [lʲ] in the middle of a word: *невольно – нево[#] но*.

/š/, /ž/

Forelingual, cacuminal, constrictive, voiceless and voiced consonants /š/, /ž/ were analyzed as part of words and word groups from the experimental text in the positions of absolute word beginning and middle before vowel and consonant, absolute end: /š/ **–** *шалун, задумавшись, нашего, малыш прислушивался, пишут, Шурочка; /ž/ – нужде, рыжий, сажала, дорожной, животных, художник, пассажиров, желтого, нужно, жизни, женщину*

The following non-normative realizations of /š/, /ž/ were noted during the auditory analysis**:**

1) Pronouncing [**š**ʲː] in place of **/š/:** *шел* – [**š**ʲː] *ел, пишут – пи*[**š**ʲː] *ут*.

2) Pronunciation [s] in place of [š]: *Шурочка* – [s]*урочка*.

3) Pronunciation [zʲ] in place of [ž]: *нужде – ну*[zʲ]*е*.

/r/, /rʲ/

Forelingual, cacuminal, constrictive, hard and soft consonants /**r/, /r**ʲ/ were analysed as part of words and word groups from the experimental text in the positions of absolute word beginning and middle before vowel and consonant, absolute end: *серый, вечер, прорывались, радио, центральному, равенство, впереди, эксперименту, при, разговор, которая, первой, нарисовал, вопросы, Шурочка, руке, ребенка, первых, кроме, работы, решил, проверке*

[29] Elision (from Latin "squeezing", "pushing out" - the falling off of a sound (vowel or consonant or syllable in a word or phrase to make it easier for the speaker to pronounce.

The following non-normative realizations of **/r/, /r^{j}/** were noted during the auditory analysis:

1) Pronunciation of [l] in place of [r]: *равенство* – [l]*авенство*, *работы* – [l]*аботы, разговор* – [l]*азговор, серый – се*[l]*ый, рыжий* – [l]*ыжий, раз* – [l]*аз, проверке – п*[l]*оверке, Шура – Шу*[l]*а, граммами – г*[l]*аммами, город – го*[l]*од.*

2) Pronunciation of [l^{j}] in place of [r^{j}]: *нарисовал – на*[l^{j}]*исовал, впереди – впе*[l^{j}]*еди, эксперименту – экспе*[l^{j}]*именту, решил* – [l^{j}]*ешил, говорили – гово*[l^{j}]*или, моряк – мо*[l^{j}]*як*.

3) Pronunciation of hard sonant [r] in place of soft [r^{j}]: ребят– [r]ебят, *решил* – [r]*ешил*.

3) Pronunciation of [r] (syncope[30]): *поверхностью – пове*[#]*хностью*.

4) Pronunciation of [r^{j}] in place of [r]: *держа – де*[r^{j}]*жа*.

5) Inserting a vowel (epinthesis) after [r^{j}]: *держа – де*[r^{j}i]*жа*.

6) Insertion of a vowel (epenthesis) at the absolute end of a word after [r], [r^{j}]: *ветер – вете*[rʌ], *теперь – тепе*[ri].

3.2.3. Mediolingual consonant

In Russian there is one mediolingual consonant, in Chinese there are 3 initials. Table 31 shows the Russian and Chinese mediolingual consonants.

Table 31 – Russian and Chinese Middle English consonants

Place of obstruction	Russian	Chinese
mediolingual:	j	tɕ, tɕ^{h}, ɕ

The share of the mediolingual consonant is 2.3 per cent of the total number of consonants in Russian; in Chinese it is 13 per cent of the total number of initials in the language.

[30] Syncope is a phonetic phenomenon in which a sound or a group of sounds or a syllable (more often in the middle of a word) falls out.

/j/

Mediolingual, constrictive sonant /**j**/ was analyzed as part of words and word groups from the experimental text in the position of absolute word beginning and middle before vowel and consonant, absolute end: *тих<u>ий</u>, сер<u>ый</u>, музе<u>я</u>х, объединени<u>ях</u>, об<u>ъе</u>ма, сам<u>ый</u>, умн<u>ый</u>, весел<u>ый</u>, мо<u>я</u>, п<u>ой</u>дем, интересн<u>ой</u>, юн<u>ый</u>, <u>е</u>хали, е<u>ё.</u>*

The following non-normative realizations of /j/ were noted during the auditory analysis:

1) Pronunciation of [i] in place of [j]: *<u>е</u>хали* – [i]*хали*, *её* – [i]*ё*, *единиц* – [i]*диниц*.

2) Pronunciation of the diphthong [iɘ] in place of [j]: *великий – велик*[iɘ].

3) Pronunciation of the diphthong [ɨɘ]: *старый – стар*[ɨɘ].

3.2.4. Back-lingual consonants

There are 6 back-lingual consonants in Russian and 4 initials in Chinese. Table 32 shows Russian and Chinese back-lingual consonants.

Table 32 - Russian and Chinese Posterior Lingual Consonants

Place of obstruction	Russian	Chinese
Back-lingual:	k, k^{j}, g, g^{j}, x, x^{j}	k, k^{h}, x, ŋ

The share of posterior consonants is 14 per cent of the total number of consonants in Russian; in Chinese – 17 per cent of the total number of initials in the language. The greatest difficulties for the Chinese in this group are the correlation of consonants by hardness-softness, by voicing-deafness, and by type of obstruction.

/k/, /k^{j}/

Back-lingual, constrictive, voiceless, hard and soft consonants /k/, /k^{j}/ were analyzed as part of words from the experimental text in the positions of absolute word beginning and middle before vowel and consonant, absolute end: *по<u>к</u>рыто*,

которого, моряк, конференции, жидкости, лекции, показывал, книгу, купил, открыл, кто, кит, секунду, наконец, выключил, кроме.

The following non-normative realizations of /k/, /kʲ/ were noted during the auditory analysis:

1) Pronunciation of Chinese hard, aspirated [kʰ] in place of [k]: *которого* – [kʰ]*оторого, купил* – [kʰ]*упил, кто* – [kʰ]*то, моряк – моря*[kʰ].

2) Pronunciation of hard aspirated [kʰ] in place of soft [kʲ]: *кит* – [kʲ]*ит*.

3) Pronouncing soft aspirated [kʲʰ] in place of soft [kʲ]: *кит* – [kʲʰ]*ит*.

4) Insertion of the vowel [ъ] in the consonantal combination [ъ]: who - k[ъ]to.

5) Pronunciation of slit [ʱ] in intervocalic position in place of [ʱ]: *кто – к*[ʱ]*то*.

6) Insertion (epinthesis) of a vowel at the absolute end of a word after [k]: *художник – художни*[kэ].

/g/, /gʲ/

The back-lingual, plosive, voiced, hard and soft consonants /g/, /gʲ/ were analyzed as part of words and word groups from the experimental text in the positions of absolute word beginning and middle before vowel and consonant, absolute end: *иногда, город, разговорам, границей, говорили, Тревогин, строгий, голубому, заглядывая, тогда, годах, главное, город.*

The following non-normative realizations of /g/, /gʲ/ were noted during the auditory analysis:

1) Pronunciation of deaf [k] in place of [g]: *газетах* – [k]*азетах*.

2) Pronunciation of insufficiently voiced [g]: *года* – [g]*ода*, *голуби* – [g]*олуби, город* – [g]*ород, тогда – то*[g]*да, главное* – [g]*лавное, границей* – [g]*раницей*.

3) Pronunciation of insufficiently voiced [gʲ]: *Тривогин – Триво*[gʲ]*ин*, *строгий – стро*[gʲ]*ий*.

/x/, /xʲ/

Back-lingual, constrictive, voiceless, hard and soft consonants /x/, /xʲ/ were analyzed as part of words and word groups from the experimental text in the positions of absolute word beginning and middle before vowel and consonant, absolute end: *тихий, заходящего, ехали, легкую, необходимых, составляющих, сохранять, художник, затих, ходила, первых, годах.*

The following non-normative realizations of **/x/, /xʲ/** were noted during the auditory analysis:

1) Pronunciation of hard [x] in place of soft [xʲ]: *тихий – ти*[x]*ий*.

2) Inserting a vowel in the position of the end of the word: *затих – зати*[xɨ], *годах – года*[xɨ].

3) Pronunciation of [g] in place of [x]: *легкую – ле*[g]*ую*.

3.3. Modification of consonant combinations

This section is based on the work of the author [31,32]. A characteristic feature of the Russian language is the presence of consonantal combinations containing from two to five consonants in one syllable: **CC**: *стол, снег, сдать, трава, здесь, Пермь, сказка*; **CCC**: *страна, здравствуй, вспомнить, вскочить, завтра, латинский, отплясывать;* **CCCC**: *всплеск, вздремнуть, взгляд, встряхивать, единственный, удовольствие, встреча, Санкт-Петербург;* **CCCCC**: *мудрствовать, контрпретензия, контрпример.*

Mikhail Vasilyevich Lomonosov's words about the sound organization of speech are well known, with the recommendation to "guard against consonant

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[31] Sun Bo "Quantitative characteristics of consonant combinations of Russian in the speech of native speakers of Chinese" // Research and teaching of languages: analysis, experience, technologies / Editor-in-Chief L.D.Radnaeva. – Ulan-Ude: Buryat University Press. – 2022. – С.114-119.

[32] *Sun Bo.* Consonant Clusters study in acoustic and statistic data analysis to create effective e-learning and teaching environment // Proceedings of International Conference "E-LEARNING, METHODOLOGY, TECHNOLOGY, EVALUATION AND FUTURE TRENDS", September, 2021, Ulan-Baator, Mongolia

clusters that are unseemly to the ear, for example: “all the senses have a nobler gaze, for six consonants placed side by side - vstv-vz, make the tongue very stammering” *(Lomonosov 1952:240).*

The most frequent consonantal combinations are two-membered and three-membered combinations: CC and CCC. Consonantal combinations can occur at the beginning, middle and end of the word root, at the junction of prefix and root, at the junction of suffix and root, as part of prefixes and suffixes, etc. The phonetic system of the Russian language allows combinations: “noisy + noisy”, “noisy + sonorous”, “sonorous + noisy”, “sonorous + sonorous”, “sonorous + sonorous”.

Consonant combinations can be grouped by the method of formation. Lip + lip: /bm/, /mp/: *ла<u>мп</u>а, ко<u>мп</u>ас, о<u>бм</u>ан, о<u>бм</u>ерить*. Anterior + anterior lingual: //st/, /zd/, /nt/, /nd/, /sn/, /zn/, /nčʲ/, /tn/, /dn/: *го<u>ст</u>и, ко<u>ст</u>юм, <u>зд</u>есь, ве<u>зд</u>е, пе<u>сн</u>я, И<u>нд</u>ия, жи<u>знь</u>, ня<u>нч</u>ить, же<u>нщ</u>ина, му<u>жч</u>ина, студе<u>нч</u>еский, рома<u>нт</u>ик, ли<u>стья</u>, зо<u>нт</u>ик, а<u>тл</u>ет, ве<u>жл</u>ивый, бе<u>сщ</u>умный, ле<u>тч</u>ик, <u>что</u>-нибудь, город<u>ск</u>ой, смея<u>ться</u>*. Forelingual + posterior lingual: /nk/, /rt/, /ŋg/, /nʲk/*: пе<u>сенк</u>а, карти<u>нк</u>а, А<u>нгл</u>ия, беле<u>ньк</u>ий, доче<u>ньк</u>а, веселе<u>ньк</u>ий, малюсе<u>ньк</u>ий*. Posterior + posterior lingual: /gk/, /xk/: *мя<u>гк</u>ий, ле<u>гк</u>ий, смягчить, лё<u>гк</u>ие*. Combinations with sonorant consonants: /br/, /slʲ/, / brʲ/, /mlʲ/: *до<u>бр</u>, мы<u>сль</u>, октя<u>брь</u>, Кре<u>мль</u>*. Posterior + anterior lingual: /gčʲ/: *легче, мягче.*

The variety and frequency of consonantal combinations in Russian becomes a big obstacle to mastering normative pronunciation for speakers of languages whose phonetic systems lack them. An example of such a language is Chinese, which has no such concept as a consonantal combination. The study of the realizations of Russian consonant combinations in the pronunciation of native speakers of Chinese is an important problem in teaching Russian phonetics. The task of this stage of the present study is to investigate the realisations of Russian consonant combinations in the pronunciation of native

speakers of Chinese using the example of reading a phonetically representative text.

Phonetically representative text contains words with consonant combinations (represented in Cyrillic): пр, тн, зг, нщ, ст, зв, ткр, рх ст, пр рк, вл, тр, пр, ст, пр сл, ст, чн, пр вл, сп, нт, пр вл, сл, сл, др, ск, зд, кл, мп чк, сп, мн, сл, шн, бх, сн, всп мн, ст, зн in words: *преподаватель, соотношение, разговор, женщина, стараясь, позволить, открыл, поверхностью, проверке, давление, Тревогин, прорывались, старый, прислушивался, достаточно, сопротивления, эксперименту, сопротивлялся, следовали, следили, другим, сказала, поздно, выключил, лампочку, воспоминания, мне, слышно, необходимый, заснул, вспомнил, сторону, знаешь* и др.

The total number of consonant combinations in the text is 170. Any of the consonantal combinations presented in the text are difficult for native speakers of Chinese to learn, with the most difficult from the author's point of view being the combinations of /pr/, /pr^{j}/, /br/, / br^{j} /, /tr/, /tr^{j}/, /dr/, /dr^{j}/, /kr/, /kr^{j}/, /gr/, /gr^{j}/, /sr/, /sr^{j}/, /str/, /str^{j}/ and other combinations which contain the anterolingual, tremulous, hard and soft sonants /r/ and /rj/, which are absent in the Chinese language system. Further description is devoted to analysing the realisations of the consonantal combinations / pr/, /pr^{j}/, /tr/, /tr^{j}/ registered in syllables of words of the experimental text.

3.3.1. Combinations /pr/, /pr^{j}/

In the text analyzed words with consonant combinations /pr/, / pr^{j}/ in words of different syllable length: *прорывались* (4 слога), *проверке* (3 слога), *проплывает* (4 слога), *спросил* (2 слога) , *сопротивление* (6 слогов), *вопросы* (3 слога), *сопротивлялся* (6 слогов); /pr^{j}/ in words: *прислушивался* (5 слогов), *при* (1 слог), *привлекли* (3 слога)*; предстоящей* (4 слога), *преподаватель* (5 слогов) of the text as sung by 28 speakers. In all words except the word *вопросы*, syllables with combinations /pr/, /pr^{j}/ are in the unaccented position.

/pr/

The results of the analysis of the duration of pronunciation of syllables with the consonantal combination /pr/ by native speakers of Chinese indicate the articulatory difficulty in realizing such combinations.

The analysis of word realizations with the consonantal combination /pr/ in the pronunciation of Chinese male speakers compared to Russian male speakers showed significant differences in duration.

Table 33 presents the recorded indicators.

Table 33 – Averaged data of realizations of syllable [pr] from words of the text performed by native speakers of Russian (RM) and Chinese (CM) – males

Speakers / Words	*прорывались*	*проверке*	*проплывает*	*спросил*	*сопротивления*	*вопросы*	*сопротивлялся*
РМД	156	198	97	123	173	213	102
КМД	218	213	240	374	405	267	362

The analysis of realizations of words with the consonant combination /pr/ in the pronunciation of female speakers of Chinese compared to female speakers of Russian has also demonstrated significant differences in realizations by duration.

Table 34 summarises the indicators recorded.

Table 34 – Averaged data of realizations of syllable [pro] from words of the text performed by female speakers of Russian (RM) and Chinese (CM) languages

Speakers / Words	*прорывались*	*проверке*	*проплывает*	*спросил*	*сопротивления*	*вопросы*	*сопротивлялся*
РЖД	122	159	8	237	194	126	145
КЖД	200	247	310	242	315	271	230

Figures 35, 36 show a significant difference in the duration of the syllable /pro/ between the realizations by native speakers of Russian and Chinese, both in male and female speakers. Multisyllabic words in Russian are often realized by native speakers of Chinese by syllables. Sometimes words are pronounced with pauses between syllables within words. Words with syllables containing consonantal combinations are particularly difficult to pronounce.

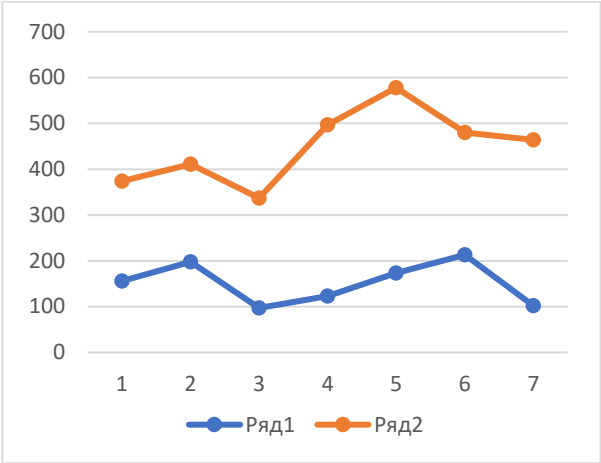


Figure 35 – Duration of the combination /pr/ in words performed by male speakers. On the ordinate axis – duration in ms, on the abscissa axis – Russian speakers (row 1), Chinese speakers (row 2).

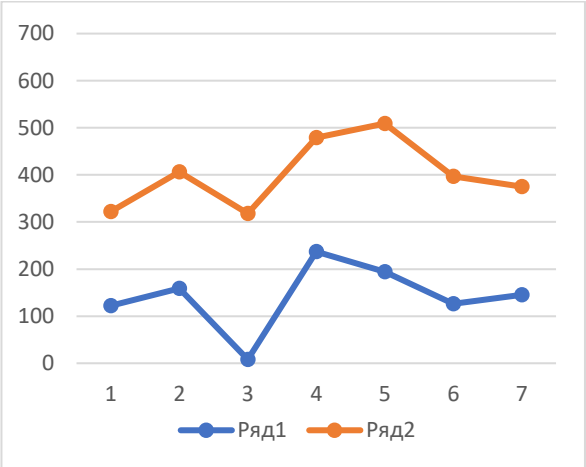


Figure 36 – Duration of /pr/ performed by female speakers. On the ordinate axis – duration in ms, on the abscissa axis – Russian speakers (row 1), Chinese speakers (row 2).

The analysis of the duration of the consonantal combination [pr] depending on the level of language proficiency demonstrates the realization of the combination in the performance of speakers with a high level of language proficiency approaching the standard (Russian native speaker). Chinese speakers with medium and low language proficiency levels spend more time on the realization of the combination respectively.

Table 35 contains indicators for the duration of syllable [pro] realization in Russian female speakers and Chinese male speakers with different levels of Russian language proficiency.

Table 35 - Realization of syllable [pro] from words of the text in the performance of native speakers of Russian (РЖД) and Chinese (КЖД-В; КЖД-С; КЖД-Н) with high, average level of Russian language proficiency

Speakers / Words	*прорывались*	*проверке*	*пропывает*	*спросил*	*сопротивления*	*вопросы*	*прорывались*
РЖД	156	198	97	123	173	213	102
КЖД - В	124	228	232	329	454	343	345
КЖД - С	260	237	215	390	293	325	373
КЖД - Н	271	175	274	402	469	134	369

Speakers with a low level of language proficiency showed a large variation in the duration of consonantal combination realisation compared to speakers with a high and medium level of language proficiency. Thus, native Chinese speakers with a low level of Russian proficiency have the greatest difficulty in realising the consonantal combination / pro / compared to Chinese speakers with an intermediate and high level of Russian proficiency. It is noteworthy that no Chinese speaker with a high level of Russian language proficiency realised the consonantal combination /rgo/ as a native speaker of Russian. This fact convinces the author that consonantal combinations with trembling /r/ are indeed the most difficult for them to master.

Figure 37 demonstrates the duration indicators of realisations of the consonantal combination /pr/ in the syllable /pro/ in the realisation of the Russian speaker and native speakers of Chinese with different levels of language training in Russian: high, medium and low. The longest duration was demonstrated by speakers with a low level of Russian language proficiency. They are followed by speakers with medium and high levels of language proficiency. None of the Chinese speakers realised the syllable /pro/ in normative performance.

Figure 38 shows the maximum and average variation of syllable realisations in the performance of the Russian speaker and native speakers of Chinese with high, medium and low levels of Russian language proficiency.

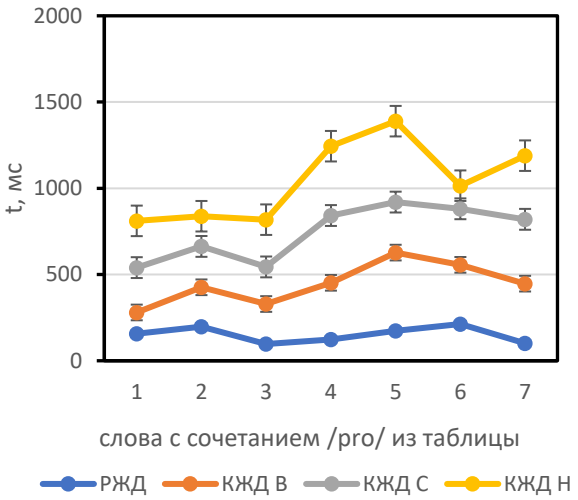


Figure 37 – Duration of the combination /pr/ in the realisation of the Russian speaker and Chinese speakers with different levels of language proficiency. On the abscissa axis - duration of the combination of words (1-7): on the ordinate axis – duration in ms.

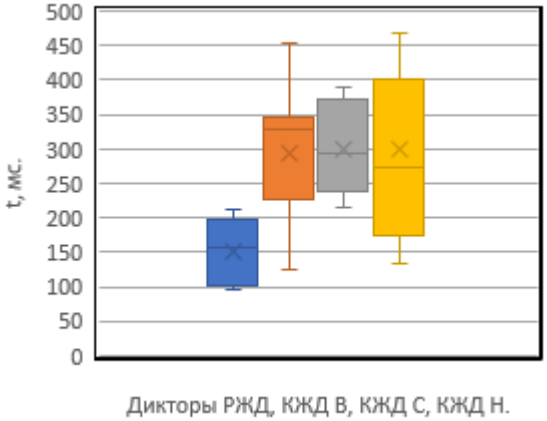


Figure 38 – Maximum and average variation of duration of realisations of the combination /pro/ in the Russian speaker and Chinese speakers with different levels of Russian language proficiency in ms.

The greatest scatter of indicators is observed in native speakers of Chinese with a low level of language proficiency. The maximum level was a scatter of duration values from 134 to 469 ms. while the average indicator was a scatter from 274 to 402 ms. The data indicate a great variability of sound-types in this group of speakers. The variation is smaller for the intermediate level speakers, as well as for the high proficiency group. Nevertheless, none of the groups reaches the level of normative realization by duration of native speakers of Russian, both in terms of the size of the scatter of indicators and the level of these indicators.

/pr^{j}/

The results of the analysis of the duration of pronunciation of syllables with the consonantal combination /pr^{j}/ by native speakers of Chinese testify to the articulatory difficulty of realizing such combinations. The absence of the soft trembling consonant /**r^{j}**/ in the Chinese language system causes the greatest difficulty in mastering Russian pronunciation. Indicators of the duration of pronunciation of syllables with the consonantal combination /pr^{j}/ in words in the realizations of native speakers of Chinese and Russian are presented in Table 36.

Table 36 - Average data on the duration of syllable realizations /pr^{j}i/ performed by native speakers of Russian and Chinese languages in ms.

Male speakers				Female speakers			
Words	*прослушивался*	*при*	*привлекли*	Words	*прослушивался*	*при*	*привлекли*
РМД	122	111	112	РЖД	72	101	6
КМД	315	200	303	КЖД	251	161	201

The data demonstrate a significant difference in the realization of the consonantal combination /pr^{j}/ in the realization of native speakers of Russian and Chinese. Chinese male speakers realize the combination /pr^{j}/ 2.7 times longer than Russian male speakers. Chinese female speakers realize the combination /pr^{j}/ 3.4 times longer than Russian female speakers. At the same time, female Chinese speakers realize the consonantal combination /pr^{j}/ 1.3 times faster than male Chinese speakers. Figures 39 and 40 show the duration of realizations of the text words: listened, at, attracted in the performance of Chinese and Russian female and male speakers respectively.

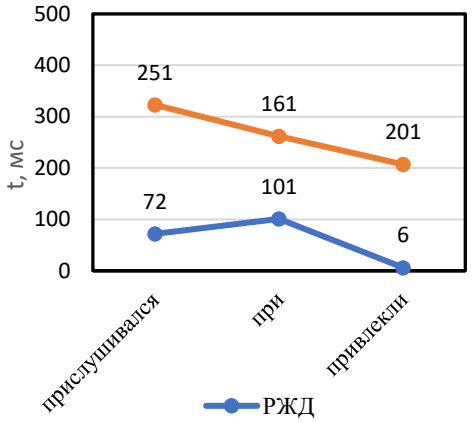


Figure 39 – Duration of the combination /prʲ/ as part of words in the realisations of female speakers of Russian (РЖД) and Chinese (КЖД) languages in ms.

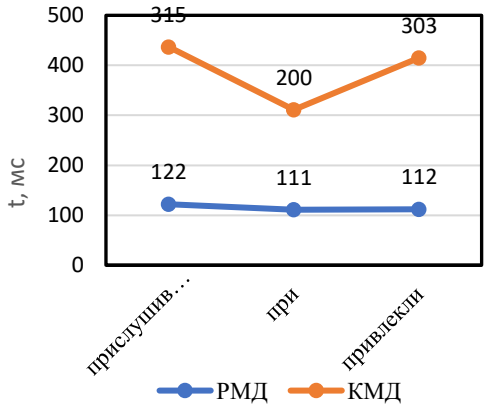


Figure 40 – Duration of the combination /prʲ/ as part of words in the realisations of male speakers of Russian (РМД) and Chinese (КМД) languages in ms.

A comparative analysis of the duration of pronunciation of the consonantal combination /prʲ/ in unaccented syllables of polysyllabic words of the upcoming text by native speakers of Chinese and Russian showed noticeable differences in the duration of the combinations. Male and female native speakers of Chinese implement the combination /prʲ/ 2.6 times longer than native speakers of Russian, as well as the analyzed consonantal combinations.

The indicators of the duration of pronunciation of syllables with the consonant combination /prʲ/ as part of the words: *предстоящей*, *преподаватель* in the realizations of native speakers of Chinese and Russian are presented in Table 37.

Table 37 – Average data on the duration of syllable realizations /prje/ in Russian and Chinese native speakers in ms

speakers / Words	РМД	РЖД	КМД	КЖД
предстоящей	197	168	203	249
преподаватель	204	11	263	251

In the course of the analysis, summary statistical graphs were prepared on the comparative characteristics of the realizations of all words with the consonantal

combinations /pr/, /prʲ/ in Chinese males and females. Figures 41 and 42 show the obtained maximum and minimum scatter of data in the realizations of the combinations.

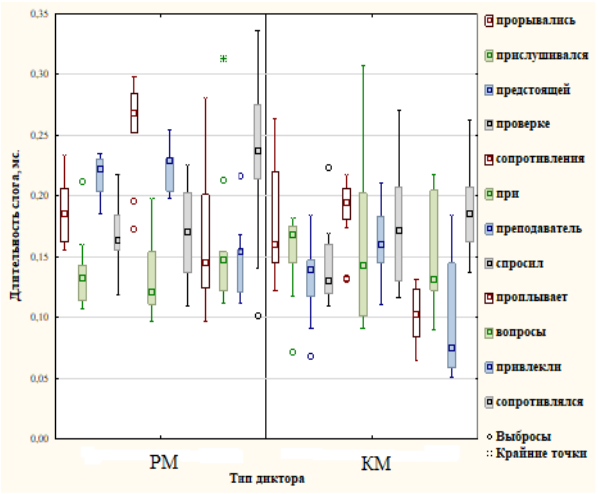


Figure 41 – Summarised duration of combinations /pr/, /prʲ/ as part of words within words in the performance of Russian and Chinese male speakers in ms.

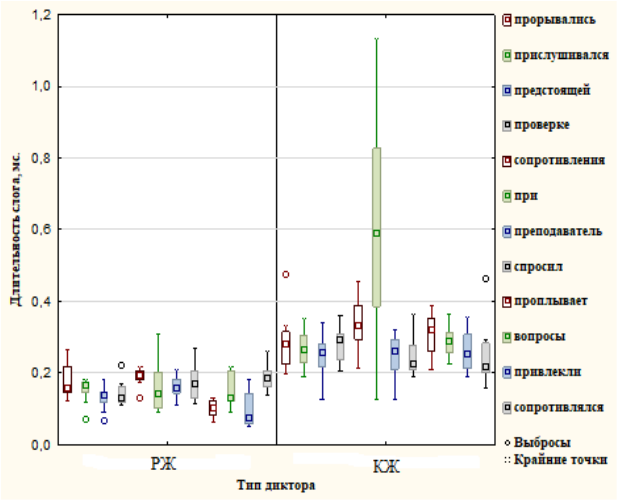


Figure 42 – Summarised duration of combinations /pr/, /prʲ/ as part of words within words in the performance of Russian and Chinese male speakers in ms.

Both female and male speakers of Chinese demonstrate the maximum variation of data when realizing words with consonantal combinations /pr/, /prʲ/ in comparison with Russian speakers.

In the course of the study, the spectra of sound recordings of words with the combinations /pr/, /prʲ/ were analyzed. It is known that a specific feature of the spectrum of trembling sonants /r/, /rʲ/ are periodic weakenings of the intensity and formant structure of the sound (*Dukelsky 1983: 61; Bondarko, Verbitskaya, Gordina 2004: 76*). They are caused during articulation of /r/, /rʲ/ by thrilling of the front part of the tongue at the place of its contact with the palate.

The analysis of spectral characteristics of realizations of the consonantal combination of the lip-lip sonant and the anterior tongue trembling sonant in the combinations /pr/ shows a clear expression of weakening and strengthening of frequency components at the realization of /pr/ in the words *проплывает*, *вопросы*,

проплывает, *спросил* in Russian speakers. Figures 43-44 show the spectrograms of realizations of the consonantal combination /pr/ in words in Russian and Chinese speakers.

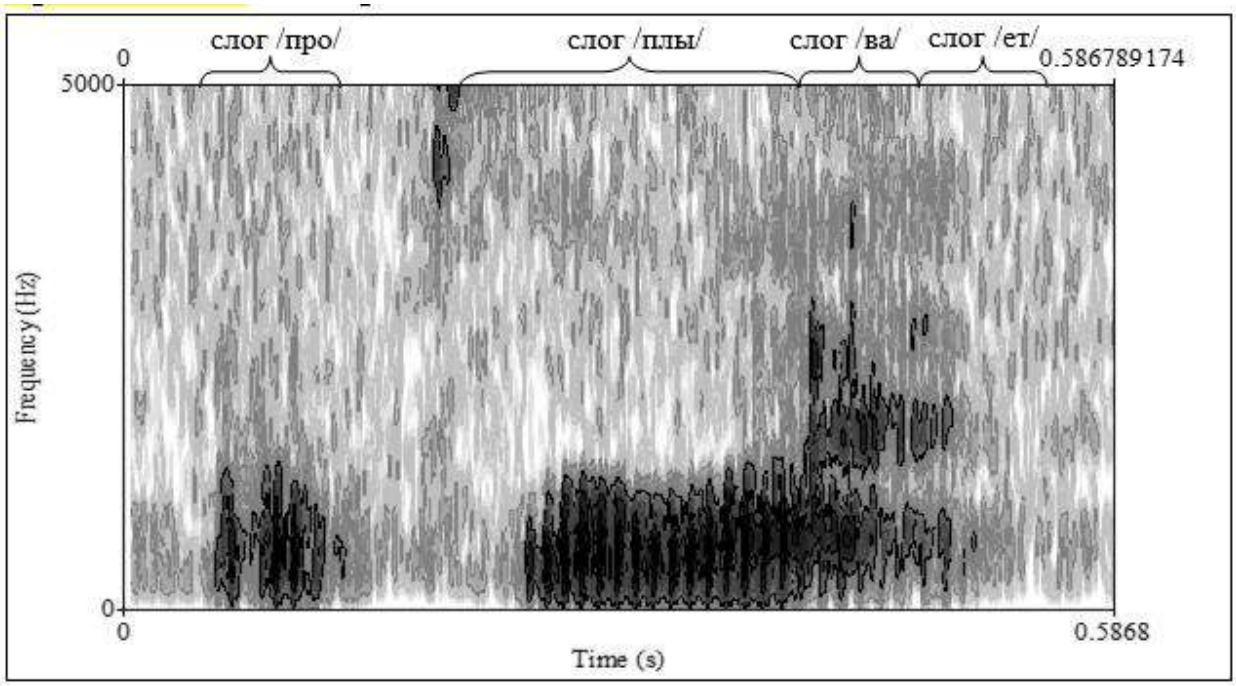


Figure 43 - Spectrogram of the word *проплывает* in the realisation of Russian speaker 1, male. On the ordinate axis - frequency characteristics in Hz, on the abscissa axis - duration in ms.

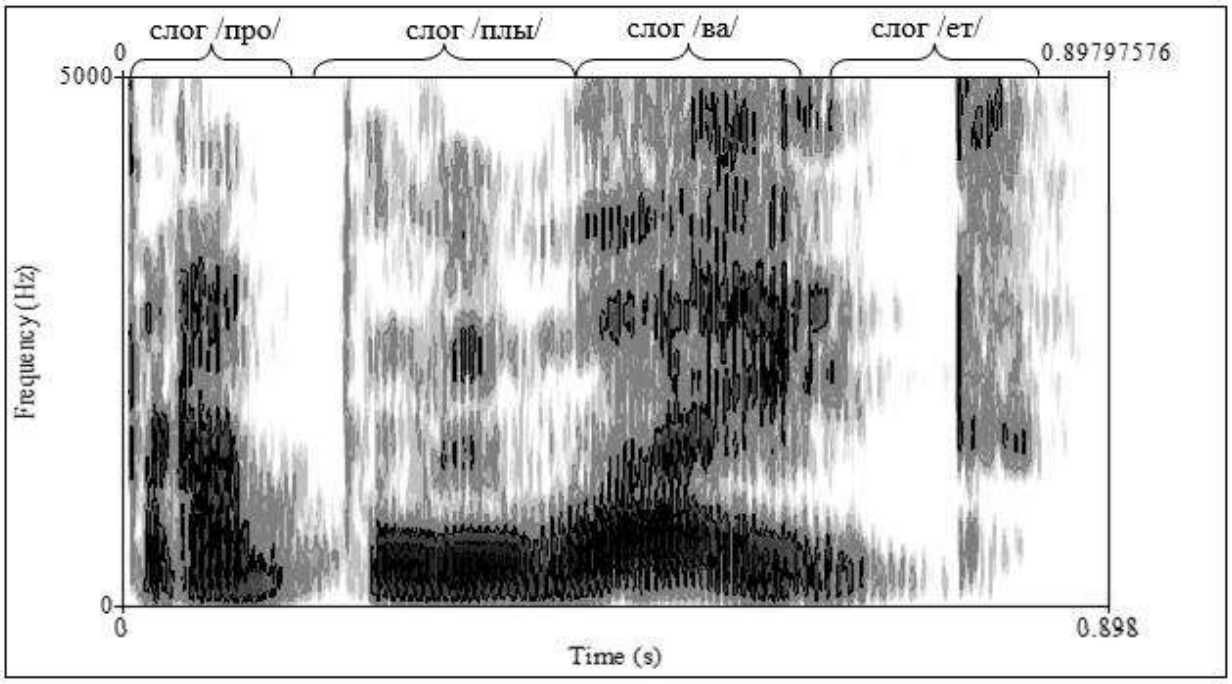


Figure 44 - Spectrogram of the word *проплывает* in the realisation of Chinese speaker #1, male. On the ordinate axis - frequency characteristics in Hz, on the abscissa axis - duration in ms.

The spectrum indicates two areas of intensity gain corresponding to two strokes of tongue-tongue contact with the palate. When realizing the isolated pronunciation of /r/, one can observe three or more areas of intensity gain in the spectrum corresponding to three or more tongue-to-palate contacts. On the contrary, in Chinese speakers the intensity gain is less intense and vague in native speakers of Chinese with a high level of Russian language proficiency, with the exception of the male speaker KM1B, in the spectra of the words *привлекли*, *преподаватель*, which is observed two sites of intensity gain corresponding to the normative pronunciation. Even weaker and less pronounced is the combination /pr/ in the spectra of words performed by native speakers of Chinese with a low level of proficiency in Russian. In addition, frequency amplifications corresponding to vowel insertions between the consonants /p/ and /r/ in the combination /pr/ are observed in the spectra of words performed by Chinese speakers.

The analysis of the spectral characteristics of the realizations of the consonantal combination of the lip-lipped consonant /p/ and the forelingual trembling soft sonant /rʲ/ in the combinations /prʲ/ shows a clear expression of weakening and strengthening of frequency components in the realisation of /prʲ/ in the words *привлекли*, *преподаватель* in Russian male and female speakers. On the contrary, in native speakers of Chinese, no pronounced strengthening and weakening of frequency components corresponding to the articulatory locus in the place of contact between the tongue body and the palate, characteristic of the sonant /rʲ/, is observed in the word spectra. The exception is the realization of /prʲ/ in the performance of the Chinese speaker of a man with a high level of Russian proficiency KM1B, in the spectra of which we can observe strengthening and weakening of the basic tone and formant structure in the realization of /rʲ/. The realization of /prʲ/ by native speakers of Chinese with a low level of language proficiency does not correspond to the normative realization, which is confirmed by the corresponding spectra, in which the pattern characteristic of /prʲ/ is not observed, in particular, the absence of pronounced areas of intensification and weakening of intensity in the locus of the spectrum of the combination /prʲ/.

Thus, the difficulties in realizing the combinations /pr/, /pr^{j}/ are caused by the absence of such consonantal combinations in the Chinese language system, including the combinations that include the forelingual, trembling hard and soft sonants /r/, /r^{j}/, which present the greatest difficulty for native speakers of Chinese when mastering Russian pronunciation.

Figure 44-45 show spectrograms of realizations of the consonantal combination /pr^{j}/ in the words *привлекли*, *преподаватель* in Russian and Chinese speakers.

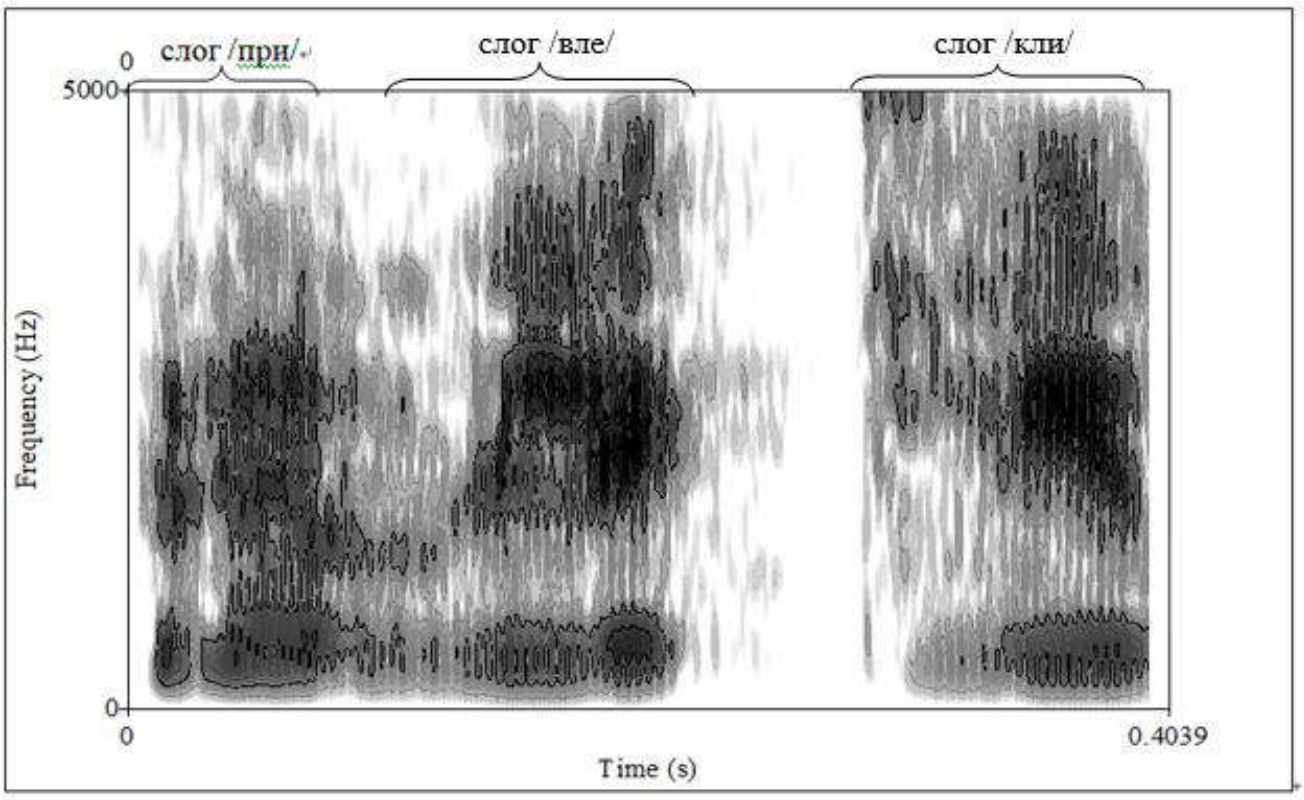


Figure 45 - Spectrogram of the word *привлекли* in the realisation of Russian speaker 1, female. On the ordinate axis - frequency characteristics in Hz, on the abscissa axis - duration in ms.

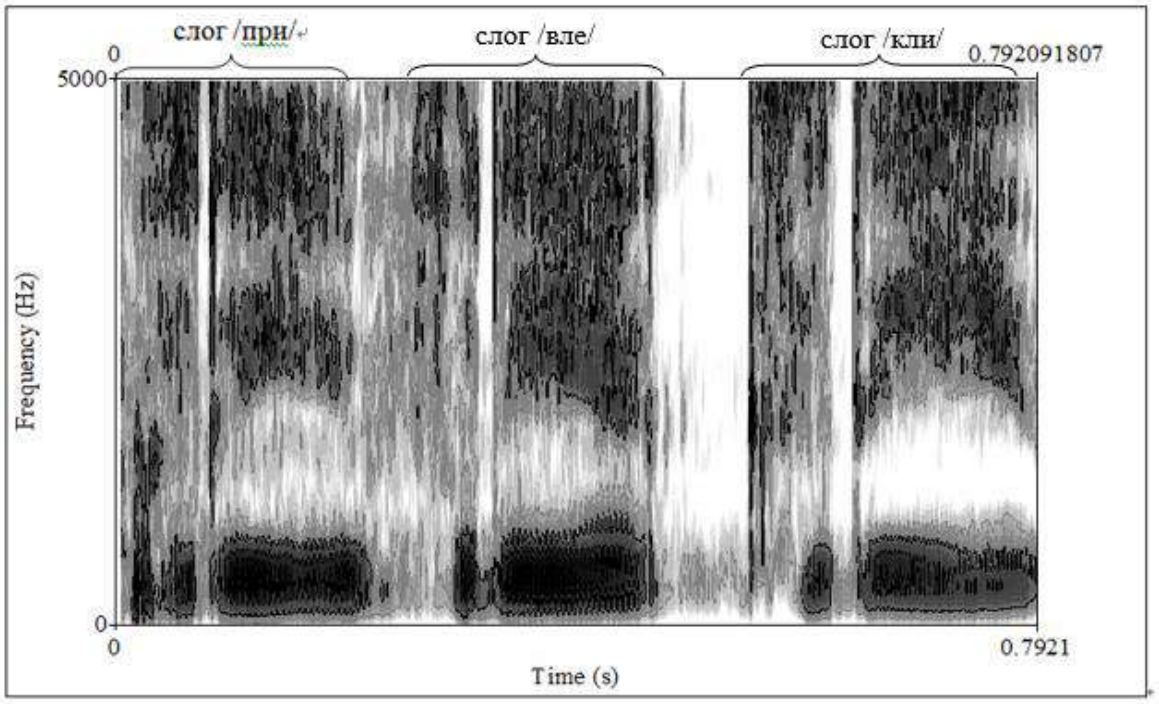


Figure 46 - Spectrogram of the word *привлекли* in the realisation of Chinese speaker 2, female. On the ordinate axis - frequency characteristics in Hz, on the abscissa axis - duration in ms.

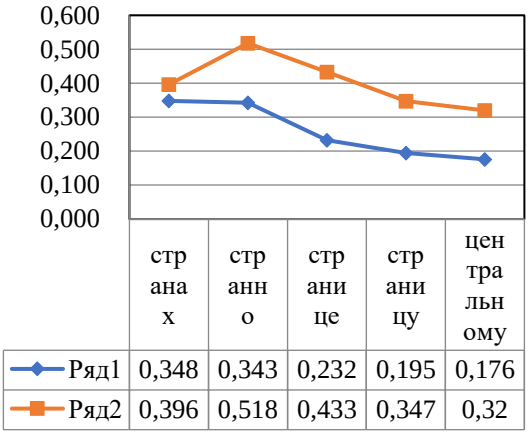
3.3.2. Combinations /tr/, /str/, /trʲ/

This case study is based on the author's work[33] . In the text we analysed words with the consonant combination /tr/, /str/, /trʲ/, in the syllable /stra/ in words of different syllable length: *странах* (2 слога), *странно* (2 слога), *странице* (3 слога), *страницу* (3 слога), /tr/ in the word *центральному* (4 слога); /tri/ в словах *три* (1 слог), *электрические* (6 слогов); /tro/ in the word *строгий* (2 слога).

/tr/, /str/

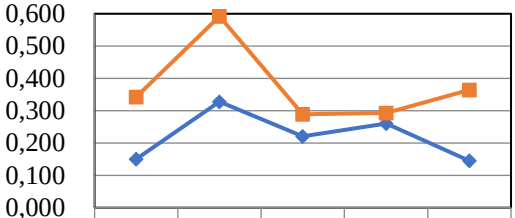
Figures 47, 48 demonstrate the difference in syllable durations /tr/, /str/ between the realisations of native speakers of Russian and Chinese, both in male and female speakers.

[33] Sun Bo Realisation of Russian complex consonant combinations in the speech of Russian and Chinese speakers // Speech analysis: theoretical and applied aspects / Ed. by L.D.Radnaeva. - Ulan-Ude: Buryat University Publishing House, 2023. - C. 146-151.



	стр ана х	стр анн о	стр ани це	стр ани цу	цен тра льн ому
Ряд1	0,348	0,343	0,232	0,195	0,176
Ряд2	0,396	0,518	0,433	0,347	0,32

Figure 47 – Duration of [str], [tr]. Row 1 – duration of [str], [tr] in pronunciation of Russian male speakers; Row 2 – duration of syllable [str], [tr] in pronunciation of Chinese women. On the ordinate axis – duration in ms, on the abscissa axis – words with combinations [str], [tr].



	стра нах	стра нно	стра ниц е	стра ниц у	цен трал ьно му
Ряд1	0,150	0,328	0,221	0,260	0,145
Ряд2	0,343	0,592	0,289	0,293	0,364

Figure 48 – Duration of [str], [tr]. Row 1 – duration of syllable [str], [tr] in Russian female speakers; Row 2 – duration of syllable [str], [tr] in Chinese male speakers. On the ordinate axis – duration in ms, on the abscissa axis – words with combinations [str], [tr].

Analysis of the realizations of /tr/, /str/ in the words *странах*, *странно*, *странице*, *страницу*, *центральному* from the experimental text with the consonantal combination /tr/, /str/ in the pronunciation of Chinese male speakers compared to Russian male speakers showed significant differences in duration. The absence in the Chinese language system of the anterior lingual tremulous hard sonant /r/, as well as the absence of the consonantal combinations /tr/, /str/, /tr^{j}/ caused articulatory difficulties in duration in Chinese speakers when reading the text.

The analysis of realizations of the word *строгий* showed a similar pattern, with the duration of realizations in Chinese speakers exceeding the duration of realizations of the combination in Russian speakers. It is noteworthy that both male speakers in both languages realize the combination /str/ longer than female speakers.

Figures 49, 50 show the realization of the word strict by Russian and Chinese male and female speakers in comparative terms.

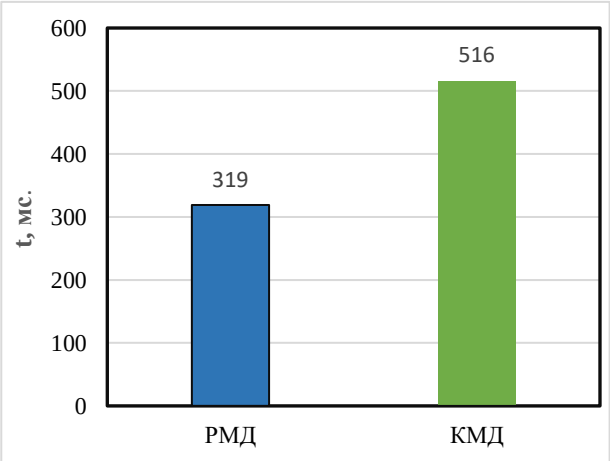


Figure 49 – Duration of the combination /str/ in the performance of Russian and Chinese male speakers. On the abscissa axis – Russian speakers (РМД) and Chinese speakers (КМД). On the ordinate axis – duration in ms.

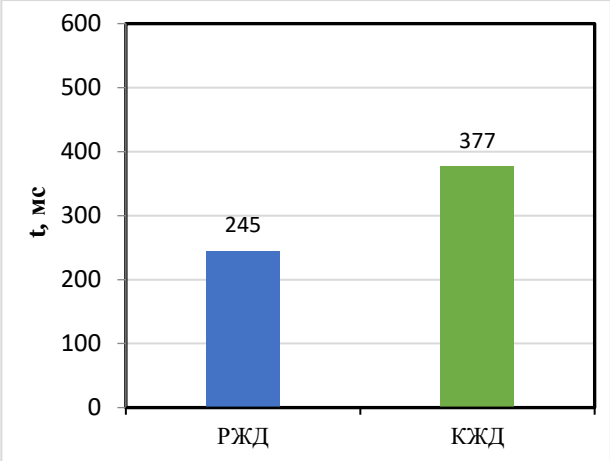


Figure 50 – Duration of the combination /str/ in the performance of Russian and Chinese female speakers. On the abscissa axis – Russian speakers (РЖД) and Chinese speakers (КЖД). On the ordinate axis – duration in ms.

The results of the analysis of the duration of pronunciation of syllables with consonantal combinations /tr/, /str/ by native speakers of Chinese testify to the articulatory difficulty of realization of such combinations.

/tr^{j}/

Analysis of the realizations of the words *три*, *электрические* from the experimental text with the consonant combination **/tr^{j}/** in the pronunciation of Chinese male speakers compared to Russian male speakers showed significant differences in duration. The absence in the Chinese language system of the forelingual trembling soft sonant /r^{j}/, as well as the absence of the consonantal combinations /tr/, /str/ caused articulatory difficulties in duration for Chinese speakers when reading the text. The analysis of /tr^{j}/ is carried out on the example of the words *три* (3 syllables) and *электрические* (6 syllables), which are different in number of syllables. Figure 51 demonstrates the duration of realizations of /tr^{j}/ in the performance of Russian and Chinese male and female speakers.

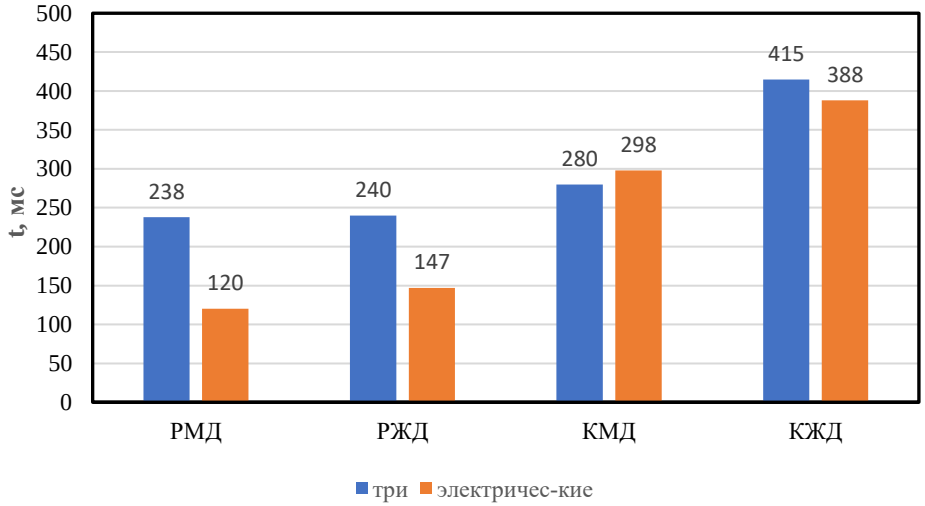


Figure 51 – Realization of /tr^{j}/ in the composition of words in the performance of Russian and Chinese male and female speakers. On the ordinate axis – duration in ms, on the abscissa axis – РМД, РЖД - Russian speakers; КМД, КЖД – Chinese speakers.

The analysis of the duration of the combination /tr^{j}/ in the performance of Russian speakers, both male and female, is the same. The one-syllable word *три* from the text sentence «Рыжий мальчик, которому было года *три*, отворачивался, вырывался, показывал маме розовый язык» is key, stressed and pronounced longer. The duration of the consonantal combination is 238ms. and 240ms. in males and females respectively. The duration of the combination /tr^{j}/ in the stressed syllable of the polysyllabic word *электрические* is 130 ms. and 147 ms. respectively.

The combination /tr^{j}/ in a single-syllable word is pronounced 1.7 times longer than in a multi-syllable word. Both male and female native speakers of Chinese realize the combination /tr^{j}/ in words longer than Russian speakers. It is noteworthy that the duration of realization of the combination /trj/ in the multi-syllable word *электрические* exceeds the

duration of realization of the combination in the one-syllable word *три*. The duration of realizations is 280 ms. and 298 ms. in the word *три* and 415 ms. and 388 ms. in the word *электрические*. As mentioned earlier, Chinese speakers try to pronounce each syllable of a multi-syllable word in the stressed position as a separately pronounced word, so the syllable durations in a multi-syllable word are equal to or greater than the /tr^{j}/ durations in single-syllable words.

The spectra of sound recordings of words with the combinations /tr/, /str/, /tr^{j}/ were analyzed in the course of the study. The analysis of spectral characteristics of realizations of consonantal combinations of an forelingual explosive semantic and forelingual trembling sonant shows a clear expression of weakening and strengthening of frequency components in the realizations of /tr/, /str/, /tr^{j}/ in the words *страницe*, *страница*, *странно*, *центральному*, *строгий*, *три*, *электрические* in the pronunciation of Russian speakers. No amplification of frequency components in the locus of sonants /r/, /r^{j}/ is observed in the spectra as a result of the influence of preceding deaf /s/, /t/ on them. In addition, native speakers of Chinese pronounce the Chinese aspirated /t^{h} / in place of /t/. Vowel insertions in the realization of combinations /tr/, /str/, /tr^{j}/ in the performance of native speakers of Chinese with a low level of Russian proficiency are also noted. Vowel insertions increase the duration of pronunciation of combinations and words in general.

Figures 52-53 show spectrograms of realizations of the consonantal combination /tr/, /str/ as part of the words *страницe*, *странно*, *строгий* in Russian and Chinese speakers.

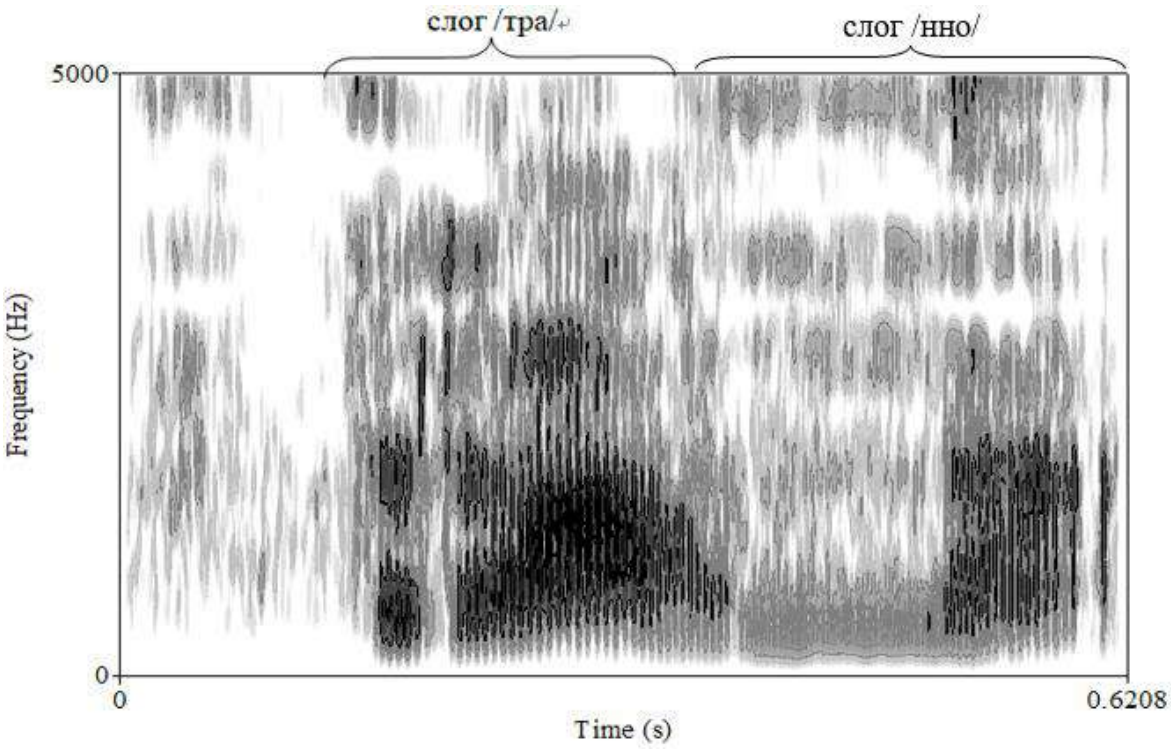


Figure 52 - Spectrogram of the word *странно* in the realisation of Russian speaker 1, female. On the ordinate axis - frequency characteristics in Hz, on the abscissa axis - duration in ms.

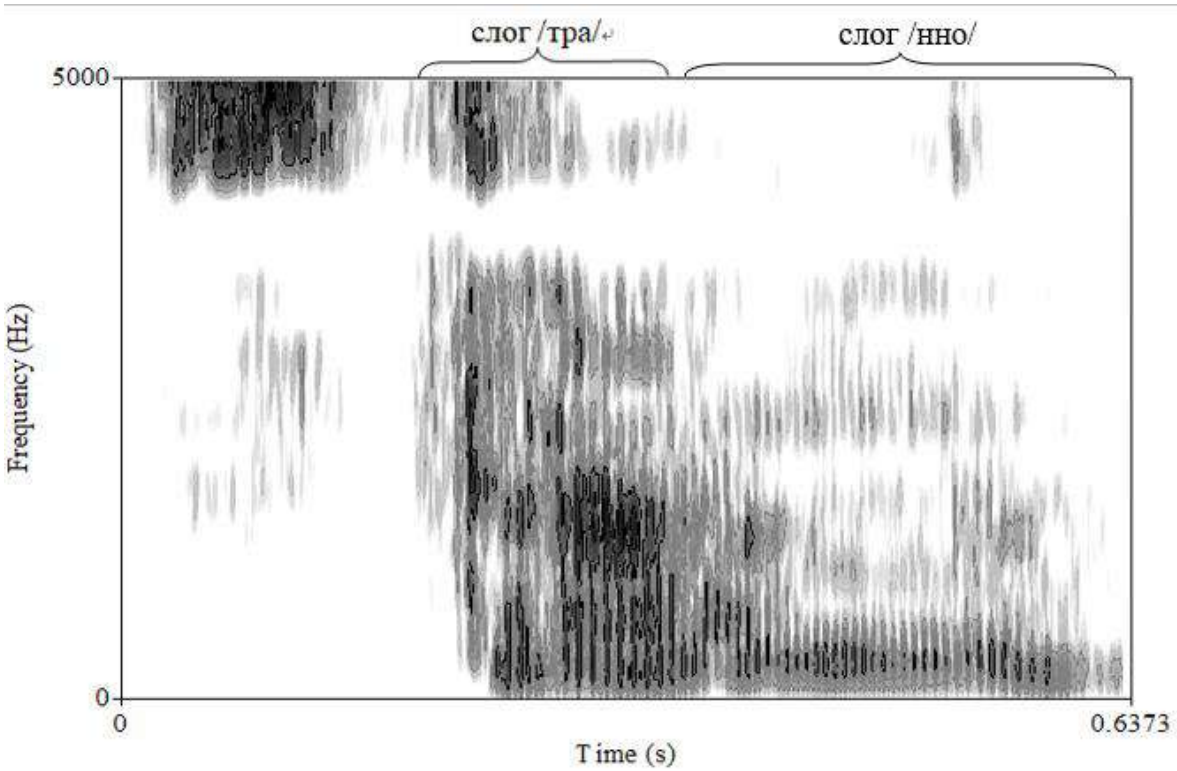


Figure 53 - Spectrogram of the word *странно* in the realisation of Chinese speaker 1, male. On the ordinate axis - frequency characteristics in Hz, on the abscissa axis - duration in ms

Chapter 3 conclusions

1. The hypothesis about modifications of the Russian vowels, consonants and consonant combinations in the speech of native Chinese speakers.

2. Modification of Russian vowels in the realisation of Chinese speakers is characterized by the absence of quantitative vowel reduction.

3. native speakers of Chinese language replace Russian vowels with their Chinese analogues, as well as diphthongs and diphthonggoids.

4. The realization of Russian vocalic units /i/, /ɨ/, /u/, /e/, /ɑ/, /o/ by the Chinese is characterized by the full type of vowel pronunciation characteristic of their isolated pronunciation.

5. Difficulties of realizations of Russian consonants are connected with the absence in the Chinese language has no correlations on the signs "hard-softs" and "voiceless–voiced", as well as the difference in the way and place of their formation.

6. The systematic influence of the differential feature "aspirated-unaspirated" and "unaspirated" has been established. "aspiration - unaspiration" at realization of Russian /p/, /pʲ/, /t/, /tʲ/, /k/, /kʲ/ in positions of absolute beginning, middle and end of the word.

7. The phonetic phenomena of elision, syncope (falling out of a sound), as well as epinthesis (sound insertion) in the realization of both vowels and consonants.

8. The duration of realizations of Russian combinations in the performance of Chinese speakers exceed twice this indicator in Russian speakers.

9. Sonants /r/, /rʲ/ in the composition of consonantal combinations in the performance of Chinese speakers are characterized in the spectral pattern by a pronounced weakening of intensity and formant structure. The consonantal combinations with forelingual, tremulous hard and soft sonants /r/, /rʲ/ present the greatest difficulty.

10. Parameters of the realizations of vowel, consonant and consonantal combinations in the performance of Chinese speakers with a high level of Russian proficiency are equivalent to those of Russian speakers.

CONCLUSION

In the dissertation study, on the basis of a representative array of sound recordings of an exemplary model of Russian speech - a phonetically representative text in the realization of 50 speakers of normative modern Russian and Chinese, a comprehensive experimental-phonetic analysis was carried out and detailed phonetic indicators of modifications of Russian vowels, consonants and consonant combinations were obtained. The main results of the performed research are as follows:

New acoustic data on the realization of Russian vowels demonstrate the diversity of vocalic sound-types of vowels, their frequency characteristics in F1- F2 space depending on their location in the stressed or unstressed position, gender characteristics of speakers and the level of their linguistic competence (high, medium, low), pronunciation rate, as well as the influence of the Chinese phonetic system. The main cause of non-normative vowel realization at the initial stage of Russian language acquisition for Chinese is erroneous stress leading to distortion of the whole word and, as a consequence, to the identification of formant indicators of vowels beyond the limits typical for the Russian language;

The hypothesis about modifications of Russian vowels, consonants and consonant combinations in the speech of native speakers of the Chinese language, connected with the difficulties of realizations of consonants according to the features not typical for the Chinese language, such as "hard-soft" and "voiceless –voiced", as well as according to the regular features "type of obstruction" and "place of obstruction", has been experimentally confirmed. The systematic influence of the feature "aspiration-unaspiration" peculiar to the sound system of the Chinese language has been established. The phonetic phenomena of elision or syncope (sound dropout) and epinthesis (sound insertion) have been revealed;

The new empirical information on the analysis of consonantal combinations of Russian in Chinese speech by duration and spectral

(acoustic) pattern indicators clearly demonstrates and substantiates the obstacles that Chinese speakers face in mastering Russian consonantal combinations. The greatest difficulty is presented by the combinations that have the forelingual, trembling, hard and soft sonants /r/, /rʲ/, which are absent in the Chinese language system;

The results of the dissertation research reflect the scientific novelty, theoretical and practical significance of the work related to the linguistic interpretation of the data obtained experimentally, reflecting the specificity of modification phonetic processes of Russian vowels and consonants in the speech of native speakers of Chinese with different degrees of language training, gender, detailed knowledge of which is extremely necessary in the practical implementation of pronunciation of modern Russian in the Chinese audience.

As a result of the conducted research, the main statements put forward for the defence have been proved:

1. Theoretical and applied bases of modifications of Russian vowels, consonants and consonant combinations in the performance of native speakers of the Chinese language allow us to methodologically substantiate the difficulties of mastering articulatory, acoustic and perceptual features of the sound system of the Russian language.

2. Peculiarities of the Russian verbal accent, connected with its mobile and different place character, the presence of stressed and unstressed vowels have a negative interfering influence on the non-normative modification of vowels in the performance of native speakers of Chinese, manifested in the absence of quantitative reduction of vowels, replacement of Russian vowels by their Chinese analogues, diphthongs and diphthongoids and sound-types

of the full type of pronunciation of all vowels in the composition of words from two-syllable to multi-syllable words.

3. Systematic interfering influence of the peculiarities of the sound system of the Chinese language on the realization of the sound units of the Russian language, manifested in the pronounced aspirated character of Russian /p/, /pʲ/, /t/, /tʲ/, /k/, /kʲ/; the tendency of pronunciation of the open syllable of the CV type, expressed in such phonetic phenomena as elision and syncope (falling out of sounds); epenthesis and epithesis (vowel insertion) in consonantal combinations, in the middle and at the absolute end of the word after consonants.

4. The action of phonetic interference in the pronunciation of Russian consonants by the Chinese arises in the manifestation of those features that are not represented in Chinese, namely: "hard-soft consonant correlation", "voiceless-voiced consonant correlation", as well as substitution of Russian sounds that are not represented in the Chinese language system..

LIST OF REFERENCES

1. *Avanesov R. I.* Phonetics of the Modern Russian Literary Language. -M.: Moscow University Press, 1956. - 239 c.
2. *Bertagaev T. A.* Bilingualism and its varieties in the system of usage // Problems of bilingualism and multilingualism. - M., 1972. - 82-85.
3. *Baudouin de Courtenay I. A.* Selected Works on General Linguistics. - Moscow: Izd-vo Acad. of Sciences of the USSR, 1963. - 384c.
4. *Bogdanova N. V.* Live phonetic processes of Russian speech. - SPb.: Filol. faq. SPbSU, 2001. - 186 c.
5. *Bogdanova N. V.* Pronunciation and transcription: Tutorial-methodical manual on modern Russian lit. yaz. - SPb.: Filol.fak. St.-Petersburg State Univ., 2001. - 64 c.
6. *Bondarko L. V.* Phonetic description of language and phonological description of speech. - SPb.: Izd-vo SPbSU, 1981. - 199 c.
7. *Bondarko L. V.* Sound organisation of an utterance and phonetic structure of a syllable // Hearing and speech in norm and pathology. - Л.:, - 1982. - С.3-9.
8. *Bondarko L. V.* Sound structure of the modern Russian language. - Moscow: Prosveshchenie, 1977. - 175 c.
9. *Bondarko L. V.* Structure of a syllable and characteristics of phonemes // Problems of Linguistics. - 1967. - № 1 - С. 34-46.
10. *Bondarko L. V.* Phonetics of the modern Russian language: textbook. - SPb.: Izd-vo SPbSU, 1998. - 276 c.
11. *Bondarko L. V., Zinder L.R.* About some differential features of Russian consonant phonemes // Voprosy linguoznaniya. 1966. - №1.
12. *Bondarko L. V., Verbitskaya L. A. A.,* Gordina M. V. Fundamentals of General Phonetics - St. Petersburg: Philological Fact. SPbSU, 2004 - 160 p.
13. *Bondarko L. V.* Pronunciation styles and pronunciation types / *L. A. Verbitskaya, M. V. Gordina, L. R. Zinder, V. B. Kasevich* // Questions of linguistics. - 1974. - №2. - С. 64-70.

14. *Bondarko L. V.* Text module "Phonetic representative text" / *S. B. Stepanova* // Bulletin of the Phonetic Foundation of the Russian Language. - Bochum Leningrad. - 1992. - №2. - C. 132-134.
15. *Bryzgunova E. A.* Sounds and intonation of Russian speech. - Moscow: Russian Language, 1977. - 278 c.
16. *Weinreich U.* Unilingualism and multilingualism. New in Linguistics. - Vyp. 6. - Language contacts. - M., 1972. - C. 25-60.
17. *Weinreich U.* Language contacts. K.: Vyshcha Shkola, 1979. - 264 c.
18. *Vasilieva L. A., Tananayko S. O*. Consonant combinations in the Russian speech of foreigners // Bulletin of the phonetic fund of the Russian language. No. 8: Phonetic properties of spontaneous speech. SPb., Bochum, 2001. - C. 111-129.
19. *Vasilieva, L. A.* The study of phonetic information as a basis for diagnosing accent and dialect in a multinational society / *S. O. Tananayko* // Analysis of Spoken Russian Speech" (AR3 -2010): Proceedings of the 4th interdisciplinary seminar - SPb.: GUAP. - 2010. - C. 4-9.
20. *Vasilieva L. A., Tananaiko S. O.* Consonant combinations of consonants in interfered Russian speech / Experimental-phonetic analysis of speech: problems and methods. - Vyp. 5. -Phonetic diversity of world languages. - SPb.: Izd-vo SPbSU. - 2004. - C. 34-47.
21. *Verbitskaya L. A.* Modern Russian literary pronunciation: autoref. dis. ... doctor of philological sciences. - Л., 1977. - 43 c.
22. *Verbitskaya L. A., Ignatkina L. V.* Practical phonetics of the Russian language for foreign students: textbook. - SPb.: Izd-vo SPbSU, 1993. - 152 c.
23. *Verbitskaya L. A., Zinder L. R.* To the question of combinations of consonants in Russian speech // Philological Sciences. № 3,1969.
24. *Verbitskaya L. A.* Theoretical problems of interference in teaching Russian language (system and norm) // National and international in the development

of languages: Interuniversity collection of scientific works / Ivan. State Univ. - Ivanovo, 1984. - C. 22-27.

25. *Verbitskaya L. A., Gordina M. V.* Features of phonetic interference of languages of different degree of affinity // Problems of phonological research. - Л., 1980. - C. 115-116.
26. Dragunov A.A., Dragunova E.N.. The structure of the syllable in the Chinese national language // Soviet linguistics. 1955. № 1. C. 57-74.
27. *Du Yunsha.* Methodical aspects of Russian pronunciation to Chinese students of the initial stage of training: dissertation .... Cand. phil. n. - SPbSU, 2017. - 242 c.
28. *Du Yunsha.* In-depth analysis of Chinese language sounds as an element of teaching Russian pronunciation // World of Science, Culture, Education. - 2016, - №4 (59). - C.108-113.
29. *Deng Jie.* Positional regularities of the Russian phonetic system "in the mirror" of the Chinese language. [Electronic resource] - URL: http://www.dslib.net/russkij-jazyk/pozicionnye-zakonomernosti russkojfoneticheskoj-sistemy-v-zerkale-kitajskogo.html (date of reference: 15.03.2019)
30. *Deng Jie.* Language situation in China and its influence on the process of mastering Russian pronunciation / M. Antropova // Philology and Culture. - 2017. - 34(50). - C. 107-111.
31. *Deng Jie.* Native dialect as the basis of phonetic interference in the Russian speech of the Chinese // Vestnik of Moscow University. Series 9: Philology. - 2011. - № 4. - C. 194-202.
32. *Deng Jie.* Syllabic "prism" of the native language as a factor of phonetic interference in the Russian speech of the Chinese // Vestnik of Moscow University. Ser. 9. Philology. - 2010, - № 4. - C. 101-108.
33. *Evdokimova V. V.* Acoustic analysis of speech signal: methodical manual for seminars and practical classes. - SPb.: Izd-vo SPbSU, 2014. - 104 c.

34. *Elkina V. N.* Statistics of Russian speech syllables / *L. S. Yudina* // Computing systems. Vyp. 10. - Novosibirsk - 1964. - C. 47-53.
35. *Erofeeva E. V., Polyakova E. N., Stern A. C.* Russian govoras of the Perm region: Formation. Functioning. Development. Perm, 1998.
36. *Zhluktenko Y. A.* Linguistic Aspects of Bilingualism. Kiev: Vyshcha Shkola, 1974. - 176 c.
37. *Zemskaya E. A.* Russian colloquial speech: linguistic analysis and problems of teaching. - Moscow: Russian Language, 1979. - 240 c.
38. *Zinder, L. R.* K omozheniyu o priblizheniya statistiki v linguoznaniya / *T. V. Stroeva* // Voprosy linguoznaniya. - 1968. - № 6. - C. 120-123.
39. *Zinder L. R.* General phonetics. - Moscow: Vyshaya Shkola, 1979. - 312 c.
40. *Ivanov A.I., Polivanov E.D., Dragunov A.A.*, Yakhontov S.E., et al. Chinese language / Linguistic encyclopaedic dictionary. - Л., 1990. - C. 225-226.
41. *Ignatkina L. V.* Territorial variation of the Russian literary pronunciation (on the material of vowels in the speech of informants of the cities of Vologda and Perm): autoref. diss. ...kand. philol. nauk. - Л., 1982. - 18 c.
42. *Ignatkina L. V.* Realisation of the correlation "phonation-deafness", "hardness-softness" in the Russian speech of the Chinese / *S. Zhou* // Experimental-phonetic analysis of speech. - SPb.: Izd-vo SPbSU, - 1997. - Vol. 3. - C. 173-181.
43. *Ignatkina L. V.* Articulatory characteristics of Chinese vowels in comparison with Russian // Problems and Methods of Experimental Phonetic Research. St. Petersburg State University, 2002.
44. Interference of sound systems: a collective monograph. Edited by *L. V. Bondarko, L. A. Verbitskaya.* - L.: Izd-vo LSU, 1987. - 280 c.
45. *Karlinsky A. E.* Fundamentals of the theory of language interaction and the problem of interference: autoref. dissertation. D. in Philology. Kiev, 1980. – 48 c.
46. Kasevich V. B. Integrity of linguistic units in the system and speech activity // Vestnik of Leningrad State University. Series 2. History, Linguistics,

Literature Studies. 1987. Vyp. 4. № 23. C. 49-56.

47. *Kasevich V. B.* Phonological Problems of General and Oriental Linguistics. - Moscow: Izd-vo Nauka, 1983. - 295 c.

48. *Kasevich V. B.* Elements of General Linguistics. - Moscow: Izd-vo Nauka, 1977. - 183 c.

49. *Kasymova B. K.* Studies of the perceptual base of language in the conditions of Kyrgyz-Russian bilingualism. - Frunze: Izd-v Ilim, - 1991. - 88 c.

50. *Kodzasov S. V., Krivnova O. F*. General phonetics. - Moscow: Izd-vo Ros. gos. humanitarian. un-unit, 2001. - 590 c.

51. *Krylov Yu. Yu.* Languages tonal, register, post-register / Izvestiya Rossiiskogo gosudagogicheskogo pedagogicheskogo universitet named after A. I. Herzen. - 2009. - C. 149-155.

52. *Kuznetsov V. I*. Vocalism of coherent speech. - SPb.: Izd-vo SPbSU, 1997. - 248 c.

53. *Li Min.* Typical errors of Chinese students studying Russian and ways of their correction: question sentences // Pedagogical Education in Russia. - 2010, - № 4. - C. 98-105.

54. *Li Huei-Ying*. Features of realisation of consonants in the Russian speech of Taiwanese: autoref. dis. ... Cand. philol. SPb., 1999. - 24 c.

55. *Lomonosov M. V*. Complete Works: In 10 vol. M.; L., 1952. T. 7. C. 240.

56. *Logasheva E. S*. Accent-rhythmic features of Russian word-forms in the speech of Chinese students. Avtoref. kand dis. ... SPb, 2006. - 19c.

57. *Loginova I. M*. Description of phonetics of Russian as a foreign language (vocalism and accent). - M.: Izd-vo Ros. un-ta Druzhby Narodov, 1992. – 157 c.

58. *Lyubimova H. A*. Phonetic interference. - L.: Izd-vo LSU, 1985. - 55 c.

59. *Lyubimova H. A.* Phonetic aspect of communication in a non-native language (in the conditions of Finnish-Russian bilingualism). - L.: Izd-vo LSU, 1988. - 196 c.
60. *Lyubimova N. A.* Linguistic bases of teaching articulation of Russian sounds. Articulation and correction. - Moscow: Russian language. Courses, 2011. - 240 c.
61. *Lyubimova N. A.* Phonetic aspect of communication in a non-native language: a collective monograph / Under general supervision and ed. by *N. A. Lyubimova*. - SPb.: Izd-vo SPBSU, 2007. - 294 c.
62. *Lyubimova N. A.* Phonetic interference and communication in a non-native language: Ph. D. in Philology. SPb, 1991.
63. *Maslov Y. S.* Introduction to Linguistics. - Moscow: Vysh. shk., 1987. - 272 c.
64. *Matusevich M. I.* Modern Russian Language. Phonetics. - Moscow: Prosveshchenie, 1976. - 288 c.
65. *Mordvintseva V. S.* Formation of auditory pronunciation skills of Chinese students on the material of regionally oriented dialects // Philological Sciences. Issues of theory and practice. - Tambov: Gramota. - 2016, - №10. - C. 124-126.
66. *Panova R. S.* Phonetic interference in the Russian speech of the Chinese / Vestnik Chelyabinskogo gosudarstvennogo universiteta. Philology. Art History. - Vyp. 33. - 2009. - №22 (160).- C. 83-86.
67. *Polivanov E. D.* Works on Oriental and General Linguistics. - Moscow: Nauka, 1991. - 623 c.
68. *Polyakova E. N., Stern A. S., Erofeeva E. V.* Russian colloquialisms of the Perm region: Formation. Functioning. Development. - Perm: Izd. of Perm University, 1998. Vol. 1. - 1998. - 147 c.
69. *Popov M. B.* Phonetics of the Modern Russian Language. - SPb.: Izd-vo SPbSU, 2014. - 303 c.
70. *Popova T. V., Gubanova T. V.* Practical phonetics of the Russian language: textbook. - Tambov: Izd-vo TSTU, 2001. - 107 c.

71. Applied linguistics: textbook / *L. V. Bondarko, L. A. Verbitskaya, G. Y. Martynenko* [et al]. - SPb.: Izd-vo SPbSU, 1996. - 528 c.
72. *Radnaeva L. D.* Sound form of the modern Buryat language (Theoretical and practical aspects of qualitative and quantitative analysis). Dissertation. ... doctor of philological sciences. - St. Petersburg, 2003. 450 c. (typewritten).
73. *Radnaeva L. D.* Criteria for determining the phonological status of phonemes and phoneme composition / University Scientific Journal. - 2016. - №18. - C. 89- 93.
74. *Radnaeva L. D.* Quantitative characteristics of allophonic variation of vowels and consonants / Experimental-phonetic analysis of speech: problems and methods: a collection of articles / Edited by L. V. Bondarko, S. B. Stepanova. - SPb.: Izd-vo SPbSU, 2004. C. 124-167.
75. *Radnaeva L. D.* Complex vowels in the vocalic system. - Ulan-Ude, Izdvo Buryatskogo gosudarstvo unsta. - 2019. - 219 c.
76. *Reformatsky A. A.* From the history of Russian phonology. - Moscow: Nauka. - 1970. - C. 47-74.
77. *Rosentsveig V. Yu*. Language contacts. L.: Nauka, 1972. - 80 c.
78. *Rumyantsev M.G. To the problem of syllophoneme // Vestnik of Moscow University. Series13. Oriental Studies. 1978. №2. C. 33-38.*
79. *Skrelin P. A.* Segmentation and transcription. - SPb: Izd-vo SPbSU, 1999. – 106 c.
80. *Skrelin P. A.* Phonetic aspects of speech technologies: Cand. ... in the form of a scientific report on a thesis for a doctoral degree in philology. sciences. - St. Petersburg, 1999. - 75 c.
81. *Sorokin V. N.* Theory of Speech Formation. - Moscow: Radio and Communication, 1985. - 312 c.
82. *Speshnev N. A.* Introduction to the Chinese language: phonetics and spoken language. - SPb.: KARO, 2015. - 250 c.
83. *Speshnev N. A.* Phonetics of the Chinese language. - L.: Izd-vo LSU, 1980. - 143 c.

84. *Stepanova S. B.* Tempo of spontaneous Russian speech (on the materials of the Sound corpus of everyday communication "One speech day" // Language and Speech Activity. - SPb., 2010-2011. - VOL. 2. - PP. 204-214.
85. *Stepanova S. B.* Phonetic properties of Russian speech: autoref. diss. ... kand. philol. nauk. - Л., 1988. - 15 с.
86. *Sun Bo.* Theoretical and applied problems of phonetic design of speech in a foreign language / S. V. Budazhapova, L. D. Radnaeva // Kazan: Izd-vo Kazanskaya nauka. - 2022. - №5. - С. 133-135.
87. *Sun Bo.* Quantitative characteristics of consonant combinations of Russian in the speech of native speakers of Chinese // Research and teaching of languages: analysis, experience, technologies / Ed. by L. D. Radnaeva. - Ulan-Ude: Izd-vo Buryat State University. - 2022. - С. 114-119.
88. *Sun Bo.* Realisation of Russian complex consonant combinations in the speech of native speakers of Russian and Chinese // Speech analysis: theoretical and applied aspects / Ed. by L. D. Radnaeva. - Ulan-Ude: Buryat State University Publishing House, 2023. - С. 146-151.
89. *Sun Bo.* Pronunciation modifications of the Russian consonant-vowel type combination in the Chinese reading // Kazan: Izdvo Kazanskaya nauka. - 2019. - № 12. - С. 196-197.
90. *Sun Bo.* Features of the sound system of the modern Chinese language. Acoustic aspect // Kazan: Izd-vo Kazan Science. - 2018. - № 12. - С. 207-210.
91. *Sun Bo.* Problems of the current state of Russian language teaching in the border areas of China // Materials of the international scientific-practical conference: collection of articles. -Ulan-Ude: Izd-voor Buryat. gos. un-ta, - 2020. - С. 142-145.
92. *Xu Laidi.* Typical errors of Chinese students in Russian speech accent and methods of their correction // Russian language abroad. - М.: - 2011. - № 1. - С. 47-50.

93. *Xu Longchuan.* The main discrepancies in the systems of Russian and Chinese languages that create difficulties in learning Russian by Chinese and Chinese by Russians // Bulletin of SUSU. Series "Linguistics". - 2017. - T. 14. - № 4. - C. 68-71.
94. *Tananaiko S. O.* Chinese-Russian phonetic interference on the material of errors in the pronunciation of Russian consonants / *A. A. Ignatyeva* // Eurasian Scientific Association. - 2018. - № 40 (6). - C. 91-94.
95. *Tan Yanjie.* Comparison of Russian sounds with Chinese equivalents // Russian language abroad. - M., 2017. - №4. - C. 82-86.
96. *Thompson A. I.* General linguistics - Odessa: Izd-vo Econ, 1906. - 416 c.
97. *Trubetskoy N. S.* Fundamentals of Phonology - M.: Izdvo Foreign Lit., 1960. - 372 c.
98. *Trubetskoy N. S.* Thoughts on the Indo-European problem // In Selected Works on Philology. M., 1987. - C. 44-60.
99. *Ushakov D. N.* Orthographic Dictionary of the Russian Language. - 6th ed., revised and updated - Moscow: Uchpedgiz, 1944 (58 editions from 1934 to 2015).
100. *Fant G.* Acoustic theory of speech formation / translation from English. - M.: Nauka, 1964. - 284 c.
101. *Haugen E.* The Process of Borrowing // New in Linguistics. M., 1972. 6. C. 344-382.
102. *Chang Ching-Gwo* Perceptual-acoustic analysis of speech in a non-native language (on the material of realization of Russian paired voiced and deaf consonants by Taiwanese): autoref. dis. ... candidate of philological sciences. - SPb., 1999. - 21 c.
103. *Chang Ching-Gwo* Perceptual-acoustic analysis of speech in a non-native language (on the material of realisation of Russian paired voiced and deaf consonants by Taiwanese). Dissertation. ... candidate of philological sciences. - SPb., 1999. - 557 c. (typewritten).

104. *Chen Zhao-Lin* Phonetic Aspects of Russian pronunciation to the Chinese: Cand. ... candidate of philological sciences. - St. Petersburg, 2000. - 24 c.

105. *Chen Zhao-Lin* Phonetic aspects of Russian pronunciation to Chinese. Dissertation. ... candidate of philological sciences. - St. Petersburg, 2000. - 240 c. (Typewritten).

106. *Zhang Xiaozuan*. Features of teaching Chinese students the pronunciation of hard and soft consonants of the Russian language // Pedagogical Journal. - 2019. - №9. - C. 215-223.

107. *Zhang Xiaohui.* Typical errors in the prepared speech of Chinese students learning Russian / N. N. Sergeeva // Pedagogical Education. - 2019. - № 6. - C. 120-124.

108. *Zhang Xiaojuan.* Analysis of the peculiarities of phonetic accent in Russian speech of Chinese speakers of Shanghai dialect // Philological Sciences. Issues of theory and practice. - 2018. - №5(83). -C. 427-430.

109. *Zhao Xing.* The influence of Chinese language tones in teaching Russian accent to Chinese students // Vestnik RUDN, series Russian and foreign languages and methodology of their teaching. - 2016. - № 1. - C. 136-141.

110. *Zhao Zouying.* Articulation base of the Chinese language // Teaching Russian in China (Beijing). - 1987. - № 2. - C. 6-10.

111. *Zhao Zhe.* Sound interference in Russian language under the influence of native language in the conditions of Russian-Chinese language contacts // Philological Sciences. Voprosy teorii i praktika. - 2016. - № 12 (66). - C. 179-184.

112. *Zhao Zhe.* Sound interference in the Russian language under the influence of the substrate language in the conditions of Russian-Chinese language contacts: autoref. diss. ... candidate of philological sciences. - M., 2017. - 22 c.

113. *Zhao Zhe.* Sound interference in Russian language under the influence of the substrate language in the conditions of Russian-Chinese language contacts. Dissertation. ... candidate of philological sciences. - M., 2017. - 191 c. (Typescript)
114. *Zhu Yujia* Comparison of the composition of consonantal sound units in Russian and Chinese in the context of teaching Chinese to Russian pronunciation. Philological sciences. Voprosy teorii i praktika. Tambov: Gramota, 2017. № 2 (68): in 2 parts Ch.1. P.10-215.
115. *Chen Zhaoling*. Phonetic aspects of Russian pronunciation to the Chinese. Dissertation. ... Cand. phil. n. - St. Petersburg, 2000. - 241 c.
116. *Shatokhina G. S*. Perceptual aspect of Russian-Japanese phonetic interference (experimental-phonetic research on the material of biphonemic consonants). Dissertation. ... candidate of philological sciences. - SPb., 2007. - 234 c. (Typescript).
117. *Stern A.S*. Perceptual Aspect of Speech Activity. St. Petersburg: Izd-vo St. Petersburg University, 1992. - 411 c.
118. *Shcherba L.V*. On the Notion of Language Displacement // Selected Works on Linguistics and Phonetics. Л., 1958. - 40-53.
119. *Shcherba L. V*. Theory of Russian writing. - L.: Izd-vo Nauka, 1983. - 134 c.
120. *Shcherba L. V*. Language system and speech activity / Ed. *L. R. Zinder, M. I. Matusevich*; Acad. of Sciences of the USSR, Dept. of Lit. and Yaz, Komis. on the History of Philological Sciences. - L. : Izd-vo Nauka. Leningr. department, 1974. - 427 c.
121. *Shcherba L. V.* Russian vowels in qualitative and quantitative relation. - L. : Izd-vo Nauka, 1983. - 160 c.
122. *Shcherba L. V.* Teaching foreign languages at secondary school: general questions of methodology. Moscow: Vysshaya Shkola, 2002. 160 c.

LITERATURE IN OTHER LANGUAGES

123. *Chaofen Sun* Chinese. A linguistic introduction. Cambridge University Press 2006.
124. ENCYCLOPEDIA OF CHINESE LANGUAGE AND LINGUISTICS/ Vol.4. LEIDEN - BOSTON, 2017.
125. *Sun Bo.* Consonant Clusters study in acoustic and statistic data analysis to create effective e-learning and teaching environment // Proceedings of International Conference "E-LEARNING, METHODOLOGY, TECHNOLOGY, EVALUATION AND FUTURE TRENDS", September, 2021, Ulan-Baator, Mongolia.
126. *Zhu Zhihao.* A Comparison Study on Emotion Recognition with Glottal Features and Speech Features / *Zheng Zhiyu*, *Xiao Zhongzhe* // Voice Technology. - 2020, - № 44(5). - С. 41-46.
127. *Duanmu, San* (2000). The Phonology of Standard Chinese. Oxford University Press. ISBN 978-0-199-25831-4.
128. The Phonology of Standard Chinese (2nd ed.). Oxford University Press. 2007. ISBN 978-0-199-21579-9.
129. *Lin, Yen-Hwei (2007).* The Sounds of Chinese. Cambridge University Press. ISBN 978-0-521-60398-0**.**
130. *Ladefoged, Peter; Wu, Zongji (1984).* "Places of Articulation: An Investigation of Pekingese Fricatives"**.** Journal of Phonetics. 12: 267–78. doi**:**10.1016/S0095-4470(19)30883-6**.**
131. *Maddieson, Ian (1996).* The Sounds of the World's Languages**.** Oxford: Blackwell.
132. *Lee, Wai-Sum; Zee, Eric (2003).* "Standard Chinese (Beijing)" *(PDF)*. Journal of the International Phonetic Association. **33** (1): 109–112. doi**:**10.1017/S0025100303001208.
133. *Norman, Jerry (1988).* Chinese. Cambridge University Press. ISBN 978-0-521-29653-3**.**

134. *Zhu, Xiaonong; Wang, Caiyu (2015).* "Tone". In Wang, William S.-Y.; Sun, Chaofen (eds.). The Oxford Handbook of Chinese Linguistics. Oxford University Press. pp. 503–515. ISBN 978-0-199-85633-6.

135. National Taiwan Normal University; Chinese Phonetics Textbook Editorial Committee *(2008).* **國音學** [Mandarin Chinese Phonetics] (in Chinese) (8th ed.). Zhengzhong shuju. ISBN 978-9-570-91808-3.

136. *Чжоу Тунчунь*. Chinese phonetics / Ed. by: Beijing Normal University. – 2003, - 258 c. (周同春, 汉语语音学 / 北京师范大学出版，2003, 258页).

137. *Ding Chunming*. A course of modern Chinese phonetics / Ding Chunming, Rongjing / edited by: Language and Literature of Peking University. – 2012, – 291c. (丁崇明, 荣晶 现代汉语语音教程 / 北京大学出版，2012，291页).

138. *Shao Jingming. The General Theory of Modern Chinese - Phonetics of Normative Modern Chinese / Publishing House : Shanghai Educational Publishing House*, – 2016, 186 c. (邵敬敏. 现代汉语通论–普通话语音现代汉语概述教程书. 上海教育出版社, 2016，186页).

139. *Jiang Liping. Training in modern Chinese phonetics / Ed. by: Jinan University*. – 2013, – 253 c. (蒋利平. 现代汉语语音训练. 暨南大学出版社, 2013, 253页).

140. *Wang Tianchang. A study of Chinese language phonetics / Publisher: Mandarin Daily*, – 1974, – 394 c. (王天昌. 汉语语音学研究. 国语日报出版, 1974, 394页).

141. *Huang Bojun. Modern Chinese Language. Third edition* revised / Huang Bozhong, Liao Xudong. - Beijing: Higher School Publishing House. - 2002,

- 643 c. (**黄伯荣**，**廖序**东。现代汉语【增订三版】。北京高等教育出版社，2002。643 页).

142. Zhao Yuanzhen. Selected articles on linguistics - Beijing: Chinese Social Sciences Publishing House, -1985, - 910 pp. (赵元任。赵元任语言学论文选。中国社会科学出版社，1985。910 页).

DICTIONARIES AND OTHER RESOURCES

143. *Akhmanova O. C.* Dictionary of linguistic terms. - Moscow: Unitorial Urss, 2004. - 576 c.
144. Big Encyclopaedic Dictionary / Editor-in-Chief V.N. Yartseva. 2nd ed. M.: Big Russian Encyclopaedia, 1998.
145. Big explanatory dictionary of the Russian language: modern edition / D.N. Ushakov. - Moscow: Slavic Book House, 2008. - 959 c.
146. Large explanatory dictionary of the Chinese language 汉语大词典/ Hànyǔ dàcídiǎn zlibrary.cc'dl/hanyu-da-cidian-1
147. Praat: an experimental computer programme for speech signal processing. URL: www.fon.hum.uva.nl/praat
148. Statistica: computer programme http://statsoft.ru/

LIST OF ABBREVIATIONS AND SYMBOLS

1. КМ — the Chinese speaker is a male;
2. КЖ — Chinese speaker - female
3. РМ — Russian speaker - male
4. РЖ — Russian speaker - female
5. Гц — Hertz
6. F1 — first formant
7. F2 — second formant
8. ФПТ — Phonetically representative text
9. МФА — International Phonetic Alphabet
10. С — consonant sound.
11. V — vowel sound.
12. В — high level of Russian language skills
13. С — average level of Russian language proficiency
14. Н — low level of Russian language proficiency
15. мс — milliseconds

APPLICATIONS

Application 1

ФОНЕТИЧЕСКИ ПРЕДСТАВИТЕЛЬНЫЙ ТЕКСТ

Был тихий серый вечер. Дул ветер, слабый и теплый. Небо было покрыто тучами, сквозь которые иногда прорывались лучи заходящего солнца.

Наш автобус номер 7 шел на запад. Мы все ехали в великий старый город, электрические огни которого были видны далеко впереди. По центральному радио передавали легкую музыку. Хор ребят исполнял песенку "Золото осени". Я невольно прислушивался к разговорам в автобусе.

Сосед-моряк, не раз бывавший за границей, рассказывал о различных странах, о музеях, о газетах. В них защищают всеобщее равенство, говорят о нужде и судьбе обыкновенных рабочих. Тема была мне знакома: у нас достаточно много пишут о внешних связях, необходимых для механизации в объединениях заводов.

Впереди меня двое ученых говорили о предстоящей конференции: "Наша лаборатория семь лет отдала эксперименту по проверке этой формулы. Нам было неизвестно значение функции сопротивления, особенно при высоком давлении над поверхностью жидкости. Опыты показали, что оно равно десяти в пятой степени условных единиц". "Странно, – ответил его товарищ, – а наш преподаватель Тревогин в лекции называл другую цифру. Очевидно, это вызывается неравномерным размещением плотности составляющих. Я думаю, теперь надо изучить соотношение длины и объема." Их разговор был совсем непонятным для меня.

Я обратил внимание на женщину, которая уже не в первый раз сажала на сиденье своего малыша. Рыжий мальчик, которому было года три, отворачивался, вырывался, показывал маме розовый язык. Я решил, что мама сейчас рассердится. Но она, стараясь сохранять строгий вид, не могла не

улыбаться. Было видно, что она очень любит своего сына, считает, что лучше нет детей на свете: он самый умный, самый милый, самый веселый. Юный шалун мог позволить себе многое.

Я отыскал в дорожной сумке книгу о животных, которую купил для дочки, вынул ее, открыл. На первой странице по голубому небу летели голуби. "Дядя, это кто?"- спросил малыш, заглядывая на следующую страницу. "Это кит". "А ты знаешь, сколько килограммов он весит? Сто? Сколько сантиметров в секунду он проплывает? Двадцать? Кит сильный? Он ест мясо? А мед? Кто его нарисовал? Художник?" Вопросы следовали один за другим. Мы привлекли внимание пассажиров. Все с улыбкой следили за нами. Наконец, мама сказала: "Шурочка, душа моя, уже поздно, скоро ночь. Здесь нельзя шуметь. Пойдем спать. Сядь сюда". Сначала Шура сопротивлялся, тащил маму в сторону. Потом затих, держа в руке желтого песика. Его дыхание было чуть слышно. Я выключил лампочку дневного света.

Вид спящего ребенка вызвал во мне воспоминания о моем детстве. Тогда беда ходила рядом, и даже необходимый для жизни хлеб выдавали граммами. Потом вспомнил об учебе в вузе, о первых годах на фабрике. Там я понял о себе главное: кроме интересной работы, мне мало что нужно в жизни. Так, задумавшись, я не заметил, как заснул. Город - цель нашего пути - был еще не близко.

Applicaion 2

Table 38 – Erroneous accents in words performed by native Chinese speakers

№	Word	Wrong accent	Announcers
1	небо	небО	КМ1
2	было	былО	КМ1
3	тучами	тучАми	КМ1, КМ5, КМ8, КМ11, КМ12 КЖ1, КЖ4, КЖ7, КЖ16
4	лучи	лУчи	КМ7, КЖ1, КЖ6, КЖ14, КЖ16
5	запад	запАд	КМ12
6	видны	вИдны	КЖ1, КЖ2, КЖ3, КЖ5
7	огни	Огни	КМ11, КЖ4
8	странах	странАх	КМ1, КМ3, КМ4, КМ9
9	исполнял	испОлнял	КЖ4
10	песенку	песЕнку	КМ8
11	золото	золотО	КМ8, КЖ4
12	прислушивался	прислушивАлся	КМ6, КМ9, КМ11, КЖ4
13	моряк	мОряк	КМ8
14	границей	грАницей	КЖ4
15	рассказывал	рассказывАл	КМ9, КЖ1
16	музеях	мУзеях	КМ5, КМ9
17	равенство	равЕнство,	КМ6, КЖ1, КЖ13, КЖ15
18	была	бЫла	КМ6, КЖ3
19	нужде	нУжде	КМ5, КМ9, КМ11
20	судьбе	сУдьбе	КМ5, КМ12, КЖ13
21	формулы	формУлы	КМ4, КМ6, КМ7, КМ11
22	поверхностью	поверхнОстью	КЖ4, КЖ10
23	степени	степЕни	КМ6, КМ8, КЖ3
24	опыты	опЫты	КМ11
25	единиц	едИниц	КМ8, КМ11
26	странно	страннО	КМ11
27	ответил	ответИл	КМ8, КМ11, КЖ2, КЖ3
28	другую	дрУгую	КМ6
29	знакома	знакомА	КМ1, КМ2, КМ3, КЖ5, КЖ10 КЖ11
30	знакома	знАкома	КЖ6
31	механизации	мехАнизации	КЖ7
32	впереди	вперЕди	КМ12
33	отдала	отдАла	КМ1 КМ6, КМ8, КМ10,

			КМ11 КМ12, КЖ4
34	сопротивления	сопротИвления	КМ11, КЖ9
35	товарищ	товарИщ	КМ1, КМ3, КМ4
36	длины	длИны	КМ5, КМ8, КЖ4, КЖ16
37	объема	Объема	КМ9, КЖ4
38	малыша	малЫша	КМ1, КМ2, КМ3, КМ4, КМ10, КМ11, КЖ1, КЖ3, КЖ5, КЖ6, КЖ7, КЖ12, КЖ13, КЖ14, КЖ16
39	малыша	мАлыша	КМ5, КМ6, КМ9, КМ12
40	стараясь	стАраясь	КМ6, КЖ16
41	сохранять	сохрАнять	КЖ16
42	малыш	мАлыш	КМ5, КМ8, КЖ3
43	отворачивался	отворачивАлся	КМ11, КЖ1
44	вырывался	вЫрывался	КМ8, КЖ7, КЖ13, КЖ16
45	показывал	показывАл	КМ4, КЖ4
46	розовый	розОвый	КМ8
47	розовый	розовЫй	КМ9, КМ11
48	могла	мОгла	КМ6
49	улыбаться	улЫбаться	КЖ13
50	рассердится	рассердИтся	КМ2, КМ4, КМ7, КМ9, КМ10, КМ12, КЖ7
51	любит	любИт	КМ1, КМ5, КМ9, КЖ3, КЖ10
52	детей	дЕтей	КЖ4
53	веселый	вЕселый	КМ5, КМ6
54	шалун	шАлун	КЖ4
55	позволить	позволИть	КМ8, КМ11, КМ12, КЖ4, КЖ9, КЖ15
56	вынул	вынУл	КМ12, КЖ4, КЖ15
57	летели	лЕтели	КЖ13
58	голуби	голубИ	КМ7, КМ8
59	голуби	голУби	КЖ4
60	отыскал	отЫскал	КЖ7
61	страницу	стрАницу	КМ6, КЖ4, КЖ10
62	заглядывая	заглядывАя	КЖ4
63	двадцать	двадцАть	КМ10
64	весит	весИт	КМ9, КМ11
65	нарисовал	нарИсовал	КМ8
66	следовали	следовАли	КМ6, КМ8, КМ9, КЖ1
67	пассажиров	пассажирОв	КМ12

68	следили	слЕдили	КМ1, КМ3, КМ10, КМ11, КЖ4 КЖ7
69	другим	дрУгим	КЖ8, КЖ13
70	мама	мамА	КЖ9
71	душа	дУша	КЖ8
72	шуметь	шУметь	КЖ3, КЖ4
73	сопротивлялся	сопротИвлялся	КЖ7, КЖ10
74	дыхание	дЫхание	КЖ7
75	сторону	сторонУ	КМ3, КМ8, КМ11, КЖ2, КЖ3, КЖ5, КЖ6, КЖ7, КЖ8, КЖ10
76	сторону	сторОну	КМ6, КМ12, КЖ4
77	желтого	желтОго	КЖ4
78	песика	песИка	КМ6, КМ8, КМ11, КМ12
79	дыхание	дыханИе	КМ6
80	привлекли	привлЕкли	КМ4, КМ6, КМ11, КЖ13
81	весит	весИт	КМ2, КЖ1
82	выключил	выключИл	КЖ1, КЖ3, КЖ6
83	выключил	выклЮчил	КЖ13
84	лампочку	лампОчку	КМ4, КМ7, КЖ4
85	дневного	днЕвного	КМ1, КМ3, КМ4, КМ8, КМ9, КМ10, КМ12, КЖ1, КЖ2, КЖ3, КЖ7, КЖ8, КЖ9, КЖ10, КЖ11, КЖ12, КЖ13, КЖ14, КЖ15, КЖ16
86	выдавали	вЫдавали	КМ10, КМ11, КЖ16
87	выдавали	выдАвали	КЖ4
88	задумавшись	задумАвшись	КМ4, КМ8, КМ12, КЖ7, КЖ10
89	годах	гОдах	КМ8, КМ10, КЖ4, КЖ13
90	фабрике	фабрИке	КМ12, КЖ7, КЖ10, КЖ13
91	беда	бЕда	КЖ1, КЖ4
92	граммами	граммАми	КМ6, КМ9, КМ11, КЖ4, КЖ13, КЖ16
93	заметил	заметИл	КМ6, КМ9, КМ11, КЖ1, КЖ2, КЖ3, КЖ8, КЖ9
94	пути	пУти	КМ6, КМ9, КМ10, КМ11, КМ12
95	пути	путь	КЖ16

Commentary on the table: КМ – Chinese speaker, male; КЖ – Chinese speaker, female. The digit is the number of the speaker. Capital letters highlight the stressed vowel in the word, which is stressed in the pronunciation of Chinese speakers. The words are presented in the table in the order in which they occur in the phonetically representative experimental text.

Application 3

Fragment of phonetic text analysis

ФОНЕТИЧЕСКИ ПРЕДСТАВИТЕЛЬНЫЙ ТЕКСТ

Был тихий серый вечер.// Дул ветер, слабый и теплый.// Небо было покрыто тучами,/ сквозь которые иногда прорывались лучи заходящего солнца//

Наш автобус/номер 7/шел на запад.// Мы все ехали в великий старый город,/ электрические огни которого были видны далеко впереди.// По центральному радио передавали легкую музыку.// Хор ребят исполнял песенку "Золото осени".// Я невольно прислушивался к разговорам в автобусе//

Сосед-моряк,/ не раз бывавший за границей,/ рассказывал о различных странах,/ о музеях,/ о газетах.// В них защищают всеобщее равенство,/ говорят о нужде и судьбе обыкновенных рабочих.// Тема была мне знакома:/ у нас достаточно много пишут о внешних связях, необходимых для механизации в объединениях заводов.//

Впереди меня двое ученых говорили о предстоящей конференции:/ "Наша лаборатория семь лет отдала эксперименту/ по проверке этой формулы.// Нам было неизвестно значение функции сопротивления, особенно при высоком давлении над поверхностью жидкости.// Опыты показали, что оно равно десяти в пятой степени условных единиц".// "Странно,/– ответил его товарищ,/– а наш преподаватель Тревогин в лекции называл другую цифру.// Очевидно,/ это вызывается неравномерным размещением плотности составляющих./ Я думаю,/ теперь надо изучить соотношение длины и объема."// Их разговор был совсем непонятным для меня.//

Я обратил внимание на женщину,/ которая уже не в первый раз сажала на сиденье своего малыша.// Рыжий мальчик, которому было года три,/ отворачивался,/ вырывался,/ показывал маме розовый язык.// Я решил, что мама сейчас рассердится.// Но она,/ стараясь сохранять строгий вид,/ не могла не улыбаться.// Было видно, что она очень любит своего сына,/ считает, что лучше

нет детей на свете: он самый умный, самый милый, самый веселый. Юный шалун мог позволить себе многое.

Я отыскал в дорожной сумке книгу о животных, которую купил для дочки, вынул ее, открыл. На первой странице по голубому небу летели голуби. "Дядя, это кто?" - спросил малыш, заглядывая на следующую страницу. "Это кит". "А ты знаешь, сколько килограммов он весит? Сто? Сколько сантиметров в секунду он проплывает? Двадцать? Кит сильный? Он ест мясо? А мед? Кто его нарисовал? Художник?" Вопросы следовали один за другим. Мы привлекли внимание пассажиров. Все с улыбкой следили за нами. Наконец, мама сказала: "Шурочка, душа моя, уже поздно, скоро ночь. Здесь нельзя шуметь. Пойдем спать. Сядь сюда". Сначала Шура сопротивлялся, тащил маму в сторону. Потом затих, держа в руке желтого песика. Его дыхание было чуть слышно. Я выключил лампочку дневного света.

Вид спящего ребенка вызвал во мне воспоминания о моем детстве. Тогда беда ходила рядом, и даже необходимый для жизни хлеб выдавали граммами. Потом вспомнил об учебе в вузе, о первых годах на фабрике. Там я понял о себе главное: кроме интересной работы, мне мало что нужно в жизни. Так, задумавшись, я не заметил, как заснул. Город - цель нашего пути - был еще не близко.

Application 4

Spectrograms of realisations of Russian consonant combinations performed by Russian and Chinese speakers

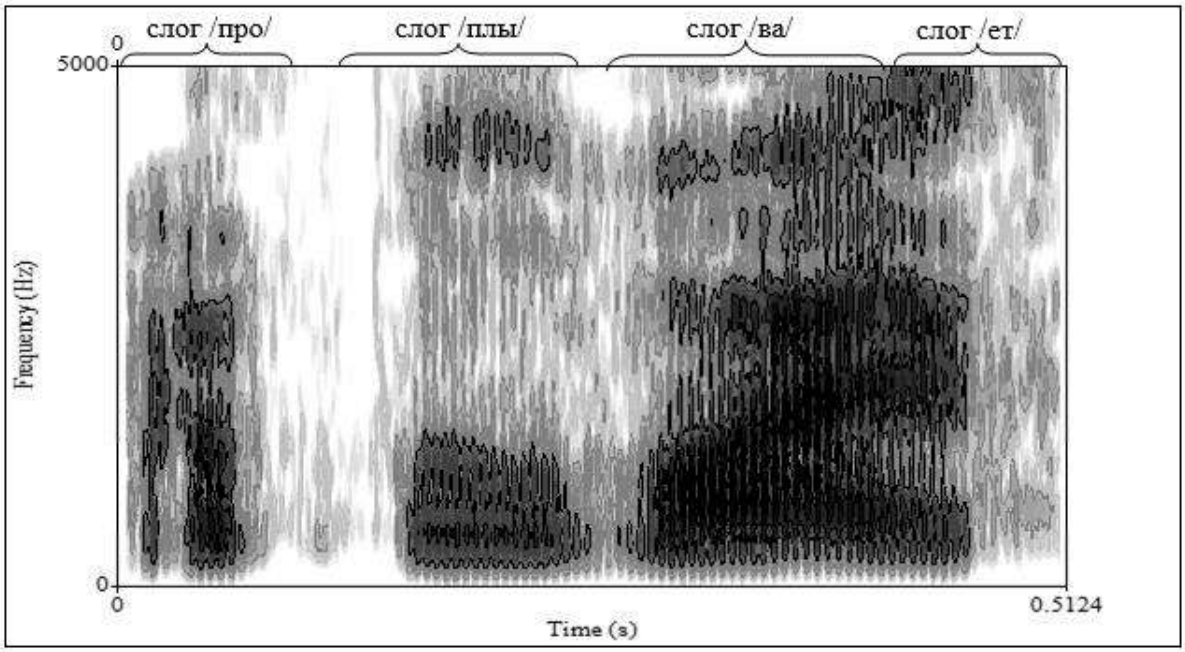


Figure 54 - Spectrogram of the word *проплываем* in the realisation of Russian speaker #1, female. On the ordinate axis - frequency characteristics in Hz, on the abscissa axis - duration in ms.

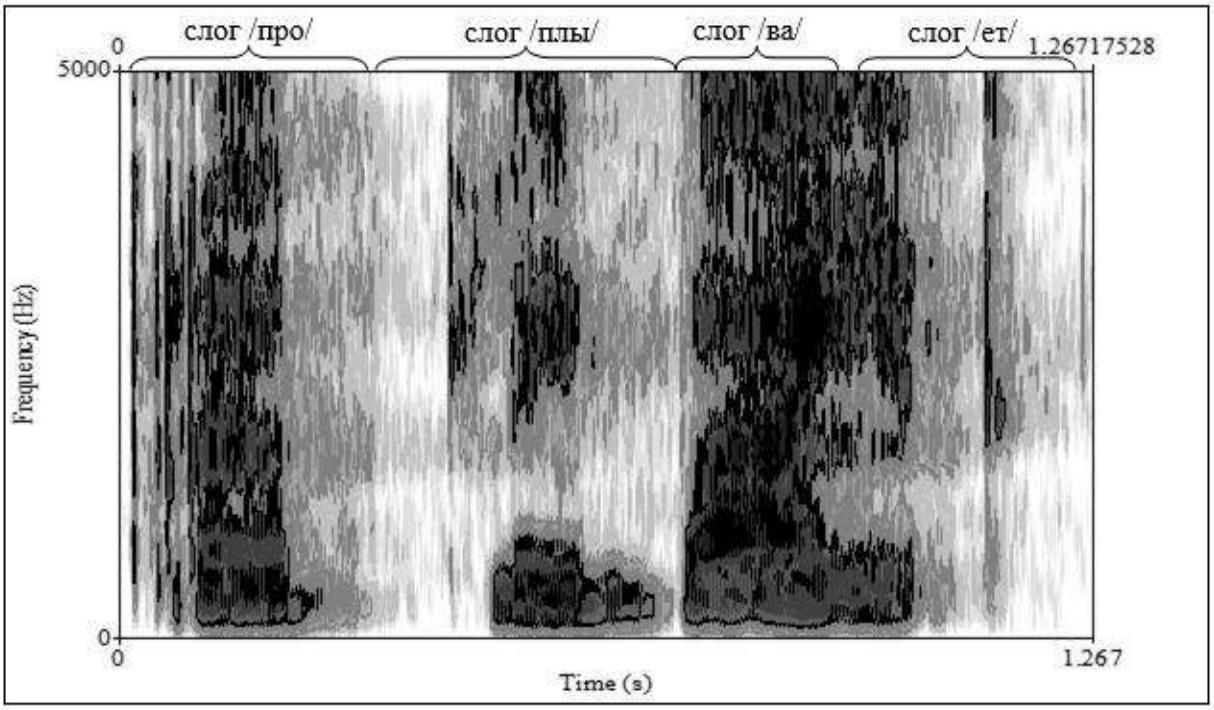


Figure 55 - Spectrogram of the word *проплываем* in the realisation of Chinese speaker #1, female. On the ordinate axis - frequency characteristics in Hz, on the abscissa axis - duration in ms.

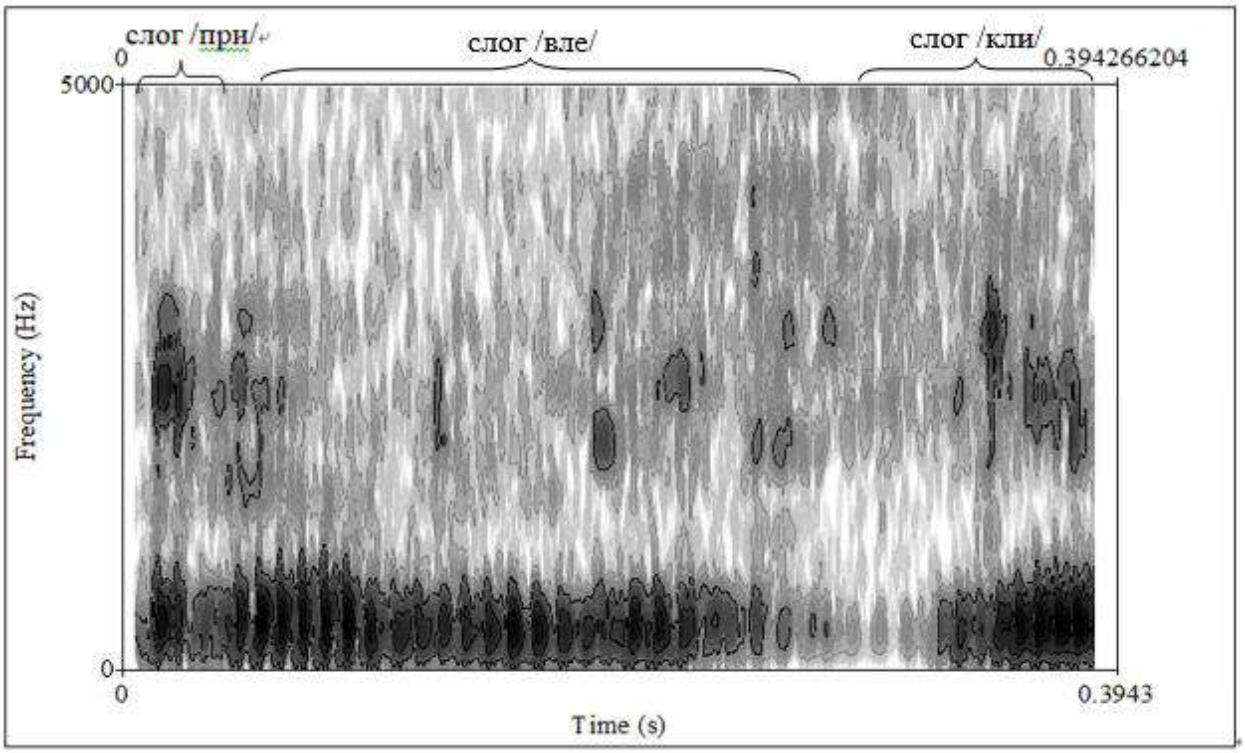


Figure 56 - Spectrogram of the word *привлекли* in the realisation of Russian speaker 1, male

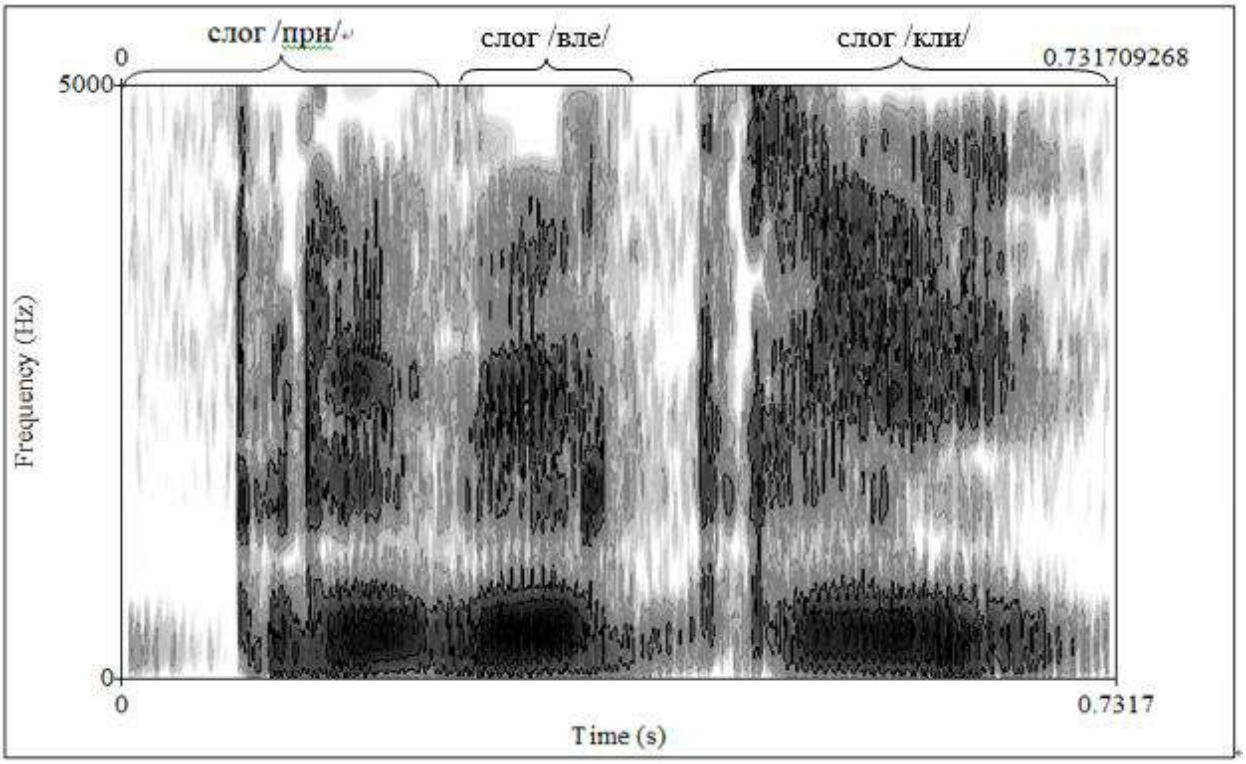


Figure 57 - Spectrogram of the word *привлекли* in the realisation of Chinese speaker 1, male.

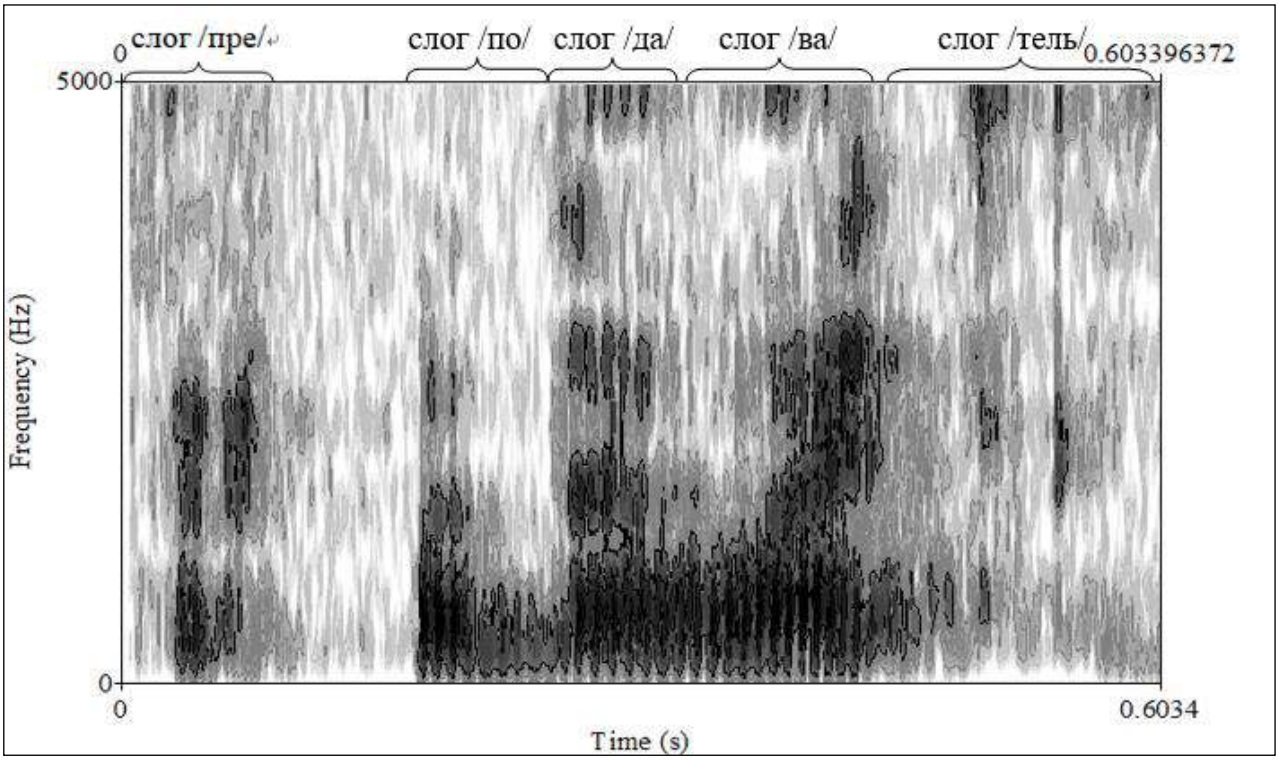


Figure 58 - Spectrogram of the word *преподаватель* in the realisation of Russian speaker 1, male

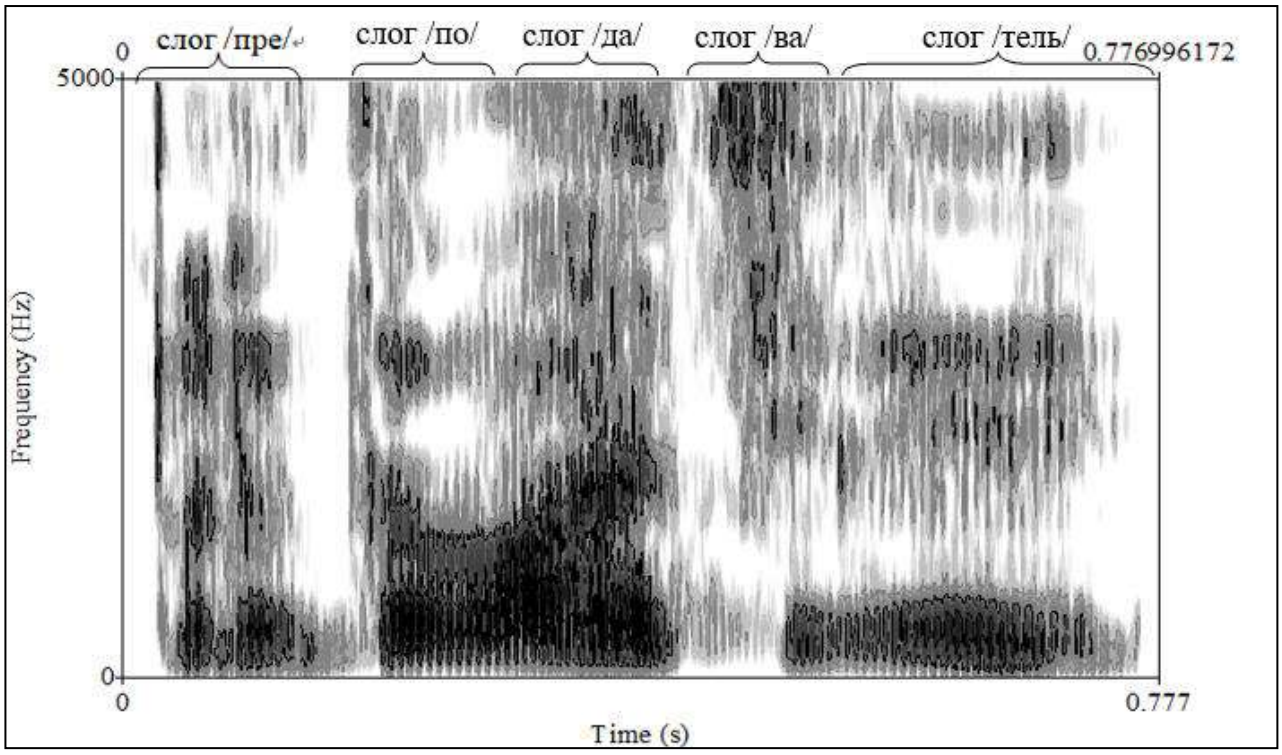


Figure 59 - Spectrogram of the word *преподаватель* in the realisation of Chinese speaker 1, male

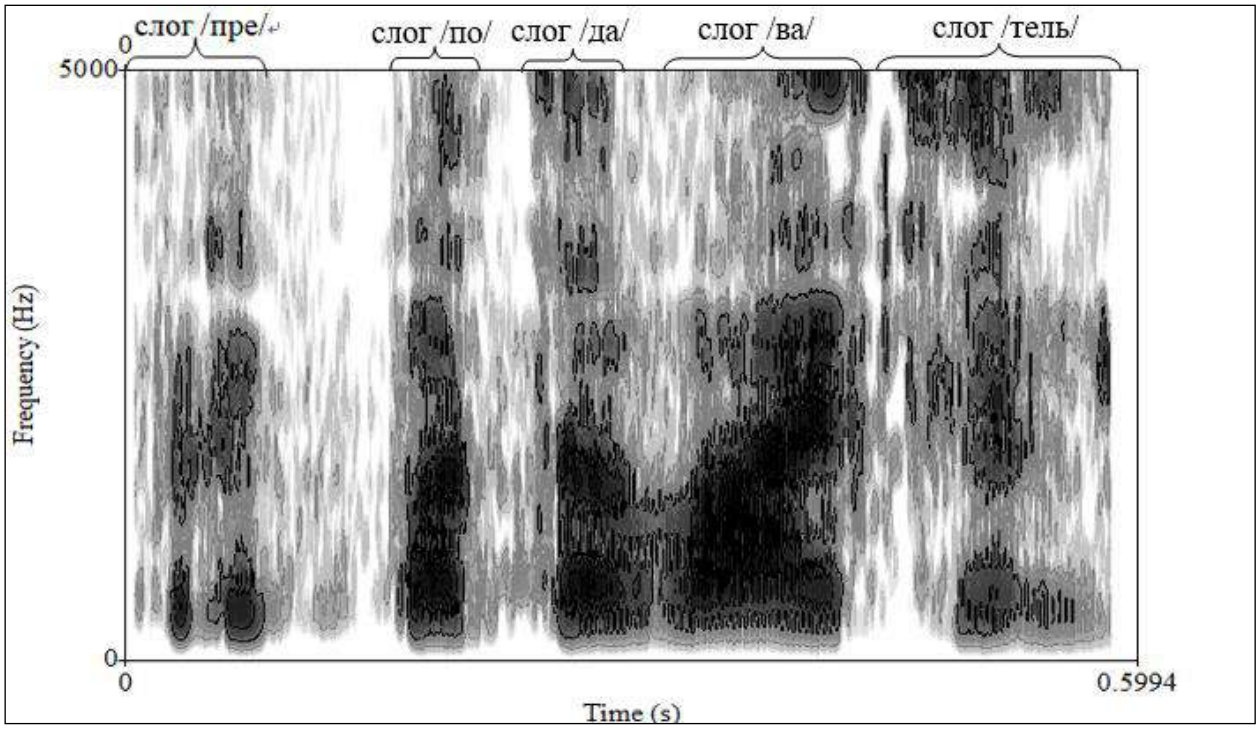


Figure 60 - Spectrogram of the word *преподаватель* in the realisation of Russian speaker 1, female

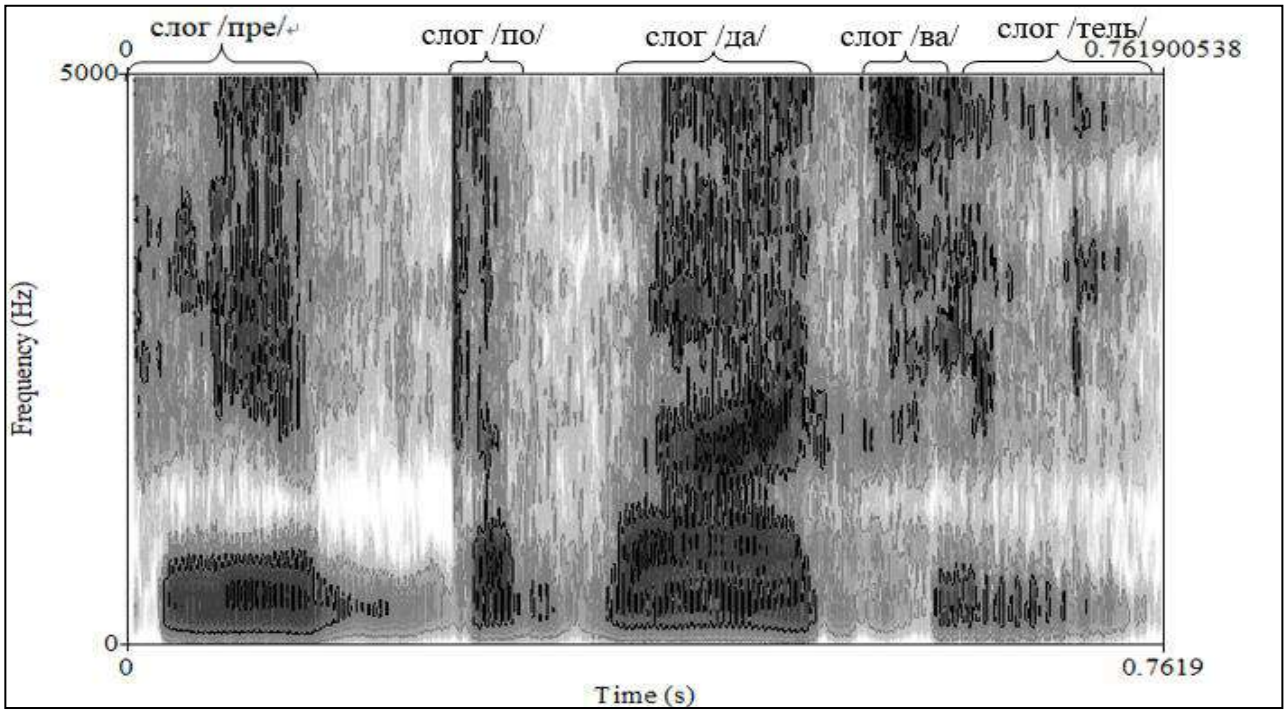


Figure 61 - Spectrogram of the word преподавательin the realisation of Chinese speaker1, female

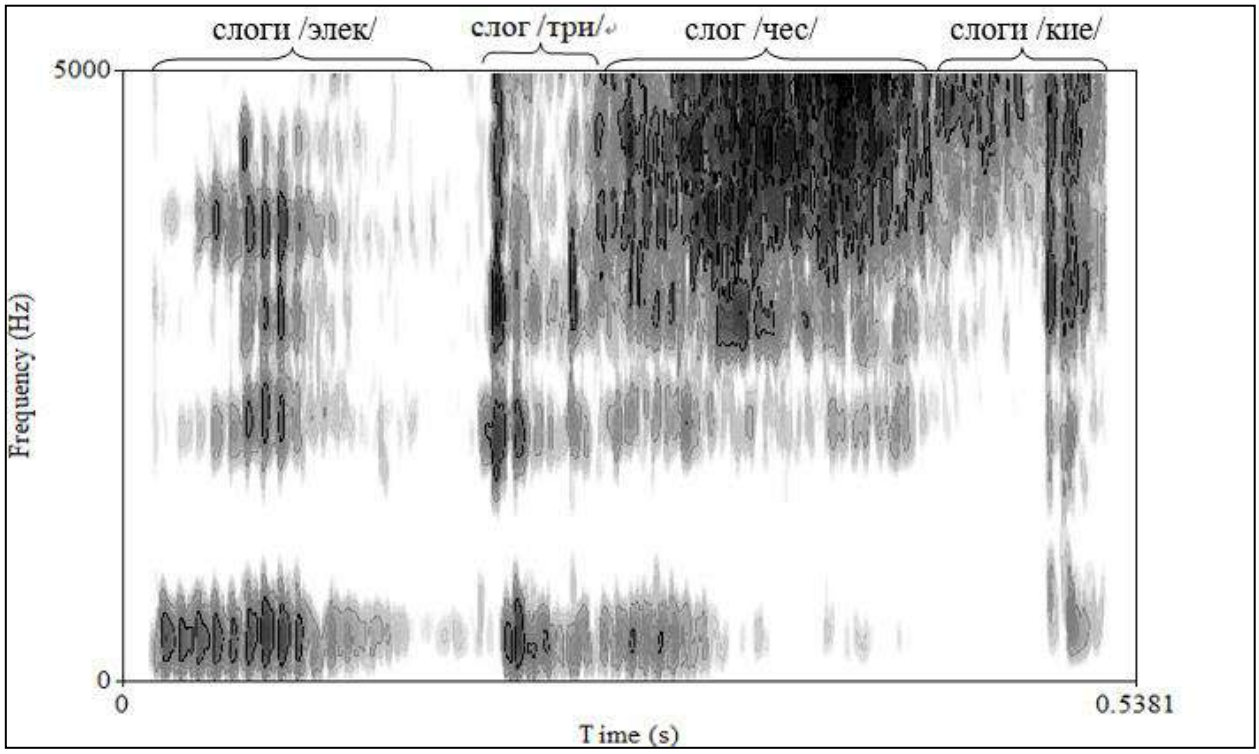


Figure 62 - Spectrogram of the word *электрические* in the realisation of the Russian speaker 1, male

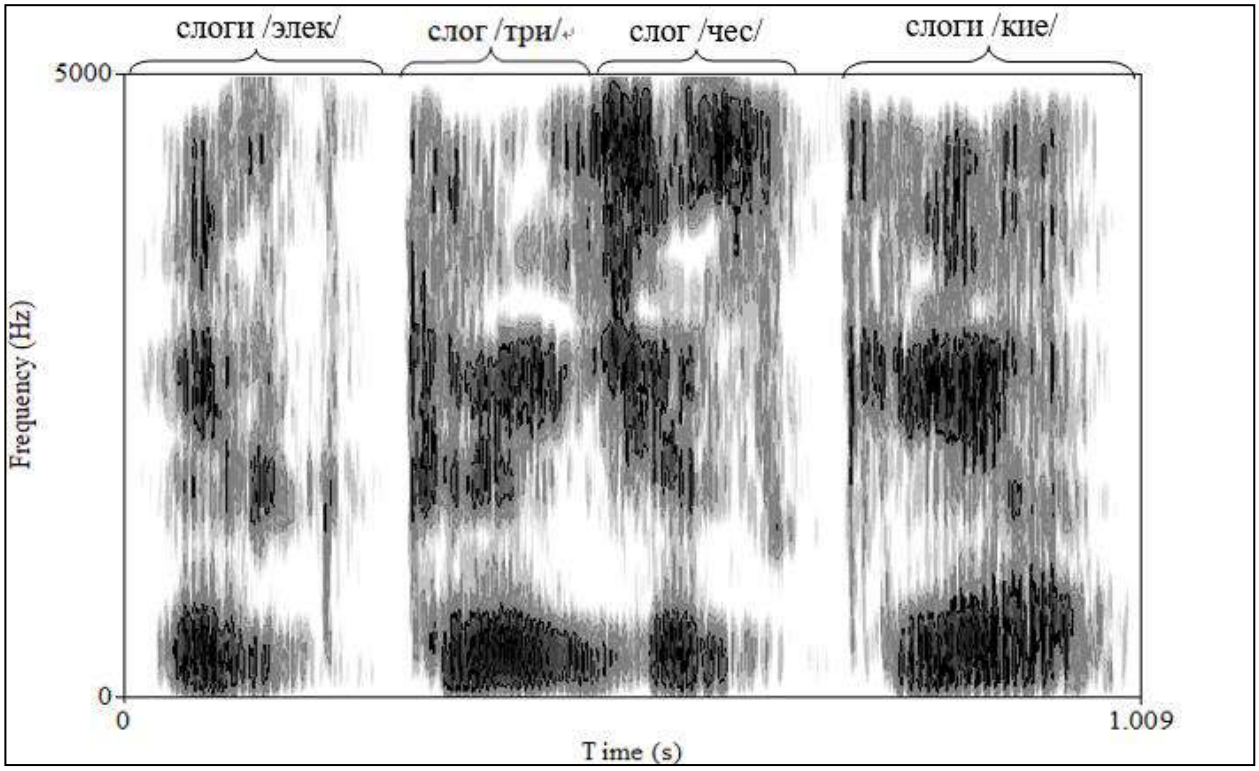


Figure 63 - Spectrogram of the word *электрические* in the realisation of the Chinese speaker 1, male

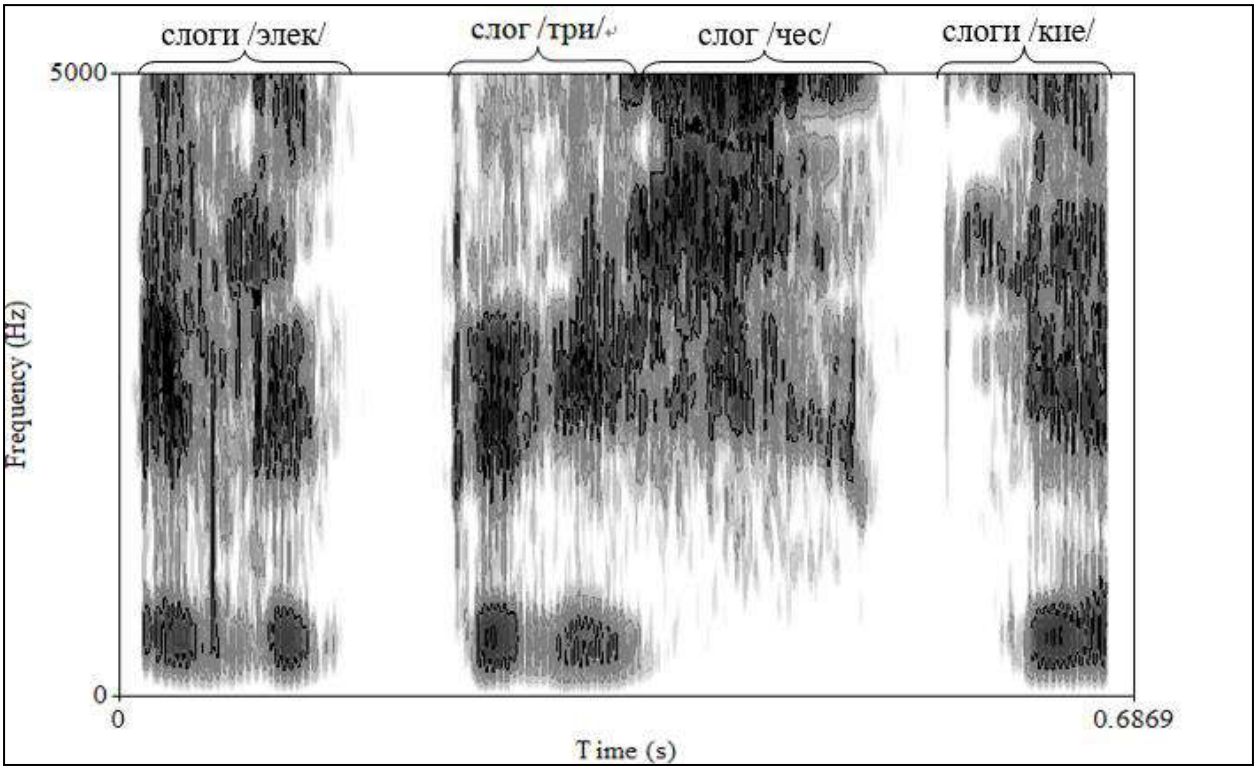


Figure 64 - Spectrogram of the word *электрические* in the realisation of the Russian speaker 1, female

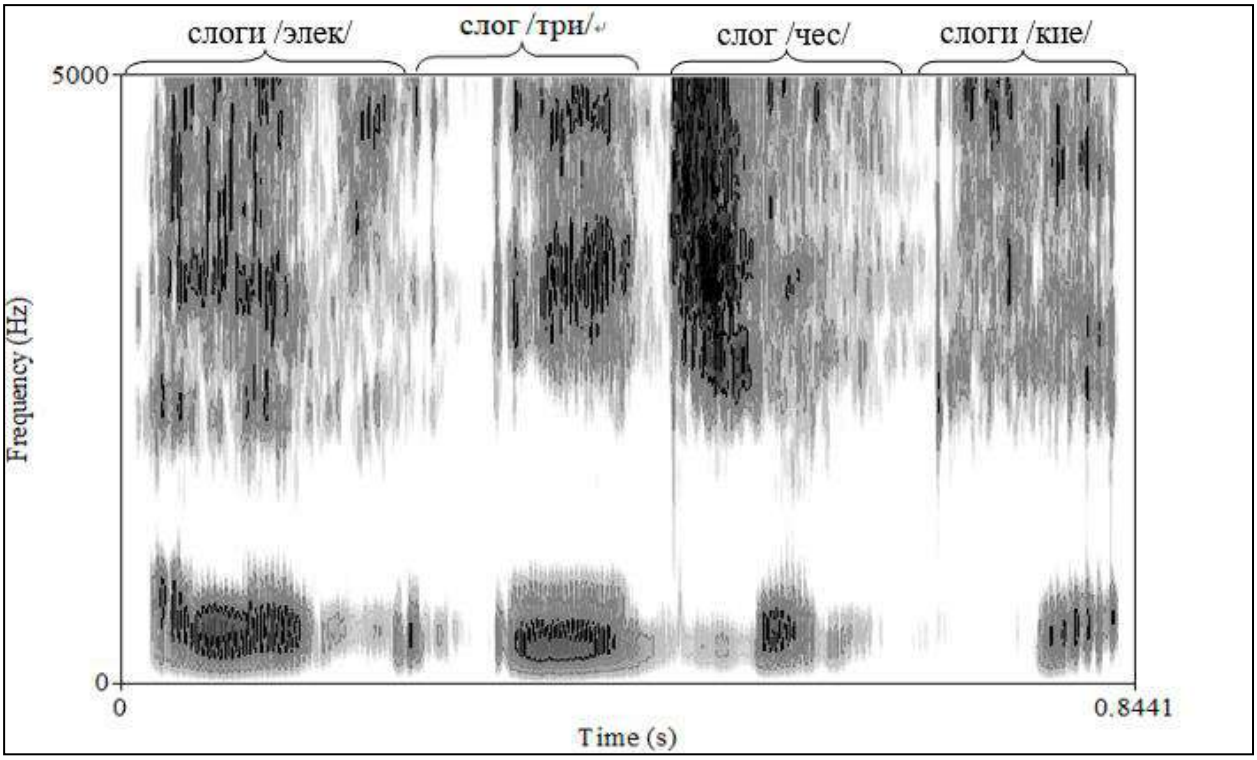


Figure 65 - Spectrogram of the word электрические in the realisation of Chinese speaker 1, female

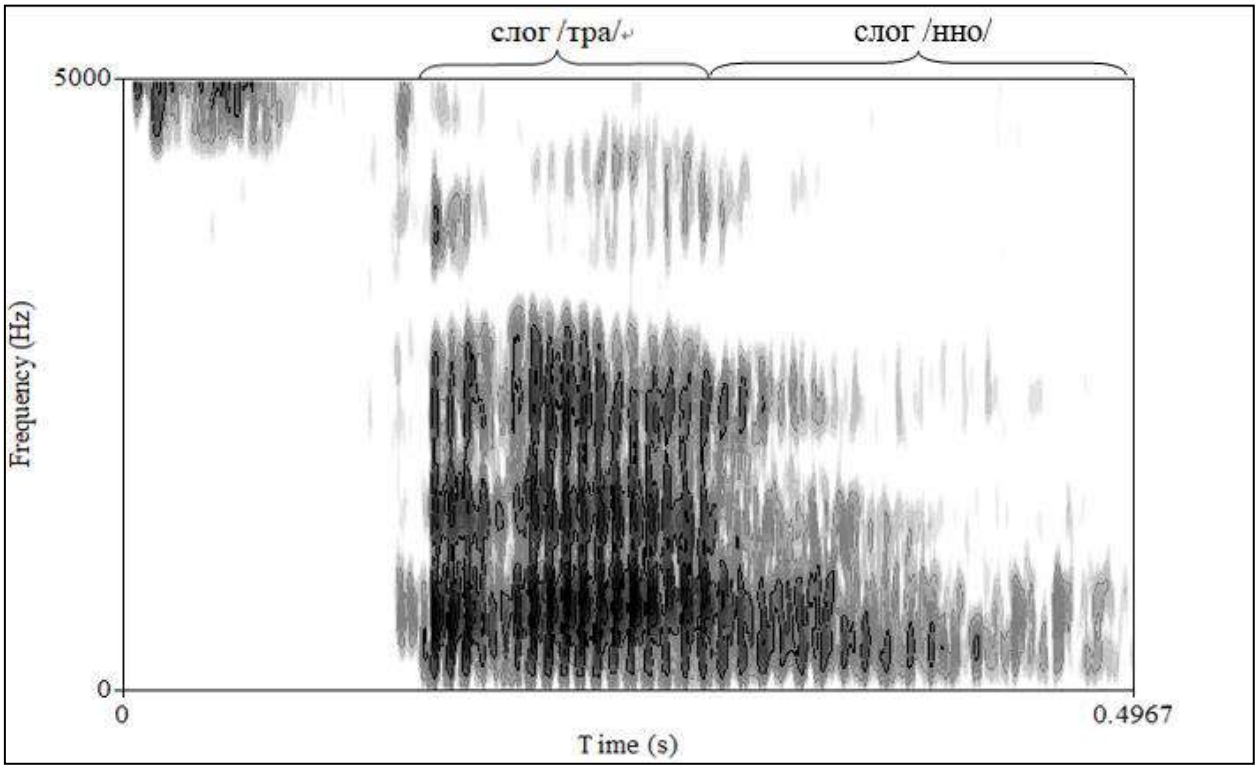


Figure 66 - Spectrogram of the word *странно* in the realisation of Russian speaker 1, male

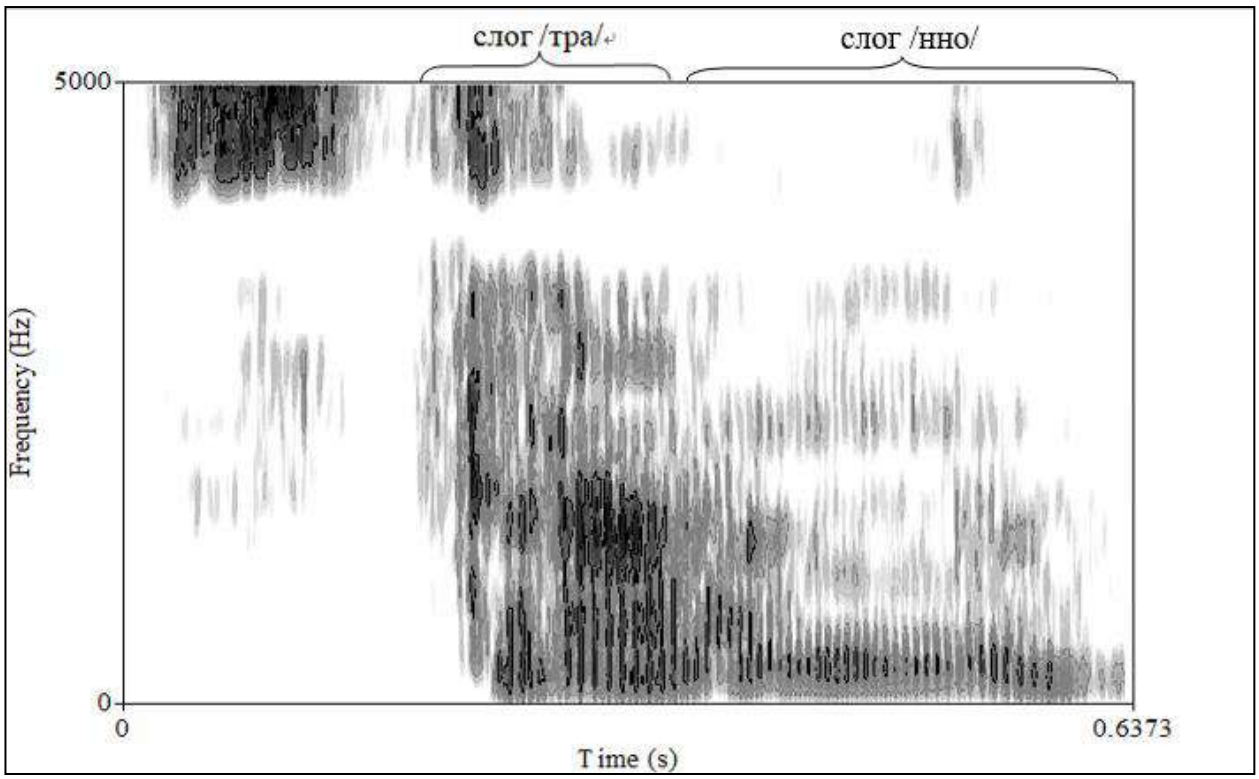


Figure 67 - Spectrogram of the word *странно* in the realisation of Chinese speaker 1, male

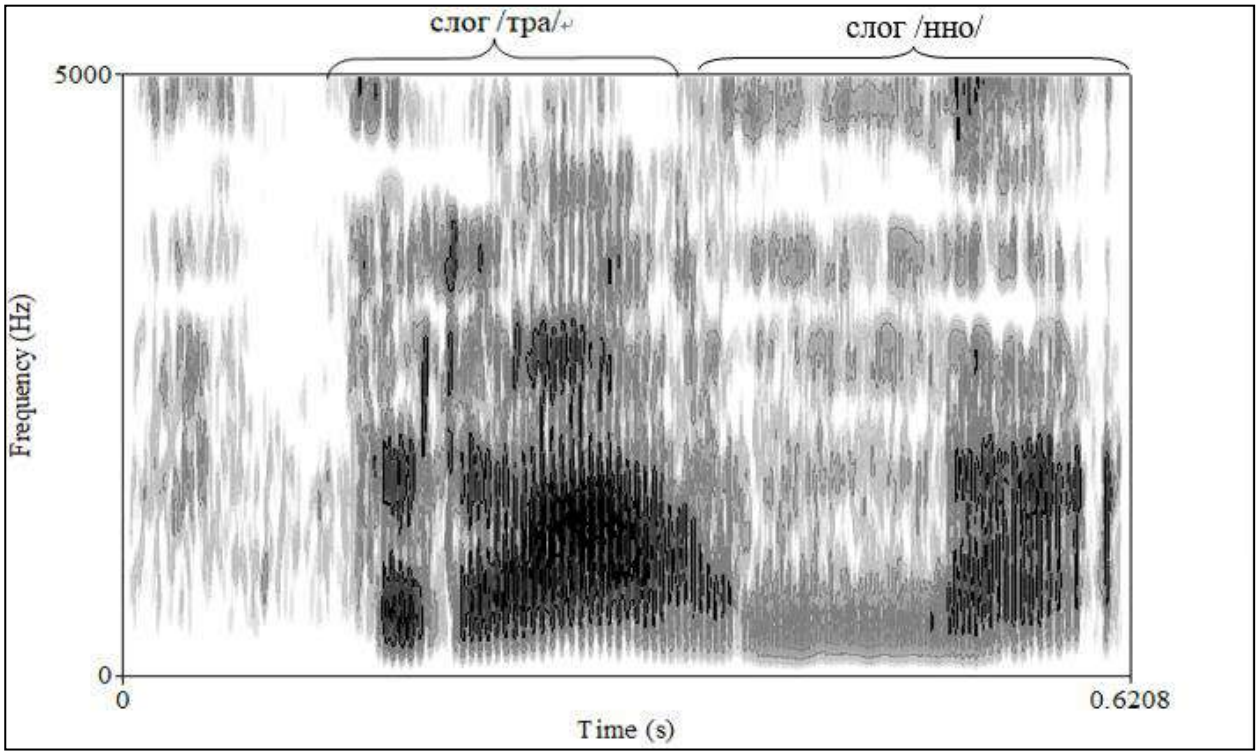


Figure 68 - Spectrogram of the word *странно* in the realisation of Russian speaker 1, female

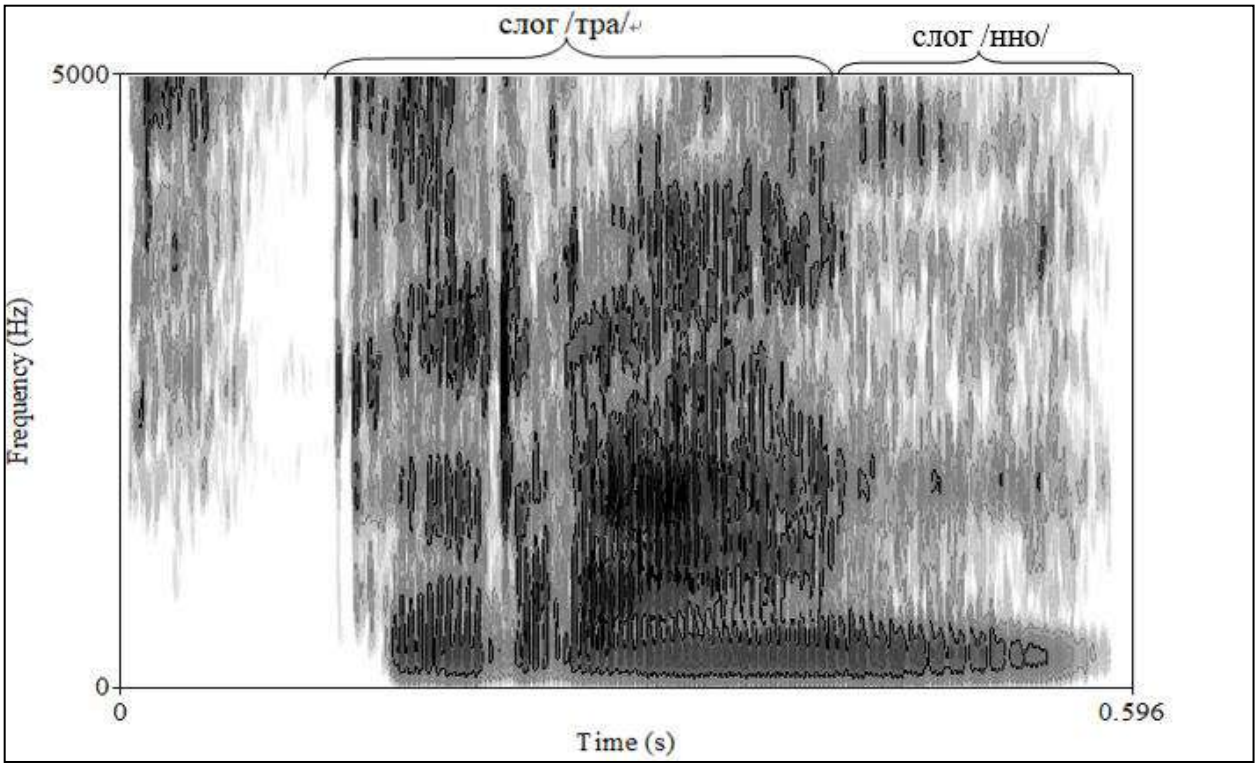


Figure 69 - Spectrogram of the word *странно* in the realisation of Chinese speaker 1, female

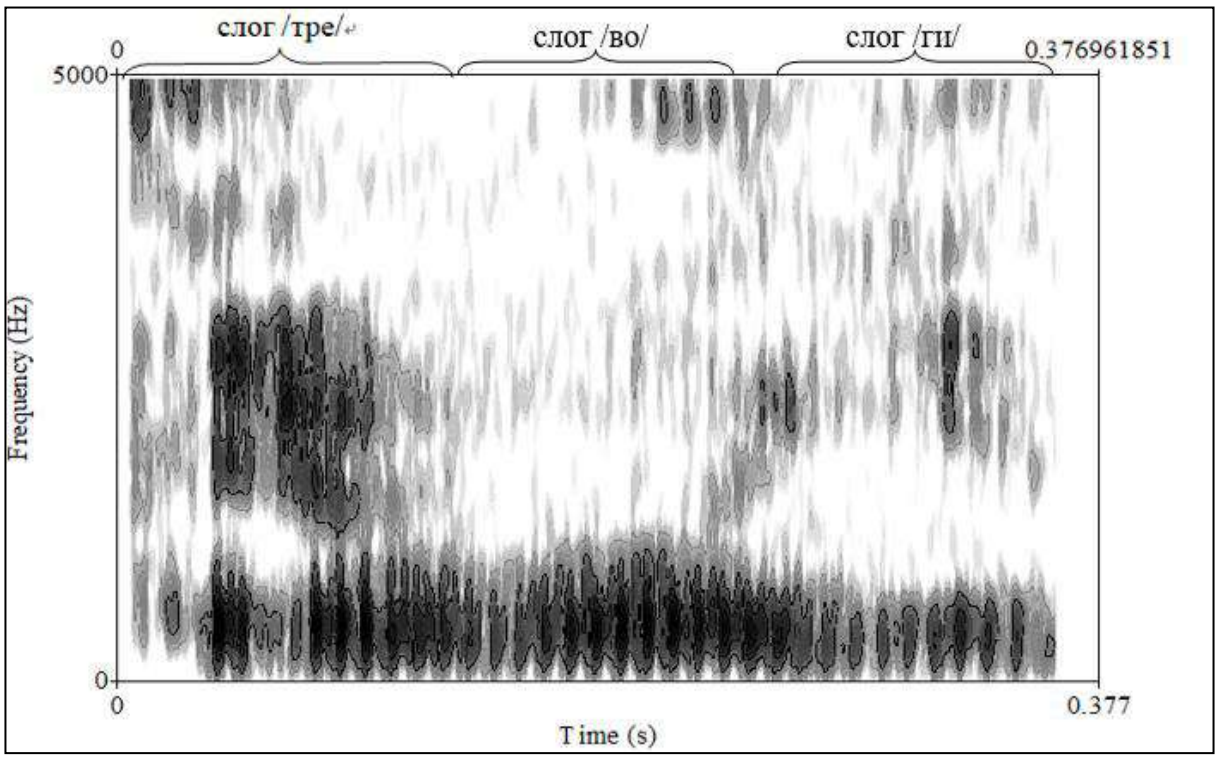


Figure 70 - Spectrogram of the word *Тревогин* in the realisation of the Russian speaker 1, male

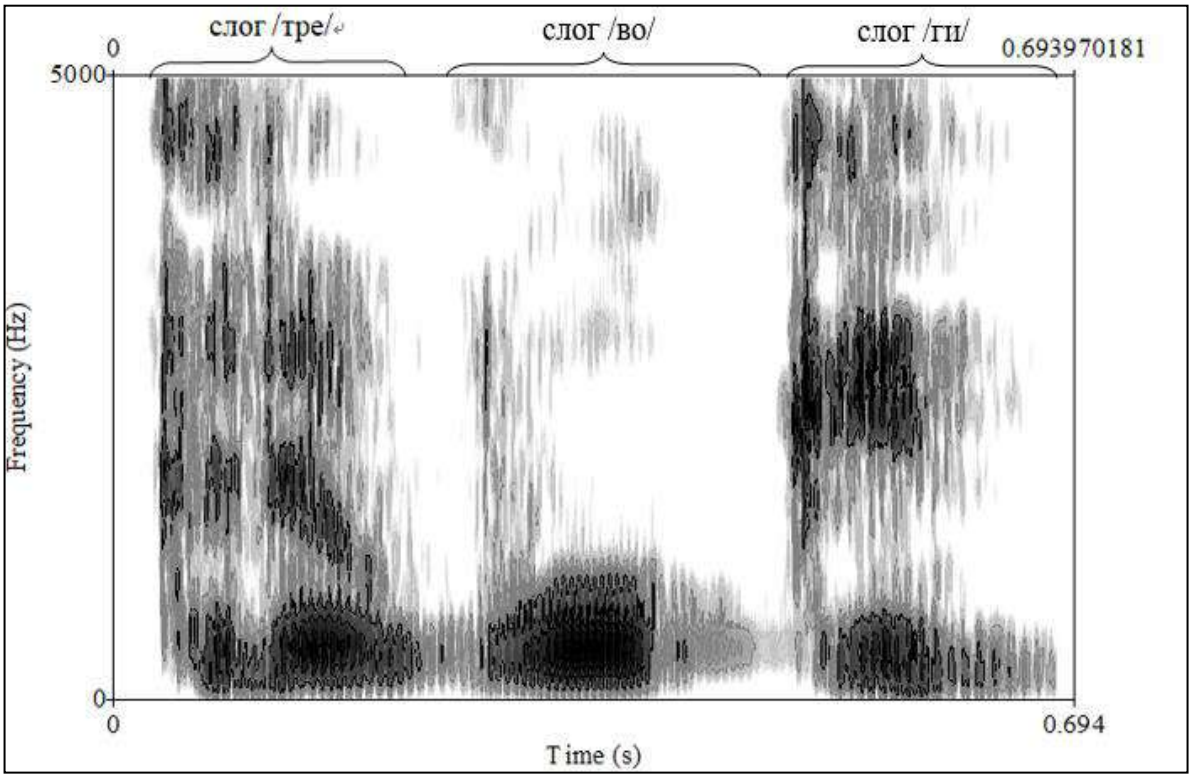


Figure 71 - Spectrogram of the word *странно* in the realisation of Chinese speaker 1, male

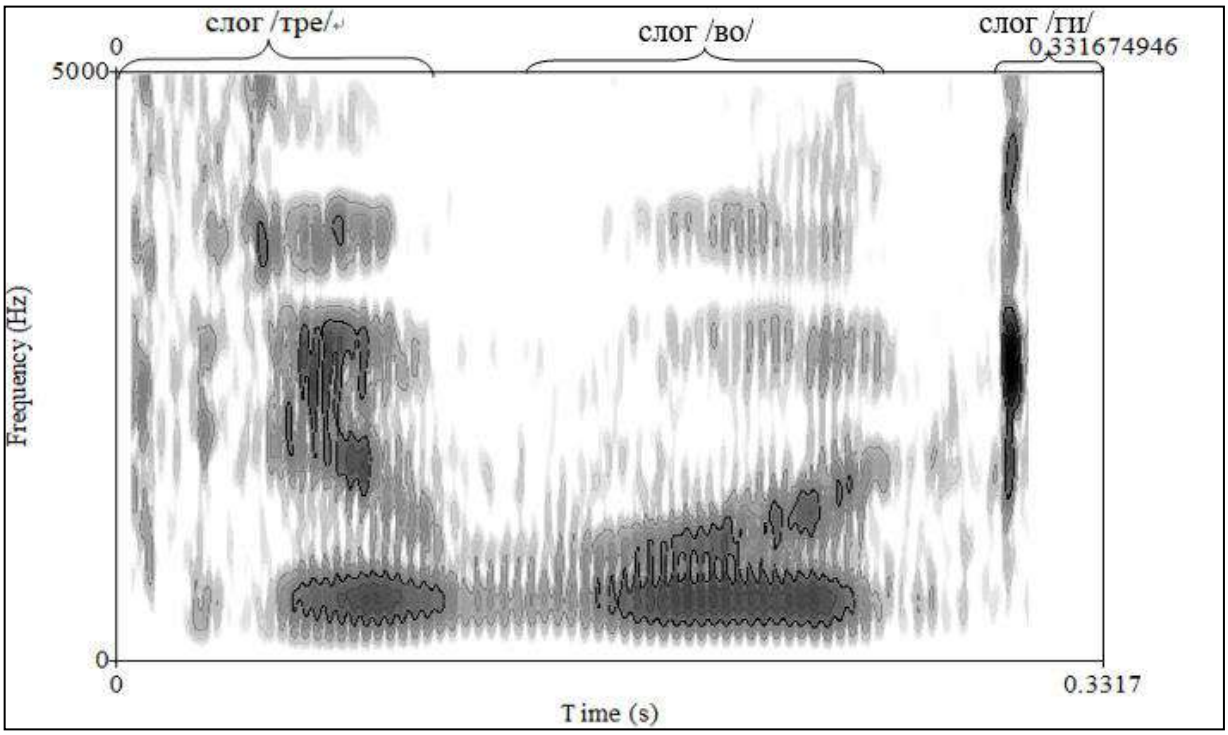


Figure 72 - Spectrogram of the word *Trevogin* in the realisation of Russian speaker 1, female

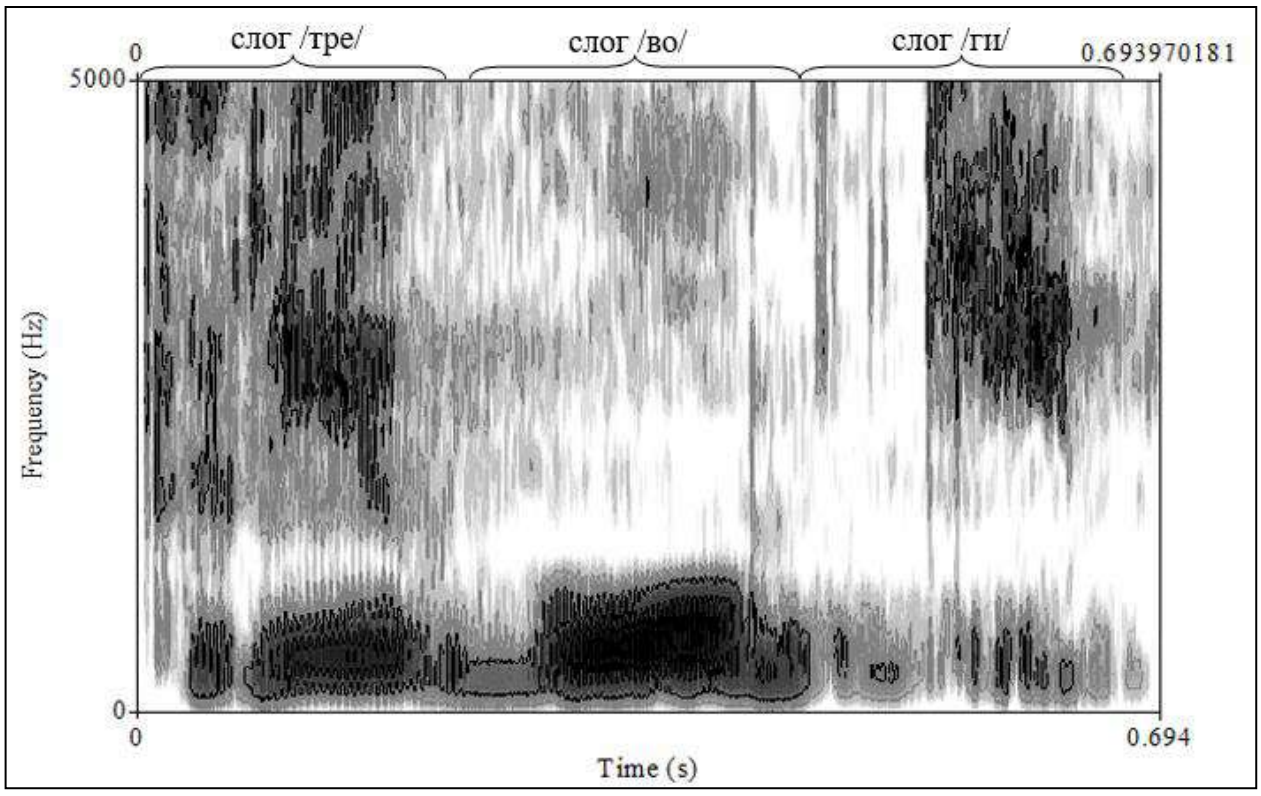


Figure 73 - Spectrogram of the word *Trevogin* in the realisation of Chinese speaker 1, female

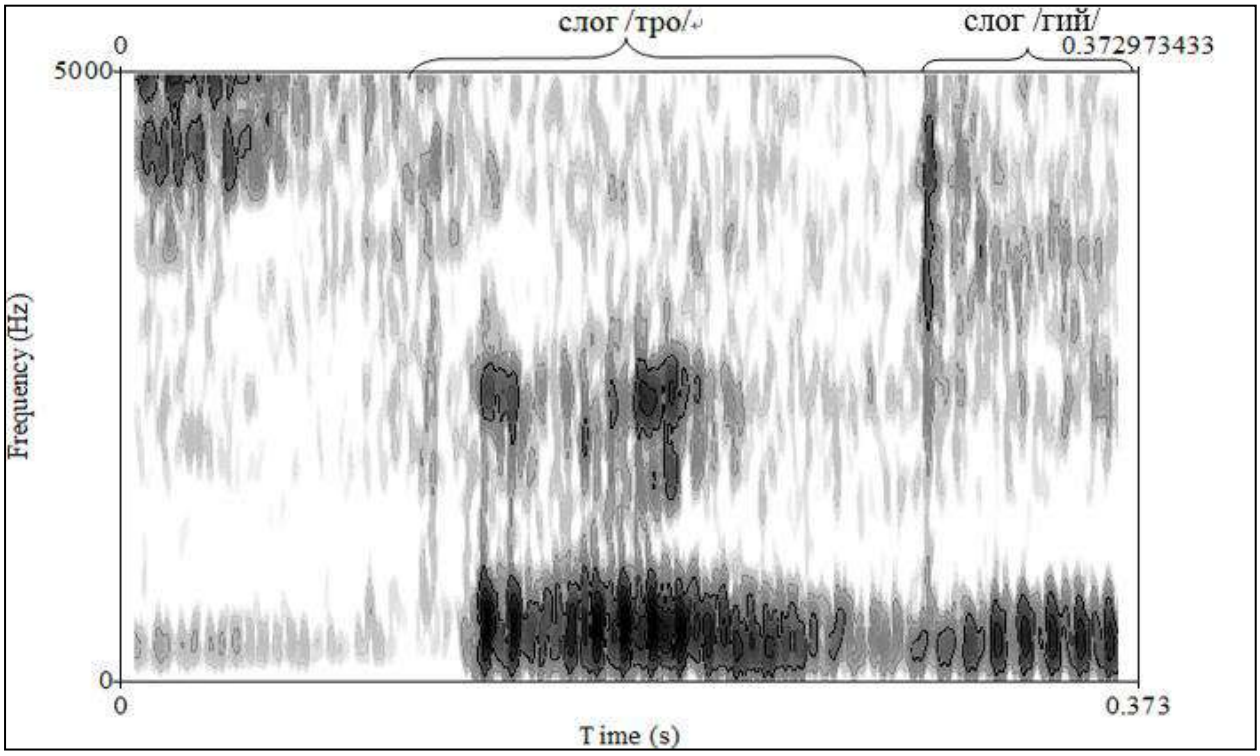


Figure 74 - Spectrogram of the word *строгий* in the realisation of Russian speaker 1, male

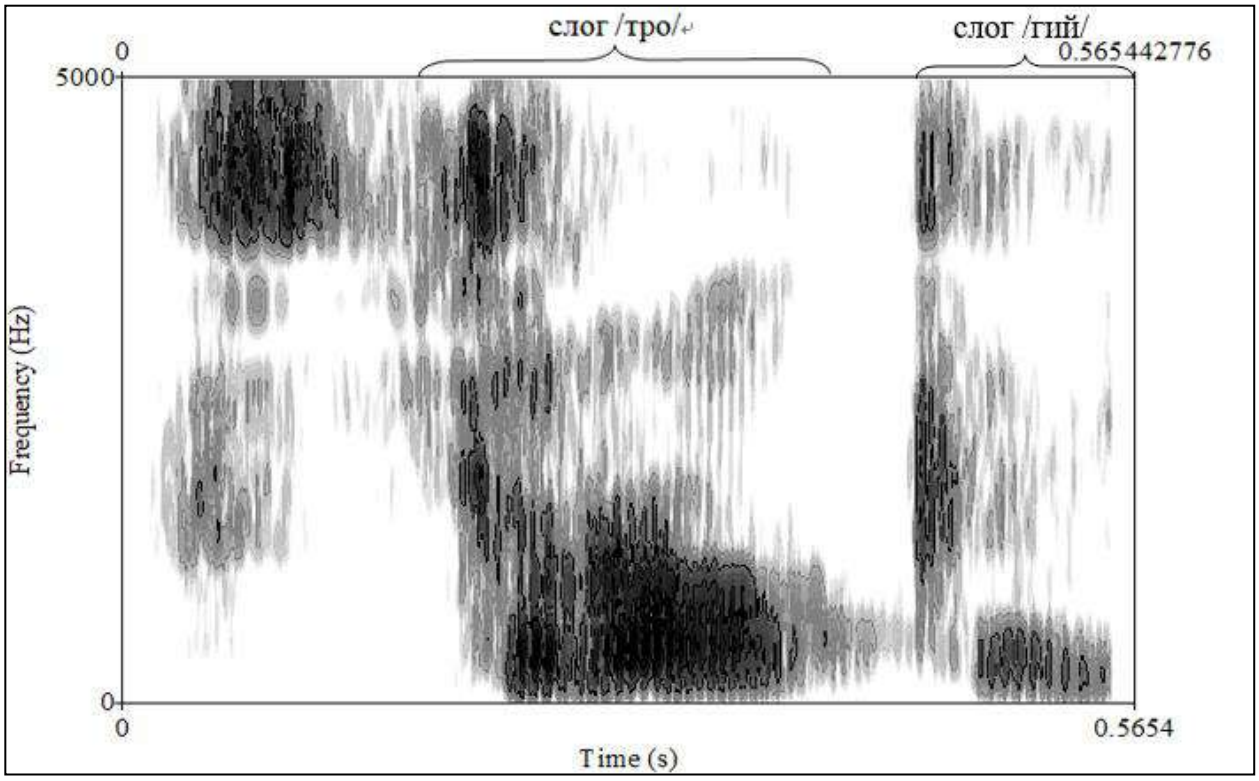


Figure 75 - Spectrogram of the word *строгий* in the realisation of Chinese speaker 1, male

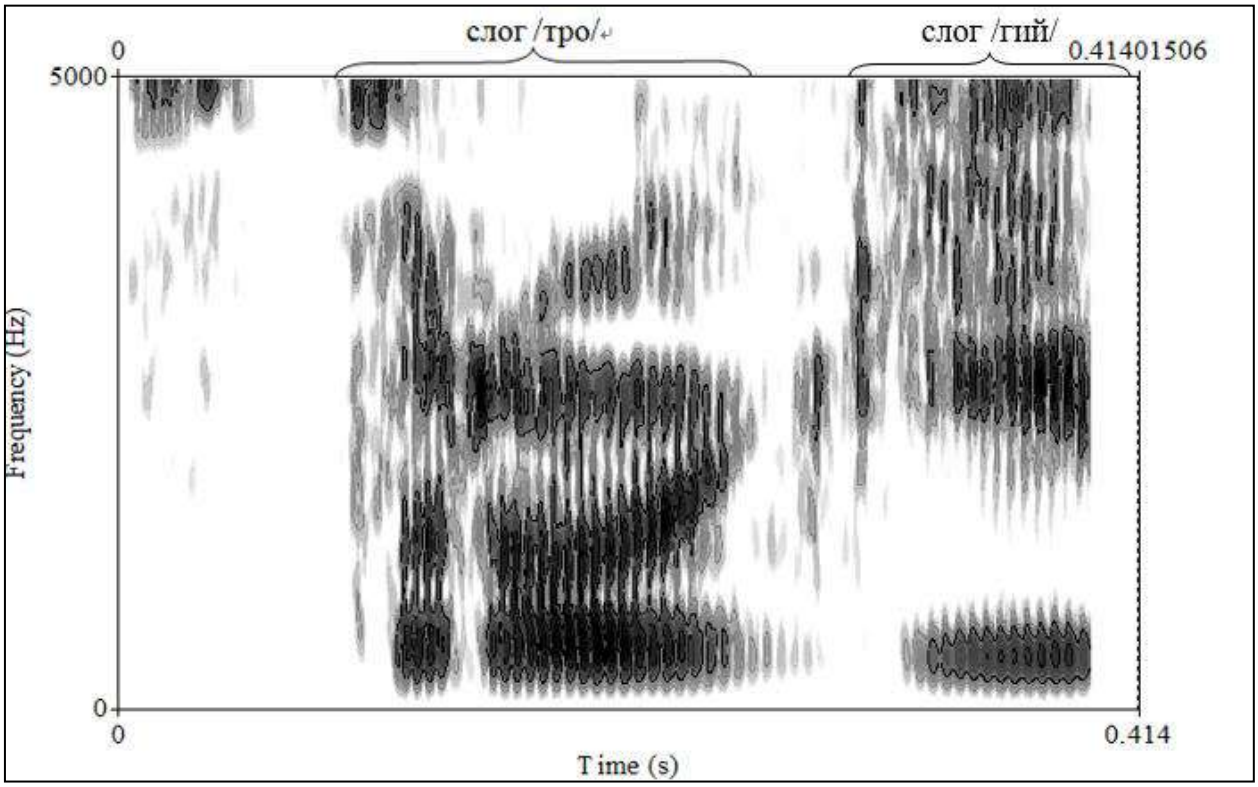


Figure 76 - Spectrogram of the word *строгий* in the realisation of the Russian speaker 1, female

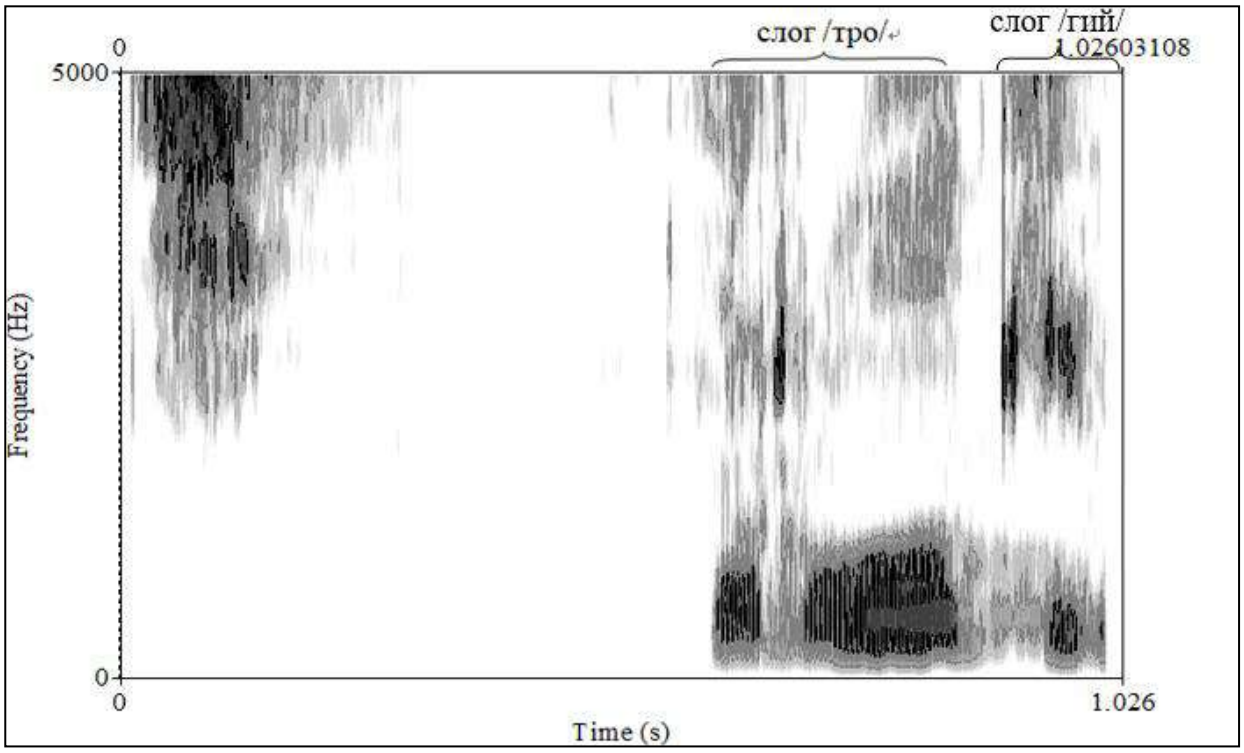


Figure 77 - Spectrogram of the word *строгий* in the realisation of Chinese speaker 1, female.